Denominations and their allocation among banknotes and coins

– proposal for a review of the banknote and coin series

FINAL REPORT FROM SUB-PROJECT 3
of the review of the banknote and coin series

FEBRUARY 2010

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Introduction

The following report is the final report from sub-project 3 of the Riksbank's review of the banknote and coin series. The report was prepared by the project organisation appointed by the Executive Board of the Riksbank in 2008.

The project has obtained accounts of experiences from the European Central Bank (ECB), as well as from the central banks of Denmark, Norway and Switzerland. The Riksbank's suppliers of coins and banknotes, Crane AB and Mint of Finland, have contributed advice. Grontmij AB has taken responsibility for the assessment of environmental aspects. This project owes a vote of thanks to all concerned for their contributions.

The reference group, which consists of representatives of commerce, the banks and cash-in-transit companies, has continually presented its opinions, contributing, in various ways, to the results of the investigation. The dialogue with the reference group has been valuable for the Riksbank's assessments and the project would like to express particular gratitude towards the members of the reference group.

Reports and other documentation from the project are continually published on the Riksbank's website www.riksbank.com, under "Notes and coins". Comments and suggestions can also be submitted there. It is also possible to write to the Riksbank at the address Sveriges riksbank, 103 37 Stockholm, Sweden.

Stockholm, February 2010

Christina Wejshammar
Chairman of the steering group

Information on foreign currencies is based on the exchange rate of 18 January 2010.

1. Summary

The project proposes that the Riksbank initiates work on the renewal of the Swedish banknote and coin series. The present banknote series was designed 25 years ago, and modernisation is necessary to maintain effective protection against counterfeiting. The coin series needs to be renewed in the direction of lighter and smaller coins to reduce handling costs and environmental impact.

The project proposes that the coin series be complemented with a new 2-kronor coin and that the banknote series be complemented with a 200-kronor banknote, at the same time as the 20-kronor banknote is replaced by a 20-kronor coin. Following a proposal by the Riksbank, the Riksdag has previously determined that the 50-öre coin is to become invalid on 30 September 2010.

The primary justification for resuming the production of a 2-kronor coin and introducing a 200-kronor banknote is that these denominations will replace a significant number of 1-krona coins and 100-kronor banknotes. This implies that the number of banknotes and coins in circulation will be reduced.

The 20-kronor banknote needs to be replaced with a coin due to quality problems with the banknotes. Due to

their declining value, these are being handled increasingly carelessly by the public, resulting in increasingly reduced lifetimes. Damaged and worn banknotes entail practical problems in cash handling and make authentication more difficult.

As the new coins will be smaller and lighter, the total weight of coins in circulation will decrease considerably when the new coin series is introduced, even though the series will include two new denominations. The reduction in weight will have considerable significance in reducing environmental impact and handling costs, and will improve working conditions for employees in the cash management business.

The project proposes that the 1 000-kronor banknote be retained, despite its decline in usage. The abolition of these banknotes would lead to the increased dominance of the 500-kronor banknote in the banknote series, which would be negative from a security perspective. The project also deems that the 1 000-kronor banknote continues to fulfil a function in terms of cash payments and as an alternative means of payment, should the electronic payment system become subject to disruption. Additionally, the number of banknotes would be greater if the 1 000-kronor banknote were to be withdrawn.

The project considers that the other denominations in the present banknote and coin series will continue to be natural denominations in the future. It is thus proposed that the coin series will consist of the denominations 1, 2, 5, 10 and 20-kronor and the banknote series of the denominations 50, 100, 200, 500 and 1 000-kronor.

The proposed changes form a combined solution for the increased efficiency of the Swedish banknote and coin series. Payments by the public would be simplified, the cash market's handling costs would be decreased and the environmental impact of the production and handling of banknotes and coins would be reduced. The Riksbank would also need to purchase fewer banknotes and coins than would otherwise be the case.

2. Background

2.1 The assignment

In March 2008, the Executive Board of the Riksbank decided to carry out a review of the banknote and coin series. The project description is presented in Appendix 1.

According to a plan determined by the Executive Board in May 2008, this work was to be conducted under five sub-projects.

1. Background description, with facts on banknotes and coins.

2. Examination of the need for the 50-öre coin

3. Analysis of denominations and their distribution between banknotes and coins.

4. Detailed design and implementation.

5. Follow-up.

2.2 Status of the project

Sub-project 1 was concluded in September 2008 with a factual report, "The Use of Cash in Sweden". This report forms the basis of the considerations and conclusions of the following subprojects.

Sub-project 2 was concluded with a report in November 2008. In this, it was proposed that the 50-öre coin cease to be legal tender on 30 September 2010. The Riksdag passed a motion in accordance with this proposal in March 2009.

In sub-project 3, presented here, proposals are to be submitted regarding denominations and their allocation among banknotes and coins. Proposals are to be submitted regarding the future direction of this work. The report

is based on a preliminary report submitted in the spring of 2009, which has subsequently been referred for consideration and finalised.

2.3 Outline

The report opens with a summary of the conclusions of sub-project 1, together with a description of the criteria utilised by the project in its analysis.

Following this, an analysis is performed of the denominations to be included in the future banknote and coin series. Starting from the conclusions presented in sub-project 1, the project has studied the need for the denominations 2-kronor, 200-kronor and 1 000-kronor. Other denominations in the present banknote and coin series are deemed to continue as natural denominations in the future.

The project then undertook an analysis of where the boundary between banknotes and coins should lie. The project has focused on the issue of whether to replace the 20-kronor banknote with a 20-kronor coin. Replacing banknotes with coins has not been considered to be a relevant issue for any other denomination.

Proposals are subsequently submitted for the design of a new banknote and coin series. A discussion of the implementation and its consequences is then held.

2.4 Conclusions of sub-project 1

One conclusion of sub-project 1 is that cards and cash are efficient for different types of payment and that there are types of transaction in which cash payments will probably always be more attractive than card payments. Cards and cash also function as alternatives to one another. Even though cards have increased in significance, society will continue to need an effective system for cash payments.

Cash payments are more cost-effective for society than cash payments, as regards payments of lesser amounts. The limit for this has been defined as approximately SEK 70, but is continuing to fall as card payment systems are becoming increasingly effective.

The allocation of banknote denominations has changed over the last ten years. Demand for 500-kronor banknotes has increased and these banknotes currently account for more than half of the value of banknotes in circulation. At the same time, demand for 1 000-kronor banknotes has declined.

A large majority of members of the public consider that the banknotes are of good or acceptable quality. A lower assessment is received by 20-kronor banknotes, in comparison with other denominations.

As a result of the poor circulation of coins, the Riksbank issues more coins than are needed. A significant portion of the coins issued by the Riksbank are not used as a means of payment by the public. Consequently, the Riksbank's purchasing costs for coins are higher than necessary.

Sub-project 1 also established that environmental aspects had, so far, played a subordinate role in decisions dealing with banknotes and coins. As society as a whole is involved in the handling of banknotes and coins, the environmental consequences of major changes should receive more attention in the future.

2.5 Criteria for analysis

The project has weighted significant aspects together in order to formulate a banknote and coin series that is appropriate from the points of view of efficiency, environment and security. Five criteria have acted as starting points:

THE NUMBER OF BANKNOTES AND COINS

The amount of banknotes and coins needed to meet society's cash requirements affects the costs for purchase and handling and is significant in terms of environmental impact. Consequently, the target is for as few banknotes and coins as possible to be required in circulation in order to maintain a well-functioning cash system.

PAYMENT PATTERNS

The payment patterns of the general public, such as choice of card or cash payment, can be affected by the denominations existing and the design of banknotes and coins. This is therefore one factor to consider when making changes to the banknote and coin series.

ENVIRONMENTAL CONSEQUENCES

The manufacture and handling of banknotes and coins is a process involving many participants. The target is for this process to have the lowest possible total environmental impact.

SECURITY ASPECTS

Confidence in banknotes and coins is dependent on the public trusting that these are genuine. They must be designed in such a manner as to impede counterfeiting. It is also desirable that dependence on one particular banknote denomination does not become excessive.

COSTS

Costs for banknotes and coins principally consist of three parts: the Riksbank's purchasing costs, handling within the Riksbank and handling on the cash market. The target is the lowest total costs possible.

2.6 International experiences

The experiences of other countries are particularly valuable for assessing the consequences of change, for example as regards payment patterns and demand for banknotes and coins among the public. The experiences of Denmark, Norway and the Euro countries have been included, as have experiences from other countries, in certain cases.

2.7 Opinions of the general public and the cash market

One condition for the effective functioning of banknotes and coins is that the public has confidence in them and experiences them as functional means of payment. The public's opinions of banknotes and coins were surveyed through an investigation conducted by Synovate on behalf of the Riksbank at the end of 2006. An appropriate summary is presented in each section of the report.

The report also includes a summary of opinions provided by retail industry organisations, major banks and cash-in-transit companies when the preliminary report was referred for consideration in the spring of 2009.

3. Denominations

3.1 Starting points

Historically, lower denominations have successively been withdrawn as a consequence of the decline in the value of money. Lower banknote denominations have been replaced with coins. However, no general assessment of which denominations may be deemed appropriate from the point of view of efficiency has been conducted for a relatively long period of time.

A certain degree of support for an analysis can be obtained from a Belgian study from 2001 (see sub-project 1), which describes the manner in which an effective banknote and coin series should be designed. The focus of the

study is that the number of banknotes and coins required for a cash payment should be as small as possible, at the same time as it should be easy for members of the public to count and handle different denominations.

The basis of the model proposed is that denominations should follow the principle of 1-2-5-10-20-50-100-200-500-1 000 and so on. This model is applied, with minor variations, by most countries. Sweden currently has all denominations up to 1 000 kronor, except for 200 kronor. However, the denomination 2-kronor exists in the form of a coin which is no longer manufactured.

The Riksbank has brought attention to the fact that, from the point of view of effectiveness, there may be reason to have a denomination between 100 and 500 kronor – an opinion also presented by banks and the retail industry. Another observation is that demand for 1 000-kronor banknotes has successively declined since the start of the century.

Against this background, the project considers an analysis of the denominations 2-kronor, 200-kronor and 1 000-kronor to be justifiable. Other denominations – 1, 5, 10, 20, 50, 100 and 500 kronor – are natural denominations in the banknote and coin series and also correspond well with the denominations used in neighbouring countries.

3.2 The 2-kronor denomination

3.2.1 History

In 1969, a government coin committee presented proposals for changes to the Swedish coin series (SOU 1969:17). The committee proposed that the 2-öre and 2-kronor coins should be withdrawn. This would decrease the number of coin denominations from nine to seven.

The reason for the withdrawal of the 2-kronor coin was partly that this coin denomination was not deemed to be necessary and partly that withdrawal would open up the possibility of reducing the size of the 5-öre and 5-kronor coins.

As a consequence of the committee's proposals, the manufacture of the 2-kronor coin ceased in 1971. However, the coin has not been declared invalid, but is still legal tender. The number of coins in circulation is currently only approximately four million, equivalent to a couple of thousandths of the total number of coins. The silver value of most of the coins exceeds their nominal value. In practice, this coin is no longer used as a means of payment.

3.2.2 Volume of coins

In order to assess the impact of a 2-kronor coin on the volume of coins, the project has undertaken theoretical calculations of how such a denomination would affect the number of coins in circulation. The starting point for these calculations is that the 2-kronor coin is completely available and that the public and retailers always choose to use as few coins as possible.

The tables in Appendix 2 provide two examples of the number of coins required to make a payment of less than SEK 10, both with and without 2-kronor coins. The first example refers to payment in correct change and the second to payment with a 10-kronor coin, in which change is given. In both cases, the result is that the number of coins used is reduced by up to 32% if 2-kronor coins are available. This is because the 2-kronor coin replaces a number of 1-krona coins.

The public and retailers do not always act as assumed by theoretical calculations, i.e. using as few coins as possible. Neither will all coin denominations be completely available in all payment situations. However, any reduction in the volume of coins would be of great significance for purchasing and handling expenses, even if this was only partly attained.

3.2.3 Payment patterns

The introduction of a new 2-kronor coin is not expected to affect the payment patterns of the general public.

3.2.4 Environmental consequences

All other factors being equal, the reduction of the number of coins resulting from the introduction of a 2-kronor coin will reduce raw material requirements and transport volumes, thereby entailing reduced environmental impact. The alloy to be used in a new 2-kronor coin would be selected on the basis of the lowest possible environmental impact of the raw materials. A new 2-kronor coin would also probably weigh less than the present coins.

3.2.5 Security aspects

Counterfeit coins are highly unusual in Sweden. There is no reason to believe that interest in counterfeiting 2-kronor coins would be greater than is the case with the currently existing coin denominations.

3.2.6 Costs

Handling costs for coins among banks, the retail industry and cash-in-transit companies will decline if the volume of coins is reduced. The Riksbank's purchasing costs for coins would be reduced.

3.2.7 Neighbouring countries

Denmark has a 2-kronor coin in its coin series (worth approximately SEK 2.72). The Euro countries have a coin with the denomination 20 cents (worth approximately SEK 2.02). Norway lacks a 2-kronor coin.

As these countries have differing coin denominations, completely fair comparisons cannot be made. However, statistics for the manner in which coins are allocated among denominations indicate that the significance of the 1-krona coin is lesser in Denmark, as compared with Norway and Sweden (Table 1), which lends support to the assumption that a 2-kronor coin would reduce the need for the 1-krona coin.

Table 1. Percentage allocation of number of coins per denomination in Sweden, Denmark and Norway 2009.

3.2.8 The public and the cash market

In an investigation among the public in 2006, it was asked whether it was felt that any other coin denomination was needed, beyond those utilised at present. A large majority, 89%, answered no. The most common suggestion from those answering yes was for a 20-kronor coin. A few also suggested a 2-kronor coin.

In their consultation response, the companies in the cash market are positive towards the idea of a 2-kronor coin, as such a denomination would reduce the volume of coins.

3.2.9 Conclusions, 2-kronor denomination

A 2-kronor coin would reduce the need for 1-krona coins, thus leading to a decrease in the number of coins in circulation. Theoretical calculations indicate that this reduction could be significant in the long term.

A reduction in the volume of coins would entail reduced handling costs for participants in the cash market and reduced costs for the purchase of coins. Payments by the general public would be simplified. Environmental impact would be reduced as a consequence of decreased raw material and transportation requirements.

Against this background, arguments in favour of the resumption of the issue of 2-kronor coins are overwhelming.

3.3 The 200-kronor denomination

3.3.1 History

When the current banknote series was designed in the mid 1980s, there were six banknote denominations: 10, 50, 100, 500, 1 000 and 10 000 kronor. The 10-kronor banknote was replaced by a coin in 1991 and the 10 000-kronor banknote was abolished in the same year. The 20-kronor banknote was introduced in 1992. The

50-kronor banknote was abolished in 1990, but reintroduced in 1996. There has never existed a denomination between 100 and 500 kronor.

3.3.2 The volume of banknotes

In order to assess the impact of a 200-kronor banknote on the volume of banknotes, the project has undertaken theoretical calculations of how such a denomination would affect the number of banknotes in circulation. The starting point for these calculations is that the 200-kronor banknote is completely available and that the public and retailers always choose to use as few banknotes as possible.

The tables in Appendix 2 present two examples of the number of banknotes needed to make a payment with and without the 200-kronor banknote. The first example refers to payment with a 500-kronor banknote in which change is given. The second example refers to payment with correct change. In both cases, the result is that the number of banknotes used is reduced by up to 40% if 200-kronor banknotes are available. This is because the 200-kronor banknote replaces a number of 100-kronor banknotes.

The public and retailers do not always act as assumed by theoretical calculations, i.e. by using as few banknotes as possible. Neither will there be complete availability to the banknote in all payment situations. However, any reduction in the volume of banknotes would be of great significance for purchasing and handling expenses, even if this was only partly attained.

If the 200-kronor banknote is to achieve general distribution, it needs to be present in ATMs. As can be seen in section 3.3.8, the banks have expressed interest in this. In such a case, three denominations will be present in ATMs: 100, 200 and 500 kronor.

3.2.3 Payment patterns

The introduction of a 200-kronor banknote would make paying with cash simpler and more effective. The number of banknotes used per transaction would decrease. This could lead to an increased propensity among the public to pay with cash, as opposed to by card.

If 200-kronor banknotes were provided in ATMs together with 100 and 500-kronor banknotes, the public would divide withdrawals among several denominations. All other factors being equal, this would mean that ATMs would need to be refilled less frequently, reducing transport costs and security risks.

3.3.4 Environmental consequences

A 200-kronor banknote would reduce the number of banknotes in circulation. This implies that fewer banknotes would need to be manufactured and handled, which would reduce environmental impact.

3.2.5 Security aspects

For security reasons, central banks try to avoid becoming excessively dependent on certain banknote denominations. This is because it can be difficult to replace these with other denominations if such replacement becomes necessary due to problems such as counterfeiting. Even if the risk of widespread counterfeiting is low in Sweden, it remains a factor to consider.

The 500-kronor banknote has taken an increasingly dominant position in the banknote series. During the period 2000 – 2009, its portion of the total value of banknotes increased from 39 to 57 per cent. The 200-kronor banknote would be a suitable complement and replacement for the 500-kronor banknote if, for security reasons, this should need to be replaced rapidly by other banknote denominations.

3.3.6 Costs

Handling costs for banknotes among banks, the retail industry and cash-in-transit companies will decline if the volume of banknotes is reduced. The Riksbank's purchasing costs will be reduced.

3.3.7 Neighbouring countries

Norway and Denmark both have 200-kronor banknotes (respectively worth SEK 248 and 272). The Euro countries have the denomination EUR 20 (worth SEK 202).
As these countries have differing banknote denominations, completely fair comparisons cannot be made. However, certain conclusions can be drawn from the comparison of Sweden, Denmark and Norway.

Norway introduced its 200-kronor banknote in 1994 as a complement to the existing series of 50, 100, 500 and 1 000-kronor banknotes. This was because the number of 100-kronor banknotes was high and the introduction of a 200-kronor banknote was deemed to contribute to the increased efficiency of cash usage. The impact of the 200-kronor banknote has been great and it has become the most common banknote.

Denmark introduced a 200-kronor banknote in 1997, also as a complement to the existing series. Its impact has not been as great as in Norway. One reason for this is that the banknote is not provided by ATMs in parts of the country.

The number of banknotes in proportion to GDP is lowest in Norway. The primary reason for this is presumably that card usage is higher in Norway than in Sweden and Denmark, but the 200-kronor banknote is probably a contributory factor. Denmark and Norway both have a more even division of banknote denominations than is the case in Sweden.

Table 2: Allocation by denomination of numbers of banknotes in Sweden, Denmark and Norway, per cent, 2009.

3.2.8 The public and the cash market

When asked in 2006 whether other denominations of banknotes were needed in addition to those presently in use, 18% of members of the public answered yes. The most common suggestion was for a 200-kronor banknote. In their consultation responses, cash market participants are positive towards the introduction of a 200-kronor banknote. The banks have expressed interest in providing such a banknote via their ATMs.

3.2.9 Conclusions, 200-kronor denomination

A 200-kronor banknote would reduce the need for 100-krona banknotes, thus leading to a decrease in the number of banknotes in circulation. Theoretical calculations indicate that this reduction could be significant in the long term. A reduction of the number of notes would entail lower costs for production and handling and a reduced environmental impact. Payments by the general public would be simplified.

Comparisons with Denmark and Norway indicate that a 200-kronor banknote contributes to a more even spread of the number of banknotes across denominations and to a reduction in the volume of banknotes. A 200-kronor banknote would also form an appropriate complement to the 500-kronor banknote in the event that this needed to be replaced.

If 200-kronor banknotes were provided in ATMs together with 100 and 500-kronor banknotes, withdrawals would be divided among several denominations. This should mean that the ATMs would need to be refilled less frequently, reducing costs and security risks.

In light of the above, the project considers that convincing arguments speak in favour of the introduction of a 200-kronor banknote.

3.4 The 1 000-kronor denomination

3.4.1 Historic background

Banknotes in the denomination 1 000-kronor have existed since the end of the 19th Century. In 1939, a 10 000-kronor denomination was introduced, remaining until abolition in 1991. The reasons for the abolition of the 10 000-kronor banknote were that such a denomination was no longer considered necessary and that the

banknote was being counterfeited to a relatively extensive degree.

At the end of 2009, there were 31 million 1 000-kronor banknotes in circulation, equivalent to eight per cent of the total number of banknotes. The value of the banknotes in circulation was equivalent to 30 per cent of the total value of banknotes.

Since 2000, the number of 1 000-kronor banknotes in circulation has decreased by a third. The average length of time these banknotes spend in circulation is 17 years, which is considerably longer than for the other banknotes.

There are probably several explanations for this reduction in demand. Larger payments are increasingly being made by card. The abolition of wealth tax may also have played a part. As demand declines, the banks are retaining ever smaller reserves of banknotes, meaning that the availability of these banknotes is also decreasing.

This development means that the 1 000-kronor banknote will be used less and less frequently as a means of payment in commercial transactions. It can consequently be asked whether there is a need for a 1 000-kronor banknote. The project has analysed the consequences of the abolition of this denomination of banknote.

3.4.2 Volume of banknotes

If the 1 000-kronor banknote is abolished, the transactions and savings currently being made with 1 000-kronor banknotes must be made with other means of payment. A portion of these transactions will presumably be replaced by electronic payments, but a significant portion will probably be replaced by other banknotes, primarily 500-kronor banknotes.

If every 1 000-kronor banknote were to be replaced by two 500-kronor banknotes, the number of 500-kronor banknotes would increase by 62 million. The 500-kronor banknote would take a highly dominant position in the banknote series and account for over 80% of the value of banknotes in circulation.

3.4.3 Payment patterns

A withdrawal of the 1 000-kronor banknote would probably entail that a portion of the transactions previously made with 1 000-kronor banknotes would instead be made by card. However, many of those individuals currently using 1 000-kronor banknotes would probably continue to use banknotes as means of payment.

It has occasionally been claimed that the 1 000-kronor banknote is primarily used in illegal transactions. If the 1 000-kronor banknote were to be abolished, the illegal transactions carried out with 1 000-kronor banknotes could easily be made with other means of payment instead, for example other denominations of Swedish banknote or other currencies. Consequently, this provides no reason to abolish the banknote.

3.4.4 Environmental consequences

A withdrawal of the 1 000-kronor banknote would lead to an increase in the number of banknotes, which would increase the environmental impact of manufacture and handling.

3.2.5 Security aspects

From the perspective of security, it is desirable to reduce the current imbalance, in terms of value, towards the 500-kronor banknote. An abolition of the 1 000-kronor banknote would have the opposite effect – that is to say, the dominance of the 500-kronor banknote would be greater than at present.

A further security aspect is that the 1 000-kronor banknote should be able to function as an alternative means of making large payments if the system for card payments were to be affected by technical problems.

3.4.6 Costs

As the abolition of the 1 000-kronor banknote would mean a larger number of banknotes in circulation, it would also entail increased costs. The amount of these increased costs would depend upon the number of transactions

using 1 000-kronor banknotes replaced with electronic payments and the impact of the abolition on the time in circulation of 500-kronor banknotes.

More banknotes in circulation would entail increased handling costs on the cash market. At the same time, abolition would mean one banknote denomination less to handle, which should imply savings.

3.4.7 Neighbouring countries

The highest banknote denomination in Denmark and Norway is 1 000 kronor (worth SEK 1 360 and 1 240 respectively). The highest denominations in the Euro countries are EUR 100 (SEK 1 012), EUR 200 (SEK 2 024), and EUR 500 (SEK 5 056).

3.4.8 The public and the cash market

When asked, in 2006, whether any of the current banknote denominations were no longer necessary, 23 per cent of members of the public answered yes. The most frequent answer given was the 1 000-kronor banknote.

In their submission responses, the industry organisations Svensk Handel and Butikerna advocate retaining the 1 000-kronor banknote, while one of the cash-in-transit companies considers that it should be abolished.

3.4.9 Conclusions, 1 000-kronor denomination

If the 1 000-kronor banknote were to be abolished, it would undoubtedly largely be replaced by other banknotes, primarily 500-kronor banknotes. This would imply an increase, from an already high level, of the dominance of the 500-kronor banknote in the banknote series, a negative development from the perspective of security.

Even if usage in commerce has declined, the 1 000-kronor banknote continues to provide a cash payment function for larger amounts. The banknote also provides an alternative in the event that the electronic system should become subject to disruptions.

An additional result of abolition would be an increase in the number of banknotes, which would entail increased costs for purchase and handling. Partial compensation for this cost increase would arise through there being one less banknote denomination to handle.

All in all, the project deems that there are overwhelming reasons to retain the 1 000-kronor banknote.

4. Distribution of banknotes and coins

4.1 Starting points

General experience tells us that lower banknote denominations have higher turnover and are handled less carefully than higher denominations. Consequently, the banknotes become increasingly worn and have increasingly shorter lifetimes. The consequence of this is that low-denomination banknotes must successively be replaced by coins, which have significantly longer lifetimes. The last such change in Sweden was implemented in 1991, when the 10-kronor banknote was replaced by a coin.

For a number of years, the Riksbank has noticed increasing problems with worn 20-kronor banknotes. The 20-kronor banknote also received lower quality ratings from the public than other banknote denominations. Most countries in Sweden's geographical vicinity have opted for a lowest banknote denomination of considerably greater value than SEK 20.

Against this background, the project considers an examination of the question of replacing the 20-kronor banknote with a coin to be justifiable. Considering that the problems with worn banknotes primarily concern the 20-kronor banknote, the question of replacing banknotes with coins is not presently deemed to apply to any other denomination.

4.2 The 20-kronor coin

4.2.1 History

The 20-kronor banknote was introduced in 1992 in conjunction with the replacement, by the Riksbank, of the 10-kronor banknote with a coin.

At the end of 2009, there were 92 million 20-kronor banknotes in circulation, equivalent to 25 per cent of the total number of banknotes. The value of these banknotes, SEK 1.8 billion, constituted just below two per cent of the total value of all banknotes.

4.2.2 Amounts

On average, the Riksbank presently issues approximately 40 million new 20-kronor banknotes per year. If the banknote were to be replaced by a coin, the number of coins issued over time would be significantly lower than the number of banknotes presently issued, due to coins' longer lifetimes. If the public were to demand as many coins as banknotes, the Riksbank would be required to issue an average of approximately three million 20-kronor coins per year.

The actual time in circulation of the banknote is presently approximately two years. However, if the Riksbank's standard for the lowest acceptable quality of banknotes were to be applied, this time in circulation would become significantly shorter. The excessive length of the time in circulation is due to the usage of the banknotes as change in the retail industry, with the result that they are not returned to the banking system to the same extent as higher banknote denominations.

The Riksbank currently issues more coins than are needed, as large amounts of coinage are not used as means of payment. A higher coin denomination could potentially increase public interest in also using coins of lower denomination. If so, this would mean that the Riksbank would need to purchase fewer coins of the current denominations.

4.2.3 Payment patterns

Replacing the 20-kronor banknote with a coin is not deemed likely to affect the public's payment patterns.

4.2.4 Environmental consequences

The project has commissioned Grontmij AB to carry out a comparison of the environmental impact of the 20-kronor banknote and a conceivable 20-kronor coin. Environmental impact has been examined in all phases of the life cycle up to handling by the public, including raw material production, manufacture, handling by the Riksbank, transportation into the community and destruction in the form of melting or incineration. The conclusions have been presented in the form of six impact variables: consumption of non-renewable energy (fossil fuels), emissions of greenhouse gases, emissions contributing to ground-level ozone, emissions of acidic substances, emissions of substances affecting eutrophication, and water usage.

In one scenario, the lifetime of the coin has been assumed to be 25 years and that of the banknote two years, at the same time as the volume of 20-kronor coins has been assumed to increase by 70 per cent over ten years. This rate of increase is equivalent to that of the 10-kronor coin over the last ten years. In this case, the result is that the 20-kronor banknote is better than the 20-kronor coin as regards five of the six variables studied. The coin is only preferable as regards eutrophication.

In a second scenario, the lifetime of the banknote has been reduced to one year and the growth rate of the coin has been reduced to 50% over ten years. The result is that the environmental impact of banknotes is greater than that of coins in terms of consumption of energy, eutrophication and water usage. As regards the other three impact categories, the coin continues to have a greater environmental impact, although the gaps have narrowed. The increased environmental impact of the banknote in the second scenario is primarily due to the increased rate

of production of banknotes due to their shorter lifetime.

An important factor in terms of environmental impact is the exploitation of raw materials, i.e. the production of cotton for banknotes and the extraction of metals for coins. Consequently, the selection of material has a relatively high impact on the result.

The assignment also included carrying out an overall assessment of the impact on the working environment. Grontmij states that the cultivation of cotton is an industry entailing significant risks from a health and safety perspective and that the extraction of metals is also a problematical branch of industry from a working environment point of view. As regards the working environment, manufacture of coins and manufacture of banknotes are relatively equal. The risk of robbery is greater as regards banknotes, while coins require heavy lifting in transportation and storage.

4.2.5 Qualitative aspects

The banknotes returned to the Riksbank for destruction are, as a rule, badly worn and many should have been destroyed significantly earlier. The consequence of this is that the 20-kronor banknotes in circulation are often far below the level of quality considered acceptable by the Riksbank. Poor quality banknotes are increasingly responsible for stoppages in machinery for sorting and counting.

A number of years ago, the Riksbank introduced stronger paper for 20-kronor banknotes. This improvement has probably meant that the time in circulation is slightly longer than it otherwise would have been, but the problem of worn banknotes has nevertheless increased.

In a survey of the public conducted in 2006, the 20-kronor banknote was the only banknote not considered to maintain good or very good quality, according to a majority of respondents. One in five considered that the 20-kronor banknote was of poor or very poor quality. In general, higher denomination banknotes were considered to maintain the highest quality. The 500-kronor banknote received the best rating and was considered to maintain good or very good quality by 81 per cent of respondents. The corresponding figure for the 20-kronor banknote was 45 per cent.

4.2.6 Security aspects

In 2009, just over 300 counterfeit 20-kronor banknotes were registered, equivalent to 30 per cent of all counterfeit banknotes. In comparison with many other countries, Sweden sees a low number of counterfeit banknotes. However, the low level of banknote quality makes it increasingly difficult to control the authenticity of banknotes. Consequently, the risk exists that counterfeit 20-kronor banknotes will be accepted by the retail industry to a much greater extent than at present.

Counterfeit coins are very unusual and only a few cases have been registered. Should coin denominations become higher than they are currently, an increased risk of counterfeiting may also arise. In general, it is easier to counterfeit a coin than a banknote, which features more advanced security details. If a 20-kronor coin were to be introduced, it could be provided with better security details than the present coins.

4.2.7 Costs

The replacement of the 20-kronor banknote by a coin would necessitate the adjustment or, in certain cases, replacement of the retail industry's closed cash-handling systems and other machinery for the handling of banknotes and coins. See also section 5.4 below.

Due to the coin's longer lifetime, the coin alternative would entail reduced purchasing costs for the Riksbank. If as many 20-kronor coins as banknotes were to be required in circulation, the average cost reduction would amount to a figure in the range of SEK 10 million per year at 2009's price level. If the introduction of a 20-kronor coin entailed a general improvement in the circulation of coins, savings would increase.

4.2.8 Neighbouring countries

The countries in Sweden's immediate geographic vicinity have long since introduced coins of a value approximately equivalent to SEK 20. The lowest banknote denominations in the Euro countries, Denmark, Norway, the UK and Switzerland are of values equivalent to between SEK 51 and 69. Sweden also has comparatively few coin denominations. The Euro countries have eight denominations, Denmark has six, Norway has five, the United Kingdom has eight and Switzerland has seven. If a 20-kronor coin is introduced, Sweden will have five coin denominations following the abolition of the 50-öre coin.

Table 3: The highest coin denominations and lowest banknote denominations in the Euro countries, Denmark, Norway, Switzerland and United Kingdom. Value of lowest banknote denominations in SEK, 18 January 2010.

4.2.9 The public and the cash market

In a survey conducted in 2006, 22 per cent of members of the public were very or quite positive towards the idea of a 20-kronor coin, while 66 per cent were quite or very negative. In comparison, 90 per cent were quite or very negative towards the idea of replacing the 50-kronor banknote with a coin.

Opinions are divided on the cash market. In their submission responses, the industry organisations Svensk Handel and Butikerna are negative towards the idea of a coin as this would entail changeover costs and because coins are heavier and more expensive to handle than banknotes. Other participants wish to see the introduction of a coin, as worn banknotes entail problems in sorting and authentication and lead to breakdowns and wasted time in cash handling.

4.3 Conclusions

Problems concerning the quality of the 20-kronor banknote have increased as the banknotes are being handled increasingly carelessly. This entails significant practical problems in cash handling and makes authentication more difficult. These problems increase as the value of the banknote declines. The improvements in paper quality that the Riksbank has made have not reduced these problems in any decisive manner. The public gives this banknote a lower quality rating than other banknote denominations.

A comparison of the environmental impact of the current 20-kronor banknote and a conceivable 20-kronor coin indicates that the differences are minor, but that a coin would have a slightly greater environmental impact under the conditions currently prevailing. However, a coin would be relatively preferable from an environmental point of view as the lifetime of the banknotes decreases.

Replacing the banknote with a coin would entail changeover costs for the retail industry and other segments of the cash market. At the same time, the coin alternative would imply reduced purchasing costs for the Riksbank. If a 20-kronor coin were to lead to an improvement in coin circulation, this would also imply reduced purchasing costs for other coin denominations.

Most countries in Sweden's geographical vicinity have long opted for a lowest banknote denomination of considerably greater value than SEK 20.

All in all, the project considers that the quality of the 20-kronor banknote is no longer acceptable. Even if the banknote could remain in use for a few more years, developments are inevitably leading towards the necessity of replacing the banknote with a coin, due to the fact that its lifetime has become unreasonably short and it can no longer function as a means of payment. Consequently, the project considers that the Riksbank should take the decision to replace the 20-kronor banknote with a coin.

5. Design of banknotes and coins

5.1 Security aspects

The level of security of the present banknote series has been upgraded on a number of occasions. For example, the 50, 100 and 500-kronor banknotes have been provided with foil strips and the 1 000-kronor banknote with a

security detail known as 'motion' (a moving image in the striped band). The present level of security is considered satisfactory, at the same time as Sweden also sees a small number of counterfeits compared with many other countries.

However, printing and copying technology is developing rapidly and opening up new possibilities for advanced banknote counterfeiting. Several larger currency areas are presently facing large-scale counterfeiting problems, with many of the counterfeits being highly sophisticated.

Effective protection against counterfeiting is an issue of public confidence in banknotes as means of payment and is thus of major significance for all central banks. Most countries upgrade their banknote series on an ongoing basis or introduce new banknote series.

In Sweden's geographical area, the euro countries are preparing an upgrade of euro banknotes with new security details. The schedule has not been determined, but the aim is for this to be implemented during the coming years. Denmark started to introduce a new banknote series with new motifs and security details in 2009. A new banknote series is also being prepared in Switzerland.

The project deems that the Riksbank will need to undertake a more comprehensive upgrade of the security of Swedish banknotes within a period of approximately five years if the level of security of the banknotes is to continue to be satisfactory and comparable to that of neighbouring countries. The age of the banknote series, 25 years, means that the possibilities of adding additional, more advanced security details to the existing series are limited. Security considerations argue that a new banknote series is required.

Counterfeit coins are highly unusual in Sweden. The risk of counterfeits is deemed to continue to be low.

5.2 Practical aspects

In general, Swedish banknotes function well in practical usage. However, due to the age of the banknote series there are possibilities for modernisations that would improve functionality and reduce costs.

The banknotes have a relatively large format. Their dimensions do not follow a logical progression of size in that the format of the 50-kronor banknote deviates from that of the other denominations. The colour scale, intended to make it easy to distinguish the denominations, is unclear. The design is professional, but, for natural reasons, no longer completely modern.

The coins also generally function well in practical usage. However, by modern standards, they are large and heavy, making purchasing and handling costs considerably higher than necessary. The environmental impact of production and transportation could also be reduced by the introduction of smaller and lighter coins. The 5-kronor coin, in particular, has a large format and is expensive to purchase as there are only a few suppliers of the raw materials used.

5.3 Adaptation of new denominations

When a new 2-kronor coin, a 20-kronor coin and a 200-kronor banknote are introduced, these denominations must fit into the banknote and coin series in such a manner as to function in practical usage. If this is to be carried out without altering other banknotes and coins, the design of the new banknotes and coins must conform to that of the existing ones. This means that their security standards and graphic design must be similar.

As the existing banknote and coin series needs to be modernised, strong arguments exist for carrying out such modernisation in conjunction with the introduction of new denominations. Carrying out several changes simultaneously will help keep changeover costs down.

5.4 Costs for the cash market

In the event of a cash changeover, the retail industry, banks and cash-in-transit companies will be required to adjust and, in certain cases, replace machines and systems such as ATMs, cash-handling systems and currency-counting machines. A replacement would also entail costs for transportation, stock-keeping and so on, as well as

information initiatives aimed at employees and customers.

The consultations held by the project with suppliers indicate that ATMs for banknotes will probably be relatively straightforward to adjust to new denominations, assuming that the new banknote formats do not deviate radically from the current ones. However, in total, this may still be a matter of a not insignificant non-recurring cost, as there are just over 3 000 ATMs in Sweden.

According to suppliers, modern systems for closed cash handling systems in the retail industry have the capacity to handle a 20-kronor coin. However, the systems would need to be adjusted. Older systems have lower capacity and would need to be replaced if a 20-kronor coin were to be introduced. However, the great majority of the country's shops do not have automated systems, but use manual cash handling.

Coins are also used for purposes other than making payments, such as in supermarket trolleys and storage lockers, which will need to be adjusted to the new conditions.

The Riksbank sees reason to plan a changeover in close collaboration with the cash market to minimise changeover costs.

5.5 Costs for the Riksbank

The Riksbank's costs for replacing the banknote series can be estimated with a reasonable degree of probability, as the number of new banknotes needed will probably be approximately equivalent to the number of old ones. Costs for replacing the coin series are harder to assess, as it is uncertain how many new coins will be needed in practice. Many of the coins issued by the Riksbank have probably been lost or worn out.

Replacement costs will depend upon whether the Riksbank chooses to actively withdraw and declare invalid older banknotes and coins or whether older banknotes and coins will be permitted to circulate in tandem with the older ones for a specific period of time or until worn out.

If older banknotes and coins are withdrawn and declared invalid, the project estimates costs for the replacement of banknotes of SEK 200-250 million and for the replacement of coins of SEK 500-600 million. It is more expensive to replace coins as there are significantly more of these than banknotes. These costs would be allocated over a period of approximately five years. Costs would be significantly lower if older banknotes and coins were not to be withdrawn.

If older banknotes and coins are declared invalid, the costs of a new banknote and coin series will be financed by the incomplete return to the Riksbank of invalid banknotes and coins. As an example, during the withdrawal of the silver 50-öre coin and older versions of the 20, 100 and 500-kronor banknotes in 2005, the Riksbank received approximately one-third of the coins and approximately two-thirds of the banknotes back. The banknotes and coins remaining after the expiry of the redemption period are eventually written off, which has a positive effect on the Riksbank's earnings.

Unit costs for the purchase of coins will be reduced if a new coin series is introduced. Unit costs for banknotes will probably increase slightly, as any new banknotes would be given more advanced and more expensive security features than at present.

5.6 Time aspects

The project deems that the process of planning and introducing a new banknote and coin series would take approximately five years from the date of decision to the entry into circulation of the final banknotes and coins. The entire replacement would thus be completed by approximately 2015.

In order to minimise the costs, the whole future design of the banknote and coin series should be determined before any implementation process is started, so that machinery and systems need be adjusted only once. Large volumes of cash will be transported and stored when old banknotes and coins are withdrawn and new ones issued. Consequently, in addition to cost aspects, the decisive factors for scheduling will be logistics and security.

The question of Sweden's adoption of the euro is raised at recurring intervals. Bearing this is mind, it would be

appropriate for the costliest changes to be scheduled for the end of the implementation process.

5.7 Risks

A replacement of the banknote and coin series would be a comprehensive process entailing risks for security and costs etc. A risk analysis is presented in Appendix 3.

5.8 Conclusions

In the coming years, a renewal of the banknote series will become necessary to maintain effective protection against counterfeiting. A renewal of the coin series is necessary to obtain lighter and smaller coins, which would reduce purchasing and handling costs and entail reduced environmental impact.

The fact that the banknote and coin series will be increased by two new coins and one new banknote suggests that this would be an appropriate point at which to make comprehensive changes, particularly considering that the present banknote and coin series has been in use for a long period of time.

The introduction of a new banknote and coin series implies changeover costs for the retail industry, cash market companies and the Riksbank. Even if these costs will be significant, it is more cost effective to make many changes at the same time and in one context.

Against this background, the project deems that there are overwhelming arguments for the Riksbank to implement a renewal of the entire banknote and coin series.

APPENDIX 1

Review of the banknote and coin series – project description

Background

Questions constantly arise in cash handling regarding the design of banknotes and coins and the choice of denominations etc. Such questions have repeatedly been collated and reported to the Executive Board, most recently in 2004.

The essential features of the Swedish banknote and coin series have remained unchanged for a lengthy period of time. For economical and practical reasons, the Riksbank has chosen to implement increasingly minor adjustments and improvements.

A number of proposed changes have arisen since the most recent report. The Administration Department's assessment is that these should not be treated separately, but should be collected into one context as parts of a comprehensive review.

It is suggested that this review be implemented in project form, in accordance with the following. The General Council of the Riksbank was informed on 8 February 2008 and is to receive ongoing information on the project.

Objectives and definitions

The project's objective is to design a banknote and coin series that is appropriate from the perspective of efficiency, environment and security, and which has the capacity to remain unchanged for at least a five year period as a main characteristic.

There currently exist no practical problems justifying a completely new banknote and coin series. Consequently, the project has taken the approach that the motifs and other elements of graphic design in existing banknotes and coins should remain unchanged. However, it cannot be ruled out that the issue of a new banknote and/or

coin series has arisen as a consequence of the changes proposed.

Within this framework, all aspects are to be tested, including need, environmental and security aspects, cost aspects and technical design. The effects of the changes on payment patterns as a whole are to be described.

Schedule

The project was initiated in March 2008 and is estimated to run for 2–3 years, depending on the extent of the changes. The work is to be divided into stages, with reporting taking place on an ongoing basis to enable regular interim decisions.

This timeframe assumes that changes of banknotes and coins, as a rule, take a longer period of time to implement, due to their social consequences. Certain measures may require decisions from the Riksdag.

Initially, a schedule will be prepared stating the rate at which sub-issues are to be handled and which aspects are to form the basis of the analysis work. This schedule is to be presented to the Executive Board for decision in the spring of 2008.

Cooperation and communication

The process is to be open, with recurring external information events.
The views of the public will be taken into account.

This work is to be performed in collaboration with participants in the cash-handling industry. Consultation regarding the design of banknotes and coins is also to take place with other affected interested parties.

The Riksbank's own analytical expertise is to be utilised to the greatest extent possible. External expertise may need to be engaged for certain studies.

Organisation

The planned organisation of the project is as follows:

Project budget

Project expenses will be charged to the Administration Department's working budget.

Proposed decision

It is proposed that the Executive Board resolves

– to assign the Administration Department to implement a review of the banknote and coin series in accordance with the proposals above, and

– to assign the Administration Department to report back to the Executive Board during the second quarter of 2008 with an overall schedule for the project.

* Peter Kvist was replaced as chairman by Christina Wejshammar in February 2010.

APPENDIX 3

Risk analysis

PAYMENT PATTERNS

Risk	Consequences	Probability *	Measures	
Card payments increase	Banknotes and coins become less		Low.	None.

significantly faster than expected.	important as means of payment.

ACCEPTANCE

Risk	Consequences	Probability *	Measures
Changes are poorly accepted by the public and cash market.	Effects fail to arise as new denominations are not available and are not fully utilised.	Low.	Dialogue with cash market. Information to the public.
The public develops a negative attitude due to practical problems with new banknotes/ coins or criticism of their design.	The Riksbank's reputation is impacted negatively. Effects fail to arise as new banknotes and coins are not utilised fully.	Low.	Information to the public. Thorough planning. Openness in the implementation process.

SECURITY

Risk	Consequences	Probability *	Measures
Increased counterfeiting as the public is unfamiliar with new security details.	Decreases confidence in banknotes and coins.	Low.	Information to the public and cash market. concerning security details.

TIME AND COSTS

Risk	Consequences	Probability *	Measures
Costs are greater than expected.	Profits from the changes are less than expected. The Riksbank's reputation is impacted negatively.	Medium	Thorough planning and budgeting.
Implementation takes longer than expected.	Practical problems and increased costs. The Riksbank's reputation is impacted negatively.	Medium	Thorough planning and generous time frames.

* Scale: Low-Medium-High