

# **Fixed-rate Mortgages and Prepayment in Europe**

*A model review and conclusions  
for the prepayment indemnity model*

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## Management summary

Giving consideration to historically low capital market interest rate levels, many German consumers would prefer to prepay and refinance their mortgage loans. A barrier for doing so is the indemnity charged in the case of prepaying a fixed-rate financing. Do other mortgage markets deliver better models?

The construction or purchase of real estate usually requires investment for whose financing consumers need to take up long-term debt. Against the background of varying interest rates and long interest rate binding periods the option to prepay and refinance to a new loan naturally plays a great role. In this regard, the question arises who bears the costs for the reinvestment risk associated with varying interest rates arising from a prepayment, and whether government should regulate this area.

## Three main mortgage loan classes

At the introduction it shall be noted that mortgage finance in Europe and the U.S. is characterized by three main mortgage loan classes:

- Variable-rate loans are predominant in anglo-saxon countries (without U.S.), and also in Spain and Portugal.
- Fixed-rate loans with call protection mechanisms such as the prepayment indemnity are the predominant credit form in continental Europe and Scandinavia. These loans are also dubbed as 'non-callable' or loans 'without prepayment option'.
- Fixed-rate loans with prepayment option against an options premium are offered in Denmark and the U.S.

These three loan classes are essentially the product of their historical refinancing conditions:

- in the anglo-saxon countries mainly through building societies, with the important exception of the U.S. with the secondary market institutions Fannie Mae and Freddie Mac;
- in continental Europe via the different covered bank bond systems including the Pfandbrief. Denmark is a special case of a covered bond system that generates fixed-rate loans with prepayment option.

How do these different products distribute the costs and risks of interest rate variations and protections respectively between lenders and consumers?

## **Variable-rate loans**

Loans with variable interest rates do carry almost no interest rate risk for depositaries, i.e. banks and savings banks or building societies. In contrast, the borrower may be subject to strong variations of his debt service burden. Portugal and Spain did take advantage of the product's characteristic of interest rate pass-through in times of interest rate decline and developed a dynamically growing mortgage market in the past decades. Other markets with predominance of variable rate products did not avoid credit crises during which many consumers lost their homes – an example being Great Britain in the early 1990s.

Variable-rate loans have become increasingly popular, both internationally and in Germany, - on the one hand because of their relative interest rate levels and on the other hand because consumers in times of job uncertainty seek increasingly for greater financial and physical mobility. In order to protect consumers, most German variable-rate loans carry caps, in contrast for example to Great Britain. However, there is no legal requirement for such protection in Germany.

## **Fixed-rate loans with and without prepayment option**

Because they fix rates for long terms, fixed-rate loans require a benchmarking, and often also refinancing, over bonds issued in the capital markets. An example is the Pfandbrief, in the meantime over 230 years old, whose yield is established as a mark-up over Bunds. This procedure generates hardly beatable financing conditions for mortgage loans, of which German borrowers benefit.

However, in exchange for the favorable refinancing via bonds similar to government debt the borrower needs to accept that barriers to prepayment are erected through call protection mechanisms as the prepayment indemnity. When such indemnities are capped – as in France since 1979 to 3% of the outstanding loan volume or 6 monthly interest payments – prepayments undertaken after interest rates have fallen will produce large costs with the financing banks. As a result of the indemnity cap alone, French mortgage loans are currently approx. 30 basis points more expensive than German mortgage loans.

Fixed-rate loans prepayable entirely without indemnities are currently offered in the U.S. and in Europe in Denmark, where lenders issue callable bonds in order to offset the risk. These fixed rate loans offer the consumer both, interest rate risk protection and the option to participate in interest rate declines via prepayments. However, since reinvestment losses arising from prepayment after interest rate declines are entirely allocated to investors this product comes with an even larger interest rate mark-up, currently between 50 and 100 basis points.

This mark-up can be considered as the market price for the prepayment option, a price that is obsolete in the German case where prepayment indemnities are levied. It can increase the initial debt-service burden of a mortgage loan significantly and thereby induce in particular lower income consumers to prefer variable-rate loans. This process can be observed currently inter alia in the U.S.

In contrast, with fixed-rate loans 'without prepayment option' and subject to call protection mechanisms, the initial debt service burden is lower. However, in exchange,

the increased duration of the fixed interest rate period relative to loans that are frequently prepaid carries risks in itself, which should be cushioned by sufficient equity in the financing. In Germany, where equity ratios around 25% and more are the rule, this should be generally the case.

### **Design of call protection**

In Europe, call protection mechanisms applied to fixed-rate mortgages 'without prepayment option' appear essentially in two versions. These behave similarly when interest rates drop, but quite different when interest rates rise, a scenario that carries an increased likelihood going forward.

- In the *indemnity model* practiced in Germany the lender may compensate his reinvestment loss when investing the prepaid sums through a yield maintenance prepayment indemnity. However, a reinvestment gain that may arise when interest rates have risen, does not have to be disbursed to the consumer, with the result that prepayments in those phases, for instance because of a move, are associated with a financial disadvantage („lock-in“).
- This disadvantage is eliminated in the case of the *market price model* practiced in Denmark in the important case of the so-called 'non-callable' fixed-rate mortgage loan. While this loan cannot be prepaid to the lender, it can be bought back from the capital market investor at the prevailing market price. When rates fall, this price will rise above par, implying a payout to the investor which is equivalent to the yield maintenance prepayment indemnity. If interest rates rise and thus the debt price falls below par, and buying back the debt is associated with a capital gain arising on the side of the consumer. This means that the consumer is symmetrically treated in phases of interest rate declines and rises.

If, as is the case in Denmark, no indemnity is charged for the foregone interest margin of the loan, the burden of the consumer remains always the same before and after a prepayment. In the German case, where damages for foregone interest margins can be charged, deviations of between 1 and 3% of the loan amount arise.

Arguably, in the past decades phases of interest rate increases were rare in Germany during which the indemnity model would have led to a higher burden after a prepayment than the market price model. However, the continuation of this interest rate trend is becoming increasingly unlikely. For this reason consideration should be given to whether German consumers should not be offered a payout mechanism that is analogous to the Danish model. To this end, the indemnity model could be modified in order to allow for payouts to the consumer.

### **A complete market creates alternatives for consumers**

As shown in the study, the costs of prepayment can be levied in the form of

- an indemnity or market price levied in the case of exercise of the option, or
- as a general component of the interest rate or options price.

Legal restrictions to an economically justified price for the exercise of the option (as in France) lead to general interest rate increases. They produce moreover a cross-subsidy from the non-users of the option to the users. Finally, they do not solve the described problem of a rise in interest rate burden in phases of rising interest rates, because in this case yield maintenance indemnities are zero.

In the alternative model of a complete mortgage market, economically adequate exercise prices for the prepayment option are admissible. In this situation, consumers can self-select between various pricing models of prepayment – either they opt for an always costfree prepayable variable-rate loan, or for a fixed-rate loan ,without prepayment option' call protected by an exercise price, or for a fixed rate loan with prepayment option against payment of an options price.

The latter loan form is currently not on offer in Germany apart from interest rate binding periods beyond 10 years and partial prepayments. However, this fact cannot be interpreted as a market failure. German consumers traditionally closely observe the absolute interest rate level, which leaves a product that requires a significant margin increase with little appeal to them. Also, the product, as attractive as it has been when interest rates fell, is losing relevance in times of low interest rates. Still, various options are conceivable that could support its introduction, including – provided sufficient demand potential exists – the issuance of callable Pfandbriefe.

# Fixed-rate Mortgages and Prepayment in Europe

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## Introduction

### Background

The background of this study is the current debate on consumer protection with respect to prepayment of fixed-rate mortgage loans in Germany and Europe.

The actual reason, however, is a study by the Institute for Financial Services (IFF) in Hamburg published at the beginning of 2004, which compares the prepayment indemnities paid in Germany and eight other European countries as being an important model for impeding loan terminations ('call protection'). In its conclusion, the study demands legal restrictions on prepayment indemnities in Germany.

### Hypotheses

This analysis investigates whether the data situation as presented by the IFF reflects the empirical picture of prepayment indemnities in Europe correctly, and whether the conclusions drawn for proposed regulations are in line with the data situation and the intention of consumer protection.

Furthermore, this analysis aims at identifying the alternatives to the proposed regulations and how these could be implemented.

### Methodology

To this end, a simulation model was developed that goes beyond the methodology of the IFF, which is based on a simple calculation example. The model for this analysis is able to map different combinations of loan closing and termination dates as well as interest processes when calculating the prepayment indemnity. At the same time, the implications of an alternative model, repurchasing loans at market prices, is analysed since it establishes an important conceptual alternative to indemnities. The study also deals with the alternatives to cope with the loss of future interest margin that the lender incurs upon early repayment.

Furthermore, by comparing the pricing of credit products internationally, this analysis investigates what fixed-interest mortgages with and without call protection imply in terms

of pricing policy. It raises the question of what – in the event of prepayment - serves the consumer better, differentiated prices or uniform pricing?

In addition, by using international examples, this study reviews the effects of regulatory interventions on the loan supply and the substitution processes they trigger on the demand side.

### Structure

Chapter 1 provides an introduction to the economic issues related to prepayments, outlining the three most important loan classes in mortgage finance, i.e. variable-rate loans and fixed-rate loans with and without call protection mechanisms. It briefly discusses the differing legal practices in Europe and identifies the main economic models associated to call protection.

Chapter 2 presents the results of the simulation for the two main economic models of call protection and assesses central consumer protection issues like the burden before and after a prepayment with such call protection mechanisms as well as the effects of regulatory constraints placed on them.

Chapter 3 presents the discussion on loan pricing, in particular with respect to how to quantify the costs of a prepayment option and an international price comparison of loans with and without call protection. It also analyses whether objections brought forward against a differentiation in pricing by call protection mechanisms are from a consumer protection perspective.

Chapter 4 deals with the effect of restrictions on call protection mechanisms on mortgage market supply and raises the question whether as a combined result of intervention and market reaction the exposure of the consumer is likely to be improved.

Chapter 5 draws conclusions for the consumer policy debate and asks how the German mortgage loan market could be further developed in the area.

### Terminology

The term “*call option*” or “*prepayment option*” describes the right – usually associated with a positive market price - to terminate a mortgage loan prior to the maturity date.

An economic analysis of the issues outlined above deals with all essential pricing mechanisms related to the exercise of this option, and the financial valuation methods that are used for this purpose.

The terminology adopted here to describe such pricing mechanisms is thus not identical with common language terms such as “*prepayment fee*”, or “prepayment indemnities” that only describe single mechanisms.

Rather, the term “*call protection*” is defined as describing all pricing mechanisms that reduce the financial incentives for consumers to exercise the prepayment option.

Both extreme points of the price distribution are excluded in this definition: at one extreme, the contractual *exclusion of prepayment* is tantamount to charging an infinite

price for the exercise of the prepayment option, which goes beyond the central purpose of defining a pricing mechanism; at the other extreme, call protection cannot be meaningfully associated to a zero price for the exercise of the option either. Finally, obstacles for a termination that are not pricing mechanisms, such as the legal transactions costs of prepayment, are not included in the definition although they may lead to the same economic results.

The term *damage to the interest margin* or, shorthand, *margin damage* refers to the difference between the asset and liability interest, corrected by risk and management costs saved. In financial literature, the latter are also described as *servicing costs*.

The term “*lock-in*” refers to situations in which, after having terminated a loan and concluding a new agreement, the debt service of the consumer increases, thus generating an incentive against selling the property or moving.

## **Chapter 1 Fixed-rate loans and call protection – an introduction**

### **1.1 The main loan product classes in mortgage financing**

There are three important loan product classes in mortgage financing worldwide:

- loans with variable interest rates,
- fixed-rate loans with prepayment option, i.e. the option to repay prior to maturity, and
- fixed-rate loans without prepayment option or with call protection mechanisms that minimise the financial advantages of a prepayment.

Each of these loan classes distribute interest rate risk between borrowers and lenders differently.

Loans with variable interest rates are traditionally offered by lenders that are funded by short-term deposits, i.e. banks, and these loans are thus a product that is universally available in any banking system. They carry virtually no interest risk for the lender.

By contrast, variable interest mortgages may cause strong fluctuations in the debt service that may even lead to a loan default or insolvency of the borrower. On the other hand, the borrower may be able to enjoy the benefits of interest rate cuts without or little delay. This is particularly true for indexed loans such as those typical for Western and Southern Europe. Markets that experienced sustained disinflation processes in the past, such as Portugal and Spain, have created dynamically growing mortgage markets with this product. Still other markets where variable interest rates dominated slipped into credit risk crises. The United Kingdom experienced such a crisis at the beginning of the '90s.

Fixed-rate loans, predominant in Scandinavia, Germany, France, and also in the U.S., are usually also offered by banks. However, owing to their long-term perspective they typically require funding through bonds issued on the capital markets because the short-term deposit base that is typical for banks does not suit this purpose. In Europe, the funding of mortgages on the capital markets for long time periods has in essence been limited to the above-mentioned jurisdictions, with the German Pfandbrief looking back on

a history of 250 years. Over the past 15 years, however, almost all European countries have introduced similar bank bonds, as well as mortgage-backed securities that originated in the U.S..

Fixed-rate mortgages protect the borrower against interest rate risk, usually against a mark-up to be paid for that protection. The most favourable interest rates can be obtained by funding fixed-rate mortgages with long-term bonds that are non-callable and that are priced only narrowly above government bonds, like the Pfandbrief. However, there is a price to pay for the borrower, because – as will be shown in the following sections – funding via these non-callable bonds means that early repayment ought to be limited by call protection mechanisms.

The alternative are fixed-rate mortgages that may be prepaid free of charges, in Europe only offered in Denmark, and outside of Europe only in the U.S.. For borrowers, these instruments provide the protection of the fixed rate against interest risk while allowing them to participate in interest rate cuts by way of prepayment. As will be shown in the following, this product does, however, trigger considerable costs in the form of an option premium and more complex funding techniques.

**Table 1 Key figures of international mortgage markets and product landscapes, around 2003/2004**

Country	Outstanding mortgage loans (€ bn, 2003)	Share of Gross Domestic Product (% , 2003)	Dominating mortgage loan product	Important missing mortgage loan products	Share of retail loans refinanced by Pfandbrief or MBS (estimate)
<b>EUROPE</b>					
Germany	1,156	54.3%	Fixed-rate with call protection	Fixed-rate without call protection	20%
Great Britain	1,119	70.4%	Variable rate	Fixed-rate with and without call protection	5%
France	385,4	24.7%	Fixed-rate with call protection*	Fixed-rate with complete call protection*	12%
Netherlands	453,2	99.9%	Fixed-rate with call protection	Fixed-rate without call protection	<2%
Spain	312,9	42.1%	Variable rate	Fixed-rate with and without call protection	13%
Denmark	164,4	87.5%	Fixed-rate without call protection		90%
<b>WORLD</b>					
USA	6,911	71%	Fixed-rate without call protection	Fixed-rate with call protection*	53%
Japan	1.042 (2002)	39.6% (2002)	Fixed-rate with call protection	Fixed-rate without call protection	<1%
Canada	311 (2002)	42.1% (2002)	Fixed-rate with call protection	Fixed-rate without call protection	6%
Australia	217 (2002)	50.4% (2002)	Variable rate	Fixed-rate with and without call protection	19%

Source: European Mortgage Federation, Mortgage Bankers Association of America, OECD, International Union of Housing Finance Institutions. Evaluation by the author. Note: \*call protection heavily restricted by law or legal practice. \*\*strongly deviating statistics.

Table 1 provides an overview. An important observation to be made is that almost all mortgage markets are incomplete with respect to the three product classes discussed, i.e. one or several products are not offered at all or only as an extreme niche product. In Germany, for instance, fixed-rate loans are not offered without call protection, while the U.S. market, on the other hand, does not provide fixed-rate loans with call protection comparable to the ones available in Germany. Most markets with a dominating variable rate loan supply only supply very short-term fixed-rate mortgages (up to 2-3 years). Only Denmark has all three product classes available.

## 1.2 What happens from an economic perspective if fixed-rate loans are prepaid?

### Generation of reinvestment gains and losses

Fixed-rate mortgages generate a wide range of cost distributions, depending on whether they are call protected or not and whether a termination could cause a financial loss to the investor when reinvesting the prepaid funds.

Figure 1 on the following page illustrates the fundamental relations. The upper graph shows the changing value of two loan pools or portfolios of fixed-rate mortgages in response to interest rate changes. In both pools the loans carry the same contractual interest rate.

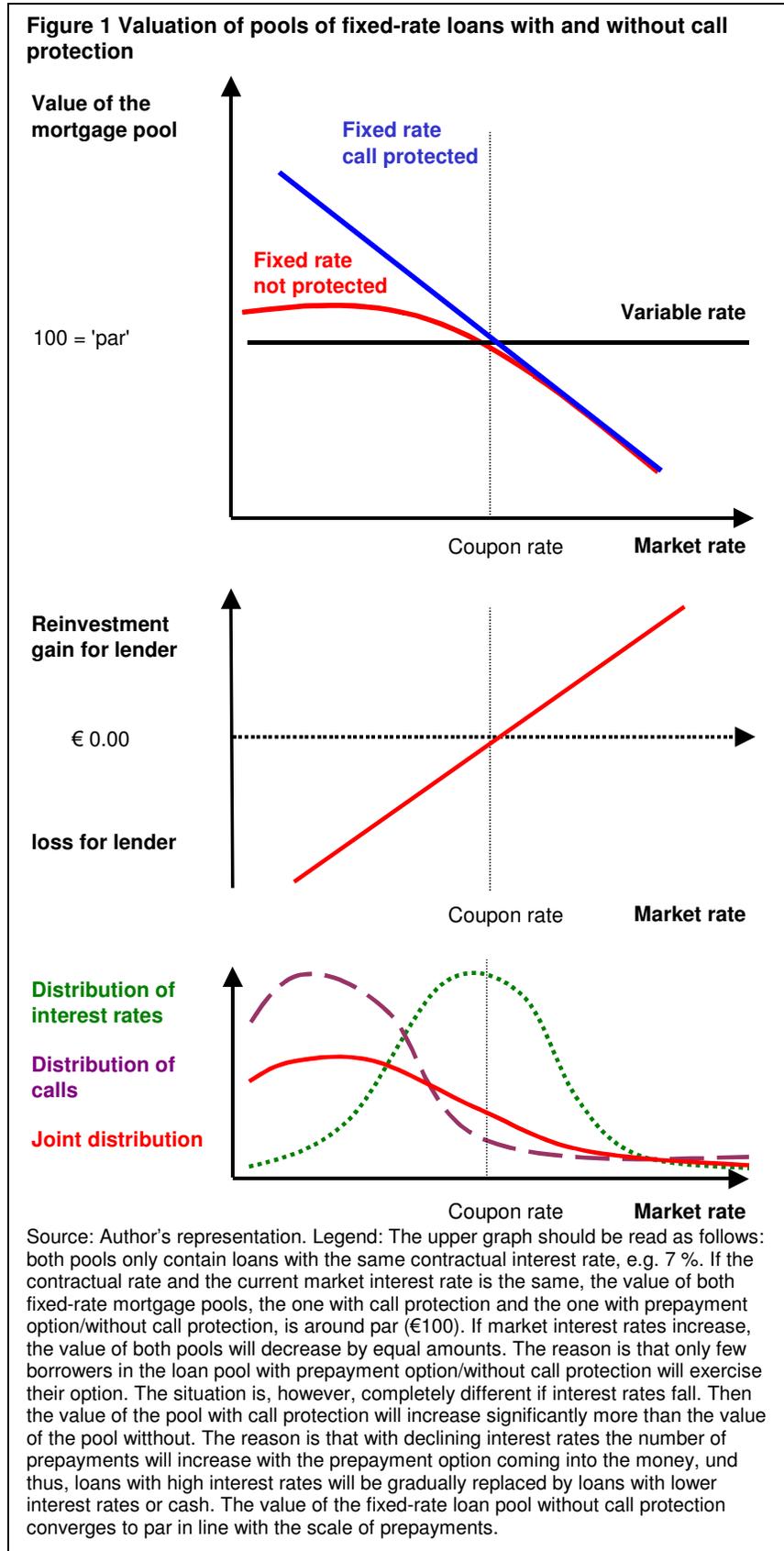
The value of the pool of loans with call protection – in the example to the level of yield maintenance - is depicted in blue. It increases (decreases) when interest rates fall (increase) and, thus, responds to the interest rate cycle as the majority of government or corporate bonds that feature no call option for the issuer.

The pool of fixed-interest loans without call protection marked in red shows a different price pattern. Prepayments will flow in that have to be reinvested at the going market rate. When interest rates fall this leads to reinvestment losses, when they rise it leads to reinvestment gains for the investor, see centre graph.

The likelihood that such losses or gains will occur for the investor critically depends on two factors: the probability distribution of interest rates over time and the behaviour of borrowers with respect to calling a loan over the interest rate cycle.

For instance, while the probability that interest rates will drop or rise may be symmetrically distributed, because the financial incentives differ, many more borrowers will exercise their prepayment options if rates fall than if rates rise, provide they are not call protected. In contrast, if interest rates rise, implying a reinvestment gain for the investor if the loans were cancelled, only few consumers are willing to terminate their loans; most do so for reasons that are described as “non-financial” in literature, e.g. a move or sale of a property. The lower graph provides a simplified view of the interactions between both distributions.

In conclusion, when interests rates drop, the capital gain potential of a pool of fixed-rate loans with prepayment option and no call protection is limited from the perspective of the investor (upper graph). The result is a hybrid asset: the price pattern is similar to one with variable rates if interest rates fall, and to a pool of fixed-rate loans with call protection if interest rates rise.



If the differences in value across the empirical interest and call scenarios are aggregated, the resulting expected value of such a pool must be lower than the value of a pool of fixed-rate loans with call protection.

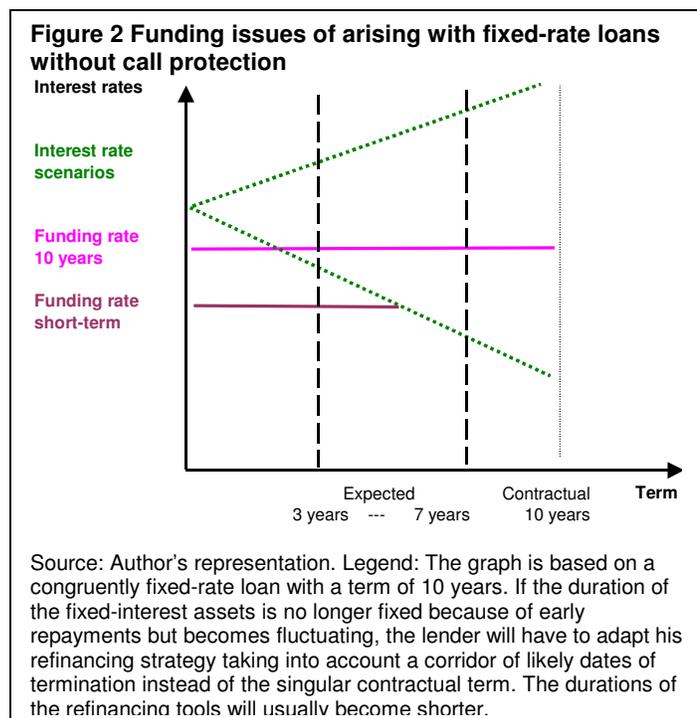
In order to ensure that both obtain the same market price on the capital market, investors consequently charge a higher interest rate for the fixed-rate loan pool no call protection, which translates into a price for the prepayment option to be paid by borrowers.

### Impact of changing durations

When funding fixed-rate loans without call protection, the investor, i.e. a bank or an institution on the capital market, is forced to use a more complex refinancing strategy.

Without call protection the loan's expected time to repayment ("duration") not only usually decreases, it also becomes volatile. For instance, in long-term perspective 30-year fixed-rate mortgage loans have an expected duration of around 7-10 years in the U.S.; in recent years marked by heavy interest rate cuts the expected duration came down to 3 years.

In this situation, a bank that refinances a long-term fixed-rate loan with long-term fixed-rate bonds would be exposed to a considerable risk of loss, which is known as negative maturity transformation risk. Figure 2 illustrates this: faced with a possible rate decline and thus higher prepayments, funding with a 10-year bond would carry a significant risk due to negative or too small margins, possibly resulting in the lender becoming insolvent.



The duration of the refinancing tool will, therefore, have to be reduced as well. This can be done in two different ways:

- a loan with an interest rate agreed for 10 years would, for instance, be refinanced with a 5-year bond or a mix of instruments including savings deposits. This is what most European banks do who basically use short-term fixed-rate bonds and deposits for refinancing. Because of the duration of the loans is variable, the maturity transformation risk in this case must be still borne by the lender.
- Maturity transformation risk may alternatively be shifted from bank balance sheets by passing it on to investors on the capital market through corresponding instruments. An example would be callable mortgage bonds in Denmark. But investors in such bonds, such as pension funds and life insurance companies,

often have to offer their customers a guaranteed interest rate, and thus experience similar risk management problems as banks.

In summary, implementing a more complex refinancing model results with a high likelihood in higher costs for the supply of loans. Asset-liability-management for loans without call protection is more complex and requires more capacity dealing with interest risk and consumer behaviour. The liquidity of refinancing instruments may decrease or vice versa demand higher volume issues. Since these effects lead to generally higher operational costs of the lender that cannot be allocated to an individual prepayment, interest rates will generally increase.

A second relevant impact of shorter and more variable loan durations is on the profit of an intermediary from loan origination and servicing, i.e. the sum of fees for loan origination and interest margins less the related costs. In the discussion, two different interpretations exist that trigger different conclusions with respect to the scale of the impact:

- In the first interpretation, the origination/servicing profit is considered as servicing the capital return required for a given balance sheet total. In this static view, the lender would not experience any loss if the capital was released by a prepayment and reinvested in new loans, which is associated with new profits.
- In the second, dynamic, interpretation, the origination/servicing profit is seen as arising once per unit of loan or customer. The profit represents a fixed economic parameter that is budgeted in the overall calculation of the lender, and that will only be generated over the entire planned duration of loan servicing. If the duration of servicing is unexpectedly reduced, the lender incurs a damage. This argument assumes that costs are not completely passed on to the customer in the initial phase of the loan, which is typical for many mortgage markets.

Both interpretations are largely equivalent in practice. When new customers are acquired by incurring initial losses the average return on equity decreases due to prepayments in proportion to the number of loans. If the losses cannot be compensated by gains from regular servicing over a sufficiently long period, there will be a damage for the lender. However, the extent depends heavily on the price structure chosen for loan origination and servicing, as will be shown below.

### **1.3 Call protection models for fixed-rate loans**

#### Basic legal concepts

It is basically law or legal practice that defines European call protection for fixed-rate mortgages. There are two fundamental concepts:

- freedom of contract, implying far-reaching options for lenders to design type and amount of fees, and also the exclusion of prepayment;
- normative restrictions on the freedom of contract, including imposing a universal prepayment option and subjecting prepayment indemnities to limits.

In practice, full freedom of contract is no longer characteristic for Europe. In particular, contractual options to exclude prepayment are usually outlawed or have become severely restricted, e.g. in Germany by the reform of the Civil Code in 2002. The case is

not pursued in more depth in the following analyses. Rather, they focus on the situation of a borrower with a universal prepayment option.

From an economic perspective, the areas of relevance are the treatment of the above discussed risk and cost dimensions of prepayment, reinvestment profits and losses and interest margin damage.

### Reinvestment profits and losses

In Europe only two economically relevant models are used to treat reinvestment gains and losses - the indemnity and the market price model.

- (a) The indemnity model allows the lender to compensate his loss from reinvesting the prepaid funds by a commensurate prepayment indemnity. A compensation is given if the indemnity reflects the residual maturities and interest rate differences of a typical reinvestment (“yield maintenance”).

The indemnity approach implies an asymmetric compensation, i.e. a reinvestment gain for the lender does not have to be paid out to the consumer.

All European jurisdictions known to the author allow for the indemnity model, however, many of them restrict it through various legal interventions.<sup>1</sup>

The indemnity principle is, for instance, firmly anchored in the legal systems of Central and Northern Europe; there are, however, a wide variety of restrictions. Germany, for example, restricts the admissible residual term for levying an indemnity to a maximum of 10 years. In the Netherlands, certain cases of borrower hardship are exempt from the payment of indemnities.<sup>2</sup>

In Europe, France and Belgium impose legal restrictions on the size of indemnities. These are set at such a low level that - as will be shown in the following – they become tantamount to a fixed prepayment fee. In France the law known as Loi Scrivener stipulates that indemnities may not exceed six monthly interest payments or 3 % of the outstanding balance. Other European countries apply legal restrictions on indemnities only to partial prepayments.<sup>3</sup>

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<sup>1</sup> Here and in the following sections, the assumptions of the author are based on his work with Professor Reinhard Welter/University of Leipzig in 1997 for the EU Commission (see Dübel, Lea, Welter (1997)) as well as a number of his own and other subsequent studies (e. g. Köndgen (2000) and Dübel and Lea (2000)). There is no detailed European-wide analysis of legal restrictions that compares different legislations. The IFF study (2004) very often refers to business practice instead of providing a stringent analysis of valid legal restrictions. In its most recent justification for the reform of the Consumer Credit Directive, the EU Commission (2002, footnote 22) quotes Ireland, the Netherlands, Belgium, Luxemburg and the United Kingdom as countries with legal restrictions on the indemnity model. As the Commission itself remarks, this list is not complete and may not even be fully correct because e. g. France is wrongly quoted as a country where indemnity payments are prohibited.

<sup>2</sup> The exceptions in the Netherlands are the sale of a property or people moving because of a new job, the death of a borrower and the situation of loan default.

<sup>3</sup> For example the Netherlands.

Some countries in Southern Europe have equivalent industry standards on restricted indemnities which are, however, not legally binding. Examples are Portugal, Spain, Italy and Greece. In these countries, the prepayment indemnities for variable-rate mortgages are usually restricted by law (normally to a maximum of 1 %, which means that they are even higher than in Germany where the limit is zero), but not for fixed-rate mortgages.

All countries with restrictions placed on the indemnity level have a common history of high and volatile inflation rates. Their restrictions date back to periods with extremely high interest rates in today's perspective, for instance the Loi Scrivener from 1979/80, when there were justified concerns about possibly high credit losses arising from long fixed-interest periods.

While there are lenders in countries without legal restrictions on indemnities that do reduce the indemnity amounts they demand, by contract or ex-post, as the IFF study outlines, this does not represent an independent legal model but is a result of market conditions or business strategy.<sup>4</sup>

- (b) The market price model in Europe is currently empirically restricted to the “non-callable” fixed-rate loan that is used in Denmark.<sup>5</sup> In terms of the underlying economic concept, it is, however, of utmost importance. While the term “non-callable” hints to the fact that prepayments in this loan instrument are being excluded by the lender, the borrower enjoys a factual prepayment option by being able to buy back the loan at the market price. All Danish mortgage loans are placed as bonds on the capital market and can be bought back from the investors anytime via the so-called “delivery option”.

As the market price of a fixed-rate loan changes in line with the going interest rate level (see blue line in figure 1) and its residual term, there is an automatic compensation, comparable to a prepayment indemnity, going to the investor if loans are prepaid after interest rates have dropped. However, the borrower is also entitled to buy back the loan if interest rates have risen, resulting in a capital gain for himself. In contrast to the indemnity model, therefore, the market price model is symmetrical with respect to payouts to borrower and lender.

The “non-callable” fixed-rate loan must not be confused with the “callable” fixed-rate loans that have an important market share in Denmark and that can, by contrast to the “non-callable” fixed-rate loan, be bought back at their nominal value (par) instead of at market prices. See again figure 1.

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<sup>4</sup> The IFF study here gives Austria and Greece as examples. The U.S. is also an important case because in most states there it is possible by law to charge prepayment fees but in practice they only exist outside the large market segments that are defined by the purchasing policy of the Fannie Mae and Freddie Mac secondary market duopoly.

<sup>5</sup> In practice, Danish “non-callable” mortgages are granted for a term of up to 5 years. However, longer fixed-rate terms are not restricted by law, the maximum exclusion term is as in Germany 10 years.

A third, but no longer relevant model is the contract penalty in the case where it may exceed the compensation for an economic loss of the lender. In the past such high penalties were nothing unusual in Great Britain. As late as at the end of the '90s, Dübel and Lea (2000) still found penalties for prepayments of up to 7 % of the loan volume.<sup>6</sup> However, this practice is now strictly limited because of intervention by consumer protection bodies and courts. That said, the British market structure is not fully comparable to that of continental Europe so that no conclusions as to an analogy with the French approach may be drawn.<sup>7</sup> In addition, it must be clearly stressed that contract penalties pursued by individual lenders in continental Europe, which are outlined in the IFF study, represent a subcase with respect to the indemnity model that is legally admissible in the respective countries.

Similar effects as a compensation payment made to the lender are produced by factors related to property law and its administration, or closing practices; in some countries these generate high transaction costs of prepayment. Examples are the costs for entering a new mortgage into the land register which in France or Belgium may even amount to several percent of the loan volume because their, usually accessory, mortgages require the mandatory involvement of a notary.<sup>8</sup> These factors are not analysed in further detail, although they play an important role for the later analysis of the reasons for reigning into call protection mechanism adopted by the lenders.

**Table 2 Overview of the effects of call protection for fixed-rate mortgages in Europe for the case of reinvestment losses**

Payout through call protection ..	..is greater than reinvestment loss	..equals reinvestment loss	..is lower than reinvestment loss	Zero
Prepayment options costs	Zero options costs	Zero options costs	Partial options costs	Full options costs
Denmark*		X		X
France			X	
Germany		X		
Italy		(X)	X	
Netherlands		(X)	X	
Portugal			X	
Spain			X	
Great Britain	(X)	(X)	X	

Source: Dübel (2003). Note: X: currently applied; (X): no longer applied or diminishing. \*Denmark uses both callable and non-callable fixed-rate loans (with implicit yield maintenance indemnity). The table addresses only the financial motives for prepayment.

<sup>6</sup> See Dübel and Lea, l. c., p. 232.

<sup>7</sup> Great Britain is a special case, because there fixed-rate mortgages with terms that are relevant for this study are still rare and fees related to prepayments are generally charged only for the deeply discounted initial fixed rate periods of variable-rate agreements that lenders use to tease consumers into borrowing from them.

<sup>8</sup> See Dübel and Lea, l. c., p. 187 for a transactions costs overview of prepayment.

### Interest margin damage

There are three essential approaches in Europe:

- A fee model that only allows charging the administration costs directly arising in connection with a prepayment. An example is Denmark.
- An indemnity model that is based on a calibration of the interest margin damage. In Germany, this approach is basically restricted to two calculation methods - an asset-asset and an asset-liability comparison. Sweden uses a limited version of the asset-liability comparison that applies a small cost reduction of 1% for calculating the margin damage.
- The author estimates that a large number of countries do not allow the charging of further fees or indemnities for lost interest margins. In addition to France and Belgium this is true, for instance, in Finland.<sup>9</sup> Such a prohibition is in fact universal for the credit class of variable loans in Europe, including Germany.

### Combination of models

A combination of the three models each by type of damage results in different amounts of the highest admissible overall costs for a prepayment in the form of indemnity payments or fees. As a rule, wherever admissible individually, fees or indemnities for margin damages may be cumulated with the respective admissible indemnities and/or market prices with respect to reinvestment gains and losses.

## **1.4 Interim conclusions**

The elementary design options for mortgages comprise next to variable-rate mortgages fixed-rate mortgages which callable free of charge and fixed-rate mortgages which are call protected. The latter is the dominating loan class in Europe because it is simple to refinance and should be part of any complete mortgage market.

For this reason, call protection mechanisms are applied in all European mortgage markets. With the exception of France and Belgium, it is legally admissible to compensate banks for reinvestment losses caused by prepayments through indemnities. Some countries in Southern Europe apply industry standards in order to restrict indemnities that do not, however, have any lasting normative nature. Within the legally admissible scope in Europe, there are also individual lenders restricting indemnities by contract. That said, most European countries prohibit charging compensations that exceed lender reinvestment losses (e.g. for interest margin damages) and fees.

An second, conceptually important model is the Danish “non-callable” fixed-rate mortgage that can be bought back by the borrower at the market price.

Thus, the most important models for call protection in Europe are the indemnity model and the market price model.

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<sup>9</sup> The author does is unaware of a detailed legal essay on this issue.

## Chapter 2 Impact analysis of different call protection models using a simulation model

### 2.1 The distribution of reinvestment gains and losses

#### Static calibrations of the indemnity model leads to distorted results

The IFF's previous study worked with a single calculation example and thus masked out the empirical distribution of interest rates and residual terms. Such a procedure – however understandable for the sake of mathematical simplification – produces distorted results because the variables volatility and trend of interest rates as well as residual maturity at the time of prepayment are jointly determining the level of yield maintenance indemnities.

The following is an example for the distortion that is produced by such an approach:

- The interest rate example was chosen in such a way that resulted in a prepayment indemnity of around 10,000 € for a German loan in the amount of 100,000 €. As can be shown by a dynamic analysis, this compensation volume is, however, at the upper end of the empirical distribution. This is even true for the past 20 years which was a period marked by heavy interest cuts, something that is not very likely to happen again for decades.

<b>Box 1 Common features and differences in the approach of the IFF study and this study</b>		
	<b>Iff study</b>	<b>Present study</b>
<b>Interest rates (assets)</b>	Point observation Feb-98	Bundesbank mortgage rate series June 1982 - June 2003
<b>Interest rate binding period</b>		10 years
<b>Amortisation</b>	None	1% initial amortisation
<b>Calculation method</b>		Asset-liability comparison
<b>Interest rates (liabilities)</b>	Pfandbrief index (PEX) & Pfandbrief yield (Bundesbank) series	
<b>Call dates</b>	Call after 5 years	Call after 8/5/3 years
<b>Loan origination dates</b>	One observation February 1998 PEX und Bundesbank	with PEX 178/208/208 observation points 6-82/12-82/12-84 to 4-97/4-00/4-02 with Bundesbank yields 178/181/181 observation points 6-82/3-85/3-87 to 4-97/4-00/4-02
<b>Discount factors</b>	Pfandbrief yields, Euribor	Pfandbrief yields, money market rates
<b>Periodicity of discounting</b>	Monthly	Annually
<b>Assumptions over saved servicing costs of lender</b>	60 E p.a. saved administration costs 0,15% saved risk costs	

Source: IFF/Author. A more detailed description of data sets and methodology can be found in the appendix.

- Simultaneously, the study assumes that Austrian lenders charge prepayment indemnities only in the middle of an interval from 0 to 10,000 €, although Austria allows for analogous yield maintenance prepayment indemnities. A similar procedure is used for several other countries where banks are legally allowed to charge indemnities covering their reinvestment losses without further restriction.

Thus, the study implicitly insinuates that non-German banks would accept larger reinvestment losses after deduction of the indemnity than German banks, in spite of having the same legal options at their disposal.

The study only partially explains this significant behaviour by mentioning stronger competition. More on this topic further down. An incorrect specification of the calculation example is equally likely.

### A simulation of call protection models in dynamic perspective

The simulation aims to calibrate the reinvestment gains and losses associated with the historic interest rate distribution correctly, and with an expected future interest rate distribution realistically, including how call protection affect them.

Its underlying idea is to model, by using sufficiently long interest rate time series, a sufficient number of combinations of going interest rates upon loan closing and loan prepayment, as well as loan holding periods and residual terms respectively, covering several interest rate cycles.

With this model strategy it is possible to build a complete history of prepayment indemnities that were in fact paid and/or might have to be paid in the future. The indemnity is computed based on a standard comparison between interest rates on assets and liabilities with the usual assumptions (“Aktiv-Passiv-Vergleich”). At the same time, the IFF calculation is recomputed and put into the context of German interest rate history.

### Data

The historical interest rate distribution of the past two decades that is used in the first part of the simulation is based on the detailed mortgage interest rate report of the German Central Bank (*Deutsche Bundesbank*) and, on the other hand, on the relevant reporting on Pfandbrief interest rates of the German Central Bank and the Association of German Pfandbrief Banks (*Verband deutscher Pfandbriefbanken*).<sup>10</sup>

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<sup>10</sup> The German Bundesbank kept mortgage interest times series for periods of 2, 5 and 10 years. These were replaced in June 2003 by the new reporting structure of the ECB that, however, is only insufficiently detailed with respect to the residual terms. In addition, the Bundesbank’s yields on mortgage bonds outstanding and the PEX yields of the Association of German Mortgage Banks are used, each with an annual – slightly varying – adaptation of terms. On details of the data sets used see appendix.

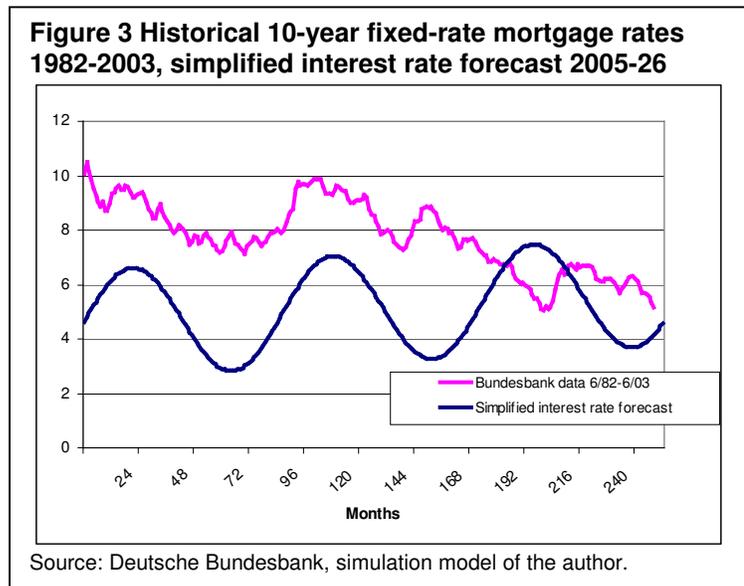
Although these are German market data, with respect to their *volatility* they can be considered representative for the current interest rate policy in the euro zone and the currencies tied to it, in our context, in particular for the Danish crown.

However, it is unlikely that the downward interest rate *trend* since the middle of the '80s will continue in the next two decades, because the interest rate reached an historically low level in the euro zone at the beginning of 2005. This can only decline further if there is sustained weak growth and, even then, only at a significantly slower rate. From today's point of view it is most likely that the interest rates remain constant or increase slightly.

This is a crucial aspect because the interest level for 10-year mortgages measured by the Bundesbank has more than halved from 10.1 % in June 1982 to 4.8 % in June 2003 even though the German inflation rate in 1982 was rather low compared to other European countries. In France, comparative interest rates for 15-year mortgage loans in the same periods amounted to around 16 % and 4.6 %, i.e. by the middle of 2003 the interest level had been cut back to between a quarter and a third of the level two decades earlier. The interest rates on liabilities, in particular the yield on covered bonds, i.e. the Pfandbrief, that nowadays form the basis for many loans in Europe, declined drastically as well.

This means that the past 20 years in Europe were marked by extremely high potential prepayment incentives on the side of the consumer and vice-versa reinvestment losses on the side of the lenders. In all probability, a repetition of this kind of decline in interest rates is not to be expected over the next decades so that there will be likely more spells of potential reinvestment gains for lenders and correspondingly lower prepayment incentives.

Figure 3 shows a comparison of the historical Bundesbank time series and a simplified synthetic



interest model for the next 20 years that is used as the basis for the second part of the simulation. Here, the amplitude and the wavelength of the synthetic model are adapted to the historical Bundesbank data in order to reflect the assumption that the volatility remains constant. The model assumes that interest rates will tend to rise slightly over the next 20 years.

## Results

Figure 4 first of all shows the distribution of the prepayment indemnities that were calculated via the asset-liability comparison over time without any further legal restrictions.<sup>11</sup> Apart from minor deviations caused by the structure of the simulation, the data is in line with the amounts that were charged as compensation over the past 20 years in Germany.

It is clearly visible that the relevant residual term does have a certain effect, e.g. the average indemnity for a termination after 3 years and 7 years remaining term amounted to 9514 € (prepayment after 3 years), for termination after 5 years and 5 years remaining term 8799 €, and for termination after 8 years and 2 years remaining term 5271 €. The interest cycles transpire to the indemnity value curves.<sup>12</sup> The aspect of the impact of different levels indemnities at different residual term levels on affordability will be discussed below (see table 1).

Furthermore, it is important to observe the minimum and maximum values with respect to the distribution of the indemnities that are caused by the volatility of the interest rates. For instance, for loans that were paid back during the periods of high interest rates at the beginning and in the middle of the '90s no indemnity payments were charged. Those who, on the other hand, opted for repaying in times of a heavy interest rate decline, like during the '80s, the early '90s and since the end of the '90s, even had to pay as much as 21,140 €.

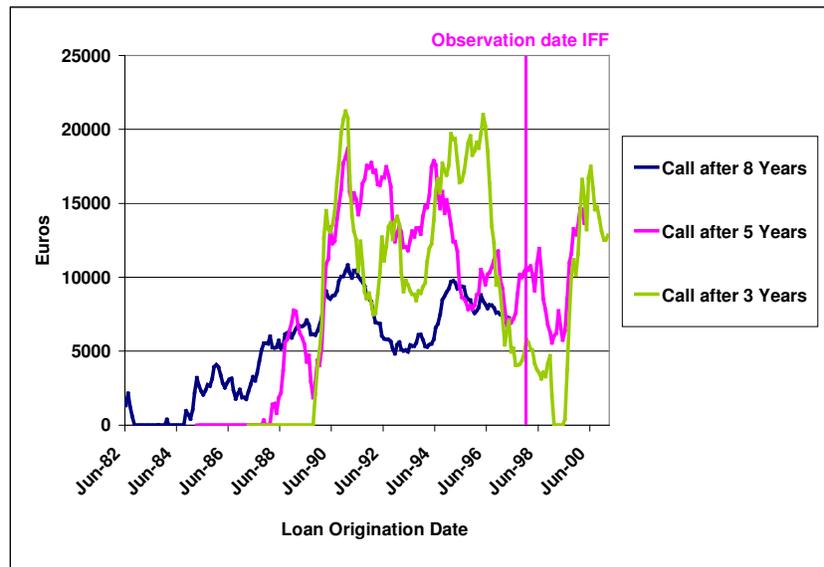
Figure 4 also shows the key date chosen by the IFF study. The minor deviation of the value for the prepayment indemnity in this simulation is explained by the different assumptions with respect to loan amortisation as well as by the calculation method that was simplified here because of the high data volume. See box 1 and the discussion in the appendix to learn more about the differences and common features of both studies. The distribution of compensation payments over time also makes clear that the calculation methodology chosen by IFF results in an amount that, although having been typical of the interest cut period at the end of the '90s and the beginning of this decade, does not consider the large fluctuations of the entire historical interest rate distribution over a longer period.

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<sup>11</sup> Figure 4 is based on Pfandbrief yields data published by the Bundesbank. The appendix contains a graph with the relevant data based on PEX yields for reasons of comparison. PEX yields have time series around two and a half years longer.

<sup>12</sup> A longer holding period of a loan goes along with fewer monthly observations of loan origination dates because of data restrictions. E.g. the average figures specified above are related to 181 months (call after 3 and 5 years) and 178 months (call after 8 years). See also the varying length of time series in the figures.

**Figure 4 Indemnity model: values for indemnities due by loan origination date, at varying call dates/residual terms, with historical interest rates 1982-2003**



Source: Deutsche Bundesbank, simulation model of the author. Notes: 10-year fixed-rate loan with 1% initial repayment. Time series of mortgage rates, bond rates and money rates by Deutsche Bundesbank. Assets-liability comparison. Further assumptions see box 1. Details on data sets and methodology see annex. Residual terms are 10 years minus period to call.

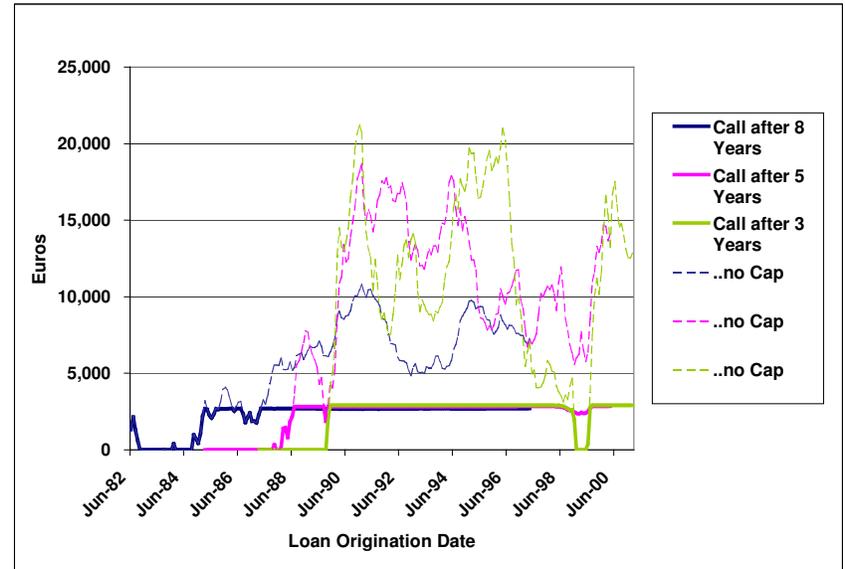
Figure 5 compares the unfettered indemnity levels in figure 4 with the result arising in a market that is subject to the heavy restrictions of the French Loi Scrivener that are favoured by the IFF also for Germany. The prepayment indemnity is limited here to a maximum of 6 months of interest payments and/or 3 % of the remaining debt. Since the indemnity model is based on the principle that the lender has to be economically compensated for his damage, a restriction means that part of the damage will remain with the lender. Figure 5 shows the amount of the remaining damage between the closed (restriction) and the dotted (full indemnity) line.<sup>13</sup> In the period under review, the loss of a lender who was subject to French laws while acting in the historical interest environment in Germany would have amounted to between zero and more than 16,000 €. Since a lender who is governed by such heavy restrictions is not able to obtain full compensation for his damage, he is forced to charge a price for the reinvestment loss as a margin premium. And this is the case in France, as will be shown further down, exacerbated by the fact that prepayment incentives had been very high because of the stronger decline of the interest rates during the comparative period.<sup>14</sup>

<sup>13</sup> The assumptions with respect to interest margin losses are identical in both cases.

<sup>14</sup> Estimates of French banks in the context of internal debates of the European Mortgage Association on the results of the forum group of 2004 assume that the loss of credit institutions due to restrictions on prepayment indemnities amounted to round 10 bn euro between 1986 and 2003.

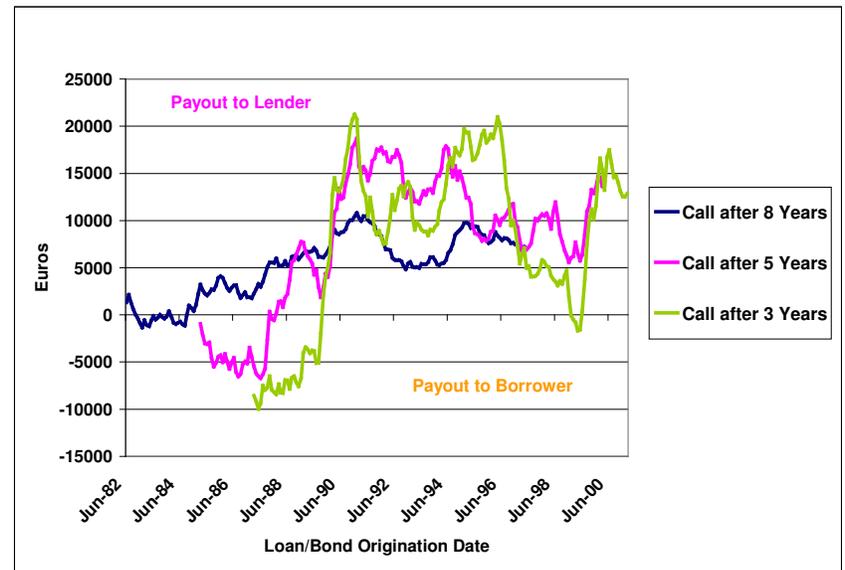
However, this finding can be transferred to any other European jurisdiction with similar restrictions. A general rule in this context is that the higher the legally admissible indemnity, the smaller the residual reinvestment loss and the lower the margin premium charged to the customer additionally. This aspect will be discussed in more detail below.

**Figure 5 Constrained indemnity model: as figure 4, cap by law to the lower of 6 monthly interest payments or 3% of the outstanding balance (Loi Scrivener)**

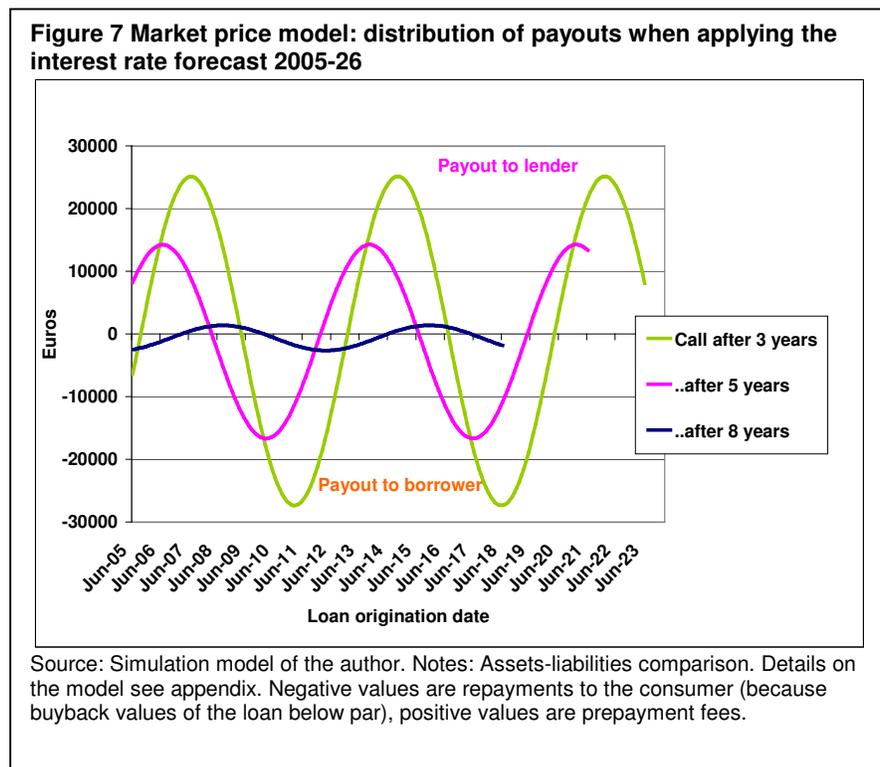


Source: Simulation model of the author. Notes: see Figure 4.

**Figure 6 Market price model: distribution of payouts with historical interest rates 1982-2003**



Source: Simulation model of the author. Notes: see above. Negative values are payouts to the consumer (because the loan buyback value lies below par), positive values are equivalent to yield maintenance prepayment indemnities.



The market price model. What effect, then, would the Danish model that allows buying back a loan at market prices have had in the historical interest environment? Figure 6 provides an answer: for most origination periods, the market prices that Danish consumers would have had to pay would have been identical to the costs of prepayment indemnities in Germany, excluding the damage to the interest margin.<sup>15</sup> For example, a prepayment fee of 13,400 € for a German loan that was originated in May 1990 and paid back in May 1995 is equivalent to the increased callback value for a Danish non-callable bond of 114,30 €.

However, even during the period of sinking interest rates in the past 20 years there would have been phases where the Danish borrower would have made a capital gain had he bought back the bond prior to due date. For example, the callback value with a remaining term of 5 years would have fluctuated between 93 and 120. As will be shown further down, this symmetric payment structure affects debt servicing before and after a prepayment and thus affordability.

### The different models and interest rate forecasts

Figure 7 shows the expected reinvestment losses and gains assuming callback values at market prices if the interest rate forecast model that is presented in figure 3 becomes

<sup>15</sup>

See below for a further discussion of the differences in dealing with the interest margin loss.

real. Indemnity payments are derived by considering only positive values of the distribution, since an indemnity by its definition cannot become negative, while a callback value can very well be below par/100.

There is no significant difference between the expected maximum values during the two interest rate periods because of the similar volatility assumptions. However, the slightly positive interest rate trend does have an effect during the forecast period resulting in an increase in the number of phases where the borrower may achieve reinvestment gains instead of losses.

This fact – as is shown in the summarising box 2 below – is of vital importance with respect to the difference between both models from the lender’s and borrower’s point of view. While there was scarcely any difference between the indemnity and the market price model considering historic interest rates of the past 20 years, a change in the

interest rate trend would imply a significant improvement of the expected payout – aggregating over all prepayment dates - for the borrower under the symmetric market price model.

Changes in prepayment frequencies are unlikely in that regard: both with the indemnity and the market price model financial incentives for prepayment are largely cancelled out since the mortgages cannot be repaid free of costs (see below). Rather, it is reasonable to expect constant prepayment frequencies, as they are made mostly for ‘non-financial’ reasons, e.g. due to moves or home sales.

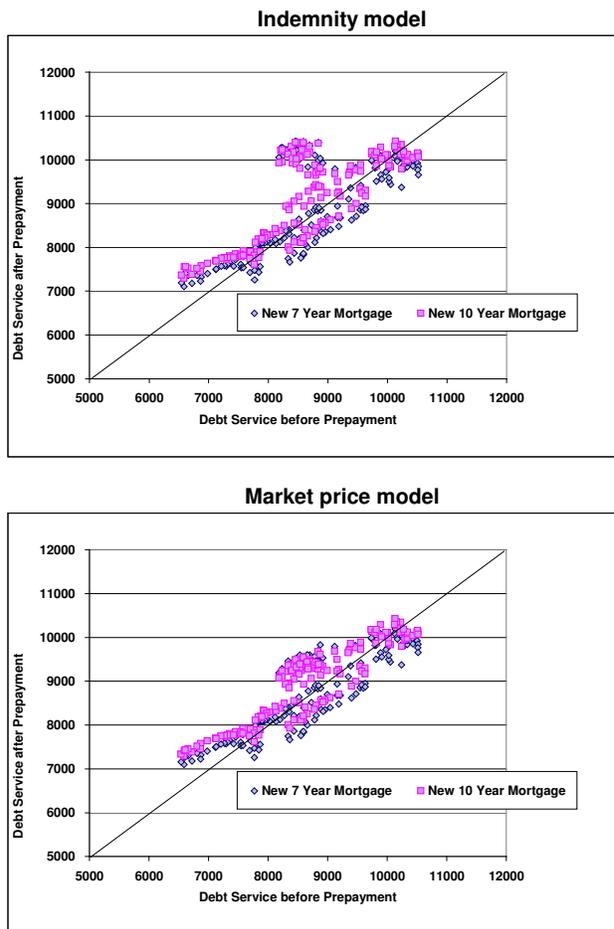
### 2.3 Loss of interest margin

The German legal policy debate attaches great importance to the aspect of the lender’s lost interest margin.

The quantitative difference between the fee model and the indemnity model (see above) is almost insignificant for short remaining times to maturity; with longer remaining terms it increases moderately.

For example, compensation for a loss of interest margin with a

**Figure 8/9 Debt service burden before and after prepayment in the indemnity and market price models of call protection**



Source: Simulation model of the author, monthly new mortgage interest rate data of Deutsche Bundesbank, 1982-2003. Notes: Call (prepayment) of a 10-year mortgage after 3 years. Borrowers pays (indemnity model) or pays and receives (market price model) the payouts as defined above. The payout – positive or negative - is capitalized into a new fixed-rate loan (7 year or 10 year), which is financed at the new borrowing rate applicable at the time of call.

residual term of 2 years amounts to less than 1 %, with a term of 5 years slightly more than 2 % and with a remaining term of 7 years, i. e. call after 3 years, around 3%.

## 2.4 Consumer policy considerations

The debate in terms of consumer policy focuses on two major questions about prepayment indemnities that can be answered by way of the simulation program.

### Do prepayment indemnities imply a real burden for the borrower?

This question may sound strange at first glance, but it isn't. The fundamental question is whether the servicing burden of a borrower changes or not after a prepayment was made.

In order to explore this aspect in more detail, the simulation program is applied to the economic situation of refinancing by taking up a new loan. It is assumed that a borrower who prepays a 10-year fixed-rate loan after 3 years either signs a new loan agreement with a term of 7 years, corresponding to the residual term of the old agreement, or a contract with a fixed-rate for 10 years, which is the more realistic example. Then the old and the new debt service levels are compared.

The expectation is that an indemnity oriented at the reinvestment loss or gain of the lender does not lead to higher debt service levels of the borrower, as the additional or reduced borrowing requirements which are generated by the indemnity and the new interest rate level cancel each other out.

With the indemnity model - see results in figure 8/9 with historical data of the Bundesbank - there is in fact no significant additional debt service burden due to the prepayment fee for most dates of loan origination. There may, however, be charges for the bank's loss of interest margin, or service charges, that would have to be financed; but their effect is small relative to the typically long remaining amortisation period of the loan.

However, there is a problem with the indemnity model that becomes visible when comparing it to the market price model. For some dates of loan origination there actually is an additional burden arising from prepayment. On the upper left side of the first chart in figure 8/9 a group of combinations of loan origination and prepayment dates is visible where the refinancing borrower would not have had to pay a prepayment indemnity but his new financing would have been significantly more expensive than the prepaid one. Although one may assume that only a few borrowers prepaid in this constellation, this cannot be ignored: due to the fact

#### **Box 2 Summary of simulation model results – indemnity and market price model**

Interest rate assumption	Averages		Maxima
Historic 1982-1995/2002			
Prepayment after	Indemnity	Market price	
3 years	9514	8354	21240
5 years	8799	7984	18686
8 years	5271	5195	10806
Forecast 2005-2018/2024			
Prepayment after			
3 years	8353	4617	22622
5 years	5087	2050	13877
8 years	680	149	1972
..without interest margin loss			
Prepayment after			
3 years	7159	2718	20413
5 years	4257	594	12269
8 years	363	-499	1311

Source: Simulation of the author. Notes: For details on the calculation methodology see appendix. The results of the individual residual terms cannot be compared directly, because averages and maxima are not computed over full interest rate cycles.

that a negative indemnity is impossible, the borrower is effectively prevented from prepayment and is hindered in his financial or professional mobility. The economic literature calls this effect “lock-in”.

The lower chart in figure 8/9 shows that the debt service conditions would not have deteriorated if the loan could have been bought back at market prices. The reason is that in the said constellation it is possible to buy back a loan below par. This means that a new, higher interest rate is compensated with a new financing volume that is lower because of higher equity available to the consumer; the debt service burden will consequently not change.

At this point another graph showing the data for the interest rate forecast is obsolete. It is, however, obvious that the number of situations with a higher service burden resulting from prepayment will increase in the indemnity model if the historic falling interest rate trend changes towards a flat or even rising trend.

#### Are restrictions on prepayment fees necessary considering the liquidity aspect?

Would a burden only on liquidity be detrimental? After all, the borrower is already financed and only has to take up a slightly higher new loan for a possible indemnity, if any. Even if the old lender would refuse to grant such a higher loan, the European mortgage markets are subject to hard competition and other institutions would happily do so.

However, the question is not entirely irrelevant; against this background, even the German legislator, as seen less restrictive compared to her European peers, has limited the contractual exclusion of prepayment to 10 years. Thus, there are no call protection mechanisms in Germany that exceed 10 years.

To address this issue two questions are analyzed: first, how high can a burden on liquidity become over time, and second, is there a potential solvency impact on consumers as for indemnities charged over longer periods of time or in case of very volatile interest rates.

First of all, the historical data show that the reinvestment losses of investors in the historic interest environment had been limited in spite of a continuing decline in interest rates. The highest buyback value of a mortgage in the market price model thus did not exceed the value of 122 over the entire period under review.

Figure 10 shows the maximum payouts correlated with the residual terms in the interest forecast model, the maximum being computed over all observations for a particular term. The highest indemnity level (payout to the lender) is reached at around 7 years residual term (i.e., prepayment after 3 years) and does not increase further with an increasing residual term (i.e., earlier dates of prepayment). The reason for this is that interest cycles are typically rather short, e.g. only around 5 years pass between the highest and the lowest level of interest rates. A prepayment after two years with a residual term of 8 years, while carrying a higher refinancing volume and a longer residual term, features a lower probability of large yield differences arising in the indemnity calculation than a prepayment after three years with a residual term of 7 years.

Therefore, there is no point in reducing the maximum admissible period for prepayment indemnities unless the period was extremely limited, e.g. to a residual term between 2-

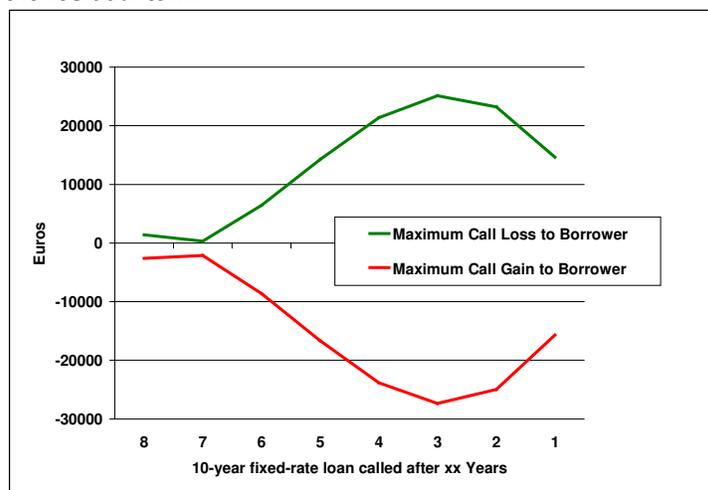
years. This, however, would have similar effects as the heavy restrictions on the amount of indemnities that are outlined above by way of the French example.

This situation may change if the underlying conditions change, e.g. if non-amortising mortgages are used (e.g. in countries with mortgage interest deduction from the income tax base), or interest rate cycles become longer.

Fluctuations in the debtor's income or changes in his life situation may represent a bigger problem. There may actually be problems with the debt servicing of long-term fixed-rate mortgages in combination with a general disinflation process if such a mortgage is not amortized quickly enough. Markets with mortgage interest deductions from income tax, as the Netherlands or the Scandinavian countries, virtually ask for such low amortizations. Against such a background, borrowers in Norway that had very long interest-binding terms in their non-callable fixed-rate mortgages – 20 years and longer -

taken up in a period of high interest rates had severe payment troubles in the '90s because their income and property price development did not meet expectations.<sup>16</sup>

**Figure 10 Maximum payouts by or to the consumer in correlation with the residual term**



Source: Simulation model of the author. Note: based on a simplified interest rate forecast as in figure 3. Includes interest margin damage. For details see appendix. Negative values are associated to payouts to the consumer (because of loan buyback value below par), positive values are analogous to yield maintenance prepayment indemnities.

Another problem may arise if the borrower was insufficiently advised on the risk arising from the interest rate commitments as implied by call protection mechanisms, or has solvency problems anyway so that they wish to restructure their debt.

This issue will be later

discussed in greater detail by taking the example of Dutch regulations.

## 2.5 Interim conclusion

A merely static analysis of prepayment indemnities does not deal sufficiently with the aspects of consumer policy issues under debate. It leads to distorted results because it

<sup>16</sup> After less severe, but similar experiences Denmark had already in 1989 limited prepayment exclusion to 10 years. As mentioned above, contrary to Norway, such non-callable loans can be repurchased from the market in Denmark.

does not include several important factors, such as the moment of loan origination and varying levels of yield differences and residual terms.

A dynamic analysis with time series of the Deutsche Bundesbank from 1982 to 2003 shows that the level of prepayment indemnities experienced strong fluctuations in the historic interest environment. The indemnity and the market price model of call protection did not vary much in terms of their expected payout values for consumers. In countries with a heavily restricted indemnity amount, like France or Belgium, a high residual damage upon prepayment was assigned to the lenders.

Over the next decades the situation is likely to change drastically, as a simple interest rate forecast suggests. As long as indemnities are not permitted to become negative, assuming constant or slightly rising interest rates, the market price model will imply significantly lower average or expected payouts from the borrowers to the lenders in the case of prepayment than the indemnity model. Thus, there will be an increasing number of situations where the borrowers in the indemnity model will have to accept a higher level of debt service after a prepayment and refinancing for a new loan. This “lock-in” effect would not be in the interest of the lenders who increasingly also wish to service mobile consumers with fixed-rate loans.

However, contrary to what consumer protection groups repeatedly claim, there is just as little negative effect on the financial burden due to indemnity or market prices for the borrowers that would affect their solvency. Although changing over to non-amortising loans, like in countries where the deduction of mortgage interest from income tax is common, or where there is higher interest volatility than in the past, may result in higher risks for fixed-rate financing, indemnity as well as a market price are essentially liquidity factors that do not or only insignificantly (damage to the interest margin) change the general burden of financing. A limited period of 10 years for call protection seems to be acceptable from this point of view, also when looking at the historical and the likely future interest rate development in Europe. Reducing this period further would not offer the consumer any liquidity or possible solvency advantages as can be shown with the structure of the interest cycles.

### **Chapter 3    Supply costs and pricing of fixed-interest loans with and without call protection**

#### **3.1 The costs of the prepayment option in fixed-rate loans without call protection**

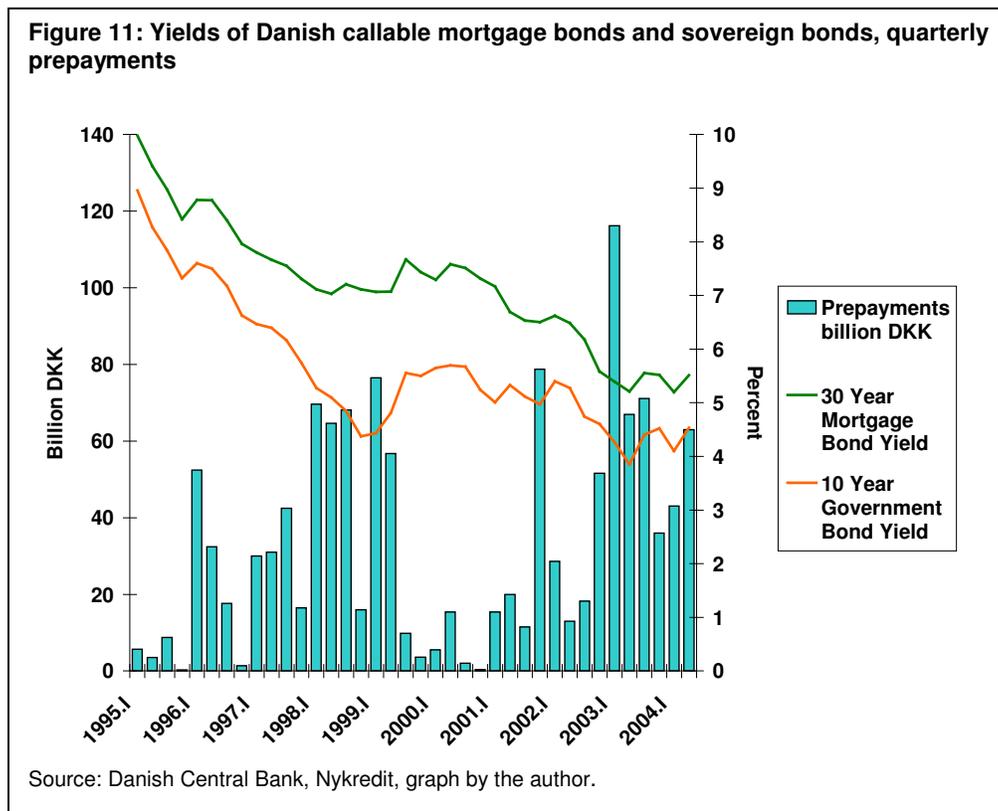
The legal right to prepayment is an economic option, and every option has a positive value, different from zero, during its term.

The prepayment option can be valued by using complex mathematical procedures. Technically, the prepayment option is an American call option whose value varies depending on the residual term of the loan, the interest rate coupon, interest rate volatility and a number of characteristics in relation to the call behaviour of consumers. On the international capital markets, investors and investment banks employ a large number of experts, often mathematicians and physicists, working on valuation procedures that are based on empirical observations of prepayments.

In Denmark and the U.S. it is even possible to identify a market price for the prepayment option. To this end, callable bonds with high credit ratings are observed; with such

bonds, prepayment risk can be passed through to the investors and, thus, is reflected in a margin on the interest rate.<sup>17</sup> Representative are Mortgage Backed Securities (MBS), i.e. securitised pools of loans, in the U.S., and in Denmark the callable covered bond that has been mentioned earlier.

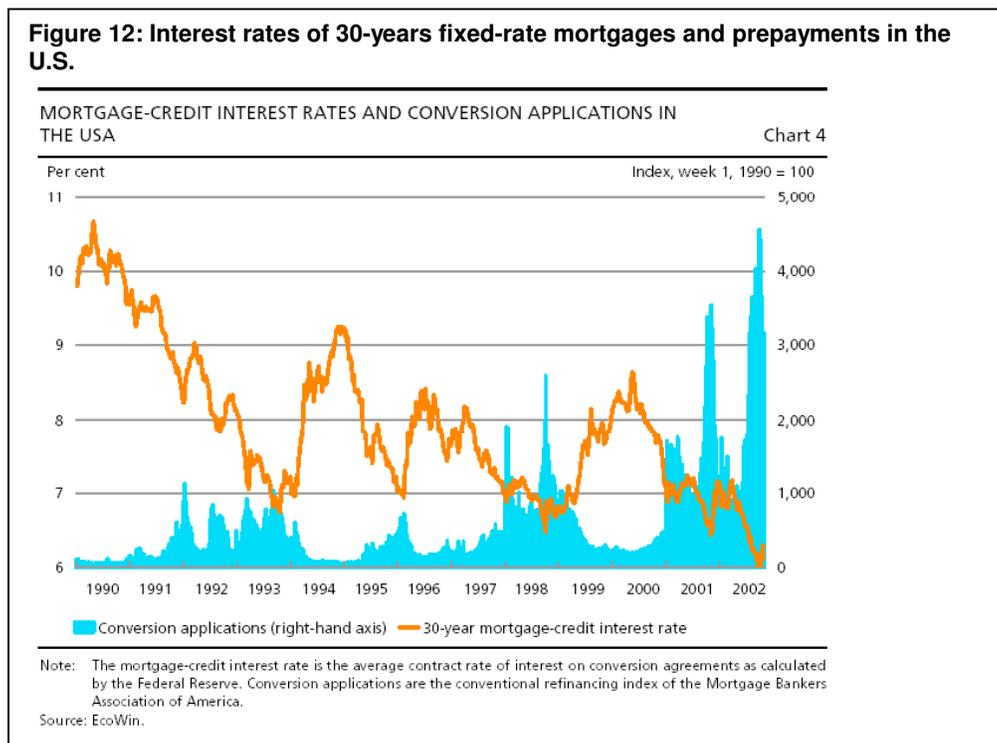
In the middle of the '90s, the typical span of an option for the prepayment risk amounted to 70 to 100 basis points for the very liquid MBS guaranteed by Ginnie Mae – a U.S. agency backed by a guarantee of the Federal Government – in comparison with U.S. treasuries with a comparable maturity.<sup>18</sup> According to market reports, these spans have considerably widened recently in a period were marked by repeated and extremely high prepayment volumes (e.g. at the end of 2001 and 2002).<sup>19</sup>



<sup>17</sup> Kalotay, Yang and Fabozzi (2004) describe their frustration about the lack of precision of the current econometrical standard and develop an empirical approach to calibrating an options-theory based prepayment model.

<sup>18</sup> See Dübel and Lea, l. c., p. 212

<sup>19</sup> For example: Wall Street Journal of 8 August 2002: Bond Market Confronts Turmoil from Homeowners' Refinancings.



There are similar findings for Denmark, where the option costs amounted to 30-45 basis points at the beginning of the '90s. However, today these have significantly increased as well.<sup>20</sup> Figure 11 provides an idea of the dimensions with respect to the interest premium for Danish callable bonds as compared to the corresponding government benchmark that exceeds the typical figures for non-callable German Pfandbriefe by far.<sup>21</sup>

### 3.2 Price effect of restrictions imposed on call protection

#### Restrictions on compensations for reinvestment gains and losses

If charging an indemnity or market price for the purpose of call protection was prohibited, one would obtain a uniform market for fixed-rate loans with a prepayment option and high option premiums, as is outlined in 3.1.

<sup>20</sup> Graven Lasen (1993) is one of the few places in literature where the option price is explicitly calculated.

<sup>21</sup> During the period covered in figure 2, the spreads of Danish callable bonds varied between 100 and 255 basis points; the peak was reached during the Asia crisis in 1998/1999. At the same time, the Pfandbrief-Bund spreads in the 10 year range varied between one and low two-digit basis points up to a peak of 70 basis points that was also reached in the aftermath of the Asia crisis in 2000.

A mere restriction placed on indemnity or market price level, however, results in a dual pricing structure – a price upon exercising the option would still be charged and an option premium would be demanded for the residual damage that is not covered by the option price.

With these consumer protection strategies, loans become significantly more expensive, as can be shown for several European countries.

**Table 3 Average interest rates for mortgage loans in Europe and estimated prepayment option premiums over all loan products (April/May 2003)**

	Average interest rate with prepayment risk	Prepayment option premium	Average interest rate without prepayment risk	Price increase due to prepayment option
Denmark	5.19%	0.46%	4.73%	10%
France	5.10%	0.29%	4.81%	6%
Germany	4.84%	0.06%	4.78%	1%
Italy	4.73%	0.20%	4.53%	4%
Netherlands	4.55%	0.20%	4.35%	5%
Portugal	3.58%	0.00%	3.58%	0%
Spain	3.55%	0.00%	3.55%	0%
Great Britain	4.88%	0.01%	4.87%	0%

Source: Mercer Oliver Wyman, under co-authorship of the author. Recalculations by the author.

Note: The analysis is based on questionnaires completed by 45 European lenders and market data. The indicated interest rates are based on a summary of all lenders registered within one country. The analysis uses published interest rates. In countries where discounts are usually determined by negotiation average interest rates indicated may be too high. The prepayment option premium was estimated with the help of anecdotal market data, typical loan maturities and interest rate volatilities, as well as market shares of fixed-rate mortgages. Please note that the figures are average numbers across all products and therefore do not reflect the features of an individual product. In particular, prepayment option premiums are not reported separately for fixed-rate mortgages, the estimated premiums for that product class in isolation lie above the indicated levels. Lenders in Great Britain, Spain and Portugal do rarely offer fixed-rate mortgages, or, if so, only for short interest rate binding periods.

Table 3 provides an overview of the costs for the option that were identified by the Mercer Oliver Wyman study in 2003 on behalf of the European Mortgage Federation. Because the compensation principle for reinvestment gains and losses is diluted, in France, Italy and the Netherlands considerable interest premiums for prepayment risk are charged.<sup>22</sup> There is a similar situation in other countries with heavy restrictions not reported here, e.g. Belgium. Finally, in Spain and Portugal the fixed-rate loan has largely disappeared from the product mix because of these restrictions.

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<sup>22</sup> With its system of mainly variable interest rates and particularly dynamic competition, Great Britain is a special case. The prepayment volumes here are very large because consumers switch over to competitors who offer low initial interest rates (known as “teasers”, for 1 or 2 years). Switching from one teasing offer to the next is blocked by high prepayment charges. However, pressure from consumer organisations resulted in a considerable reduction of admissible charges and, thus, enhanced prepayments.

The rather moderate appearance of French options costs needs to be interpreted against the background of some of the highest transaction costs for prepayments in Europe, which clearly reduces the speed of prepayments for fixed-rate loan pools.<sup>23</sup>

In this context, the Scrivener Law that was passed in 1979, the year with the highest inflation rate in the post-war era, left deep marks. Due to a stringent anti-inflation policy interest rates in France slumped as early as the beginning of the '80s, causing a wave of prepayments. Those French banks that had refinanced fixed-rate mortgage loans congruently by non-callable bonds were facing substantial losses. The Marché Hypothécaire – a refinancing mechanism for mortgages similar to the Pfandbrief system – collapsed in 1984. This event was followed by a political fight that has now been raging for two decades. In 2000 the situation culminated in high fines that the antitrust authority imposed on the French banks who were found to have colluded against consumers by mutually refusing to accept switching borrowers, certainly a precautionary measure against a further wave of prepayments. The banks also showed no inclination to get on with the overdue reform of the French mortgage legislation – many sources agree that they did not want to risk a reduction of the transaction costs of prepayment. According to the author's calculation, at the end of the '90s, France had the highest transaction costs of prepayment in a comparison between five countries.<sup>24</sup>

#### Restrictions on compensations for lost interest margin

Outside Germany, indemnity payments for a loss of interest margin are unusual. It is, therefore, interesting for purposes of the debate in Germany to understand the effect of a restriction imposed on indemnities for lost interest margins on the pricing of the lenders, or equivalently loan servicers.

In view of the dramatic prepayment waves that Denmark and the U.S. are experiencing today and which are shown in figure 11 and 12, this pricing effect is an important issue. There are several important differences in the structure, however:

- Although Denmark records a high number of repayments it is still not usual to change over to another lender on the occasion of a prepayment. Thus, there is usually a prolonged period of income from loan servicing that exceeds the actual term of the loan. Even so, the lenders adapt their pricing in such a way that the costs and desired capital yield can be obtained ideally within the expected term of a loan, even if this has not always been possible because of the recent prepayment waves.
- This way of operating is a must for the specialised U.S.-American servicers who usually cannot assume that a customer for a new loan they process returns to them. In the U.S., a change of the servicer occurs much more frequently than in Europe because of heavy competition on this market. The ever-shorter durations

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<sup>23</sup> In the middle of the '90s, the French banking association AfB estimated the margin burden on banks due to prepayment option to be around 38 bp, 19 bp thereof were covered by the admissible levels of indemnity payments. See Dübel and Lea, l. c., p. 226.

<sup>24</sup> See Dübel and Lea, l. c., p. 187

of servicing income in recent years have caused enormous pressure on the servicers to increase their prices.

A simple simulation shall illustrate the consequences if compensation for a loss of interest margin is prohibited. In the calculation example in table 4, a lender is assumed to spend 50 bp on loan acquisition after deduction of the loan origination fees that are to be recovered by a profit margin from the interest spread of 13 bp considering a required return on equity of 15 %. For a 30-year loan this plan result is achieved after 10 years, which is currently a typical fixed-rate period in Germany. If the consumer pays back after 6 years, the return on equity decreases to 9 %. This difference is compensated for by indemnities covering the loss in interest margin according to the current German prepayment regime.

**Table 4 Reaction of the return on equity to shortening of fixed-rate mortgage durations without compensation for the lost interest margin, unchanged pricing policy**

Revenues			Interest rate	
Closing	0.50	% of initial loan volume	Fixed rate p.a.	4.50%
Margin	0.43	% of current loan volume		
Costs			Return on equity after..	
Origination	1.00	% of initial loan volume	10 years	15%
Servicing	0.30	% of initial loan volume	6 years	9%

Source: Calculated by the author. Note: Fixed rate with a term of 20 years. The capital yield was calculated using the internal interest rate method.

In how far would the lender have to change his pricing policy if loss in margin could not be recovered any longer? Table 5 shows the result for the same example. In order to obtain the same capital return of 15 %, initially planned after 10 years, already after just 6 years, the lender would have to change the relation between loan origination price and loan margin; in the example, the loan origination price rises drastically to 85 bp which results in a loan acquisition loss for the bank reducing to only 15 bp. At the same time the margin could become reduced.

**Table 5 Pricing policy compensating to the shortening of the fixed rate mortgage duration in table 4**

Revenues			Interest rate	
Closing	0.85	% of initial loan volume	Fixed rate p.a.	4.50%
Margin	0.35	% of current loan volume		
Costs			Return on equity after..	
Origination	1.00	% of initial loan volume	10 years	15%
Servicing	0.30	% of initial loan volume	6 years	15%

Source: Calculated by the author. Note: as above.

A restriction on indemnities charged for loss of margin thus leads to a steepening of the pricing structure, i.e. higher prices at the moment of closing and lower margins. In the beginning this would affect the overall portfolio only to a minor degree, more so because the number of consumers who tie themselves to a lender for a long time is still very high in Germany. However, as seen, the number of people who carry out prepayments and possibly change their lender is closely linked to the possibilities for charging indemnities or market prices for a reinvestment loss. If there were a refinancing wave in Germany, like in Denmark or the U.S., this would result in a fundamental change of pricing policy of lenders towards charging higher loan origination costs.

### 3.3 Consumer policy considerations

#### Who bears the price for the option, the user or the general public?

An important aspect in terms of consumer policy is the incidence of a regulation. As described, the costs of a prepayment option can be raised in two different ways.

- as indemnity or market price to be charged when the option is exercised, or
- as a general component of the price, an options premium.

If pricing policy is free, the lender will offer products with both pricing models to different customer groups, i.e. fixed-rate loans that can be prepaid without costs and those that carry call protection.

Intervening into the pricing menu by prohibiting an appropriate price for the right to exercise the option in this context has an effect similar to cross-subsidising those who exercise the option by those who do not use it.

Even a simple quantitative restriction on the exercise price, as is common in France and Belgium, does not change this circumstance. Its only effect is that now both, options price and exercise price, will be charged simultaneously, i.e. two prices for one and the same service. This type of intervention is ultimately the expression of a political compromise short of entirely prohibiting an exercise price.

In the alternative model allowing for an economically adequate exercise price, the customer will be given incentives via price differentiation to reveal their preferences and select between the different pricing models. This presupposes that the borrower has been made familiar with the product's features upon loan offer and thus is able to self-select in accordance with his price and risk preferences.<sup>25</sup>

#### What are the limits of price differentiation?

In the interest of both the lender himself, e.g. to avoid a loan default, and to protect the consumer, limits of price differentiation should be considered.

One debatable question is whether indemnity or market prices for prepayment, as opposed to other price differentiation tools such as individual credit risk premia or contract penalties, are appropriate candidates for such limits.

The following topics are of central importance in relation in the context of price differentiation:

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<sup>25</sup> The question whether and according to which calculation method prepayment indemnities may be charged is part of the transparency standard for mortgage loans that was agreed in the European Home Loan Code and is applied by over 2,500 European banks. However, the Code does not require evidence of the fact that a prepayment option premium is charged.

- It may not be possible to identify the risks or costs efficiently, or it may not be possible to allocate them to a certain user group.
- It may not be possible to map the risks or costs precisely by a pricing model.
- Price differentiation may be contrary to general legal principles, such as discrimination or undue hardship.
- Price differentiation may lead to follow-up costs for lenders or borrowers, e.g. because the burden is too high for individual borrowers and the affected loans default.

With respect to prepayments the first argument is arguably the least sound. As shown above, it is, in fact, possible to identify the type and triggers for the risk and associated costs precisely.

With respect to the proper mapping through price models, the exact opposite of the basic assumption that a price differentiation would be harmful is the case. Price differentiation actually make the pricing of fixed-rate loans with call protection easier, because their price can be determined by very simple means by any lender in analogy to the price of government debt. At most it could be difficult to calculate interest margin losses (see below) and processing fees, if any; these are fields that court decisions deal with intensively. If, on the other hand, it is no longer possible to charge an exercise price, a price for the prepayment option has to be quoted triggering all problems outlined that may arise when creating empirical models and a mix of assumptions in relation to interest rates and consumer call behaviour.

However, there is a justified debate with respect to prepayments that involves the issue of discrimination, in particular cases of “hardship”, and loan default. These points are briefly discussed by the example of legal practice in the Netherlands.

- In the Netherlands, according to general legal practice the generally permissible yield maintenance prepayment indemnity may not be charged if the lender sells his property or moves away. This allows a considerable number of borrowers to arbitrage and reduce their debt servicing by paying back their loan, selling their property, buying another property and taking up a new loan. This is something that the rest of the borrowers is not allowed to do (see figure 8 and 9) and that all borrowers have to pay for with a risk premium. So this is a subsidy for mobility.

The only economic rationale for this subsidy could be the disadvantage of the indemnity model that is demonstrated in figure 7 which triggers a higher debt service after prepayment (“lock-in”) in the case that interest rates have risen. In this situation, as demonstrated, consumers would be discouraged from moving due to the characteristics of the indemnity model, even if it was desirable from an economic point of view – a clear problem for the flexibility of both labour and housing markets.

Alas, the yield maintenance prepayment indemnity in the relevant cases with increased interest rates amounts to zero anyway., Thus, setting the indemnity at zero or restricting it would make no sense at all if the purpose was to support affordability of movers. In the end the Dutch borrower is as little protected against mobility obstacles related to prepayment as consumers in countries with an economically adequate indemnity model. The Dutch legal practice obviously misinterpreted the economic effects of its own rulings.

- At first glance it seems to make more sense to prohibit prepayment indemnities if a loan default is imminent.

As mentioned above, during a disinflation process or a recession it may happen that the interest rates decrease parallel to a decrease in income or property value. In this case the borrower of a call protected loan faces an increasing market value of his debt (see figure 1) and at the same time a decreasing market value of his property or his income. If no indemnity was charged in this case, the market value of the debt would decrease to par and a default could be easier avoided. Although this argument may seem logical from an economic point of view, there are two objections against it:

- First of all, because it is not consistent with the overriding requirement to offer incentives to repay a debt, it would be a very questionable legal practice to anticipate the result of a (perhaps necessary) debt restructuring that could entail a partial waiver by the lender of debt repayment. Almost all lenders are in practice open to waiving part of a debt if an imminent loss by way of a foreclosure can be avoided – the corresponding mechanisms already exist in all EU countries.
- Secondly, even if the inflation rate is low, during a standard financing the market value of houses will increase faster than the market value of fixed-rate loans with call protection and regular principal repayments reduce the risk of generating a negative equity situation even more.

A consumer should, however, have a higher level of equity if he concludes a fixed-rate loan carrying call protection than if he concludes a fixed-rate loan with a prepayment option and no protection. In other words, the lower interest rate of the loan should not tempt him to contract a higher debt level. This aspect is surely at the core of the problem of consumer protection in the Netherlands because of their extremely generous mortgage interest deductions from tax.

For the same reasons, prohibiting indemnity payments is also questionable in the isolated event of an imminent loan default, e.g. because of unemployment or divorce. These issues are better taken care of in a social insurance system for homeowners, e.g. according to the British model, than in a model with an implicit automatic write-off by the lender that carries incentive problems.

From the point of view of consumer policy it seems to be important that the borrower is informed in detail about the user prices and risks of a loan when the loan is offered and the agreement is concluded.

To this end it may make sense to provide risk calculations together with the loan quotation – similar to the situation in the simulation model above – in addition to the obligation of disclosure that exists all over Europe anyway so that the decision of the borrower is facilitated. As will be discussed later, this would be relevant for all three loan classes – variable rate, fixed-rate with and without call protection.

### **3.4 Interim conclusion**

Any economic option has a market price. This price can be determined with valuation procedures or by the observation of prices formed on the capital market.

The market prices of the prepayment option amounted to around 50 to 100 basis points for very long-term loans in the U.S. and Denmark in a historical review of the last 25 years. In those European countries where prepayment indemnities are heavily restricted the option premiums amounted to 20 to 40 basis points even with significantly shorter fixed-interest periods.

The prepayment option will remain one of the most expensive components of loan costs in the future even if the most probable interest trends suggest both lower prepayment frequencies and lower reinvestment losses than in the past.

So nothing was or is for free: borrowers in countries with heavy restrictions placed on indemnities and thus high reinvestment losses of the lenders pay both a price for exercising the option and a price for the option itself. In Germany this price for the option is in fact zero – which means that Germany has the lowest mortgage loan interest rates in Europe.

Should consumer protection prohibit or restrict economically justified prepayment indemnities for the benefit of so-called hardship cases? The answer is clear as well is a clear no.

As the Dutch example shows, the problem of consumers who are faced with financial obstacles in the event of rising interest rates if they want to move cannot be solved by prohibiting compensation payments – in order to address the issue, the industry would have to switch over from the indemnity to the market price model.

Also, many problems with respect to default on fixed-rate mortgages are homemade by lax underwriting. In particular, the lower interest rate of a fixed-rate mortgage with call protection should not induce lenders to accept higher debt-service-to-income or loan-to-value ratios during underwriting. Both values need to be more conservative than in case of a fixed-rate loan without call protection. Also, in combination with government subsidies such as the deduction of debt interest wrong incentives may arise that lead to an increase in the level of indebtedness.

It seems to be important to point out to the consumer upon offering and closing a loan agreement what the conditions for terminating and the specific risks of fixed-rate financing with call protection are. The European Code of Conduct for mortgage loans already implements the former, and the latter should be in the interest of the lenders who wish to protect themselves against possible loan defaults. Furthermore, for all loan classes it should be reviewed whether there are ways to improve the consumer's

knowledge with respect to the risks of mortgage loans, similar to the proposals in Great Britain<sup>26</sup>.

## Chapter 4 Effects of regulatory interventions on the market structure

### 4.1 Effects on the loan supply

In contrast to giving consumers access to better information, it makes little sense to outlaw one of the three main loan classes described in Chapter 1 by a regulatory intervention or to saddle them with additional costs. Because both the lender and the borrower have alternatives at hand that carry new risks.

Table 6 suggests strong shifts in market share of mortgage loan products over the past few years in six comparative countries that urge caution in this respect.

**Table 6 Product market shares and the strength of security of termination for fixed-rate mortgages**

Country	Year	Germany		Denmark		France		Spain		U.K.		U.S.**	
		2003	ca 1995	2003	ca 1995	2003	ca 1995	2003	ca 1995	2003	ca 1995	2003	ca 1995
Product	Rate Fixing												
Variable	up to 1 year		40	19	10	5	20			65	70	40	27-39
Reset, short	> 1 to 5 years	20		16		35		93	80	28			
Reset, long*	> 5 to 15 years	80	60	10		60	80	7	20	7	30		
Fixed to term	> 15-30 years			55	90							60	73-61

Call protection**	Strong	None	Weak	Weak	Rel. Strong	None

Source: MBAA, Federal Reserve (USA), Nykredit (Dänemark), Low, Dübel and Sebag-Montefiori (2003), Dübel/Lea/Welter (1997), trends estimated by Dübel. Note: \*The data for France and Germany include several short-term loans of less than 20 years that have fixed rates until final maturity. \*\*For the most important fixed-rate product. \*\*\*US data for around 1995 comprise the years 1994-1996; data for variable-rate loans may include segment financing. The data for the second quarter of 2004 reflect the author's estimate based on the rephrased quarterly survey of the Federal Reserve at bank loan departments.

Some shifts in market share are natural because of the trend of decreasing interest rates and steeper yield curves.

However, the recorded shifts are rather strong where the costs of the prepayment option are passed on to long-term fixed-rate loans, i.e. both in the U.S. and in Denmark. In the past, government interventions into mortgage prepayment played an important role in both countries. Recently, there have been extremely high levels of prepayments (see figures 11 and 12), sometimes favoured by macro-economic policy, which in consequence resulted in drastic price premiums for the prepayment option.

- In Denmark, where the government exercised significant influence on the mortgage finance system in the past, up until only recently the fixed-rate mortgage with a prepayment option was the dominating instrument by far. With the deregulation – in particular, Danish pension funds and insurances not having to invest any longer mainly in Danish bonds since the '90s – the prices for the prepayment option increased. After the recent prepayments and further price

<sup>26</sup> See Miles (2004).

increases the demand for the product declined heavily. As figure 13 shows, now fixed-rate loans with call protection (non-callable) as well as variable-rate loans with a cap on interest rates are booming.

- In the U.S., where the refinancing system formed by the institutions Fannie Mae and Freddie Mac is to be considered as semi-governmental, there have also recently been strong shifts in market shares because of pricing factors. They favoured so-called “hybrid” variable-rate products that have an initial fixed-rate period of up to 5 years, usually with call protection. Pure variable-rate mortgages with and without interest caps also gained market share. It is not yet clear what the long-run consequences of the current political debate on containing purchase activities with respect to prepayment risks by Fannie Mae and Freddie Mac on the market share of fixed-rate loans with prepayment option will be.

Finally, Spain should be mentioned as an example where the terms of fixed-rate loans were considerably reduced in the period under review. Today, Spanish loans usually follow short-term indices, usually Euribor, and fixed-rate terms are between 1 and 3 years. There are no real long-term fixed-rate loans any more. Lenders repeatedly explain this with the limits for prepayment indemnities.

In France, shorter-term fixed-rate loans have become more important; however, as mentioned above for French lenders prepayments are not such a problem because of the high transaction costs. At the same time there is increasing pressure on the government to approve the indemnity model because the French version of the Pfandbrief, Obligation Fonciere, is increasingly used for refinancing.

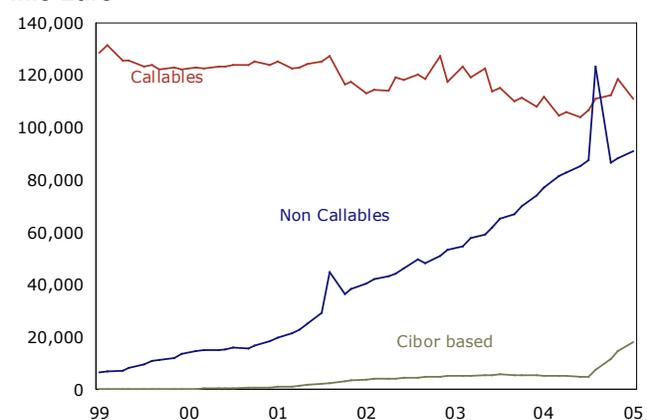
## 4.2 Effects on the borrower

A considerable problem from the point of view of consumer protection are substitution processes that trigger high and volatile costs for the prepayment option at borrower classes that are very heterogeneous in financial terms.

Table 6 above already suggests evidence for shortening terms of fixed-rate mortgages that can very likely be attributed to the price factor.

An even more important aspect is that the premium on interest rates caused by the prepayment option prompts an extremely high number of borrowers with a low income to choose presumably cheaper types of loan

**Figure 13 Outstanding volumes of callable and non-callable fixed-rate mortgages in Denmark 1999-2005, in mio Euro**



Source: Nykredit Capital Markets. Legend: Non Callables (fixed interest for 1 year and more). Cibor based: variable-rate loans indexed by 6-months Copenhagen interbank offer rate.

because they carry a lower nominal interest rate.

In particular, mortgages with variable rates become more relevant unless there are more economical fixed-rate loans with call protection as an alternative.

In Denmark and the U.S. the fact that mortgage interest rates can be deducted from taxable income is likely to cushion the substitution effect to some extent. This effect is, however, the smaller the lower the income.

In the U.S. substitution has led to warning against the possibility higher loan defaults with the most important providers of variable rates, the banks. Fannie Mae and Freddie Mac, the large semi-governmental refinancers of mortgage loans, do not purchase variable-rate loans, and thus do not protect the banks against the default risks of this product class. In addition, they do not buy fixed-rate loans with call protection either, a fact that has clearly handicapped the development of this market.

In Spain, Portugal, Ireland and Great Britain the ongoing absence of a fixed-rate loan supply and the household's increasing indebtedness gives room for concerns with respect to possible interest increases in the short term. This problem was addressed in the British Miles Review (see below).

In the future the price level of the prepayment option may be expected to normalise again, given a calmer environment with constant or slightly rising interest rates. But it is not at all clear how long this process will take considering the waves of prepayments that have been partially induced by policy makers.

Furthermore, the role of the semi-governmental refinancing institutions in the U.S. is under close scrutiny. However, it can safely be said that there in the future will be fewer fixed-rate loans with a prepayment option and a more loans with variable rates carrying interest caps as well as fixed-rate loans or hybrids with call protection features.

### **4.3 Interim conclusion**

The massive prepayment waves of fixed-rate loans with a prepayment option and no call protection have recently caused significant increases in price for the prepayment options.

This, in line with a progressing privatisation of the mortgage sector, has triggered sometimes considerable shifts in the market share favouring variable-rate loans with lower rates and fixed-rate loans with call protection in the classical supply markets U.S.A and Denmark.

In the Western and Southern European countries with restrictions on call protection, on the other hand, a market for fixed rates is not developing in spite of the increasing risks of variable-rate financing.

For consumers these problems with pricing the prepayment option mean an increasing pressure to finance more with a variable rate, often without caps. And often it is those consumers who choose variable rates whose income cushions a possible interest rate shock least. Here, the fixed-rate loan with call protection is a reasonable compromise with respect to loan price and the risk situation of the borrower. A missing supply of this

product does not improve the risk situation of the consumer, but rather makes it deteriorate.

## Chapter 5 Conclusions

### 5.1 The debate on the indemnity model in terms of consumer policy is misguided for historical reasons

#### The debate on prepayment indemnities is a child of inflation

Fixed-rate loans with call protection based on the indemnity model form part of the standard product mix on the mortgage markets because of their unrivalled cost-efficiency with respect to refinancing. Their principle is as old as refinancing housing loans by way of fixed-rate bonds. These loans, the most common in Germany, are again coming to the fore to an increasing degree in countries with fixed-rate loans with a prepayment option, e.g. U.S.A and Denmark.

The heated debate about the indemnity model in European consumer policy can only be explained by the high inflation period of the '70s. It is no coincidence that the legal restrictions still effective today date back to the '70s, e.g. with respect to their amount (France, Loi Scrivener) and residual term (Germany, Civil Code). Back then there were justified concerns that loans with long fixed-interest terms would default, and that would have injured both the lenders and the borrowers. Except for a few countries with high degrees of consumer indebtedness that are mainly due to an accommodating tax policy this concern has become obsolete in Europe.

In addition, the basic underlying question is now different because the European interest rates are very likely to remain constant or increase only slightly: in the future the indemnity model will have clear disadvantages as opposed to the market price model<sup>27</sup>. These could be eliminated with simple technological solutions according to the Danish example.

#### Interventions in the indemnity model do not improve the risk exposure of consumers and increase supply costs

Political interventions to the benefit of the consumer should principally be guided by a clear analysis of the market failure that is to be eliminated, followed by a cost-benefit analysis of the projected measures.

Take, for instance, the large degree of heterogeneity of borrowers. It is obvious that even under the best circumstances some borrowers will never fully understand their own

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<sup>27</sup> When taking expected values, the borrower pays higher indemnities than market prices in case of interest rate increases. Hence, the indemnity model implies a permanent reduction of lender margin in a competitive market that does not allow for excess profit. As in France, pricing becomes inefficient because of a dual structure of interest premium (here: discount) and indemnity.

financial situation when choosing mortgage products. But this is true for all important loan classes:

- With respect to the fixed-rate mortgage with call protection it may happen that some borrowers are tied to too high interest rates over a long period of time and do not understand that it is either impossible or financially disadvantageous to prepay their loan;
- with respect to the fixed-rate mortgage without call protection some borrowers who have a prepayment option will never exercise this option and pay considerable option premiums over a long time for nothing; and
- with respect to loans with a variable rate many borrowers who actually cannot pay high interest rates over a longer period of time still take a considerable risk.

Yet, by eliminating one of the three loan classes it is inevitable that there will be unwelcome substitution processes. Recently, in Europe and the U.S. loans were almost exclusively substituted by variable-rate loans that, furthermore, were requested by borrowers with a lower income. In Europe this is a particular problem in countries with high restrictions on indemnities and, at the same time, low transaction costs for prepayments, as e.g. in Spain or Portugal. It cannot be the purpose of consumer protection to promote this development.

In spite of the Scrivener Law, France, on the other hand, actually practises a system of implicit call protection by maintaining high transaction costs for prepayments.

There are certainly risk aspects with respect to fixed-rate loans with call protection to be considered, but rationally seen these can only be dealt with by giving information to the consumer, or, if necessary, advice by a third party. The essential point in the relation between lender and borrower is that the loan quotation and the agreement include the necessary and complete information, as is stipulated for example in the European Code of Conduct.

In addition, giving the borrower a realistic picture of his risk situation by means of an appropriate and easily comprehensible simulation upon conclusion of a loan agreement is something that should be considered. However, this should then be implemented for all loan classes. Individual national regulatory measures are out of the question when taking into account the large number of European products on the internal market.

The current debate in Germany and the Netherlands on the so-called cases of hardship does not get to the core of the problem, either. If property is sold because consumers move, a prohibition of prepayment indemnities is of no use – the actual problem here is the “lock-in” effect of the indemnity model that can be eliminated by the market price model. Defaults should be addressed by a priori forcing lenders to partially write off a loan, which would be the effect of a prohibition of prepayment indemnities, because this would destroy the incentive structure to repay loans.

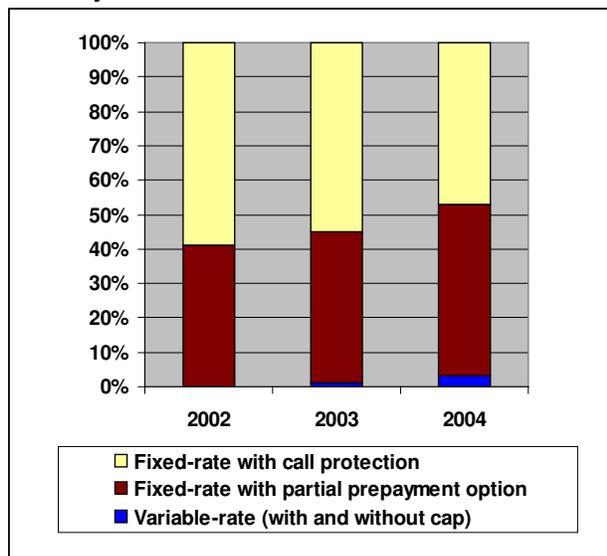
There is perhaps broader legal and political room for manoeuvre with respect to how to deal with the issue of indemnities that serve to compensate for lost interest margin. A prohibition would prompt a stronger “front-loading” in pricing and thus lead to a higher burden on younger borrowers or those with a lower income. On the other hand, this effect may not be as strong because of the still long period of customer retention in Europe, i.e. customers may want to prepay but not switch; possible savings with respect

to legal disputes and improved customer satisfaction should also be important for the lender. All in all, the topic seems to be of less importance than suggested by German legal debate that has put this issue on its priority list.

There is no doubt that interventions in the indemnity model both in case of a reinvestment loss and, to a lesser degree, lost interest margin increase the costs of mortgage loans at another point, and usually inefficiently, and the entirety of borrowers has to pay them. After having analysed the usual economic arguments against a price differentiation and legislation, in particular in France (Loi Scrivener) and the Netherlands (cases of hardship) there is no obvious reason in the author's opinion, to implement such restrictions in Germany.

## 5.2 The incomplete mortgage market as the core problem

**Figure 14 Market shares of fixed-rate loans with call protection and with partial prepayment option in Germany**



Source: Hypoport AG. Note: Data of 10,000 property financing loans from 2002 to 11/2004.

At the end of this short study a paradox will be dealt with – the prevalence of incomplete mortgage markets in market economies that are otherwise marked by a high supply of goods and services. This point was rightly taken up by the IFF study.

### The incompleteness of the mortgage markets is a global phenomenon

Contrary to a market failure, when it comes to pricing, the incompleteness of a market is not an issue for consumer protection but it has to be solved by the financial industry and economic policy. Table 1 shows that Germany is not alone at all in an international context with respect to this problem.

- In the United Kingdom, the 2004 Review that was drafted by Professor David Miles and commissioned by H.M.Treasury came to the conclusion that the missing supply of fixed-rate mortgages was alarming given interest risks and indebtedness levels. Miles explicitly recommends introducing fixed-rate mortgages with call protection according to the market price model (sic!).
- In the U.S., the rise of Fannie Mae and Freddie Mac as a semi-governmental refinancing duopoly for fixed-rate mortgages with prepayment option is causing increasing concerns. In the '90s, the pricing problems with respect to the prepayment option that are discussed above and an increasing number of early repayments became important catalysts for the practise of both institutes of taking over purchased loans into their own portfolio instead of securitising them. Both mortgage banks became too powerful because of the resulting high increase in balance sheet volume. The pressure on the institutions to reduce their engagement in prepayment risks has grown over the past few years to such

- an extent that currently purchasing strategies with respect to call protection features are under consideration.
- This year, France finally seems to have taken up the problem of high legal transaction costs for mortgage loans that is directly associated to the restrictions on indemnities imposed by the Loi Scrivener. There is increasing criticism with respect to this obsolete law and a revision seems to be on the horizon. Maybe this will happen at the same time as a European solution for consumer protection with respect to mortgage loans is found.

### Incomplete market in Germany

However, these problems of our neighbours do not mean that Germany itself would not have to do anything. In particular, Germany lacks:

- a supply of prepayable mortgages without call protection according to the Danish or U.S.-American example;
- a market price solution for the features of call protection that, in the medium term, could substitute the indemnity model which has reached its limits;
- a higher flexibility of the market when it comes to making use of certain margins that the current indemnity model provides, as is, for example, customary in our neighbouring country Austria.

With respect to the first aspect, the IFF study is of the opinion that it is unacceptable to wait until the market itself starts to supply callable fixed-rate mortgages because there was “no impulse” to do so.<sup>28</sup> However, this description of the German market cannot be accepted without further comment.

It is true that the German market for mortgage loans is developing very slowly. The supply of prepayable fixed-rate mortgages without call protection is limited to sporadically offered fixed-interest mortgages with a term of more than 10 years that are subject to mandatory regulations that exclude call protection anyway.

However, the banking industry is right in pointing out that the typical demand pattern of German borrowers is to compensate a higher interest level by reducing the fixed-rate term, and vice versa. For example, contrary to other countries with fixed-rate loans with prepayment option there actually is a marked fixed-rate term cycle on the German market.<sup>29</sup>

The low demand can also be explained by the fact that the German interest rates remain non-volatile and thus the value of the prepayment option is lower than in the U.S. or historically in France, for example. From this point of view, the fixed-rate mortgage with a prepayment option would be an expensive solution to a small interest risk problem.

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<sup>28</sup> See IFF (l. c.), p. 26.

<sup>29</sup> See Dübel and Lea (2000).

Meanwhile, there have been some changes on the German market that manifest themselves in a larger supply of loans with partial prepayments. This is in line with an increasing need for more financial flexibility and physical mobility because consumers are more insecure about whether they will keep their jobs.<sup>30</sup> Furthermore, the fact that the prices for partial prepayments can be negotiated individually indicates that pricing is becoming more flexible. It certainly cannot be said that there wasn't any competition with respect to prepayments.<sup>31</sup>

A possible source for offering new callable loan products could be foreign lenders on the European internal market who can resort to their specific refinancing sources at home – callable bonds and Mortgage-Backed Securities. Although the European market features a number of legal obstacles with respect to mortgage loans, there would probably be no such obstacle if fixed-rate products with prepayment options were offered in Germany from abroad; offers by a German subsidiary would be unproblematic anyway. However, the extremely low prices of German mortgage loans are an obstacle to foreign suppliers entering the market who prefer to offer products that are adapted to the German market. As in other European markets too, the German consumers strongly focus on absolute interest rates so that it is very difficult to sell a product, however innovative, like the fixed-rate loan with prepayment option that carries a significant margin premium.

All in all, the “business case” for a higher supply of call options is not very strong in Germany, although from the point of view of consumer policy it would be favourable.

### **5.3 Approaches for further developments**

However, such a new supply could be developed by a co-operation of the mortgage industry supported by the government, if necessary.

#### Changes in the refinancing structure

Changes in the refinancing structure could prompt German lenders to offer options for higher partial prepayments than in the past, or fixed-rate loans with a prepayment option. Basically, the market could develop in three different ways:

- If loans were securitised by Mortgage-Backed Securities, e.g. within the context of the True-Sales-Initiative, the practices of so-called pass-through MBS that exists in the U.S. and several Western-European countries, i.e. MBS that pass on the cash flow risks to the investors, could be adopted. At present, German lenders make use of the MBS market for other purposes, in particular regulatory

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<sup>30</sup> Figure 12 reflects the development of the past three years based on data of the loan broker Hypoport AG. While in 2002 almost 60 % of newly originated mortgage loans in Germany did not carry any prepayment option, in 2004 their share did not amount to more than 47 %. Loans with partial prepayment options increased from 41 to 51 %, also variable-rate loans gained again have a small market share. It is no surprise that the most important suppliers of loans with partial prepayment options are universal banks, in particular foreign suppliers entering the market.

<sup>31</sup> See IFF (l. c.), p. 25.

- arbitrage and securitisation of subordinated loans (in the case of Pfandbrief issuers). However, the incentive to securitise by MBS remains low because of the modified capital requirements stipulated by Basel II and refinancing by Pfandbriefe that is much more cost-efficient.
- As an alternative, the German KfW could expand its existing Credit Default Swap programme PROVIDE that is basically marked by regulatory arbitrage by supplying loans with a prepayment option. To this end, the prepayment risk could be structured as issues that are currently staged according to their respective loan exposure. The KfW would then structure their purchasing conditions for loan portfolios according to the costs that would have to be paid for the prepayment risk. However, this model has its limits because of the specific task assigned to the KfW and the risk it may incur.<sup>32</sup>
  - Finally, it would be possible for callable bonds to be issued, e.g. according to the Danish example, either on the initiative of individual institutions or by agreement of the issuers among themselves, because after the reform in mid 2005 the number of Pfandbrief issuers will probably grow strongly. However, this conflicts with the fact that first of all a significantly higher number of issuers would have to be integrated into a proven system – a good reason to simplify the requirements for the Pfandbrief instrument as much as possible. On the other hand, among new Pfandbrief issuers there will be savings banks and *Landesbanken* who share a considerable interest in the consumer loan market and might be more interested in developing the mortgage product menu than the current issuer circle.

In any case, adding the fixed-rate product with a prepayment option to the different types of loan supplied in Germany would require that the strong pressure on margins from the demand side lessened and borrowers focussed more on quality with respect to securing interest rates, and thus the viability of charging a market price for the option.

In particular, the market price of the prepayment option must be viable in the long run, i.e. also if the prepayment risk fluctuates heavily, as in the past in Denmark and the U.S., and without any government subsidy. It is conceivable that this may not happen in the foreseeable future as long as interest rates display a low volatility and are low in price.

#### Industry-wide market solution for call protection

It seems to be feasible that the currently existing German call protection could be structured in accordance with the market price model rather than the indemnity model in the future. Not needing governmental regulation, the Pfandbrief issuers could be the pioneers as they were in the past decade when their liquidity standards that are unique in Europe were defined.

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<sup>32</sup> Within the current mandate of KfW it would possibly be acceptable to establish a new product on the German market for an introductory period. Policy in terms of risk would encounter more problems – the KfW does not assume credit risks for their credit default swap transactions; transferred to the prepayment risk discussion this means that the agency would have to focus on pass-throughs which may be more difficult to sell to the market, at least initially, than structured products.

The market price model would offer a number of advantages to the lenders, in particular savings in servicing costs – e.g. with respect to the costs for dealing with disputed cases of indemnities. The courts and the Government would tend to intervene less and there would be stimulation of demand because the “lock-in” effect of an increasing debt service burden upon prepayment in periods with increasing interest rates that will be more frequent in the future would be eliminated.

It would be possible to implement a market model as a real secondary market for loans according to the Danish example, or as a modified indemnity model that simulates market prices by way of pricing in accordance with capital market benchmarks.

In the first case, an infrastructure would have to be created that actually allows buying back loans that were securitised by Pfandbriefe or MBS. This is very easy to do with the Danish model because mortgage loans are securitised through bonds with identical terms and interest coupons.

However, German terms and interest coupons of bonds and loans are not identical and many loans are still refinanced by deposits. Therefore, a benchmarking solution by way of the relevant capital market indices expanding on the existing indemnity model would be preferable.

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## Appendix I Description of data sets and simulation methodology

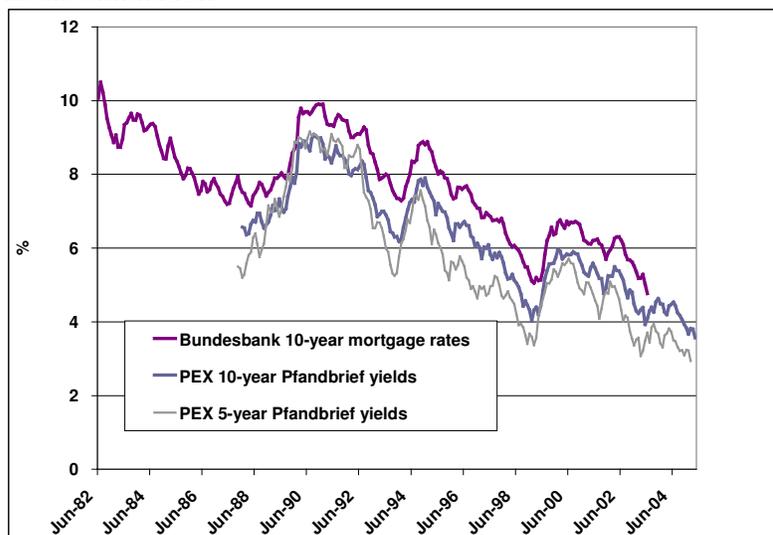
### A Data sets

The following data sets were used for calculation.

#### Mortgage interest rates

- Source: Statistic of mortgage interest rates for residential plots of the Deutsche Bundesbank. Time series SU0040, SU 0043, SU0046. Download at [http://www.bundesbank.de/statistik/statistik\\_zeitreihen.php](http://www.bundesbank.de/statistik/statistik_zeitreihen.php).
- Data types and modifications: average effective interest rates for loans with a residual term of 2, 5 and 10 years. Geometric interpolation of the rates for a residual term of 3, 4, 6, 7, 8 and 9 years.
- Periodicity: monthly.
- Period under review: First observation: June 1982; last observation June 2003. Then interruption of the time series because the interest rate statistic of the European Central Bank that replaces the statistic of the Bundesbank does not allow to precisely allocate the residual term and the interest rate due to its broader range of residual terms.

**Figure A-1 Mortgage interest rates of residential plots and bond yields, monthly data used in the simulation**



Source: Deutsche Bundesbank, Association of German Pfandbrief Banks.

#### Pfandbrief yields PEX

- Source: Pfandbrief index of the Association of German Pfandbrief Banks <http://www.hypverband.de/hypverband/html/smartcms/index.cfm?fuseaction=ShowPages&pageid=81>
- Data types and modifications: Index of 30 synthetic bonds with terms of 1 to 10 years, daily yield calculation based on trading reports of Pfandbrief issuers. Not modified by the author.
- Periodicity: daily, last daily observation of a given month was used.
- Period under review: First observation: 31 December 1987; last observation 20 April 2005.

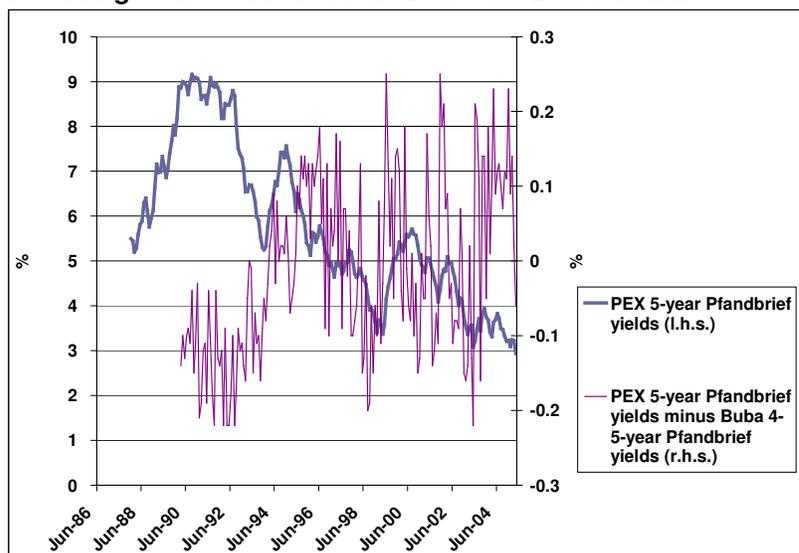
### Pfandbrief yields of the Deutsche Bundesbank

- Source: Statistic of yield on mortgage bonds outstanding provided by the Deutsche Bundesbank. Time series WX4251 to WX4260. Download at [http://www.bundesbank.de/statistik/statistik\\_zeitreihen.php](http://www.bundesbank.de/statistik/statistik_zeitreihen.php).
- Data types and modifications: average yield on bonds outstanding after average remaining terms of 1-2, 2-3, etc. .. to 9-10 years. Not modified by the author.
- Periodicity: monthly.
- Period under review: First observations at different times between January 1990 and January 1991. Last observation April 2005.

The Pfandbrief statistic of the Deutsche Bundesbank was complemented with respect to short terms by monthly 6-month money rates at the Frankfurt banking centre from January 1990 to April 2005 (time series SU0250). Due to the longer time series of loan origination dates that are reviewed here they replace the Euribor interest rates used in the IFF study.

PEX yields and yield on outstanding bonds of the Deutsche Bundesbank vary by 25 basis points at most during the period under review. This may have a positive or negative effect either on the borrower or the lender when the prepayment indemnity is calculated. When interpreting the PEX-data, note that their maturity is six months longer.

**Figure A-2 Comparison of PEX Pfandbrief yields and yield of mortgage bonds outstanding according to the statistic of the Deutsche Bundesbank**



Source: Deutsche Bundesbank, Association of German Pfandbrief Banks, calculations by the author.

The available data allows estimates for both the indemnity and the market price model for the dates of loan origination that are indicated in table A-1. Thus, the study comprises a period of between 14.8 and 17.3 years, i.e. up to four full interest cycles.

**Table A-1 Loan origination and call dates used in the study, resulting observation periods**

PEX						
Call after	Loan origination dates				Observation period	
	Observation		Starting ... ending		Months	Years
8 years	1	179	Jun-82	Apr-97	178	14.8
5 years	7	215	Dec-82	Apr-00	208	17.3
3 years	31	239	Dec-84	Apr-02	208	17.3
Bundesbank						
Call after	Loan origination dates				Observation period	
	Observation		Starting ... ending		Months	Years
8 years	1	179	Jun-82	Apr-97	178	14.8
5 years	34	215	Mar-85	Apr-00	181	15.1
3 years	58	239	Mar-87	Apr-02	181	15.1

Source: Simulation model of the author.

## B Simulation methodology

### Step 1 Calculation of prepayment indemnities with historical interest rates

The prepayment indemnities are calculated by comparing interest charged and deposit interest for the dates of loan origination indicated in table A-1 based on the assumptions in Box 1 that are almost identical to the IFF calculations.

Since this approach of covering long-term interest cycles means that one has to calculate a total of 594 (PEX) and 540 (Bundesbank) individual prepayment fees, the individual calculation must be simplified for technical reasons.

In detail:

- Instead of the 6-month Euribor money rates used in the IFF study, the 6-month money rates at the Frankfurt banking centre are used here that extend further into the past.
- Instead of the monthly presentation and discounting of cash flows used in the IFF study, annual periodicities are assumed.
- This study is based on amortising loans with 1 % initial repayment, rather than bullet loans.

Otherwise the methodology remains the same:

- For computing the lost interest margin, the annual cash flow is mapped by taking the annuity (principal and interest) of the loan less 60 € saved management costs and 15 basis points of saved risk costs over a residual term of 2, 5 and 7 years. Then the corresponding amortised amount of the loan are added at the end of the remaining term.
- This cash flow is discounted by way of semi-annual interpolated Pfandbrief yields of the Bundesbank and the 6-months money market rate (0.5, 1.5, 2.5 ... 9.5 years), and the PEX yields (1, 2, 3, .. 10 years) respectively.

- The partially amortised loan amount on the date of the call is then subtracted from the thus determined present value of the cash flow. The difference results in a fairly good estimate of the prepayment indemnity.

The thus determined approximated values vary only by a few hundred euros from the example chosen by the IFF (loan origination in February 1998, repayment in February 2003).

**Table A-2 Small effects of the differences in the calculation methodology**

	PEX	Deutsche Bundesbank
IFF	€ 11,127	€ 10,152
This study	€ 11,320	€ 10,750

Source: IFF, simulation model of the author.

Since this study is not about providing precise details that may stand up in court, but about presenting the economic dynamics of the indemnity model and its alternatives, these deviations can be accepted.

## Step 2 Forecast of prepayment fees with a simplified interest forecast model

For the simplified interest forecast model a simple oscillating process is created whose amplitude and wavelength fits the historical interest rate observations used in step 1.

The process is the following:

$$Z(t) = 2 * \sin(0.072 * t) + 4.5\% + 0.0005 * t,$$

whereby t is the ongoing index of the months from t=1 to 253 (21 years in total).

Z(t) determines the 5-year fixed rate; other fixed-rate time series from 1 to 10 years are constructed by way of a rudimentary model of term structures with a minimal geometric increase of 0.01 %. For example, the 5-year fixed interest for period 1 (June 2005) is 4.65 %, the 10-years fixed-interest 4.67 %, i.e. the curve of the interest rate structure is almost flat.

As opposed to the historical development, a slightly positive tendency for the calculation process whose global maximum amounts to 7.5 % in autumn of 2021 is assumed.

No forecasts are made for passive interest rates and thus indemnities are exclusively calculated by comparing assets and assets. Here, a lost interest margin of 40 basis points is added to the difference in interest rates. Taking the assumed 15 basis points of saved exposure costs and around 6 basis points of saved administration costs from assets-liabilities-comparison above results in the implicit assumption of a gross margin of around 60 basis points.

## Step 3 Determining the market prices of loans and bonds

The results on prepayment indemnities obtained in steps 1 and 2 do not show any negative values because there cannot be any negative indemnity. To determine the results for the market price model the zero values of the prepayment indemnities are simply replaced by the corresponding negative values.

For example, the prepayment indemnity for a 10-year fixed-rate loan with a residual term of 7 years that was taken up in April 1999 and paid back in 2002 amounted to zero. However, the market price (including the lost interest margin) amounted to  $-1,679 \text{ €}$ , i.e. in the market price model the lender would have had to pay out to the consumer.

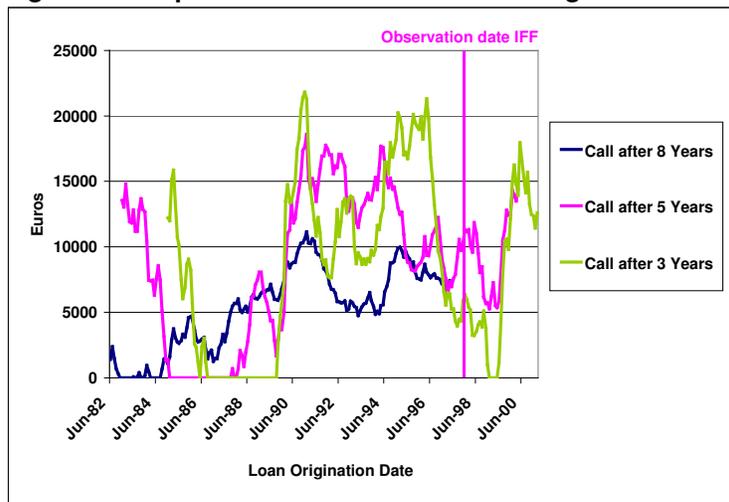
If positive and negative market prices are formulated in proportion to the outstanding debt, the market values of the debt can be identified, in the Danish case these are bond prices quoted at the stock exchange of Copenhagen. In the previous example the bond would have been quoted at 98.3, i.e. below par. Without a margin damage the quotation would have been 95.3.

## Appendix II Repetition of the simulation with PEX data

Figure A-3 repeats the prepayment indemnity calculation with the PEX yields of the Association of German Pfandbrief Banks instead of with the yields of Pfandbriefe outstanding by the Deutsche Bundesbank.

As already shown in figure A-2, the differences in yield are small for both time series. However, the PEX time series reaches two and a half years further back into the past, so that the effects of declining interest rates in the middle of the eighties are clearly reflected in the earlier call dates in the left third of the graph.

**Figure A-3 Repetition of the calculations in figure 4 with PEX yield data**



Source: Deutsche Bundesbank, simulation model of the author. Note: 10-year fixed-rate loan with 1 % initial amortisation. Time series for mortgage loan interests of the Deutsche Bundesbank. Time series for PEX yields of the Association of German Pfandbrief Banks. Comparison assets-liabilities. Further assumptions see box 1.