Box 14 The distribution and management of prepayment risk in European mortgage markets

Prepayment risk is a risk that banks can face if they grant homeowners the option to take advantage of lower mortgage interest rates by refinancing their mortgages on more favourable terms. This Box examines the prevalence of prepayment risk in the European mortgage markets, and examines how such risks are typically managed.

Mortgages with a prepayment option are commonplace in the US, and prepayment activity has tended to be highly sensitive to long-term interest rate changes. For instance, between mid-2002 and mid-2003, when US mortgage interest rates reached the lowest levels seen in more than 40 years, homeowners made substantial prepayments on their mortgages. In total, almost half of the total outstanding mortgage debt in the US was refinanced at lower rates.[1] The handling of these prepayments – mainly by the two (systemically important) US mortgage agencies Fannie Mae and Freddie Mac – had important consequences for the functioning of the financial market. This is because prepayment risk is typically hedged in fixed income and swap markets. As this hedging is often imperfect, unexpected bouts of mortgage prepayments can create volatility in bond markets, as institutions must adapt their hedges swiftly.[2]

The prevalence and handling of prepayment risk differs in two respects between Europe and the US. First, while in the US prepayment costs may be priced into the interest rate, in many European countries lump-sum prepayment penalties are induced by statutory requirements. Often banks impose charges on homeowners for early repayment. These fees force households to bear part of the prepayment risk and, if the fees are sufficiently high, may deter homeowners from prepayment, thereby nullifying the prepayment risk faced by banks. An exception to this is the Danish mortgage market, where long-term fixed-rate mortgage loans with an embedded option of a penalty-free prepayment are typically offered, as in the US.[3]

A second source of difference between the US and European mortgage markets is the way banks fund their mortgage loans, because an adequate funding instrument could allow the mortgage bank to pass on the (residual) prepayment risk to investors. In Europe, the bulk of the funding of mortgages is still provided by retail deposits and other retail instruments (in total around 75% of overall funding), rather than through funding sources that allow the transfer of the risk, such as mortgage-backed securities. Hence, in Europe, the (residual) prepayment risk lies mostly with the banks. However, the share of market funding has been rising, as housing and capital markets are becoming increasingly intertwined through mortgage (covered) bonds and mortgage-backed securities.

Mortgage (covered) bonds are debt securities that are secured ("covered") by a pool of mortgage loans. They are not ordinarily linked to specific mortgage loans. The pool of mortgage loans stays on the balance sheet of the respective mortgage bank ("on-balance sheet securitisation"). Still, in particular in the case of longer-term fixed-rate mortgages, the general interest rate risk faced by banks is relatively lower in the case of funding through mortgage bonds compared to retail deposits, owing to the better duration match between assets and liabilities. By late 2004, nearly 20% of the outstanding mortgage loans in the EU were funded through mortgage bonds,

1 See Federal Reserve Board (2004), *"Testimony of Chairman Alan Greenspan"*, the Federal Reserve Board's semi-annual Monetary Policy Report to Congress before the Committee on Banking, Housing, and Urban Affairs, US Senate, 20 July.
2 See IMF, *"Global Financial Stability Reports"*, September 2003 and March 2004.
3 See BIS (2004), *"The Danish Mortgage Market"*, BIS Quarterly Review, pp. 95-109, March. In fact, the Danish and the US mortgage markets are globally exceptional as regards the characteristics of the embedded option of a penalty-free prepayment.

with the relative importance varying between countries. Mortgage bond funding is of relatively higher importance in Germany, Sweden and Austria.

By contrast to mortgage bonds, mortgage-backed securities – involving the securitisation of specific mortgage loans which are removed from the balance sheet of the originating institution ("off-balance sheet securitisation") – transfer the prepayment risk from the originating mortgage bank to the holder of the mortgage-backed security, as in the US. Around 5% of the outstanding mortgage loans in the EU are funded through mortgage-backed securities. This type of funding is relatively more significant in the UK, Spain, Italy and Ireland. Finally, in the Danish mortgage market, funding takes place almost fully via so-called callable bonds, which are pass-through securities where the mortgage banks do not retain any prepayment risk but pass it on to investors, as in the case of mortgage-backed securities.

Prepayment risk in Europe is much less concentrated than in the US. It is nevertheless difficult to manage because borrowers do not always pursue rational option exercise strategies, even though the possibility of prepayment constitutes an 'option'.[4] This means that a precondition for sufficient hedging is adequate modelling of prepayment risk. Models that predict patterns of prepayment can be estimated from historical prepayment rates. This information can be used to calculate option-adjusted key figures so as to correctly price the prepayment risk, i.e. the option's value. Such modelling is conducted by mortgage banks and investors in the Danish market, and is facilitated by the fact that Danish mortgage banks share information on mortgages and prepayment statistics. Such information may not however be collected on a consistent basis in other European countries, and even less so on a pan-European level.[5] In the US, banks and investors also make use of models to forecast prepayment risk.

Turning to the instruments that are used in practice to hedge mortgage prepayment risk, many participants, instead of hedging the prepayment optionality with options on interest rate swaps (swaptions), use swaps-based dynamic hedging to mimic an option synthetically. Despite the dangers associated with such replication – including the risks that derive from imperfect hedging – the still widespread use of plain vanilla swaps as hedges might be explained by several factors. Familiarity with using swaps may be one explanation; another reason might be that the purchase of an option requires the outlay of cash upfront.[6] While sophisticated risk managers tend to prefer the use of options, liquid option markets to hedge prepayment risk do not yet exist in all European mortgage markets.

A study undertaken by the European Mortgage Federation in 2003[7] examined the mortgage markets in selected European countries which were deemed to be representative of the European context. It was found that in Germany, prepayment risk is fully borne by homeowners, so that mortgage banks in Germany are not exposed to this risk. Owing to either regulation or consumer pressure, early repayment fees are capped in Spain, France, Italy, the Netherlands, Portugal and

4 Homeowners do not necessarily exercise rational strategies in view of changes in interest rates (so-called optimal prepayments), and demographic events which involve house sales (e.g. job relocation) may also generate prepayments (so-called sub-optimal prepayments). On the two types of prepayment, see Federal Resere Bank of San Francisco (1998), *"Mortgage Interest Rates, Valuation, and Prepayment Risk"*, Economic Letter, 9 October.

5 See for example respective statements on the UK market in Risk Magazine (2004), *"Short Shrift for Long-term Mortgages"*, Vol. 17, No 6, June.

6 See Risk Magazine (2003), *"How to Survive a Mortgage Meltdown"*, Vol. 16, No 12, December.

7 At the request of the European Mortgage Federation, Mercer Oliver Wyman produced a *"Study on the Financial Integration of European Mortgage Markets"* in October 2003.

the UK, implying that the originating mortgage banks in these countries must, at least as a first step, take the (residual) prepayment risk that is not covered by the (capped) fee. In Denmark, investors bear the prepayment risk.

To conclude, given widespread mortgage prepayment penalty fees and the fact that the bulk of the funding of mortgages is provided by retail deposits, mortgage prepayment risk in Europe is mainly faced by the originating banks as well as homeowners, while relatively little spills over to capital markets. Furthermore, prepayment risk is much less concentrated than in the US. Hence, compared to the US, European fixed income markets tend to be less subject to bouts of turbulence stemming from mortgage refinancing.