

The Danish mortgage market¹

As housing finance evolves, are there reasons to follow the Danish model?

JEL classification: G180, G280, L890

This article is a case study of one of the world's most sophisticated housing finance markets, the Danish mortgage market.² With a standard Danish mortgage contract, it is possible to borrow long-term (up to 30 years) at fixed rates with an option to make penalty-free prepayments. This option is also embedded in the US mortgage contract. US and Danish mortgage markets are globally exceptional in this regard.

The main consequence of this option element in the US-Danish style contract is that investors are exposed to prepayment and thus reinvestment risk. On the one hand, over longer periods the risk characteristics of the typical callable mortgage bonds are found to be similar in the two markets. On the other hand, the Danish market's performance has not been much affected in periods with significant refinancing, which is a well documented characteristic of the US mortgage market. Indeed, position-taking in callable US mortgage securities has been identified as a source of an amplification effect on the volatility of US long-term interest rates during episodes of high rates of mortgage refinancing.³

The first purpose of this study is to identify elements that are important for the performance of the Danish market. This should be of interest to countries

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² A mortgage is a collateralised loan. It is typically a financial contract between an institutional provider of funds and a household or commercial entity.

³ See Packer and Wooldridge (2003), Perli and Sack (2003) and IMF (2003) pp 16–22 for discussions of the impact of mortgage refinancing and hedging on swap and other long-term interest rates.

considering modifying or developing local currency bond markets based on housing finance.⁴

The second purpose is to highlight policy choices and trade-offs involved in terms of institutional setup and sources of market volatility and financial stability when callable mortgage bonds are used for housing finance.

We identify two possible explanations for the observed differences between the Danish and US markets during periods of significant refinancing. First, the tight Danish regulation requires a matching of cash flows on the loan and funding side. As a consequence, mortgage banks do not bear market risk, and prepayment risk is assumed by buy and hold investors. Secondly, the fixed exchange rate policy for the Danish krone vis-à-vis the euro may have reduced volatility by giving investors in callable Danish mortgage bonds access to low-cost hedging of market risk in euro-based markets.

The Danish case also illustrates the institutional structure necessary for a small open economy to put in place a well performing local currency bond market.

We first discuss the performance of the Danish system. We then describe the regulation of credit and prepayment risk among lending institutions. This is followed by a description of how market liquidity is fostered in the Danish market. We go on to compare the character of the information used to price callable Danish mortgage bonds with that for comparable US mortgage-backed securities. The final section contains concluding remarks.

The performance of the Danish system

The Danish mortgage system has for many years offered nationwide standardised single-priced mortgages for households. The system was established as a cooperative system in which competition was severely restrained by regulation. Borrowers were offered only a limited range of products, with long-term fixed rate callable loans as the predominant product. However, in the course of the 1990s consolidation, deregulation and mortgage banks' adoption of new technologies gave rise to a wider range of loan types offered to borrowers and, thus, a much broader menu for borrowers to choose from when financing property.

The effectiveness of the Danish system is reflected in a high degree of reliance on mortgages relative to the size of the economy. Table 1, for example, shows that the ratio of mortgage loans outstanding to GDP exceeds 100% in Denmark, compared to 81% in the United States. This is the case even with a smaller share of owner-occupied dwellings in Denmark. The effectiveness of the system is further indicated by yields on the mortgage bonds issued by the lending institutions.

Danes rely heavily on mortgages

⁴ The Danish mortgage market has already attracted attention among those interested in developing local currency bond markets. In particular, Mexico has recently considered the possibility of developing its capital markets through the introduction of Danish-style housing financing arrangements.

Summary statistics for the Danish and US mortgage markets		
Data for 2003 ¹		
	Denmark	United States
Total volume of mortgage bonds in circulation ²	232	5,129
Daily turnover in mortgage bonds ²	2	219
Total volume of mortgage loans as % of GDP	101	81
Ratio of households' debt to disposable income	192	112
Number of residential loan originators	4	7,771
Share of owner-occupied dwellings	59	68

¹ For the United States, third quarter. ² In billions of US dollars (exchange rate used: DKK 6 = USD 1).

Sources: Board of Governors of the Federal Reserve System; National Bank of Denmark; European Mortgage Federation; Federal Financial Institutions Examination Council; Realkreditrådet. Table 1

Spreads on Danish and US mortgage bonds are comparable

For Danish and US callable mortgage bonds the average yield has been around 150 and 140 basis points respectively above the yield on government bonds in recent years.⁵ This yield spread reflects in part the premium investors demand as compensation for the borrowers' right to call at par (the call option). Thus, borrowers pay for their right to prepay. The exercise of the option is linked to interest rates. As illustrated in the box on page 98, this link changes the risk profile of a callable bond relative to a standard bond by creating uncertainty about the speed with which investors receive cash flows.

For a callable bond the option-adjusted spread (OAS) to a government bond is the pure yield spread to the government bond minus the estimated spread value of the prepayment option. This can be used to compare the yield a buy and hold investor would receive in addition to a government bond of the same maturity net of the cost of insuring against the embedded option.⁶

Graph 1 shows that the OASs are of the same magnitude for Danish and US bonds, providing a measure of the effectiveness of Danish securitisation efforts.⁷ The modest difference in the premium is interesting. One might have expected a relatively lower spread in the US market given the extensively documented presence of a subsidy to US mortgage market participants originating from a widespread investor perception of an implicit government guarantee of US housing agencies.⁸

⁵ Spread to 10-year government bonds from August 2000 to September 2003. Based on 6% RD 2032 and the FNMA 30-year current coupon.

⁶ The OAS is a computed number, with a level of uncertainty reflecting the level of uncertainty connected to forecasting prepayments. In recent years market participants' OAS estimates in both the US and Danish markets have varied by 10–20 basis points around the average OAS estimate.

⁷ A recent survey of mortgage finance in Europe gave high marks to the Danish market for delivering its basic products to borrowers at low cost. It also highlighted that a number of different funding methods are available. See Mercer Oliver Wyman (2003).

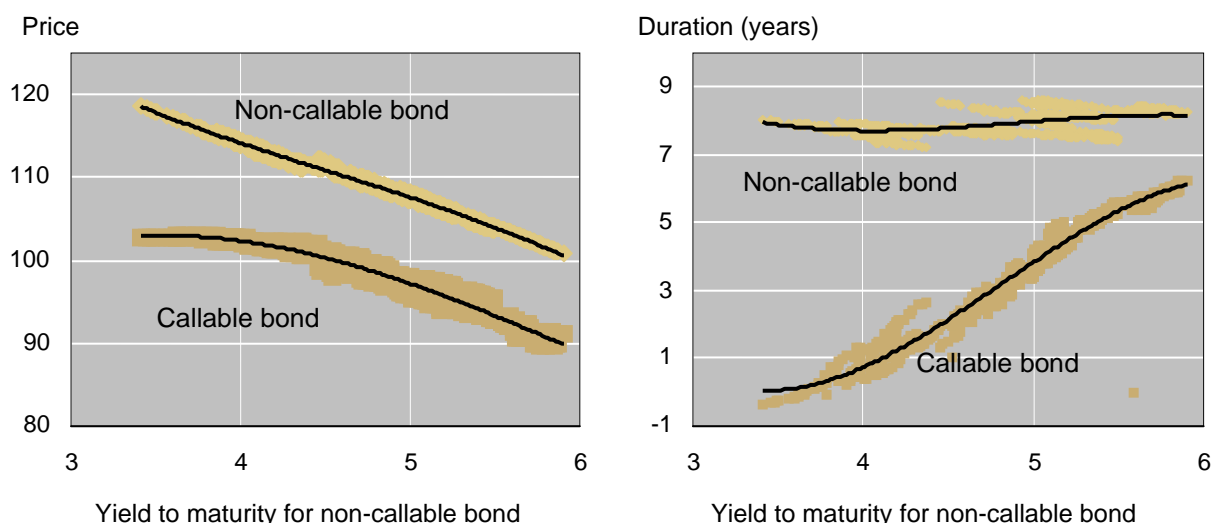
⁸ See Passmore (2003).

Callable versus non-callable bonds

Callable fixed rate bonds are priced as a fixed rate non-callable bond with an embedded option to call. The call or prepayment option creates uncertainty about the speed with which investors receive cash flows. This affects the duration of the callable bond, thus reducing the market value of a callable bond relative to a similar non-callable bond.^① As a result, callable mortgage bonds would trade at a premium to government bonds, even if judged to be identical in every other respect. Thus, assessing prepayment behaviour by borrowers plays an important part in pricing callable mortgage bonds. The differences between callable and non-callable bonds in terms of the relationship between interest rates and duration are illustrated in the graph. For non-callable bonds, duration, ie the slope of the price/yield curve, is nearly constant. For the callable bond, the yield/price relationship flattens as interest rates decrease, because mortgagors prepay their loans. Thus, duration is positively related to the level of interest rates, a relationship referred to as negative convexity.

Price and duration for callable versus non-callable bond

Empirical values for August 1999–September 2003



Note: The non-callable bond used is the 6% Danish Government bond 2011. The callable bond is the 6% Realkredit Danmark 2032.

Source: National Bank of Denmark.

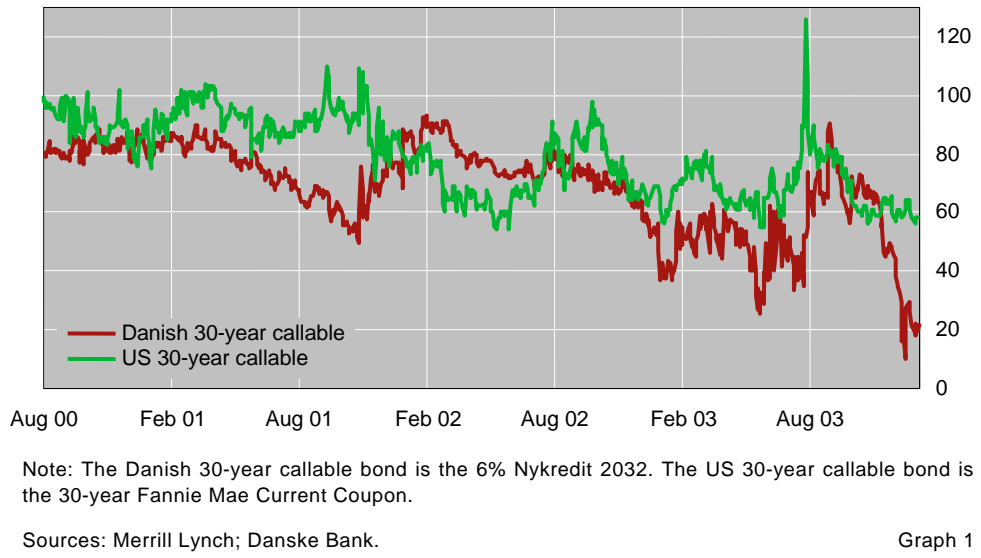
^① Duration measures the price sensitivity of the bond with respect to interest rate changes. Convexity is a measure of the direction and rate of change in duration as the interest rate changes.

However, two elements may explain this. One is that the Danish mortgage finance system as a whole is seen by investors as benefiting from broad political commitment to its integrity.⁹ The other is the perceived need to compensate US mortgage bond investors for bearing high levels of idiosyncratic risk present in individual US mortgage pools.

⁹ This view was noted in interviews conducted when this paper was being researched.

Option-adjusted spread to government bonds

In basis points



Regulation of credit and prepayment risk

The credit risk borne by both US and Danish mortgage banks is to a large extent kept very low by regulation. These limits, combined with a strong legal infrastructure, virtually eliminate credit risk on Danish mortgage bonds. This is reflected in very low losses for mortgage banks, even in severe economic downturns.¹⁰

Danish mortgage banks' credit risk is contained by the requirement that all loans must be secured by a mortgage on property and a loan-to-value ratio of a maximum of 80% for owner-occupied homes, and lower for other types of property. Mortgages have a strong legal position in Denmark owing to their registration in a central registry. Mortgage banks possess a senior claim on the proceeds from a property sale in the event of a borrower's default. The track record for Danish foreclosure processes is exceptionally good: timely execution at relatively low cost.¹¹ Strategic default by borrowers is discouraged by the fact that a Danish mortgage borrower remains liable for the full mortgage debt when falling property prices result in negative equity positions.

A key regulatory difference between the two markets is that Danish mortgage banks, unlike their US counterparts, cannot retain prepayment risk. All market risk, including prepayment risk, is passed on to investors in Danish mortgage bonds such as pension funds and commercial banks. Anecdotal

Underwriting standards and foreclosure processes keep credit risks low

¹⁰ Danish mortgage banks' maximum realised losses in the economic downturn in the early 1990s were 0.62% of total loans. Adding provisions for expected losses, a requirement introduced in the early 1990s, the total becomes 1.4% of total loans (see Realkreditrådet (1991)). However, the mortgage banks' losses were rapidly reduced during the 1990s and in 2002 they were only 0.01% of total loans.

¹¹ See Mercer Oliver Wyman (2003).

evidence gathered indicates that they, relative to US housing agencies, accept larger fluctuations in the duration measures of their bond portfolios.¹²

That mortgage banks do not retain prepayment risk is due to regulation – the “balance principle”, which requires all callable Danish mortgage bonds to be pass-through securities, ie mortgage banks fund their lending activities by issuing mortgage bonds with cash flows that fully match those of the underlying mortgage loans.¹³ This means that innovations in mortgage loans will be reflected on the funding side, ie in bond markets.¹⁴ Thus, the recent introduction of callable loans where the borrower has the option to defer instalments led to the introduction of so-called fixed rate callable deferred annuity bonds.¹⁵

Prepayment risk is passed on to bondholders

Standardisation and liquidity

Danish mortgage banks offer highly standardised and thus liquid bonds produced to be presumptively homogeneous in exposures to credit and market risks across issuers.¹⁶ In contrast to the Danish market, which has very large pools, US securities pools are smaller and display large variations in terms of quality and size of the underlying loans, and new pools are created frequently. This reflects the large number of originators.

Highly standardised bonds ...

At present, there are seven Danish mortgage banks. Three of these specialise in mortgage finance for commercial sector borrowers. The remaining four account for nearly all household mortgage lending.¹⁷ Three of the four cooperate closely with commercial banks, either as part of a financial group or as a result of a disclosed contractual arrangement. In contrast to the US system, Danish mortgage banks are one-stop shops for all aspects of mortgage

... issued by mortgage banks ...

¹² In a press conference last year, Fannie Mae’s senior financial officer noted an intention to keep the firm’s duration gap within a range of plus-or-minus six months “substantially all of the time”. See Fannie Mae (2003).

¹³ All financial institutions, including commercial and mortgage banks, are regulated by an integrated financial services regulator, “Finanstilsynet”. According to Danish law, mortgage banks are specialised institutions regulated as standalone entities. Other institutions, notably banks, may also offer loans secured by mortgages. However, only mortgage banks have the opportunity to fund mortgage loans by issuing mortgage bonds, called “Realkreditobligationer”.

¹⁴ Each time a borrower is granted a loan, bonds of equal size and characteristics are issued.

¹⁵ See Nykredit (2003) for a description of the bonds.

¹⁶ All bonds have ratings between Aa2/AA and Aaa/AAA. In addition, liquidity is supported by a market-making scheme. The market-makers are 10 commercial banks, which trade all mortgage bank bonds that are open for issuance at a common price. Pricing takes into account the presence of a cheapest-to-deliver option.

¹⁷ The four large mortgage banks are: Realkredit Danmark (Danske Bank), Nordea, Nykredit (including Totalkredit) and BRF, accounting for 32, 11, 42 and 9% respectively of gross new mortgage loans in 2002; see Realkreditrådet (2003). Of the four mortgage banks, one owns a commercial bank, and two are owned by commercial banks. These three banks are all market-makers. The seven other market-makers are commercial banks not directly linked to a mortgage bank.

finance, including loan origination, loan securitisation and loan servicing. The process is described in the box on page 102.

Historically, US mortgages were originated, and subsequently held, by a very large number of specialised depository institutions (thrifts). Over time, the US mortgage industry has become more concentrated in terms of origination volumes, securitisation and servicing. Mortgages are still originated by a large number of specialised firms, but today these have ties with the few firms specialising in mortgage securities underwriting.¹⁸

As in the United States, the typical callable Danish mortgage bond is backed by callable fixed coupon annuity loans, with all loans backing a particular bond having the same coupon and a common rate of amortisation.¹⁹ However, Danish mortgage loans are highly standardised. Danish mortgage lending rates to households and associated fees and commissions are highly uniform. The uniform pricing is combined with almost full standardisation of loans, including the elimination of differences in credit risk among borrowers. This is achieved via a combination of regulation, in particular different loan-to-value ratios for households and commercial borrowers, an element of quantity rationing and to a limited extent through different fee charges for commercial borrowers.²⁰ Thus, even though all borrowers have access to market-based financing, the uniform pricing and standardisation of Danish home mortgages means that the market clears through credit rationing rather than risk-based pricing.

In addition, mortgage banks have come to a number of agreements governing primary and secondary market functioning, including the collection and sharing of information. These agreements support a liquid secondary bond market. This and other choices provide the infrastructure for a bond market with high liquidity and limited diversity.²¹

... based on highly standardised loans

¹⁸ One measure of consolidation in US mortgage finance is the market share of mortgage servicing firms. LaCour-Little (2000) notes that the top 15 mortgage servicers had a combined market share of 16.3% in 1989 and the combined market share of the top 10 servicers was 46% by 2000. According to National Mortgage News (2003) the market share of the top five originators grew from 26.2% in 1999 to 42.8% in 2002.

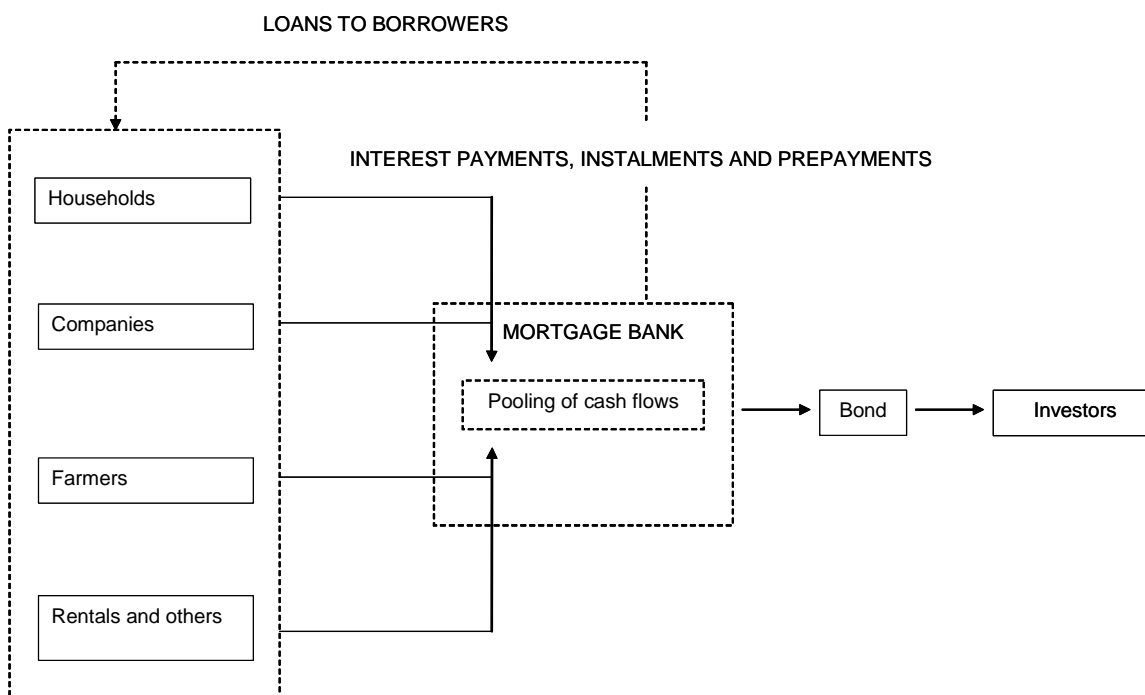
¹⁹ Annuity loans account for more than 98% of the market for callable bonds. See Realkredit Danmark (2003).

²⁰ See Ladekarl (1998) for a discussion of how credit risk on Danish mortgage bonds is kept low.

²¹ Mortgage banks open identical new bond series with different coupons, eg series of 5, 6 and 7% at the same time. These series are open for issuance up to three years. The size and liquidity of a bond series thus depends on where long-term interest rates move during the three-year period. The uniform pricing arrangements have focused on newly issued bonds, where prices are below par. For bonds with prices above par, there are price differences reflecting differences in prepayment speeds.

Origination, structuring, issuance and servicing of Danish mortgage bonds

The origination, structuring, issuance and servicing of Danish mortgage bonds take place in a fully integrated system. The process is illustrated below. First the mortgage bank grants a loan to the borrower based on collateral in the property. It then issues a bond to fund the loan. Following this the mortgage bank acts as the mortgage servicer, assuming the responsibility for collecting payments from borrowers and redistributing them to bondholders. The bond is a balance sheet liability of the mortgage bank, backed by the firm's own funds.



Bonds are issued on tap by the mortgage bank in individual “series” backed by a specific pool of loans. Loans to all types of borrowers serve as collateral for all bond issues. A standard 30-year callable bond is open for issuance for up to three years. Each bond series increases in size as loans are granted and matching tap issuance of bonds take place. The result of this process is very large tradable bond issues. The four banks’ currently issued 30-year bonds which are part of the market-making (see below) have a total outstanding volume of more than DKK 215 billion (around USD 35 billion), with around DKK 50 billion (close to USD 10 billion) for individual bonds.^①

The individual mortgage banks view themselves as jointly responsible for creating and maintaining a well functioning secondary market in Danish mortgage bonds. To achieve this objective, they have entered into a number of agreements covering market-making and the dissemination of common information on the characteristics of underlying mortgages of individual bonds and on prepayment speed statistics by bond issue. For each bond series, mortgage pool data are broken down into 20 categories covering loan type, nominal loan size and borrower type.^② Of these 20 categories, only those covering loan size are viewed as informative for investors’ prepayment forecasting.

^① Based on an exchange rate of DKK 6 = USD 1. ^② See Realkreditrådet (2003), p 20.

In recent years, increases in Danish households' demand for risk management tools and competition from commercial banks have led to the introduction of a broader range of mortgage loan types by mortgage banks.²² This has been accommodated by deregulation of the mortgage banks. The broader range of loan types has resulted in the funding of mortgage credit becoming less concentrated in the standard long-term fixed rate bonds.

The mortgage contract, prepayments and hedging

The Danish and US mortgage securities markets share the common problem that market participants, when pricing callable bonds, have to accurately capture empirical facts about "non-optimal" exercise of prepayment options by holders.²³

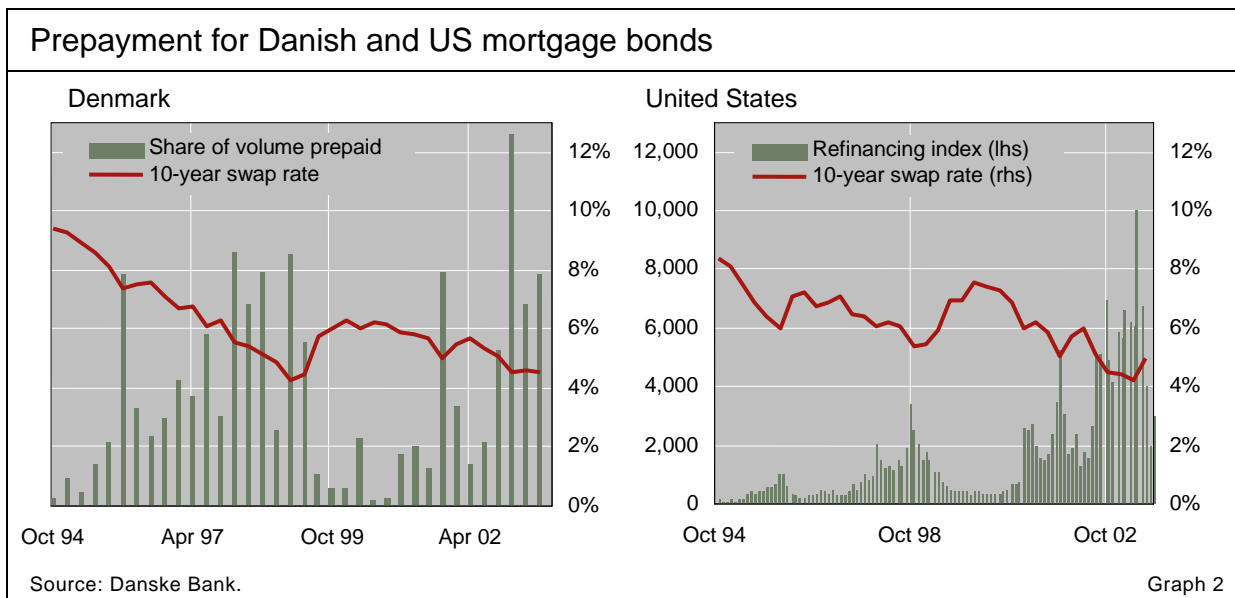
Graph 2 illustrates that the huge drop in interest rates since the early 1990s has made market risks in the form of prepayments important for investors in both Danish and US callable mortgage bonds.

Buybacks

A Danish mortgagor can (in addition to penalty-free prepayment) buy back his or her loan by purchasing corresponding bonds in the secondary market and delivering them to the mortgage bank. This is not possible in the United States.

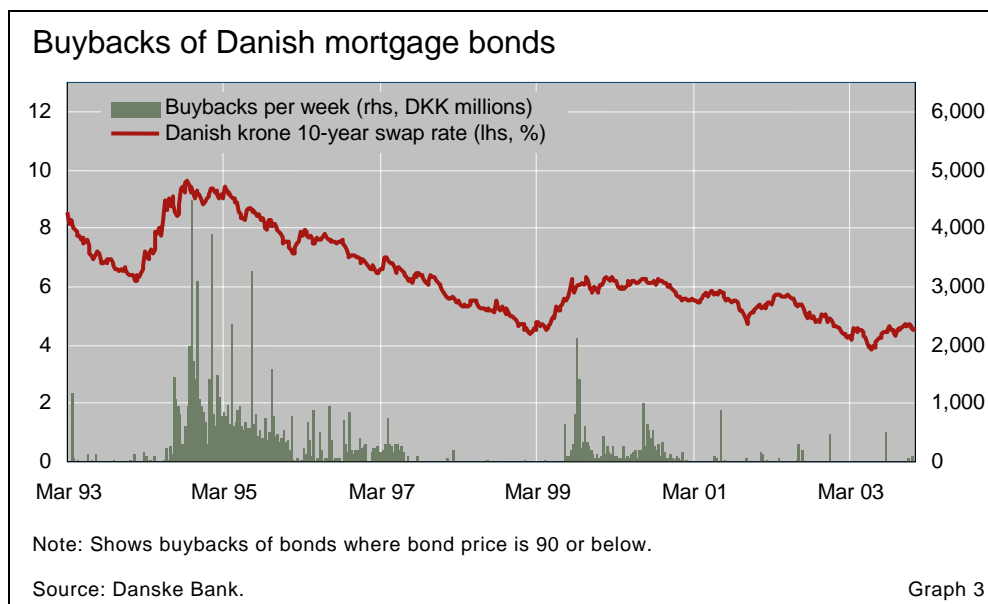
In addition, the US contract has a due on sale clause, while the Danish contract does not. A due on sale clause in a mortgage contract means that the

Danes may buy back their mortgages ...



²² For a discussion of the linkages between monetary policy and household mortgage choices in Denmark, see Christensen and Kjeldsen (2002). For an overview of household mortgage choices and risk management, see Campbell and Cocco (2003).

²³ Non-optimal exercise reflects the observation that a number of holders of "in-the-money" prepayment options do not exercise the option, ie they do not automatically refinance their mortgage.



mortgage must be repaid in the event of a house sale. Thus in the United States demographic events which involve house sales (eg job relocation) generate prepayments.

In Denmark such events do not generate prepayments. This is because a mortgagor has the right to buy back the loan or assign the existing loan to the new owner.²⁴ This means that, unlike in the US case, borrowers are never obliged to prepay when the current mortgage interest rate is above the mortgage contracted rate. That is, mortgage investors do not benefit from early repayment of mortgage loans for bonds trading below par. Apart from prepayments linked to house sales, borrowers may decide to buy back loans and refinance at a higher coupon, thereby reducing the size of the loan when interest rates rise.

Buyback opportunities have occurred only infrequently in recent years as interest rates have mainly moved downwards. However, as shown in Graph 3, mortgage holders have displayed a keen awareness of this possibility, and have used it when rates have increased.

The presence of the buyback option means that forecasters of prepayment rates for Danish mortgages need not concern themselves with demographic sources of prepayment.²⁵ Moreover, the buyback possibility is likely to smooth out prepayments over time. Consequently, investors in individual Danish mortgage securities are not exposed to risk elements present in US mortgage securities.²⁶

... minimising the role of demographics in prepayments

²⁴ For discussions focusing on the possible implications of the buyback possibility in the Danish system, see Svenstrup (2002) and Svenstrup and Nielsen (2003).

²⁵ Models of prepayments for Danish mortgages do not incorporate detailed demographic information, which is common for US models. See Hayre et al (2000) and Hayre (2001) for a description of the data used and the importance of non-economic factors for US prepayments.

²⁶ As an example, mortgages of non-prime borrowers have higher prepayment speeds because (1) an improvement in the borrower's circumstances will allow him or her to refinance at a lower credit spread and (2) a deterioration in the borrower's circumstances (eg job loss) will

Forecasting prepayments

There are Danish versions of standard models

To meet the risk management challenge due to prepayments, investors in Danish mortgage bonds, like US investors, have during the last 10–15 years developed financial-statistical models to forecast borrowers' prepayment behaviour so as to improve the accuracy of bond pricing. The outputs from these models are measures (based on common information) such as option-adjusted duration and option-adjusted spreads to government bonds and swaps. Forecasting of prepayment behaviour is typically done by estimating a prepayment function for borrowers which sets out the conditional prepayment rate as a function of a number of variables, for example borrowers' prepayment gain, loan size, the spread between long and short rates and historical prepayments as explanatory variables.

Loan size matters for prepayments

Table 2 shows the weighted average prepayment rates by loan size and coupon for bonds for the period 1997–2002. Underlying this table are data which show that there are no significant differences in prepayment behaviours across sectors once loan size and coupon are taken into account. Thus, as a result of the high degree of standardisation in the Danish market, the key feature of prepayment modelling for Danish mortgages, for a given coupon, is the relationship between prepayment rates and loan size. These data show, for a given coupon, that borrowers with large loans exercise their prepayment options more often. Thus, the standardisation of Danish mortgage contracts combined with uniform pricing results in the subsidising of larger loans (commercial and higher-income households) by borrowers with smaller loans.²⁷

In periods with differences in prepayment rates between individual bonds the result has been price differences. However, mortgage banks are subject to

Prepayment rates by loan size and bond coupon					
Percentage of mortgage loans prepaid, 1997–2002					
	Loan size in DKK thousands				
	0–200	200–500	500–1,000	1,000–3,000	>3,000
6% coupon	3.24	2.55	3.35	4.33	8.13
7% coupon	5.14	4.82	8.20	13.61	23.20
8% coupon	5.83	7.91	15.37	22.47	30.55
9% coupon	8.07	11.21	18.07	25.53	37.92
10% coupon	11.17	18.55	28.14	36.11	45.40

Note: Weighted by the outstanding amount of bonds.

Source: Nykredit. Table 2

result in failure to make mortgage payments, which triggers prepayment by the institution that has provided credit insurance on the loans.

²⁷ Based on the analysis in Duffie and DeMarzo (1999), the current structure with very large pools may well be efficient, due to the higher liquidity of the bonds, despite differences in prepayment speeds among borrowers. However, if differences in prepayment propensities increase, it may be optimal for borrowers with large and small loans to issue separate securities. A similar argument applies to credit risk, but, as indicated, we presume that credit risk differences between borrowers are negligible in the Danish system.

powerful incentives to engage in “self-corrective behaviour” to maintain their presence in the unified pricing or market-making scheme. If a given bond is expected to prepay (significantly) faster than other bonds, this bond will fall in price. The consequence may be that borrowers will avoid new bond series from the issuer behind the bond. They may even buy back these bonds, funded by a loan at a lower interest rate from another issuer. From the issuer’s perspective the result will be smaller and less liquid bonds. This provides an incentive for an issuer to align the aggregate prepayment behaviour of its borrowers with that of other issuers. Thus, the concentration of the industry is an incentive for strategic behaviour, undertaken in support of the unified pricing scheme.²⁸ For investors, the effectiveness of these incentives is important since they serve to support substitutability of bonds from different issuers.

The differences in the prepayment risk of the contracts in the US and Danish mortgage markets are reflected in the richness of the information available to investors regarding borrowers and loans. In the Danish setup the information provided is limited. This may be because the relatively less risky Danish securities offer no, or at best very limited, incentives for separate production of information by individual issuers.²⁹ In contrast, not only is the information provided in the US market more detailed, it is becoming ever more so. New information recently made available to investors led to changes in prepayment models, which resulted in significant adjustments in the pricing of certain bonds.³⁰ Thus, the more complex nature of forecasting prepayments in the US setup appears to be (on average) matched by more disclosure of information relevant to the forecasting of borrowers’ prepayment behaviour.

Different contracts require different information to forecast prepayments

Hedging

Investors who manage the interest rate risk on their investments seek to take account of the fact that a change in interest rates can change the duration of callable bonds quite considerably. In order to maintain the interest rate risk at a given level when interest rates decline, investors must hedge by buying duration. This is typically done using government or other bonds with a higher duration. Another route taken by investors is to hedge both interest rate and prepayment risk using derivatives by creating an asset swap package.³¹

²⁸ The introduction of ratings also influenced issuers’ strategic behaviour, prompting them to align their business models further.

²⁹ One of the mortgage banks, Realkredit Danmark, recently introduced a facility whereby borrowers may postpone instalments on a 30-year loan in a more flexible way than with competing products from other mortgage banks. Reflecting this difference, Realkredit Danmark has since announced that it will publish more detailed information on how borrowers have chosen to exercise their rights to postpone instalments.

³⁰ For a description of these changes and their implications, see Hayre et al (2004).

³¹ A package consists of three components: a mortgage bond, an interest rate swap and a cancellable Bermuda swaption. The interest rate swap is used to swap the bond’s fixed rate payments into floating rate. The swaption gives the investor the option to swap (in full or in part) as prepayments occur on the underlying bond. The swaption is cancellable to prevent a mismatch between the balance on the swap and the balance on the bond in the event of prepayments. See Nordea (2002) for a more detailed description.

Euro-based markets provide hedging alternatives

An important difference between the US and Danish mortgage markets is that investors in Danish mortgage bonds can hedge prepayment and interest rate risk in both Danish and euro area government bond and swap markets. Since the monetary policy commitment is to have a stable exchange rate between the Danish krone and the euro, market participants may use, without needing to hedge currency risks, the more liquid euro market to hedge their prepayment risk in kroner. In the absence of the monetary policy commitment, pricing of Danish mortgages would presumably incorporate considerably higher term swap spreads.³²

Concluding remarks

The Danish case is one of a small open economy which has a housing finance market with callable long-term fixed rate loans and bonds – similar to those used in the US market. In particular, US and Danish mortgage contracts share the important characteristic that the borrower can exercise a penalty-free prepayment option. The main consequence of this option element in the US-Danish style contract is that investors assume prepayment and thus reinvestment risk.

Stress in periods with significant refinancing is avoided ...

However, in the Danish case the institutional structure, the regulatory approach and monetary policy together have resulted in a market which, relative to the US market, has shown little or no stress in periods with significant refinancing. Thus, differences between the institutional characteristics of the two markets appear to have important implications for borrowers, investors and policymakers. Our discussion points to a number of elements that provide possible explanations for the observed differences in market performance.

... in part because investors accept larger fluctuations in durations

One element is the tight Danish regulation, requiring a strict matching of cash flows on the loan and funding side. The result of this is that prepayment risk is held by investors who, relative to the US housing agencies, accept larger fluctuations in the duration measures of their bond portfolios. A second element is that Danish investors, due to the fixed exchange rate policy for the Danish krone vis-à-vis the euro, have ample capacity to hedge unwanted interest rate risk on the euro-based markets. The availability of this “outside” option supports the liquidity of the Danish mortgage bond market.³³

Finally, the Danish case also illustrates the institutional structure necessary for a small open economy to put in place a well performing local currency bond market. It is our suspicion that there is a temptation to underestimate the institutional investments that have to be made.

³² Miles (2003), in a discussion of obstacles to the creation of a callable fixed rate mortgage market in the United Kingdom, compared the size of spreads between 10-year interest rate swaps and yields on 10-year government bonds for sterling-, euro- and US dollar-denominated contracts. It found that the spreads were larger for sterling and that they increased strongly with maturity.

³³ See Rebonato (2002) for a discussion of the importance of volatility structures for the pricing of interest-sensitive instruments.

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