RIKSGÄLDS KONTORET
THE SWEDISH NATIONAL DEBT OFFICE

REPORT
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Duration, Maturity Profile and the Risk of Increased Costs for Central Government Debt

1. Introduction

The goal of central government debt management is to minimise long-term costs while taking into account risk. In this context, risk means unexpected and sharp increases in annual interest costs. Today the Swedish National Debt Office uses two measures to limit this risk. Firstly, we have a duration target of 2.7 years. Since this duration target can be achieved in different ways, there is also a restriction on how much of total debt may fall due for payment during the next twelve-month period. Today this restriction on the maturity profile has been set at 25 per cent.

During 2002, the Debt Office has tried to develop its thinking about how duration and the maturity profile are related and how they affect expected costs and risks. This report present part of the analysis and the insights achieved. The report contains no new proposed guidelines, but should be regarded as an account of ongoing efforts to improve controls on central government debt management, in keeping with the task assigned in the Government's letter of instruction.

The report has two main parts. The first part (Section 2) discusses in a non-technical way what factors determine the risk of increased costs in government debt. This part begins with a review of three important concepts: redemptions, refinancing and interest rate refixing. Then it analyses which characteristics of the debt portfolio affect risk, and what indicative conclusions we can draw for future guidelines on the maturity profile.

The second part (Section 3) contains a quantitative analysis of how debt issuance patterns, duration and maturity profile are related and how they, in turn, can be connected to the costs and risks of a portfolio. This analysis is based on stylised, "steady state" portfolios.

Unless otherwise stated, the arguments in both parts of the report are based on nominal krona-denominated debt.

2. The risk of increased interest costs – qualitative arguments

2.1 Redemptions, refinancing and interest rate refixing

Redemptions, refinancing and interest rate refixing are three central concepts in government debt management. Redemptions are simply the part of the debt that falls due for payment during a given period. Refinancing is total borrowing during the same period, and interest rate refixing, finally, refers to the part of the debt whose interest rate will be changed during the period. Interest rate refixing usually occurs by issuing government securities at market interest rates, but it may also refer to a contractual adjustment in the interest rate on an existing loan.

Firstly, we can say that redemptions and refinancing are often *almost* but seldom *exactly* the same amount. As soon as the net borrowing requirement differs from zero, refinancing will differ from maturities. For example, if the net borrowing requirement is negative, due to a budget surplus, the volume of borrowing will be less than the volume that falls due for payment. In relation to the total volume of maturities, however, the difference is generally rather small. During 2002, for example, the Debt Office's net borrowing requirement is projected to be SEK 25 billion, compared to total maturities of around SEK 350 billion.

Another, more important aspect is that there may be a major difference between how large a percentage of the debt is refinanced and how large a portion of the debt has an interest rate refixing. This is true, for example, if there are loans with long maturities but variable interest rates, or if interest rate swaps are being used.

In connection with refinancing and interest rate refixing, the concepts of *refinancing risk* and *interest rate refixing risk* are also used. These terms are often used as synonyms, but for the sake of clarity we should be careful to distinguish between them. Strictly speaking, refinancing risk refers to the risk that the central government will not succeed in borrowing to cover its maturing loans, or will have to pay very high interest rates in order to persuade investors to lend it any money. This risk primarily affects developing countries or countries with very high debt and low confidence in official economic policy. At present, refinancing risk does not appear to be a significant risk in the case of Sweden, but it can be noted that as late as the mid-1990s this concept was not entirely academic (for example, in 1994 the head of Skandia insurance company, Björn Wolrath, announced that he was unwilling to buy more Swedish government bonds until something was done to control galloping budget deficits).

What refinancing risk instead often *means* is the risk that the interest rate on a large part of the debt will be refixed when interest rates are unfavourable. The parameter in the central government debt portfolio that controls this risk is neither the quantity of maturities or refinancing, but how large a part of the debt will be subject to interest rate refixing. This risk should therefore be labelled *interest rate refixing risk*.

To illustrate the difference between refinancing risk and interest rate refixing risk, imagine that the entire debt consisted of ten-year floating rate notes. FRN loans have long maturities, but the interest rate is reset at quarterly intervals. In this case, every year, we would borrow one tenth of the value of the debt in a new ten-year FRN loan. The central government debt portfolio would then have a relatively low *refinancing risk*, since the Debt Office would only need to refinance one tenth of the debt every year. However, *interest rate refixing risk* would be very high, since the interest rate on the entire debt is refixed every three months. Conversely, imagine another government debt portfolio, where all borrowing is in the form of three-month Treasury bills, and the borrower meanwhile carries out interest rate swaps where it pays a fixed rate for ten years and receives a three-month floating interest rate. Such a portfolio would have high *refinancing risk*, since the entire debt is borrowed again every three months, but low *interest rate refixing risk*, since only the interest rate on one tenth of the debt is refixed every year.

It is primarily interest rate refixing risk that should be limited, i.e. the risk that interest rates will need to be refixed at high levels. The control system should therefore focus on how large a part of the debt is subject to interest rate refixing during a given period. Given the existing (krona) debt, interest rate refixing is the same thing as refinancing, since interest rate swaps are not used *within* this krona debt.[1] However, the percentage of interest rate refixing in the debt may be somewhat larger or smaller than the percentage of maturities, due to the net borrowing requirement.

2.2 What affects the risk of increased interest costs?

The risk of increased interest costs on government debt is affected in the short-term perspective by several factors:

1. How volatile are market interest rates?
2. How large a percentage of debt will undergo interest rate refixing?
3. How is the volume of interest rate refixing distributed over the period?
4. For what maturity period will interest rates be fixed?

The first two factors are obvious. The larger either of them is, the greater the risk of increased costs. In principle, we can say that if one of these factors is zero, the risk is also zero. However, the first factor is independent of government debt portfolio structure. We can therefore ignore it and concentrate on the other factors.

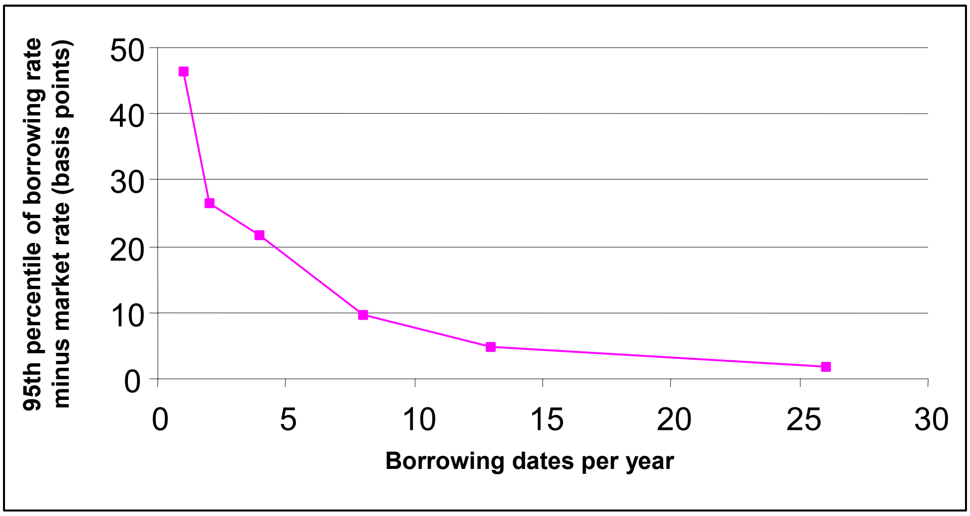
For factor two, we can note that it concerns the percentage of the debt that will undergo a change in *interest rates*. In Sweden's case, this is the same thing as the percentage of refinancing and almost the same as the percentage of maturities. However, how much of total debt will undergo a refixing of interest rates does not reveal the entire risk picture. After thinking it over a few times, it is clear that factors three and four also affect risk.

Looking at the third factor, the risk is larger if a whole year's interest rate refixing is concentrated, for instance during a single month, than if it is uniformly distributed over the whole year. The more dates that interest rate refixing is distributed among, the less risk there is that a large proportion of interest rates will be refixed on dates when the interest rate situation is unfavourable.

[1] To date, the Debt Office has used krona interest rate swaps exclusively to create foreign currency exposure. This means that the floating interest on the krona swap is exactly equivalent to one of the cash flows in a currency swap.

This factor can be illustrated by a simple simulation example. Assume that the interest rate at the beginning of the year is five per cent. We do not know how this will change during the year, but we estimate that there is a 67 per cent probability that it will be between four and six per cent at the end of the year.[2] If we borrow at a uniform pace during the year, the average borrowing rate will be the same as the year's average market rate. This may be regarded as a form of neutral behaviour – if we have no view of interest rate changes, it is just as well to borrow at a uniform pace. However, if we borrow everything on one date during the year, we run the risk that the interest rate will be significantly higher than the average market rate during the year. The more concentrated the borrowing is, the greater the risk that the outcome will deviate from the average value. The chart below shows how much higher the average borrowing rate may be on the very same loan volume, given different numbers of borrowing dates.

Figure 2.1 Potential extra cost of concentrating borrowing to fewer dates



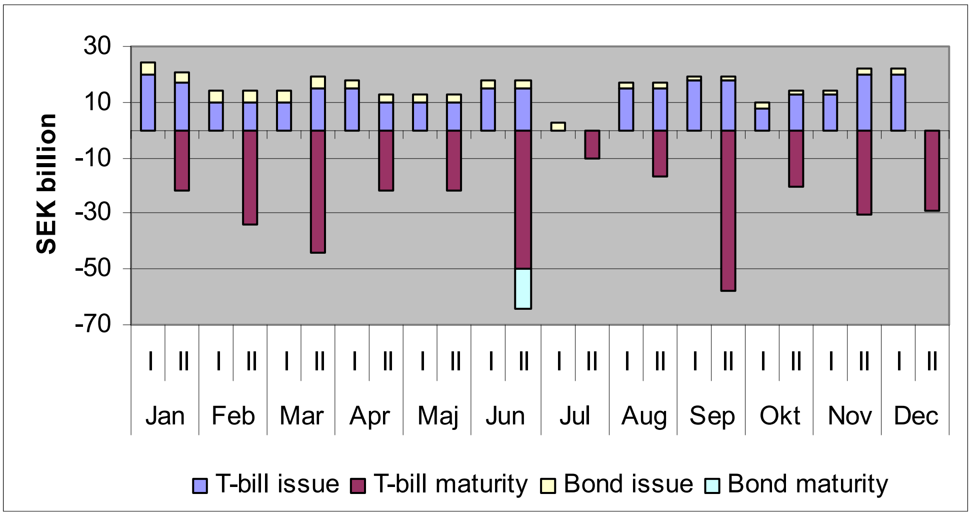
The chart shows that if the borrowing for the entire year is done on a single date, there is a five per cent risk that the issue rate will be 45 basis points higher than it would have been if the same borrowing volume had been distributed uniformly over the year. As we can expect, the potential extra cost decreases as the number of borrowing dates increases. Given more than 25 borrowing dates in one year, in principle the extra cost is nonexistent.

In its proposed guidelines for 2002, the Debt Office pointed out that one shortcoming of the existing maturity profile is that it does not regulate how *maturities* are distributed over the year. However, the above argument indicates that it is not so much the distribution of maturities that must be restricted, but rather how *borrowing* is distributed over the year. Note, however, that the Debt Office's established auction pattern, with its

[2] In technical terms, the interest rate is assumed to follow a stochastic process with no drift and a standard deviation of one percentage point.

uniform distribution of issue volumes over the year, means that in practice, this risk factor has already been addressed. Treasury bills mature once a month, while auctions take place every two weeks. When it comes to bonds, this is even clearer. The Debt Office generally has only one bond maturity per year, while there are auctions every two weeks for bonds as well. The chart below shows maturities and issues month by month for bills and bonds, respectively, during 2001.

Figure 2.2 Maturities and issues of Treasury bills and bonds during 2001



The refinancing profile is thus considerably more uniform than the maturity profile. One conclusion is that there is reason to continue with our frequent auctions, as long as this does not mean that the volumes auctioned are so small that there is declining interest in submitting bids.

The last factor on the above list – for what period shall interest rates be refixed – also plays a certain role for the risk in central government debt management. Assume, for example, that 20 per cent of the debt must be refixed during a period when interest rates are unfavourable. Then it is naturally worse to borrow in the form of a ten-year bond than in a one-year Treasury bill. In the first case, high costs are locked in over a long period. In the latter case, there is a possibility that interest rates will have fallen again by the next interest rate refixing. This argument is valid on the condition that interest rates are temporarily high and not in an upward trend.

What should thus be avoided is to have large volumes of long-term refinancing concentrated in a short period of time. However, if time to maturity is short, a large percentage of refinancing may be acceptable from a risk standpoint, since we are thus not locking in high interest rates for such a long time.

This argument has a direct bearing on the Debt Office's portfolio. Every year, between 25 and 30 per cent of the debt is rolled over.[3] But this borrowing consists mainly of an outstanding stock of Treasury bills that is rolled over for a year at a time. Only around five per cent of the debt is rolled over to long maturities. It is important to realise that even if 30 per cent of the value of the debt is refixed every year, 60 per cent is *not* refixed in a two-year perspective. This is because most of the borrowing during year two is a rollover of what was borrowed during year one. Using stylised figures, over the two-year period about 35 per cent of the debt is rolled over: 25 per cent in rolling Treasury bills plus two times 5 per cent in long-term borrowing. This means that a sharp, temporary upturn in interest rates would affect costs noticeably in the short term, while its medium- and long-term effects would be limited.

2.3 Indications for the maturity profile restriction in the future

The purpose of the existing restriction on the maturity profile is to reduce the risk of cost increases by limiting the percentage of the total debt that may *mature* every year. As discussed above, the percentage of maturities is perhaps not the best indicator of how large the cost increase may be. Instead, what is crucial is how large a proportion of the debt undergoes interest rate refixing. Theoretically, we should switch to limiting the share of interest rate refixing, or the share of refinancing. In practice, however, the share of maturities serves as a good indicator of how much is subject to interest rate refixing. As long as the net borrowing requirement is in the range of SEK ± 25 billion per year and we do not use FRN loans or interest rate swaps in krona debt, the share that we expose to interest rate refixing will largely coincide with the total volume of maturities. In addition, the percentage of maturities is measurable and lies within the Debt Office's control, while the percentage of refinancing and interest rate refixing is based partly on an estimate of the borrowing requirement and is partly affected by factors beyond the control of the Debt Office. Practical consideration therefore point towards continuing to limit the percentage of *maturities*. If the borrowing requirements become larger, or if the Debt Office begins to use loans with floating rates, this may be re-assessed.

According to the existing guidelines, in normal cases no more than 25 per cent of the debt may mature within the next year. Is 25 per cent a reasonable level, and what does it mean for the risk in the government debt? Let us use today's central government debt, SEK 1,100 billion, as a point of departure. For the sake of simplicity, we will also assume that the share of maturities, 25 per cent, also corresponds to the percentage that will be subject to interest rate refixing. If market interest rates rise sharply at the beginning of the year, for example by three percentage points, the interest rate on 25 per cent of the debt will be three percentage points higher at the end of the year than at the beginning. In terms of kronor, it

[3] Aside from the very shortest-term borrowing, liquidity management.

will mean a cost increase of more than SEK 8 billion (1,100×25%×3%). This represents around 10 per cent of the reported costs of central government debt on a cash basis during 2001. It is interesting to compare this potential cost increase to the criterion in the European Union's Stability Pact that the government budget deficit may not exceed three per cent of GDP. In Sweden's case, today three per cent of GDP represents more than SEK 60 billion. Given the budget deficits that the Government forecasts over the next few years, even such a sharp increase in interest rates as three percentage points would not threaten to approach this budget deficit ceiling.

In this perspective, it may seem as if the 25 per cent limit is rather tight. After all, the maturity profile places restrictions on the duration that the Debt Office may reach: the higher the percentage of annual maturities that is acceptable, the lower the duration may be. By easing the existing limit, in principle the Debt Office could lower duration and thereby lower the costs of central government debt.[4] On the other hand, SEK 8 billion is a large amount in absolute terms. In addition, it is possible to argue that the limit on maturities should not be set on the basis of a situation where the central government's finances are in balance. Instead, we should assume a budget situation that is strained for other reasons when we try to limit the risk of upturns in the interest costs of government debt. Viewed in this perspective, 25 per cent seems well balanced.

The Debt Office has previously pointed out that the existing maturity profile does not regulate how maturities are distributed over the year. However, the argument in Section 2.2 shows that the way borrowing is distributed is the important thing in determining risk. The Debt Office's weekly auctions mean that its borrowing is uniformly distributed over the year. There is thus no reason to make the existing maturity profile restriction more detailed. Instead, one guideline may be that the Debt Office should continue to distribute its borrowing uniformly over the year.

A final aspect of the existing maturity profile restriction is that, as now formulated, it only limits the percentage of the debt that may mature during the coming year. It does not capture how the debt is distributed over longer maturities. Here too, however, the established issuance policy deals with this risk. For many years, the Debt Office has endeavoured to maintain a uniform distribution of outstanding bonds among different maturities. This is a natural element of sound central government debt management. Having a quantitative restriction on the distribution of longer maturities therefore seems superfluous.

[4] This is described in greater detail in Section 3.1.

2.4 Conclusions of qualitative arguments

What determines the risk of increased interest costs is how large a proportion of the debt is subject to interest rate refixing each year. Given the existing nominal krona debt, the percentage that is subject to interest rate refixing is the same thing as the share of refinancing, but this may differ slightly from the share of maturities, due to the net borrowing requirement. Given the total interest rate refixing during a period, the risk is also affected by how this refixing is distributed over the period. More borrowing dates will mean lower risk. The time to maturity of the borrowing is also important. A large percentage of borrowing each year is less serious if it is largely carried out in short-term maturities.

The Debt Office rolls over a large percentage of its debt each year. However, its established pattern of weekly auctions means that borrowing is well distributed over the year. In addition, a large proportion of borrowing is for a shorter period than one year. Taken together, the Debt Office therefore has good management of its interest rate refixing risk. This is not primarily a result of the existing maturity profile restriction, but of the Debt Office's issuance policy, which have been established for many years.

The indications for future guidelines are that the existing maturity profile restriction may be retained, but that there is no reason to specify how maturities may be distributed within one year. Nor is it necessary to specify quantitatively how maturities may be distributed beyond one year. Given today's stable central government finances, it might be conceivable to raise the limit on how much of the debt may mature during the coming year. This might lower the costs of government debt, since it would allow a larger percentage of short-term borrowing. However, the absolute size of the cost upturns that may then occur, as well as the fundamental purpose of the maturity profile restriction, indicate that the existing 25 per cent level is reasonable.

3. Quantitative studies of stylised portfolios

As the Debt Office has pointed out earlier, duration is far from crystal-clear as a description of how a portfolio is structured. A given duration can often be achieved in many different ways. The question is what associations there are between duration and maturity profile, and how these two factors affect expected costs and risks.

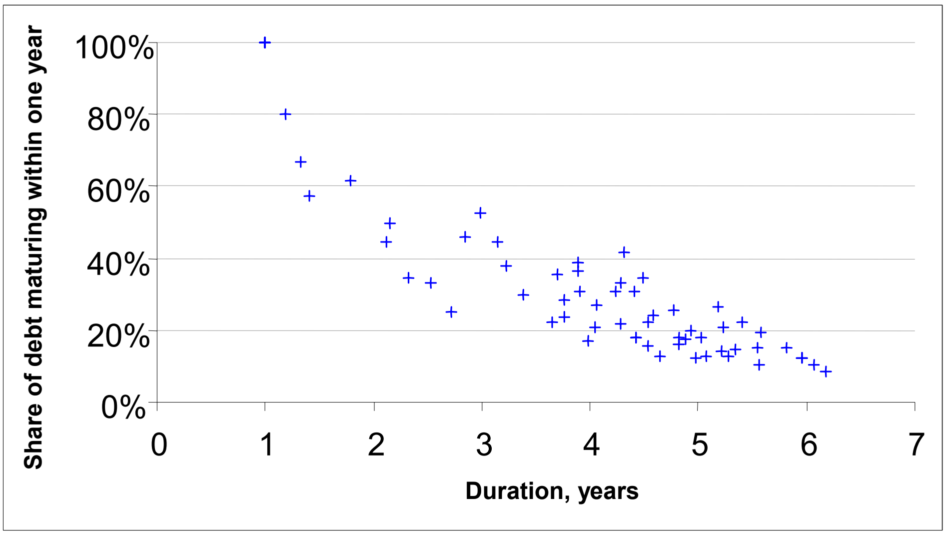
One way of analysing these associations is to study so-called steady state portfolios. Here a steady state portfolio means a portfolio whose maturity profile does not change over time. If we assume that the net borrowing requirement is zero, so that the size of the debt does not change over time, we can show that every steady state portfolio can be connected to a unique distribution of debt issues with different maturities. The converse is also true: a given (static) issue profile will sooner or later lead to a maturity profile that does not change. One important characteristic of a steady state portfolio is that there is no difference between redemptions, refinancing and interest rate refixing, in a given period of time.

The Debt Office has developed a model for studying this type of portfolios. In the model, we can issue debt with maturities of 1, 2, 5, 10 and 15 years. The model has been used in order to study 60 issue profiles and their accompanying maturity profiles.[5]

3.1 Associations between duration and maturity profile

Firstly, the study confirms that the connection between duration and maturity profile is not unambiguous. Two portfolios, in principle with the same duration, may have completely different maturities in the first year. If we plot the share of maturities in year one against duration for all 60 portfolios, the result is the following chart.

Figure 3.1 Association between maturity profile and duration



As the chart illustrates, there is an association between duration and maturity profile. Generally speaking, the higher duration is, the smaller is the percentage of debt that matures each year. It would be possible to fit a "negatively sloping" curve to the cluster of dots. However, the point is that it would not be a perfect fit. With the naked eye, we see that the very same duration may correspond to *differences* of 15 – 20 points in the percentage of annual maturities. The table below shows shares of debt issues and maturity profiles for two portfolios with the same duration, but completely different maturity profiles.

[5] Unless otherwise stated, the calculations in this section are based on a linear yield curve with a one-year yield of 4 per cent and a ten-year yield of 5.5 per cent. When the cost is expressed in kronor, it is calculated on the basis of a debt of SEK 750 billion, which represents the size of the nominal krona debt.

Table 3.1 Issue percentages and maturity profiles for two portfolios with the same duration

Issue percentage			Steady state maturity profile		
Maturity	Portfolio A	Portfolio B	Segment	Portfolio A	Portfolio B
T-Bills	75%		<1 yr	46%	20%
2 yrs	8.3%		1 - 2 yrs	12%	20%
5 yrs	8.3%	100%	3 - 5 yrs	23%	60%
10 yrs	8.3%		6 - 10 yrs	19%	
15 yrs			> 10 yrs		
			Duration (years)	2.82	2.81
			Yearly refinancing	46%	20%

Observe that in portfolio A, duration is created by borrowing a large percentage of the debt in short-term maturities, plus small percentages in long-term maturities. Borrowing is *dispersed* in terms of maturities. In portfolio B, however, only a five-year bond is issued. In this case, borrowing is *concentrated* in terms of maturities. Generally speaking, the more dispersed borrowing is over different maturities (and especially towards the shortest- and longest-term maturities), the larger the percentage of maturities during the first year will be, at a given duration.

It is worth noting that if the goal is to have a low duration, we cannot avoid having a relatively high percentage of maturities each year. For example, it is impossible to have a two-year duration and at the same time limit annual refinancing to 10 per cent. The table below shows the highest and lowest duration, respectively, that can be achieved with different maturity profiles.[6]

Table 3.2 Possible combinations of maturity profiles and duration

	Percentage maturing each year						
Duration, yrs	10%	20%	25%	30%	40%	50%	60%
Lowest	4.8	2.8	2.6	2.4	1.9	1.5	1.4
Highest	6.1	5.5	5.3	5.0	4.4	3.8	3.3

The table shows that with a maturity profile restriction of 25 per cent, we cannot achieve much lower duration than 2.6 years.[7] It is important to understand this when duration goals and maturity profiles are established, so that they do not conflict with each other.

[6] The figures are calculated in the stylised model; in reality they may be slightly different. However, the conclusion is fairly independent of assumptions on the slope and level of the yield curve.

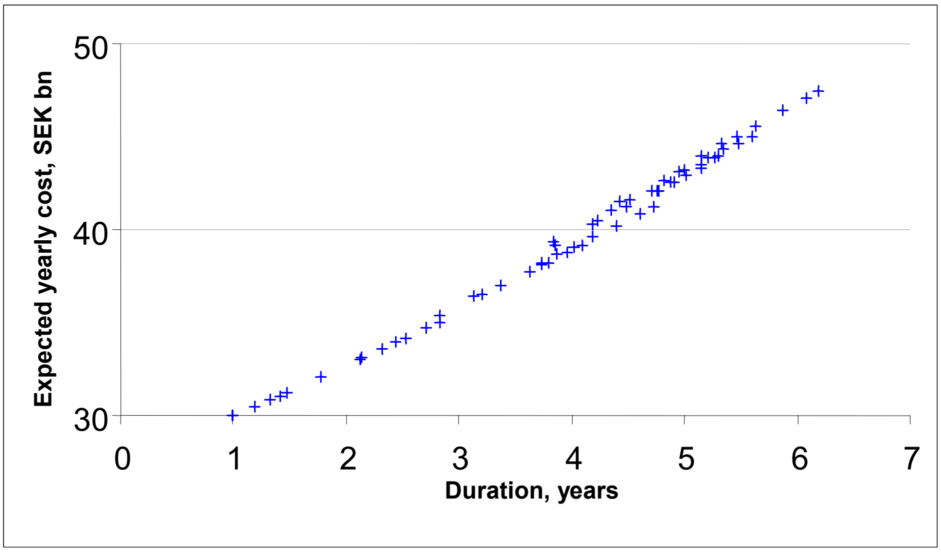
[7] Note that by using derivatives, we can achieve a combination of two-year duration and a maximum of ten per cent maturity per year, for example. But then the connection between the percentage of maturities /refinancing, on the one hand, and interest rate refixing, on the other hand, ceases. Since the latter is what controls the risk of increased costs, nothing has been gained.

3.2 Costs and risks

It is generally known that lower duration leads to lower costs in case of a normally (positively) sloping yield curve. The question is how strong the connection is between duration and expected costs. We can study this, as well as the connection between duration and interest rate refixing risk, in the stylised portfolio model.

It turns out that duration is a good indicator of expected costs, especially for duration figures of up to three years. This is true despite the fact that the duration figure per se does not define exactly how the borrowing is distributed over different maturities. If the yield curve is linear, there is a strong and linear association between duration and expected cost (see the figure below). However, if the yield curve is concave, this association is weakened somewhat. In the case of normal[8] concavity, we can note a difference in expected costs of around SEK 1 billion per year for portfolios with the same duration. The reason is that when the yield curve is concave, we can achieve a given duration more cheaply by borrowing with a combination of short-term and long-term maturities than by borrowing everything in medium-term maturities. The more pronounced the concavity is, the stronger this effect will be.

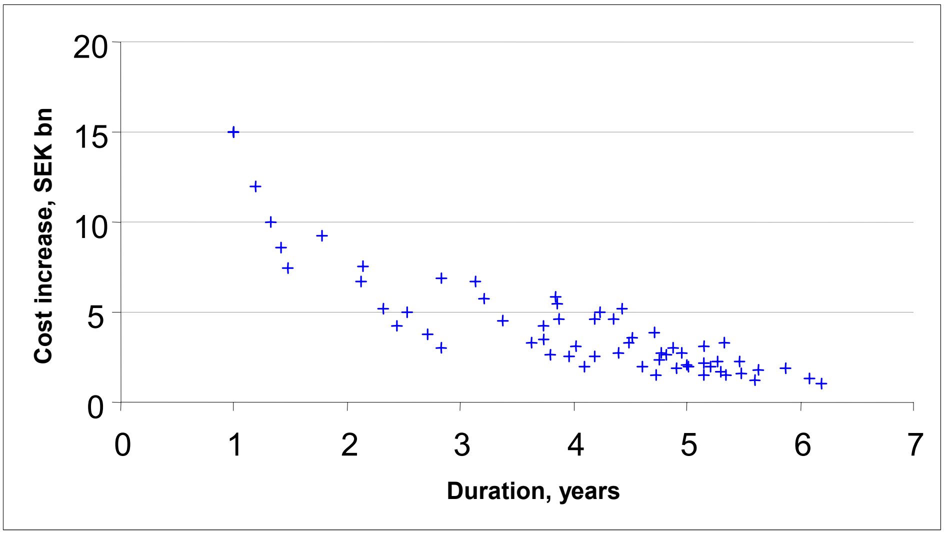
Figure 3.2 Expected cost as a function of duration



How good, then, is duration as an indicator of risk? First and foremost, we must define what is meant by risk. In this simple model, risk is defined as the cost increase in a one-year perspective when interest rates rise by two percentage points over the entire yield curve. The chart below shows risk against duration for the analysed portfolios.

[8] In this case, concavity is defined as the difference between the five-year interest rate on the yield curve and an interpolated five-year rate between the one- and ten-year points on the same curve. Since 1997, this has varied between –10 and +70 basis points for the Swedish government securities curve, with an average of about 25 basis points.

Figure 3.3 Risk of increased costs as a function of duration



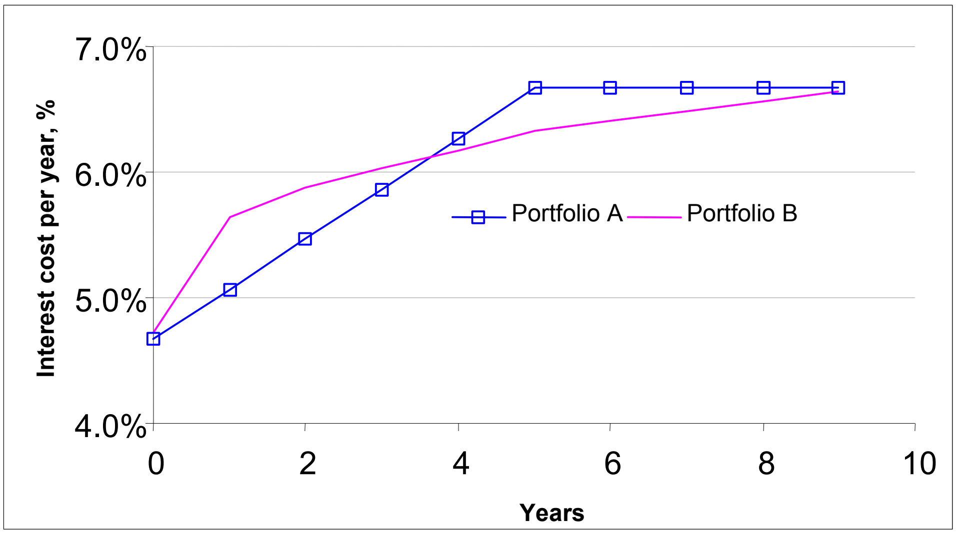
Here the association is significantly weaker than between duration and cost. Two portfolios with the same duration may react very differently to the very same interest rate upturn. Given a duration of around three years, it may differ by as much as SEK 4 billion. This is because what determines the risk of a cost upturn is not primarily the duration, but how large a proportion of the debt is borrowed during the period. A portfolio with large yearly refinancing responds more quickly to an interest rate upturn. As we have seen above, the percentage of yearly refinancing at a given duration will be larger, the more dispersed the borrowing is among different maturities.

If a given duration is achieved by concentrating borrowing to the endpoints of the yield curve (a "barbell" borrowing strategy), the risk of cost upturns will consequently be larger than if the same duration is achieved by concentrating all borrowing in the medium-term segment of the yield curve ("bullet" borrowing). Also note that given the concavity that the yield curve often shows, there is a trade-off between the cost saving we can achieve with a barbell borrowing strategy and the higher risk that this type of borrowing entails.

Medium- and long-term risks

In practice, risk is not only how much our costs may climb in a one-year perspective. We are also interested in how the costs of different portfolios change over a perspective of several years in case of a sharp upturn in interest rates. There is a dynamic here worth noting. The chart below shows how the annual costs change for portfolios A and B on page 10. Both still have a duration of 2.8 years, but a completely different share of annual maturities: 20 and 46 per cent, respectively. The cost adjustment is calculated for a persistent interest rate upturn of two percentage points.

Figure 3.4 Cost adjustment for two portfolios with the same duration



In the first year, costs rose faster in portfolio B, which is thus the portfolio with the larger share of annual refinancing. But note that after only one year, costs increase faster in portfolio A. From year 4, portfolio A has higher costs year by year until the two portfolios converge after about nine years. This is explained by how the maturity profiles of these two portfolios look. In portfolio B, 46 per cent of the debt is refinanced every year. But this is largely rolled over in short maturities. In the years immediately after the first year, not much matures besides this rolling short-term borrowing. This results in a cost trajectory that is steep at first but later flattens out. In portfolio A, however, the debt matures at a uniform pace, which results in a linear trajectory for the cost increase.

Which portfolio is more sensitive to interest rate upturns may thus depend on what time perspective we have. In the short-term perspective, a portfolio with a large share of maturities is ordinarily more risky, but in a medium-term perspective, a portfolio with a uniform maturity profile may instead be the one whose costs increase fastest.

3.3 Conclusions from quantitative studies

This analysis of the characteristics of steady state portfolios shows that two portfolios with the same duration may have very different maturity profiles. In the duration segment where the Debt Office's portfolio is, the percentage of yearly maturities in the total debt may different by as much as 20 points. The differences depend on how duration is achieved. If we achieve a given duration by borrowing in a combination of short-term and long-term maturities (a "barbell" borrowing strategy), the share of yearly maturities will be higher than if we borrow in medium-term maturities ("bullet" borrowing).

Duration is a good indicator of future costs. If the yield curve is linear, the association is very strong. Given a concave yield curve, the association is weaker. In that case, barbell borrowing results in a lower average issue interest rate than bullet borrowing, given the same duration.

However, duration is somewhat less reliable at capturing the risk of increased interest costs. This is because duration and maturity profile are not unambiguously connected to each other. The maturity profile is a better indicator: The larger the yearly maturities are, naturally the faster rising interest rates will trigger higher costs. Since portfolios whose duration is achieved by a barbell borrowing strategy have a higher percentage of yearly maturities, this type of portfolios will carry higher risk in a short-term perspective. In a medium-term perspective, however, costs may increase faster in a portfolio where the same duration is created by means of bullet borrowing.

To summarise, with a normal-looking yield curve, a given duration may be achieved at lower expected cost with barbell borrowing than with bullet borrowing. However, this lower cost must be weighed against the fact that barbell borrowing involves greater sensitivity to interest rate upturns in the short term.