

Mortgage Prepayment: An International Comparison

Achim Dübel, empirica

Michael Lea, Cardiff Consulting Services, Inc.

**Paper presented at the AREUEA International Real Estate Conference
University of California, Berkeley
June 1-2, 1997**

Research supported by the German Association of Mortgage Banks.

Mortgage Prepayment: An International Comparison

Achim Dübel and Michael Lea

1. Introduction

Pending harmonization of consumer protection laws in Europe will address the issue of early repayment (“prepayment”) of mortgage debt. In particular, the issue exists as to whether consumers should have a universal “right” of prepayment, and whether there should be limitations on the contractual provisions between borrowers and lenders that govern the circumstances allowing early repayment and the costs (penalties) that can be charged.

Whether mortgage borrowers are granted a universal right of early repayment of their outstanding principal (“prepayment option“) plays a central role in determining the costs of mortgage lending, and hence the price, either in the interest rate or up-front fees. An option of early repayment gives the borrower the right to either refinance his mortgage - typically at a lower interest rate - with the same or another lender, or substitute it with own funds. A central problem is that the resulting reinvestment loss for the lender may be high and potentially dwarfs other risk elements of the mortgage loan, even the credit risk. Prepayment risk will have a market price that will be imposed on the contract conditions of the borrower, depending on the competitive and subsidy situation. The alternative to the universal prepayment option is the contractual right to exclude prepayment in a financial contract, i.e., with the most prominent consequence of a fixing of the interest-rate by both parties, up to a maximum time period.

A fundamental question associated with the presence of a universal prepayment option is whether despite the “universality“ of the prepayment right it may be combined with penalties in case of its exercise (ex-ante), whether in the sense of a compensation for the incurred reinvestment loss or gain (ex-post), or in the sense of a market price to “buy“ the right of early repayment (ex-ante).

The prepayment option is often referred to as a basic right of the borrower. What is the general good worth protecting with respect to mortgage prepayment, and hence its likely intangible benefit? There are two lines of argument brought forward for a universal, i.e., legally mandatory, prepayment option:

1. The consumer should be protected against the consequences of a potentially large financial burden, which might fall on him when personal “hardship“ cases materialize: for example the death of spouse or divorce, or an enforced house sale (e.g., by change of employment). If financial distress is associated with these contingencies, early repayment might save him from mortgage foreclosure and/or consumer bankruptcy, provided that the financial advantage derived from it is sufficient to render the debt service burden affordable. In case of a house sale, early repayment might give him more flexibility in realizing the equity.
2. The consumer should regardless of personal situation be protected from the costs that would ensue if loan conditions remain fixed with a downward interest rate movement, i.e., he should be given the unilateral advantage of benefiting from positive realizations of interest-rate risk from his perspective.

We will show below that these intangible benefits can be converted into tangible “insurance“ costs, typically incurred by the lender or the capital market investor that will be added to the mortgage rate. Intangible costs will therefore include, in case of universality of the right, the costs of precluding borrowers who do not want to take this insurance from making their choice. For instance, a borrower may

insure himself against most of the personal hardship cases, or accept the standard procedure of consumer bankruptcy in case the debt burden rises over affordable levels, implying a preference for the prepayment option against an interest-rate discount. Behind that stands the fundamental question, which agents in mortgage lending are best able to manage interest-rate risks, and whether there is a fundamental reason (e.g., information asymmetry) to protect the borrower from assuming it.

The paper will be organized around five subsections:

- How is prepayment treated in the sample countries in the context of the legal and economic structure of domestic mortgage markets?
- What is the incidence and what are the microeconomic costs of the prepayment option considering the different contract and pricing alternatives recorded?
- How is the prepayment risk typically allocated between borrowers, lenders, and investors and what are the consequences for different loan refinancing systems and hence different mortgage products on the market?
- What stylized legal/economic contract models appear and should be considered in EU consumer protection discussions?
- Finally, what principles should a synthesis of regulations of early repayment obey?

2. Regulations Concerning Mortgage Prepayment - Empirical Overview

Table 1 gives a stylized overview over the preliminary findings concerning mortgage prepayment in the EEC countries surveyed so far. The main findings are as follows:

- A large group of the studied countries establish a *universal right to prepay mortgage loans* during the time period the interest rate is fixed; i.e., the prepayment option is mandatory for a mortgage contract. These countries include: Italy, France, Portugal, Spain, Denmark, Belgium (regulated loans), Ireland, the Netherlands, and Sweden. In Germany, prepayment is universal in the case of adjustable-rate mortgages. Limitations concerning minimum amounts to be prepaid are common.
- A smaller group *leaves prepayment to contractual freedom*, including the potential exclusion of the option: Germany (only fixed-rate mortgages), the United Kingdom, and Austria. In the United Kingdom, prepayment is universal as a default case, but may be excluded contractually under general rules of contractual freedom. Germany and Austria allow explicitly for exclusion, but cap the maximum period of exclusion for 10 years.
- Denmark is a special case in that loans can be refinanced by non-callable bonds which may, however, be repurchased by the borrower (delivery option¹).

¹ Danish mortgage borrowers have - through the special structure of refinancing - the option to buy the bond that refinances their mortgage on the capital market and deliver it to the lender. This implies the payment of a market price.

Table 1 Regulations and Effects of Early Repayment Across Countries – Preliminary Results

Country	Dominant Interest Rate Risk Regime (Typical interest rate-fixing period)	Prepayment Option: Regulatory Environment, Universal Option vs. Contractual Freedom	Prepayment Penalty: Limitation of Amount/Amount in Practice, Compensation vs. Market Price Concept, Contingencies	Frequency of Prepayments (Recent data; qualitative)	Price of the Prepayment Option on the Capital Market/Cost for Consumers	Consequences for the Lenders and the Capital Market
Austria	FRM (10 y)	<p>No universal prepayment option for interest-rate binding periods if contract duration over 10 years (mortgage loans and loans for “creation and rehabilitation of buildings”); prepayment may be excluded for up to 10 years.</p> <p>No legal obstacles to introduction of prepayable contracts, contract may include period of notice up to 6 months.</p>	<p>Market price interpretation for mortgage loans and for loans for “creation and rehabilitation of buildings”.</p> <p>Limits, Personal hardship cases: open</p>	open	open	open
Belgium	FRM (5 y), ARMs were banned until end of 1992	<p>Regulated loans (law of August 8, 1992): Universal, if over 10% of capital. Exclusion unlawful. No change in mortgage ranking in case of refinancing.</p> <p>Unregulated loans: contractual freedom.</p>	<p>Regulated loans (law of August 8, 1992): maximum penalty 3 months interest.</p> <p>Unregulated loans: contractual freedom.</p> <p>Personal hardship cases:: No penalty after life insurance payment (death).</p>	High prepayments in 1986, 1993/1994.	open	impetus for securitization (shift of prepayment risk to the capital market), after recent prepayment waves.

Country	Dominant Interest Rate Risk Regime (Typical Interest rate-fixing period)	Prepayment Option: Regulatory Environment, Universal Option vs. Contractual Freedom	Prepayment Penalty: Limitation of Amount/Amount in Practice, Compensation vs. Market Price Concept, Contingencies	Frequency of Prepayments (Recent data; qualitative)	Price of the Prepayment Option on the Capital Market/Cost for Consumers	Consequences for the Lenders and the Capital Market
Denmark	FRM (20/30 y)	<p>Callable bond refinanced loans: bond substitution (delivery option) and cash repayment at par.</p> <p>Non-callable bond refinanced loans: bond substitution only. Stamp duty transferable. No exclusion reported, but legally possible</p>	<p>Callable bond refinanced loans: Small prepayment fees, reflecting administrative costs. Non-callable mortgage bond combines both endogenous “penalty“ and right to prepay; but no compensation for foregone profit. → implicit compensation concept.</p> <p>In general neither explicit compensation nor market price concept. Personal hardship cases: open</p>	<p>Before 1993, special tax structure in mortgage lending deterred financial prepayments.</p> <p>A prepayment wave of 30% of GDP took place after a change of the tax regime in 1993/94.</p>	<p>30bp (7%)/45bp (8%), for mixed commercial/residential mortgage bonds. Underpricing of the option on the capital market likely, given special investor structure.</p>	<p>Risk borne and priced by capital markets (bond demand dominated by portfolio-regulated domestic institutions). Banks bear servicing fee risk.</p> <p>Contracts based on non-callable bonds have recently re-emerged.</p>
France	FRM (15 year)	<p>Universal, if repayment greater than 10% of capital (Article L 132-21 Code de Consommation). Exclusion unlawful, unless repayment is under 10% of capital.</p> <p>Change in ranking of the mortgage, if external refinancing.</p>	<p>Penalty capped by law (3% of outstanding or 6 months interest). Compensation interpretation. It appears that penalties are routinely competed down by banks, at least with internal refinancings. Personal hardship cases: Frequent waiver in internal refinancings and hardship cases; determined in Conseil Nle du Credit discussions.</p>	<p>10-20% relative to new residential lending. 20 bn FF prep. wave in 1986/1988, lower in 1993/1994. Approx. 3% non-financial CPR. Strong internal prepayments.</p>	<p>AfB simulations: 40 bp, considering the max- penalty, 20 bp. General underpricing of mortgage lending costs due to recent surge of competition widely assumed (unclear).</p>	<p>Risk borne and priced by banks; few MBS issuances. Prepayment risk forces banks to run high maturity mismatch. Shifts to ARM have been reported from individual banks .</p>

Country	Dominant Interest Rate Risk Regime (Typical Interest rate-fixing period)	Prepayment Option: Regulatory Environment, Universal Option vs. Contractual Freedom	Prepayment Penalty: Limitation of Amount/Amount in Practice, Compensation vs. Market Price Concept, Contingencies	Frequency of Prepayments (Recent data; qualitative)	Price of the Prepayment Option on the Capital Market/Cost for Consumers	Consequences for the Lenders and the Capital Market
Finland	ARM (reference rate)	open	Yield maintenance prepayment penalty (asset-asset comparison). Personal hardship cases: open	open	open	open
Germany	FRM (5-10 y), low ARM share (reviewable)	No universal prepayment option for interest-rate binding periods under 10 years; instead: freedom of contract. No legal obstacles to introduction of prepayable contracts (rare). §609 BGB allows for contractual exclusion over the interest binding period, but caps max. period of exclusion at 10 years. Exclusion of prepayment for ARM is legally not possible.	Penalties for ARM unlawful. Interpretation for FRM (market price vs. compensation) subject to intense debate; likely compromise: compensation of yield and margin damage (yield maintenance prepayment penalty, asset-liability comparison). Personal hardship cases:: In practice, frequent waiver of penalty in case of internal refinancings and hardship cases.	10-15% relative to new residential mortgage lending, rising tendency. Lower financial prepayments due to high penalties and need for second contract. High prepayment incidence through allotment of Bauspar/life insurance capital.	Exclusion saves borrower costs of the option; leads to low spreads over equivalent gov.bonds. Interest-rate binding periods are cyclical and short as borrowers react to exclusion of prepayment. Increased standardization of prepayment penalties. Use of second contracts.	Capital market reacted negatively in the 1970's to callable mortgage bonds. With bonds becoming non-callable in the 1980's, the prepayment option was no longer offered by lenders (supported by legal change), who will typically not take the risk. Recent reappearance of (step-up) callable mortgage bonds on the capital market. No bonds bearing prepayment risk on the market.

Country	Dominant Interest Rate Risk Regime (Typical interest rate-fixing period)	Prepayment Option: Regulatory Environment, Universal Option vs. Contractual Freedom	Prepayment Penalty: Limitation of Amount/Amount in Practice, Compensation vs. Market Price Concept, Contingencies	Frequency of Prepayments (Recent data; qualitative)	Price of the Prepayment Option on the Capital Market/Cost for Consumers	Consequences for the Lenders and the Capital Market
Greece	FRM (15 y)	Freedom of Contract. Nat. Mortgage Bank of Greece has contractual provisions.	Case: Nat. Mortgage Bank of Greece: flat 6 months interest prepayment penalty. Personal hardship cases: open	Little experience so far. Large prepayment waves expected, as nominal rates converge steeply to European Union levels.	open	Prepayment risk held by lenders; high call protection.
Ireland	FRM (1-5 y) and ARM almost equiproportional	Universal.	No penalty in ARM case charged. Interest rate penalty for FRM's applied (market price interpretation). Penalty capped at 12 months interest. Personal hardship cases:: open	open	open	Recent change in the funding structure towards congruency may cause problems. High call protection through prep. penalties.
Italy	FRM and ARM almost equiproportional	Universal.	open	open	open	open

Country	Dominant Interest Rate Risk Regime (Typical Interest rate-fixing period)	Prepayment Option: Regulatory Environment, Universal Option vs. Contractual Freedom	Prepayment Penalty: Limitation of Amount/Amount in Practice, Compensation vs. Market Price Concept, Contingencies	Frequency of Prepayments (Recent data; qualitative)	Price of the Prepayment Option on the Capital Market/Cost for Consumers	Consequences for the Lenders and the Capital Market
The Netherlands	FRM (5 year)	<p>Universal, without compensation, for partial repayment not exceeding 10% annually. Cumulative.</p> <p>Universal, with compensation, for repayments higher than 10% or equivalent accumulated percentage, subject to casewise treatment.</p>	<p>Compensation interpretation; yield maintenance penalty. Personal hardship cases:</p> <ul style="list-style-type: none"> • death: waiver, • voluntary sale of house: max 4 months interest or 3% of the amount repaid. Lender must offer portability of loan to charge compensation. • sale under execution: compensation only if consumer is blamed for default. • market interest rate higher than coupon rate: waiver of penalty • market interest rate lower than coupon rate: discounted yield difference (asset-asset comparison). 	open	open	open
Portugal	ARM (reviewable) and FRM	Universal.	open	open	open	open
Spain	ARM (reference rate), low % of FRM.	Universal.	Max penalty of 1% for ARM, 3% for FRM, but yield maintenance penalty in case of higher damage (asset-asset comparison). Personal hardship cases: open	open	open	Open

Country	Dominant Interest Rate Risk Regime (Typical Interest rate-fixing period)	Prepayment Option: Regulatory Environment, Universal Option vs. Contractual Freedom	Prepayment Penalty: Limitation of Amount/Amount in Practice, Compensation vs. Market Price Concept, Contingencies	Frequency of Prepayments (Recent data; qualitative)	Price of the Prepayment Option on the Capital Market/Cost for Consumers	Consequences for the Lenders and the Capital Market
Sweden	FRM (2, 5y)	Universal prepayment option, if “primary for consumer purposes“ (Consumer Credit Act).	New Consumer Credit Act establishes rules that regulate compensation as yield maintenance prepayment penalty (asset-asset comparison). No compensation on ARM prepayments allowed. Personal hardship cases: open	open	open	open
United Kingdom	ARM (reviewable), low FRM share (2-5 y)	Presumably contractual. Some legal impediments to prepayments (all other mortgages must be extinguished, consent of other lenders required, problems or ranking of new mortgage). No exclusion recorded.	Freedom of contract to determine penalties (mkt price interpretation). FRM prepayment penalties have risen over the past interest rate cycle from an average of 3 to 6 mths interest. No legal cap. Penalties in ARM exist, are lawful (eg. repayment of discount). In internal refinancings, penalties often waived or reduced.	15% relative to new lending; recently up to 30%. High share of financial motives due to recent discount war in the market.	Through high penalties the value of the prepayment option is widely compensated.	Lenders bear prepayment risk. Sharp reaction of lenders towards high call protection through prep. penalties. Recent MBS market development.
Memorandum item: United States	FRM (15-30 y), low ARM share (reference rate)	No national legislation. States in general extend universal right. Minnesota allows exclusion of prepayment.	Many state laws prohibit or cap penalties. Penalties are interpreted rather as market price than compensation. Personal hardship cases: open	Av 25% of new originations, rising with 1% per year (80-95), peaks over 60%.	Option price of between 70 and 100 bp (for current coupon GNMA).	Prepayment risk borne by the capital market through MBS holdings;.Secondary market agencies do not use/enforce penalties.

While prepayable mortgage loans are lawful everywhere, including in countries where exclusion is the rule, contractual freedom often allows for restrictions on exercising the right, most notably prepayment penalties. There are two competing concepts of prepayment penalties: a compensation concept, i.e., a partial or full compensation of the loss of value of the mortgage asset for the lender, and a market price concept, i.e., the interpretation of a penalty as a price that is contractually determined for the contingency of early repayment². The latter case is different to exclusion, as the price may be predetermined, i.e., underwritten in the loan contract. The following regulations apply to fixed-rate mortgages (national definitions):

- Prepayment penalties have to be paid in the standard case as an exact compensation for the loss in asset value plus in some cases foregone profit of the lender (“yield maintenance prepayment penalty“) in: The Netherlands (for some cases), Denmark (see below), Sweden, Finland. In Germany, such a compensation is being discussed. In Spain, the lender may charge higher than the penalty capped by law in the case of more severe asset losses (but no foregone profits), implying a yield maintenance penalty. The compensation interpretation is, however, not entirely clear in the case of prepayment gains for the lender in situations where the interest rate has increased (see the graphical presentation below). The Netherlands, for instance, waives the penalty in this case by law (which still renders a profit to the lender).
- Prepayment penalties can be contractually determined, i.e., as part of the contractually determined vector of prices (penalty, fee), to be paid contingent on prepayment, in: Austria, France, Belgium, Ireland, Spain, United Kingdom, Greece, and Germany. However, in the following group of countries the payment is capped by law: France, Belgium, Ireland, The Netherlands (with voluntary sale of house). In Spain, the capped penalties are binding only in the case of an ARM, not, however, for FRM if losses exceed the capped level.
- In Germany, there is an ongoing discussion whether prepayment penalties bear the character of a market price or a compensation. It appears that the system will converge to a compensation interpretation, applying a yield maintenance prepayment penalty on a yield difference plus margin concept.
- Denmark is again a special case. The delivery of a non-callable mortgage bond by the consumer automatically implies the payment of a yield maintenance prepayment penalty, by paying the bond investor the market price of the loan (which will be higher than the issuance price, if interest rates have fallen). However, the Danish borrower can at the same time get a prepayment *premium*, i.e., if he delivers a bond that trades below par as interest rates have risen. For the main class of bonds, callable mortgage bonds, the bond can be repaid at par through the call feature. The borrower incurs minimal transaction costs, but no penalty.

It is interesting to note that a number of countries explicitly or implicitly ban or cap penalties on adjustable rate mortgages. Among these are Ireland (ban), Spain (cap of 1%), Germany (ban)³, but not the United Kingdom where ARMs have the highest empirical significance.

In conclusion, the reviewed countries, including those that do not have a universal prepayment option, prestructure the form and the size of the prepayment penalty, either in written or in

2 The legal and economic differences of both concepts are important: a market price would find its limit in general regulations on unfair terms, a compensation would be more sharply confined to the damage the lender incurs.

3 The German case stems from the fact that consumers can always prepay adjustable-rate mortgages with 3 months notice (universal prepayment). It is common legal opinion that no penalties shall be charged, if the law states a universal right to prepay.

common law, with the important exception of the United Kingdom. The countries that practice exclusion cap the maximum exclusion period. As a result, nearly all countries have provisions that limit the maximum interest-rate risk exposure of the borrower, although at widely differing levels.

Particularly important, and telling about the complexity of the issue, are the derogations defined in some countries with respect to the treatment of personal hardship cases, but also a simple house sale as a result of a change in the working place. The grey areas here are obvious. It cannot be overemphasized, that de-facto special regulations in these cases perform the economic function of avoiding the - typically well-defined - foreclosure and consumer bankruptcy procedure. Examples from our preliminary overview:

- Belgium bans penalties after repayment following a life insurance payment (death).
- The Netherlands formulate a mandatory waiver in case of death and in case of house sale under execution, if the consumer is not to be “blamed“ on the default (e.g., unemployment).
- In France, the Conseil Nationale du Credit has a working group that shall determine the contingencies under which the penalty shall be waived.

Empirically, it can be often observed that penalties will be waived, or priced as a low mark-up over the subsequent loan, in cases of internal refinancings (ie. with the same lender).

Empirically, the size and calculation methods for penalties differ, so that in effect, prepayable mortgages may well become non-prepayable in an economic sense, for instance if the prepayment penalty is high enough to eliminate the economic advantage of prepayment.

3. Theory and the Empirical Costs of the Prepayment Option

The prepayment option is a complex, long-running American interest rate call option, whose value and dynamics are in addition determined by the behaviour of consumers and a specific transaction costs environment. A good discussion about the complexity of the option even without considering the latter constraints is contained in Bühler et al. (1990) and Hendershott and Van Order (1987).

The consequence of the complexity of the option is that the typical pricing strategy is to use hedonistic (i.e., empirical) prepayment functions and combine them with assumptions and scenarios about the expected interest-rate process over the duration of the option. Such prepayment risk models, basically a simulation, are constructed on a non-public basis by investment banks, mortgage securitization agencies and portfolio lenders. There is substantial evidence that despite their high sophistication, the models' likelihood of misspecification is great due to their complexity (see for example Mortgage Banking, May 1996). Evidence from investment banks suggests that the difference of conceptual bandwidth of the models as well as their performance in practice is large.

As a result, we concentrate the presentation on the direct empirical evidence of the pricing of the prepayment option on the capital market, by considering the spreads and other available data on the main debt instruments: callable mortgage-backed bonds (e.g., MBS, most Danish mortgage bonds) and non-callable mortgage-backed bonds (e.g., German Pfandbrief). The rationale behind this approach is that a spread decomposition delivers an approximation of the prepayment option value that represents the average view of the market, i.e., pools all types of prepayment risk

models. We consider this decomposition as the best available information on the market value of the option. We focus therefore on empirical evidence from Denmark and the US on one hand and Germany on the other. For France and the United Kingdom only anecdotal information can be provided, as here prepayment risk is widely held within the banking system, not the capital market.

The option of early repayment gives the right, but not the obligation, to call (repay) the mortgage at a pre-determined price (typically par, its nominal value) at any time prior to maturity of the contract. As with any interest rate call option, its value *cet. par.*

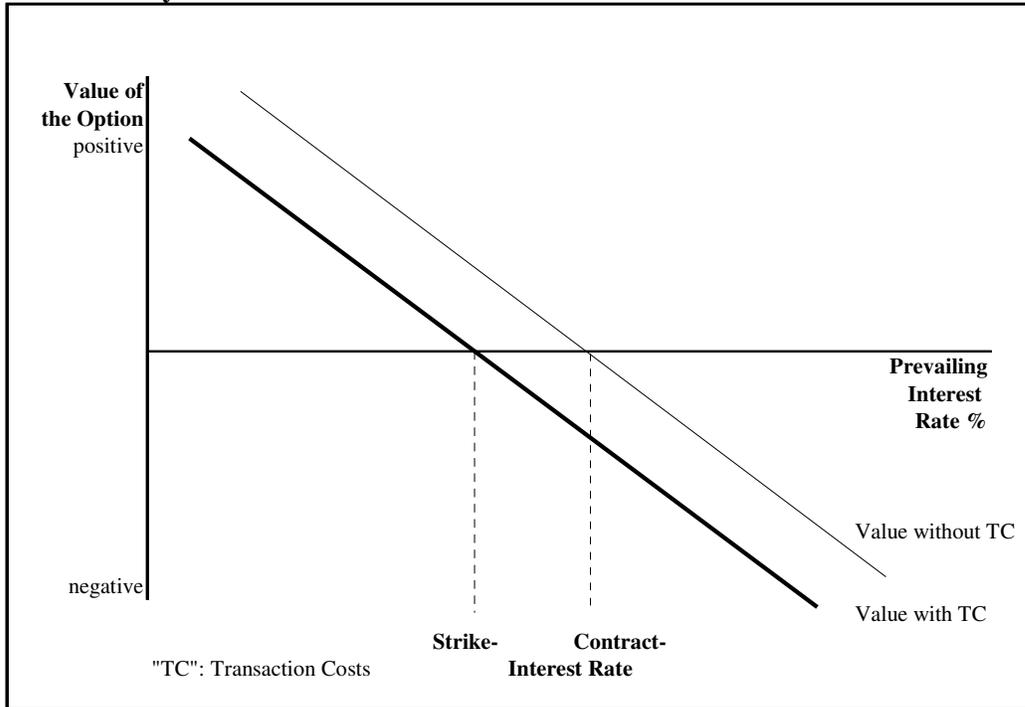
- increases with the length of the remaining debt maturity over which the option remains current, i.e., the option may be assumed to cost more in Denmark, with typically 20-30 year fixed-rate mortgages, than in Germany with a median interest-rate binding period of 5 years.
- increases with the volatility of the price of the underlying; concentrating on the financial motives the price of the underlying would be the current interest rate for a loan contract over the remaining maturity. Here, with the EMU convergence, national differences become increasingly irrelevant.
- depending on the option formula employed, decreases with the slope of the yield curve, or any other trend variable that represents market interest rate expectations.

Furthermore, it

- decreases with decreasing specific transaction costs, such as new mortgage origination fees, government stamp duty, or prepayment penalties.
- increases with increased borrower awareness and capacity to react to interest rate signals. This is a general trend that is triggered by improved information and borrower education.
- is rather independently related to so-called non-financial prepayments caused by personal hardship cases or household mobility/house sales, as long as these are in fact independent from current market interest-rates.

Table 2 shows in a stylized fashion different realizations of the value of the option as current interest rates deviate from coupon rates, and the effects of transaction costs. When the market (prevailing) interest rate is above the contract rate, the option has a negative current value (it still has intrinsic value reflecting the possibility that market rates may decline in the future). As the market rate moves below the contract rate the option value increases and becomes positive (“in the money“ in options parlance). Exercising the option yields a positive return for the borrower only, if the (positive) difference between the contract rate and the prevailing rate exceeds the transaction costs (break-even point).

Table 2 Stylized Characterisation of the Prepayment Option - Interest Rate Risk is Cushioned by Transaction Costs



A mortgage with a prepayment option and ruthless exercise is identical to a multiple cap contract on an ARM (i.e., only downward adjustment, subject to transaction costs), underwritten by the lender. Hence the lender insures the borrower. Alternatively, the bank can issue an interest rate floor contract, underwritten by the borrower in the case of excluding prepayment by contract. Here the borrower insures the bank.

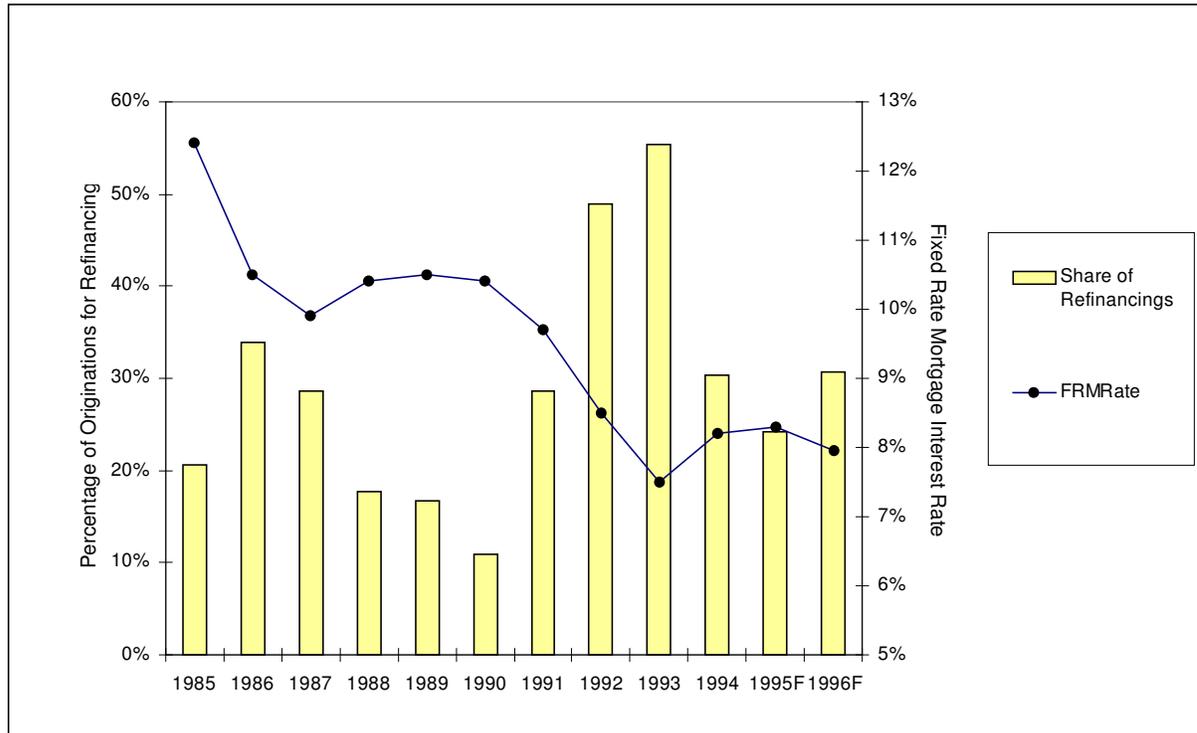
The theoretical problem with mortgage prepayment, however, is that the value of the prepayment option furthermore depends on the characteristics of the underlying mortgage pool which determines the degree of “ruthlessness“ at which the option is exercised, if in the money. Unfortunately there are no microeconomic studies of borrower behavior in exercising the prepayment option in Europe. Therefore our analysis will focus on empirical revelations of the extent of mortgage prepayment and its pricing by lenders and investors.

We start with the cases of the US, Denmark and Germany where well-developed wholesale refinancing systems for mortgages allow for isolation of the prepayment risk.

a) United States

reports the proportion of mortgage originations for the purpose of refinancing. The data show both a strong cyclicality in response to the main refinancing incentive, the current mortgage rate, and an increasing trend. Both the trend and the amplitude of the prepayment waves reflect the decrease in transaction costs and the increase in borrower awareness and information.

Figure 1 United States: Refinancing as Share of New Mortgage Originations and FRM Interest Rate



Source: HUD, MBA.

On average over the time period of 1985 to 1996 (forecast) 29% of new originations were refinancings. A simple linear regression yields an annual increase of that rate over the past 11 years of 1.2% that is largely attributed to the drop in transactions costs of refinance.

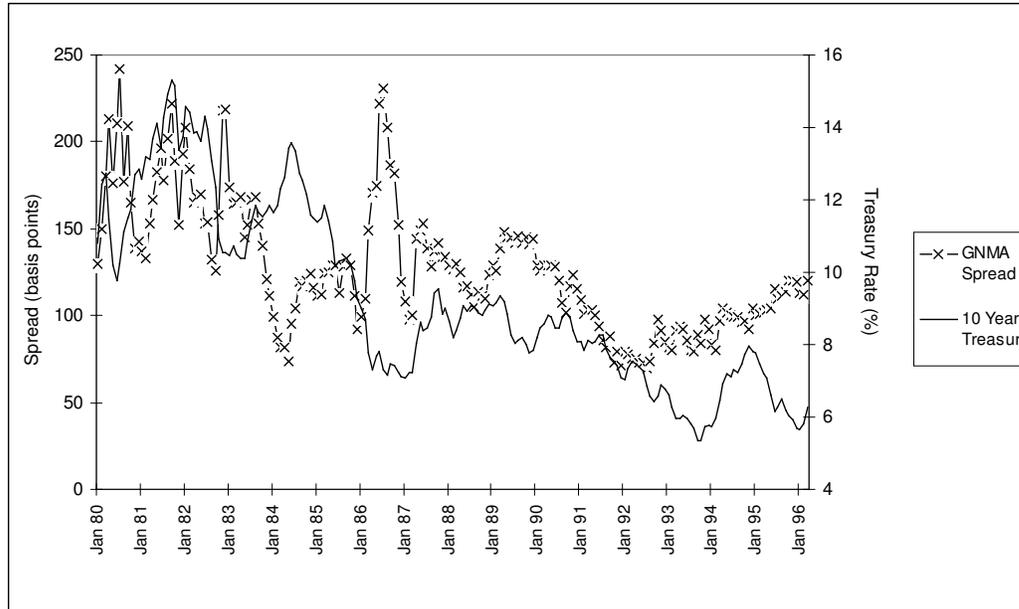
Prepayments come at a market price that can be assessed with spread analysis of appropriate mortgage instruments: The standard lending instrument is a 30 year fixed-rate mortgage. The average duration of a government insured fixed-rate mortgage with a only approximately 10 years while that of a conventional (uninsured or privately insured mortgage) is less; approximately 7 years. The 10 year government bond yield provides the closest duration instrument and is the standard benchmark for comparison with the 30 year fixed-rate mortgage.

Many of the factors that complicate spread analysis elsewhere are obviated by the existence of the mortgage-backed securities market in the U.S. The GNMA-guaranteed MBS is guaranteed by the government, is highly liquid and yields are quoted net of origination and servicing costs. Thus, if the mortgage yield is stated on a bond equivalent basis (i.e., as if cash flows were received semi-annually as opposed to monthly) then the resultant spread is mostly due to prepayment risk, and hence a reasonable approximation of the value of the option.⁴

4 Liquidity differences will vary by security. There is a slight tax difference between GNMA and Treasury securities as some states tax interest on GNMA MBS and by law none can tax Treasury bond interest. The magnitude depends on the state tax bracket of the marginal investor but is probably close to zero (the marginal investor may be an institution such as a pension fund or insurance company which is not subject to state income tax).

Figure 2 shows the GNMA current coupon to 10 year Treasury yield spread.⁵ As mortgage rates fell below 10 percent in 1986, prepayments accelerated and the yield spread widened sharply to more than 200 basis points. The sharp increase reflected the new awareness of investors about prepayment risk of the securities. The spread fluctuated between 100 and 150 basis points between 1987 and 1990. In the wake of unprecedented liquidation of mortgage assets by thrift institutions for balance sheet purposes in 1989, the current coupon GNMA yield spread widened to 150 basis points again. However, as the market gradually digested the liquidated securities, the yield spread tightened to a low of approximately 70 basis points in 1992, averaging 83 basis points between mid-1991 and the end of 1993.⁶

Figure 2 United States: GNMA-Treasury Spread and 10 Year Treasury Rate



Source: Oppenheimer

Diamond/Lea (1992) provide both a quantitative and a qualitative comparison of the spreads for the subject countries. Using data from Salomon Brothers, they estimated the value of the prepayment option during the 1988 to 1991 time period at 73 basis points.

b) Denmark

Mortgage prepayment in Denmark was rare before 1986 primarily due to tax policy reasons that induced households to take up deep discount loans⁷. The incidence of prepayment became significant thereafter, as can be easily seen in Figure 3. In 1992 and 1993, mortgage bonds with coupon rates down to a minimum of 8%, trading heavily below par, were tax exempt from capital

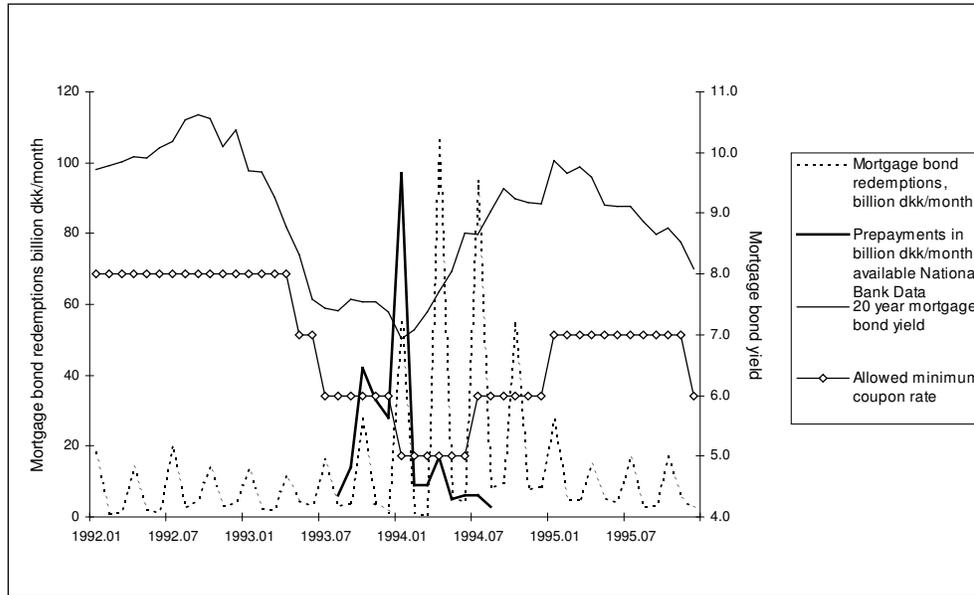
5 Current coupon refers to a newly issued security priced at par. If a pass-through is priced at par, the prepayment speed assumption does not affect the yield calculation as cash flows are assumed to be reinvested at the coupon rate.

6 The implementation of risk-based capital standards at the end of 1989 also fueled demand for mortgage-backed securities. These standards apply lower risk weights to GNMA securities (0%), and Fannie Mae/Freddie Mac securities (1.6%) than mortgage whole loans (4%). Some analyses have suggested that the savings in capital costs for a constrained institution more than pays the agency guarantee fee (average of 25 basis points.).

7 Danish discount loans are issued below par and repaid at par, implying a lower coupon interest rate and hence lower prepayment risk. The corresponding capital gain in the bond used to be tax-free.

gains, leading to low prepayment rates. However, as interest rates declined in 1993 by almost 4 percentage points, even the prepayment options embedded in the deep discount loans came into the money. In May 1993, government reduced the minimum coupon rate from eight to seven percent, only two months later to six percent, and, by January 1994 to 5%. Another factor that influenced prepayments was the increased attention that the mortgage banks and the media paid to the issue. A massive prepayment wave was triggered by each event that accumulated to 300 billion dkk, equivalent to 30% of GDP, in the matter of a year.

Figure 3 Denmark: Total Mortgage Bond Redemptions, Recorded Prepayments and 10 Year Mortgage Bond Yield



Source: Danmarks National Bank

As in the US, it is difficult to isolate prepayments for “financial“ reasons from those for “non-financial“ reasons. The dashed line in Figure 3 shows total redemptions, which include also ordinary redemptions. Also, mortgage bond redemptions not only reflect behaviours of residential but also of commercial mortgage borrowers, which are traditionally assumed to be more interest-rate sensitive.

In Denmark, the appropriate instrument to derive market values of the prepayment option is, as in the US, the callable mortgage bond.⁸ Bond yields translate with a fairly constant spread into

8 There are several types: The most common is an annuity bond wherein the payments are constant. Serial bonds which feature constant principal payments but declining periodic total payments have periodically been significant as well. Bonds are issued with an original maturity of 10, 20, 30 or 35 years at a stated coupon rate. A series can remain open for as long as 3 years and all individual bonds in the series have the same final maturity date. Issuers can chose from several coupons (e.g. currently bond issues with coupon rates of 9%, 10%, 11% and 12% are open) but an amendment to the Danish Capital Gains Act in 1986 set a minimum coupon rate for issuance which precludes substantial original issue discounts (currently 9% with market yields currently around 10%).

mortgage rates that the borrower pays. It is only recently that the traditionally low spread of 40 bp has increased somewhat, which was to some extent related to higher transaction costs as a result of prepayments.

Any interpretation of Danish figures is to be seen against the particular domestic background: Large domestic pension funds and insurance companies have limited investment opportunities with emphasis on the purchase of domestic bonds (Davis (1995)). They dominate the mortgage bond market (not, however, the government bond market, see below), making it weakly integrated into the international capital markets.

A paper published in the August 1993 in Danmarks Nationalbank Monetary Review examined the yield differential between individual 20 year mortgage bonds and the 10 year government bonds for the period between January 1990 and May 1993, *before* the large residential prepayment wave (Graven Larsen (1993)). The study analyses the most liquid series for a number of coupons. It notes that the spread between the most liquid 20 year mortgage bond and 10 year government bond widened from approximately 40 basis points at the beginning of the period to 140 by May 1993 (the average spread across all bonds during this period was 83 basis points).

Table 3 Denmark: Estimated Spread Decomposition of 20 Year Mortgage Bond over 10 Year Government Bond by Coupon

Yield differential for ...% coupon		cycle		
		decline 7/1/90-7/1/91	rise 8/1/91-19/10/92	decline 20/10/92-17/5/93
12	liquidity premium	0.2	0.5	0.5
	call premium	1.8	2.6	3.4
10	liquidity premium	0.2	0.5	0.5
	call premium	0.5	1	1.6
9	liquidity premium	0.2	0.5	0.5
	call premium	0.3	0.5	1

Source: Graven Larsen (1993)

The study concluded that a combination of differences in liquidity, credit risk and investor preferences contributes to a yield differential of approximately 50 basis points. The remaining spread, and the source of the variation, is call (conversion) risk due to prepayment. As shown in Table 3, the call premium varied by coupon and significantly increased over time. The 12% coupon, which was in the money since 1990, assuming a 100 bp break-even point, reacted strongly to the declining yield curve, by nearly doubling its call premium over the period to 340 bp. The discount bonds reacted with a lag, as expected. The 9% bond, whose prepayment option came only into the money in May 1993, was priced up to 100 bp even before.

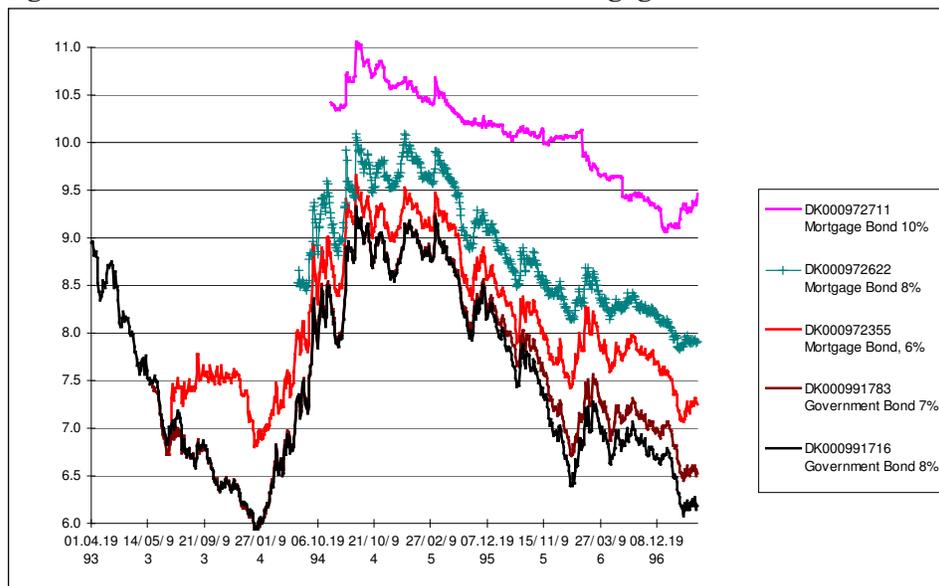
Residential prepayments may be assumed to have played a much lower role in bond pricing before 1993 than afterwards. Figure 4 shows the development after April 1993, for a selection of mortgage bonds and government bonds. The 3 month-spike in yield of the 6% mortgage bond

Mortgage bond issuance in Denmark is tightly regulated. Only authorized mortgage credit institutions can issue mortgage bonds ("Realkreditobligationer"). There are nine authorized issuers with the Big 3 institutions controlled 90% of the market in 1995. The mortgage credit institutions are subject to strict limits over the characteristics of the loans which collateralize their bond issues. However, since 1990, banks and insurance companies have been allowed to conduct mortgage credit activities through subsidiaries.

issued in July 1993, with the change of the minimum coupon rate, shows the pricing reaction during the prepayment wave. During the interest rate increase, the bond traded with a minimal premium over government bonds, due to its low prepayment risk. The average spread of the 6%/8%/10% bonds to the 8% government bond reported are reported below. Following Graven Larsen (1993) and subtracting 50-60 bp for non-prepayment risk cost components the value of the option:

- for the period until the interest rate trough in January 1994: 87 bp
- from the trough in January 1994 to the peak in October 1994: 61 bp
- from the peak in October 1994 until September 1995, when interest rates dropped below 7.5%: 36 bp/85 bp/184bp
- from September 1995 to November 1996: 87 bp/142 bp/278 bp

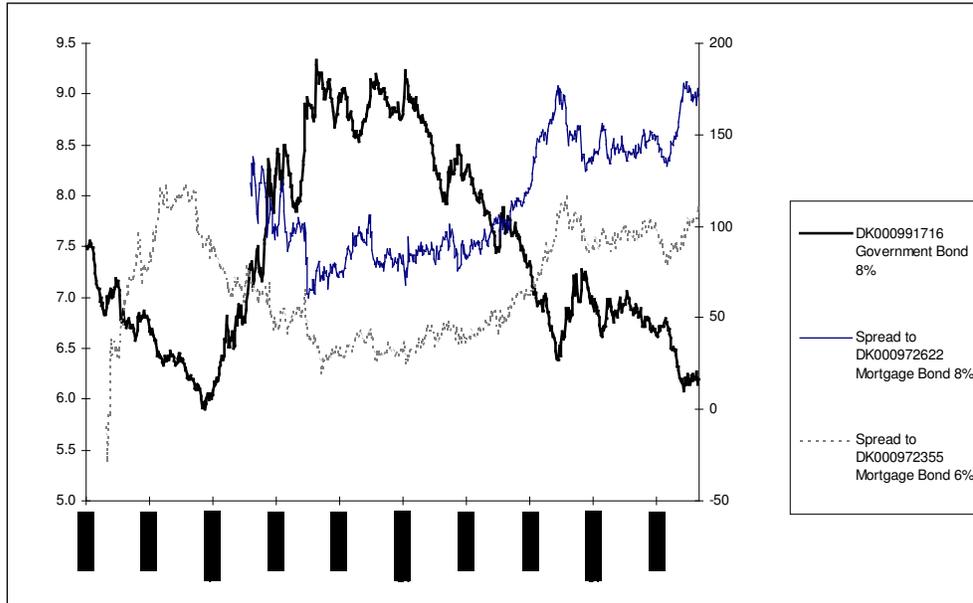
Figure 4 Denmark: True Yields of 20 Year Mortgage Bonds



Source: The Aarhus School of Business. Note: “true yield“: yield to redemption calculated under a no-prepayment assumption.

Figure 5 shows spreads in more detail. The 6% bond bears practically no prepayment risk when interest rates exceed 8%. However, even the discount bond is already interest sensitive during 1995, when the yield curve remained basically unchanged, reflecting different assumed prepayment speeds for the seasoned underlying pools.

Figure 5 Denmark: Spreads of a 6% and 8% 20 Year Mortgage Bond relative to 8% Government Bond, 1993-1996



Source: The Aarhus School of Business.

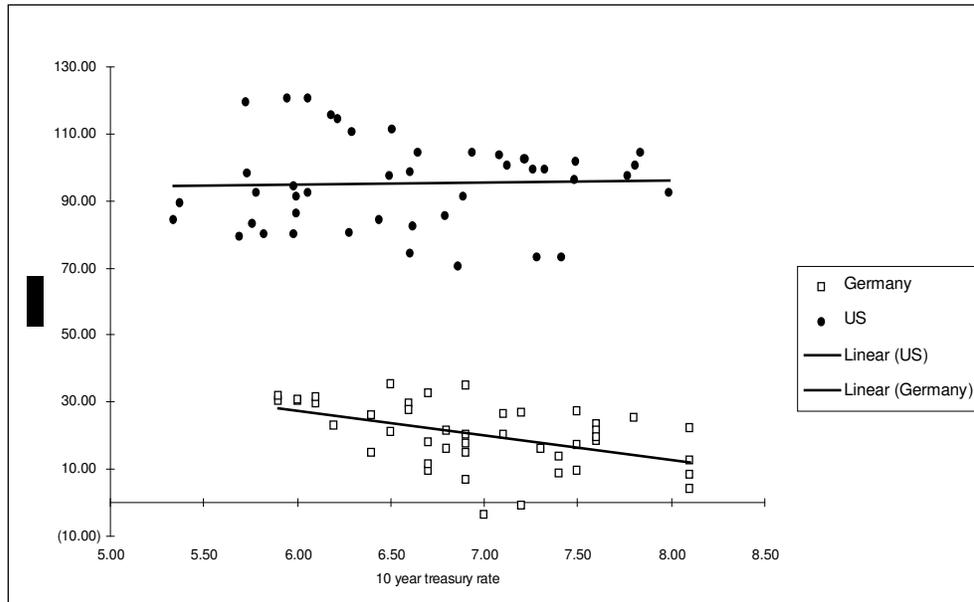
a) Germany

A substantial portion of German fixed-rate mortgage debt is refinanced by non-callable bonds, by private and public mortgage bonds (“Pfandbrief“ and “Öffentlicher Pfandbrief“), and by ordinary non-callable bank bonds (e.g., by Landesbanken, who refinance the savings banks, and private commercial banks). The predominant exclusion of the option, and the resulting market pressure through maturity cycles leads to a tightening (loosening) of spreads in the interest rate peak (trough) - the opposite to what we observe in the countries offering the prepayment option.

Figure 6 shows the difference between the callable GNMA MBS and the non-callable Pfandbrief spreads over equivalent-duration government bonds. GNMA MBS enjoy a full faith and credit guarantee from the government and thus have no investor credit risk. Pfandbrief yield contain a small credit risk premium which is quite low due to the conservative underwriting and strict oversight of the mortgage collateral.⁹

⁹ The investors have priority rights to the collateral. The maximum LTV for the collateral is 60 percent. The mortgage banks must maintain the value of the collateral pool as well as the matching between the cash flows of the collateral and the bonds.

Figure 6 GNMA and Pfandbrief Spreads and Benchmark Government Bond Yields, April 1992 - December 1995



Source: DGZ, Oppenheimer.

This mortgage bond premium directly translates into relatively low German mortgage rates, as other cost elements have remained fairly constant over time. Inversely to the price of the prepayment option, the German mortgage borrower receives a discount for waiving the prepayment penalty in underwriting the contract; he receives the “insurance premium“ for insuring the lender, or equivalently the capital market investor, against prepayment risk.

Are there prepayable mortgage loans in Germany? In order to arrive at an overview over the treatment of prepayment in practice and at some quantitative data, a *survey* among German banks was undertaken in 1996. The survey has been organized by the Zentraler Kreditausschuß (ZKA) and received 47 responses from public banks, savings banks cooperative banks, private mortgage banks and commercial banks. As expected a priori, both the lack of computerization of and the speciality of the data requested led to gaps that result in the survey being non-representative. However, roughly 33 lenders, with a DM 57 billion residential lending volume by 1995, returned sufficiently detailed quantitative information.

Table 4 reports the reported motivations for applications for second contracts that lift the interest fixing agreement (“Aufhebungsverträge“), as estimated by lenders. Not all of the 21 useful responses had sufficient information in order to differentiate all points - often the figure of “other sales/sales“ includes other motives, such as divorce and death of spouse. Note also, that the survey summarizes motives for both partial and full prepayment.

Table 4 Germany: Borrower Motivations for Applications to Second Contracts

Interest rate decline/internal refinancing	11.70
Refinancing other institution	9.30
Bauspar	11.53
Life insurance	5.94
Divorce	1.82
Death of spouse	0.31
Inheritance	0.61
Other sales/sales	54.78
Other reasons	4.10

Source: Zentraler Kreditausschuß Survey, author's calculations.

Given the fact that borrowers are in general, although not always, informed and aware of the exclusion of prepayments, the pure financial motive has a low weight in application motives: combining interest rate decline and refinancing to other institutions yields a 22% share of the total. This contrasts to data from the other countries, where competition and financial effects are main factors in prepayments. The low figure reflects that internal refinancing in Germany has mainly two motives:

- prevention of a default. With the exclusion of prepayment, default becomes an issue despite the fact that banks rather tightly control underwriting loan-to-values and debt-service-ratios; this may be particularly true if house price growth is sluggish, as in the 1980s.
- the extension of the often short fixed-rate maturities, with the effect that the borrower can be kept with the bank for an extended period. Indeed, as an additional incentive in approx. 30% of cases banks charge at least a partial prepayment penalty as a mark-up over the new loan.

Apart from these motives, banks will typically decline financially motivated prepayments, with the rigour of refusal declining with size of the lender and the degree of maturity mismatch. Against that background the 9.5% share of refinancing to other institutions brought forward as motivations comes as a surprise, as the lender will typically turn down applications with such a motive.

In Germany, contingencies such as sales and allotment of Bauspar (contract savings) loans and life insurance dominate the prepayment motives. These would constitute the “non-financial“ motives of prepayment. In general those banks that are part of a private or public bank group will accept prepayments from Bauspar loans and life insurance payments coming from affiliated institutes, and regulate this contingency in the contract. Outside this structure, however, the prepayment motive is generally declined, for instance by small private banks.

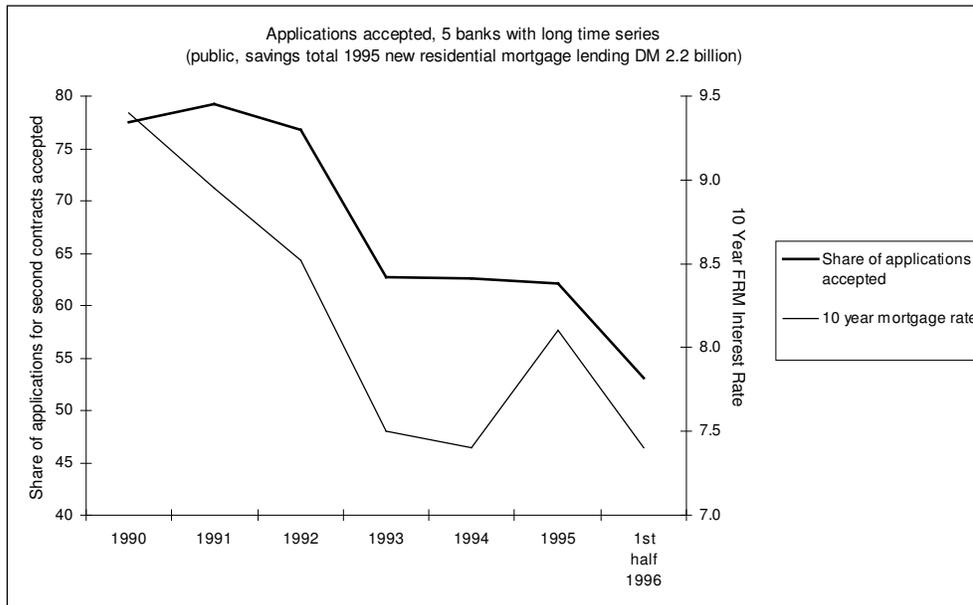
Personal hardship cases are of the expected low frequency that is exogenously determined. Although typically no contractual provisions are made, lenders in the survey hasten to assert that acceptance of prepayment in these cases is universal; prepayment penalties, however, will only be waived under special financial circumstances, notably in order to prevent a default.

As German mortgages are generally assumable with the lender's consent, the high significance of sales as a motivation comes at first glance as a surprise. However, some of the hardship cases may be included in that category. More importantly, from survey comments it appears that lenders have a preference for prepayments against applying a yield maintenance penalty because this strategy minimizes the transaction costs and risks that arise concluding a contract with a new

borrower. Nothing can be said about penalty waiver in times of a sluggish house market, as the time period considered was characterized by healthy price growth.

In terms of acceptance of applications, hard figures are reduced to a subsample of 5 lenders. Clearly, the ratio of the number of second contracts concluded to total applications is inversely related on the size of the interest rate incentive. This supports the conjecture, that German banks react positively to “non-financial“ prepayments, while typically declining “financial“ prepayments.

Figure 7 Germany: Share of Applications for Second Contracts Accepted and Mortgage Rate



Source: Zentraler Kreditausschuß Survey, author’s calculations.

The central issue, however, is whether despite the necessity of concluding a second contract there are significant prepayments in Germany. A first hint is the acceptance ratio reported which lies constantly above 50%. Figure shows the volume of second contracts as a share of total residential mortgage lending, and indicator that could be calculated only for a subsample of 13 banks that combine a residential lending volume of DM 23 billion - mainly mortgage banks (8). Clearly, prepayments play a significant role if compared to the lending volume.

An important qualification must be made as the size of prepayments strongly correlates with the lender’s size and integration into financial concerns, hinting at the importance of prepayments by Bauspar loan and life insurance allotments, but also to a different attitude of these lenders. The structure of the German residential finance package implies a minimum prepayment rate for these lenders. This special German feature is generally absent in the other countries surveyed. Both Bauspar and life insurance payments, however, involve some duration risk that the lender has to bear.

Also, from the volume data a clear interest rate sensitivity appears, which is concealed to some extent by the special problems one large lender in the sample had with prepayment.¹⁰ Looking at the data of the mortgage banks reveals that some banks have reacted quite strongly during the interest rate trough, and others (typically small ones) not. Also, according to the questionnaire, at least one of these banks offers full prepayment as a contract option (portfolio share 2.2%)¹¹.

Figure 8 Germany: Share of Second Contract Volume in Total Residential Mortgage Lending, Whole Survey Sample



Source: Zentraler Kreditausschuß Survey, author's calculations.

Even though 10 year mortgages are available in Germany at the interest rate peak at only a low premium over government bonds, many borrowers are obviously aware of the characteristics of exclusion of prepayment and shift cyclically to short-term fixed-rate loans, avoiding therefore negative interest rate risk. Figure - displays the survey results for 21 German banks including 6 public banks, 8 mortgage banks, 7 savings banks, and 2 other banks, with a total lending volume of 36 billion DM in 1995. In 1990/1991, at the peak of the German reunification interest rate high, only slightly more than 15% of the lending volume was in loans with maturity of 10 years and over; in the 1994 trough this proportion rose to over 40%. Adjustable-rate mortgages play no significant role. The typical borrower's strategy at the interest rate peak would be to start with a short-term fixed rate loan, and refinance later into a 10 year fixed-rate loan. This strategy is refined by increasing offers of combination of adjustable-rate mortgages with option to fix the rate for longer at some point in time.

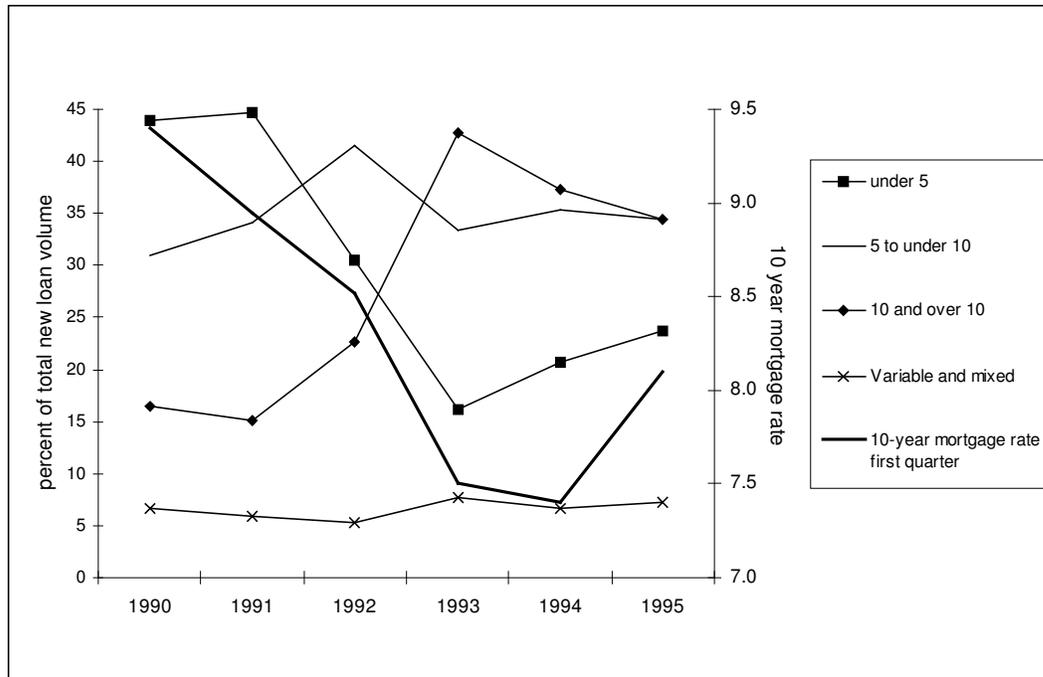
Obviously, there is positive interest rate risk embedded for borrowers if combining short-term and long-term loans cyclically. An important stabilizing factor for this borrower behavior is therefore

10 A manager of this mortgage bank had - reportedly by mistake - advertised mortgage prepayment on statements of account, triggering a strong customer response that the lender saturated..

11 It should be emphasized that in Germany the exclusion of prepayment in a fixed-rate contract for up to 10 years is a contractual option (ie. it is not imposed by law). Lenders and borrowers have full freedom to conclude contracts including the prepayment option.

the traditionally stable German interest rate environment which limits interest rate risk. There are negative consequences of the maturity cycle for lenders in terms of transactions costs.

Figure -9 Germany: Cycle of Interest-rate Binding Periods in Residential Mortgage* Lending, Survey Results from 21 Lenders.



Source: Zentraler Kreditausschuß Survey. *Note: data may include non-consumer residential mortgage lending (e.g., rental housing projects or projects developments as German lenders do not differentiate by investor type)

While German banks can and typically do exclude prepayments for maturities under 10 years, they do take prepayment risk by fixing FRM's with longer maturities than the maximum interest fixing period according to §609 BGB of 10 years. The supply of such mortgages, however, is cyclical and volume is comparably low; from our survey, only 0.35% of mortgage lending have fixed rate periods over 10 years¹². The lenders cite problems in consumer acceptance due to the widespread acceptance of the fixed-rate mortgage with prepayment exclusion.

a) Summary: Costs of the Prepayment Option

Previous research and this small overview suggest that the prepayment option comes with a substantial price: for the U.S. this can be approximated to between 70 and 100 basis points, or 0.7 - 1.0% points, for current coupon mortgages. In Denmark, one arrives at a substantially lower price for mixed mortgage bonds, e.g. 30 to 45 bp for 7 to 8% percent coupons, but there is a high likelihood of a general underpricing of Danish bonds and hence the option, due to the portfolio regulations of domestic institutions. Higher conditional prepayment rate realisations for individual issuances have led to much higher call premia.

12 For technical reason, this figure excludes mortgage banks.

For France, the option value for a 9% coupon has been estimated by the Association Francaise de Banques, AfB(1995), at 38 bp¹³, reduced by the value of the prepayment penalty of 19bp. In Britain, prepayments of both fixed-rate mortgage and ARM loans have been counteracted by a strong increase in prepayment penalties charged: between August 1994 and February 1996 alone the median prepayment penalty in fixed-rate mortgage offers rose from 3 to 6 months.

In all reviewed countries, prepayment accounts for a large, if not the largest, part of the spread difference between residential mortgage lending and the benchmark of government lending, except Germany; it is far more important than credit risk. At the other extreme, German borrowers who at present typically use non-prepayable contracts, save the option price and pay lower mortgage interest rates. German spread data show the reverse spread cyclicality if compared to data from countries with a universal prepayment option. However, as a consequence there is a cycle of interest-rate fixing periods in consumer lending.

Assuming that a future European monetary policy would result in an interest rate cycle similar to Germany for the time period of 1980-1995, taking into account lower non-financial prepayment factors, such as mobility and housing turnover, in Europe, the option would be expected to cost in the range of 40-70 basis points, or 0.4% - 0.7% points, depending on the significantly differing interest-rate binding periods.

4. Effects on the Refinancing of Mortgages

The value of the prepayment option, and hence the value of the asset to be refinanced by a mortgage lender, is *entirely independent* of the method of refinancing as it depends only on interest-rate risk, borrower behaviour risk and transaction costs. However, the implications of prepayment for the asset held by a lender (the mortgage or a mortgage pool) have important implications for the feasible refinancing strategy of the lender.

There are three principal ways for a lender to finance fixed-rate mortgage assets:

1. Deposits or short-term debt issuance, where maturities are typically mismatched and the lender takes the full prepayment risk;
2. Issuance of non-callable securities, where maturities are typically matched and the lender takes the full prepayment risk;
3. Issuance of callable securities, where the lender shifts part or the total of prepayment risk to capital market investors.

Theoretical considerations and empirical examples (e.g., from France) show that - in the absence of prepayment penalties or in the case of penalties being capped at low levels - only the third alternative provides sufficient sustainable call protection for the lender. The unrestricted right of prepayment has fueled the development of the secondary mortgage market in the U.S. along with multi-class securities and callable debt. This is however not the typical refinancing system for mortgage loans in Europe.

13 Determining the empirical pricing of the option in France is only possible in an approximative manner. The only available direct debt instrument, French MBS issues, have features that disallow the approach taken in Denmark, Germany and the US, particularly wide coupon spreads and illiquidity. Note also that the comparatively low option value for France is influenced by the fact that typical interest-rate binding periods are 15 years, ie much lower than in the US and Denmark. As well as the high transactions cost of re-registration and possible imposition of a prepayment penalty (if the new loan is with a new lender).

We analyze the problems of matched and mismatched lenders with the help of a standard duration gap model that is presented in the Annex. The result of the model is that, without sufficient protection of the lender in the form of prepayment penalties:

- a *matched funder* is subject to substantial capital risk derived from prepayment risk as long as he is not able to issue callable debt or prepayment pass throughs. Matched funders that are not able to issue bonds and pass the risk to the capital market, for whatever reason, are most critically affected.
- a *mismatched funder* is more able to cushion prepayment risk; however mismatched funding introduces much higher capital risk to the financial system in general than matched funding. Effectively, prepayments without sufficient call protection force some matched funders to finance fixed-rate mortgages mismatched, increasing their general risk exposure, or to shift to adjustable-rate finance, reducing interest-rate risk protection for consumers.

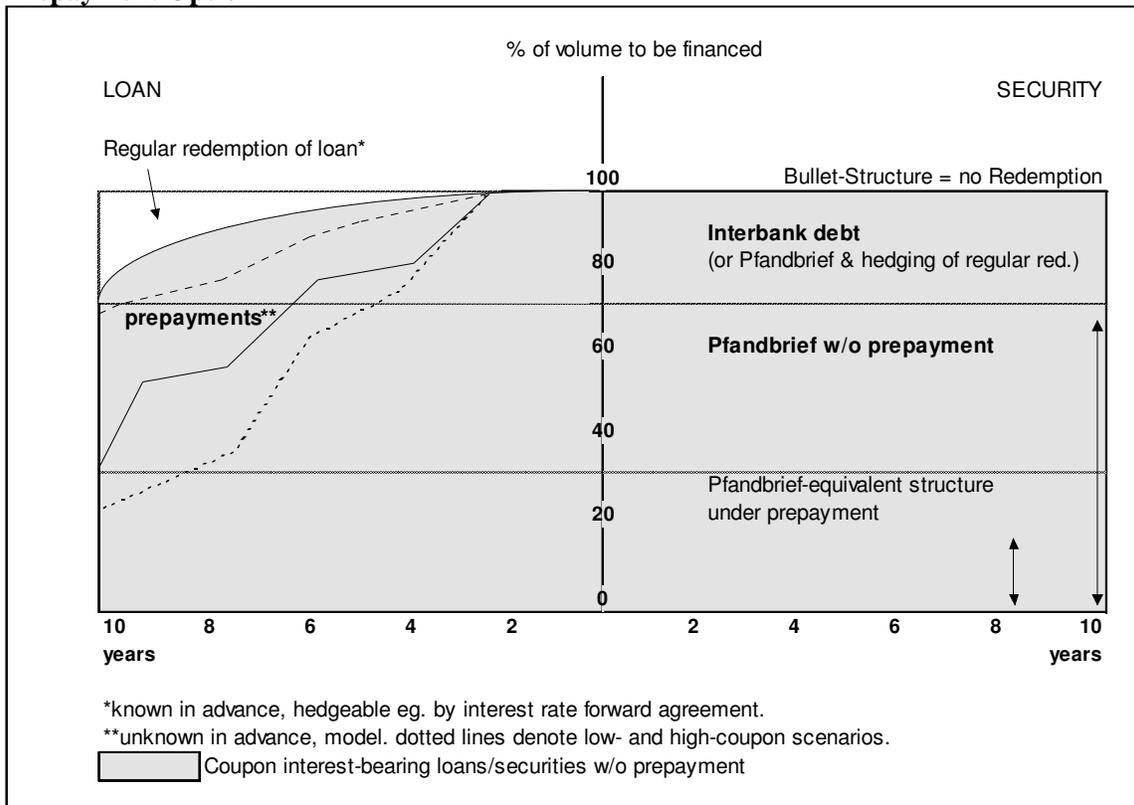
The duration gap model in the annex shows that matched funding with interest-rate locked in non-callable bond refinancing poses substantial capital risk for the lender if prepayment risk is present. In Germany, most fixed-rate mortgages are refinanced by such non-callable bonds; with the Pfandbrief and the Hypothekenbankensystem there is even a legally and economically closed refinancing system using non-callable bonds. It is interesting to note that Pfandbriefe are only non-callable since the market for callable Pfandbriefe broke down in the 1970's due to a lack of investor acceptance. Could a non-callable bond structure remain protected under universal prepayment, and what is the role of prepayment penalties?

Consider the case of universal prepayment. Figure 10 shows that regular redemptions of assets already reduce the outstanding loan balance in a predictable way, without prepayments. With prepayment, in aggregate or even individually, the outstanding loan balance reduces much quicker, depending on the prepayment speed.

For both regular and extraordinary redemptions the lender needs a strategy. Today, mortgage banks cover the mismatch from regular redemptions mostly with macro-hedges. In the case of a universal prepayment option, prepayments would however become much larger than what may be covered cost-efficiently by hedging instruments.

One potential alternative in such a case would be a CMO structure, that is a stratification of the cash flow into tranches with differing prepayment speeds and hence expected duration. However, even for the comparatively small tranches with low expected prepayments over their lifetime there is no complete call protection. The Pfandbrief would have to be externally call protected by costly hedges, or abandoned.

Figure 10 Analytical Scheme for the Assessment of the Refinancing Consequences of the Prepayment Option



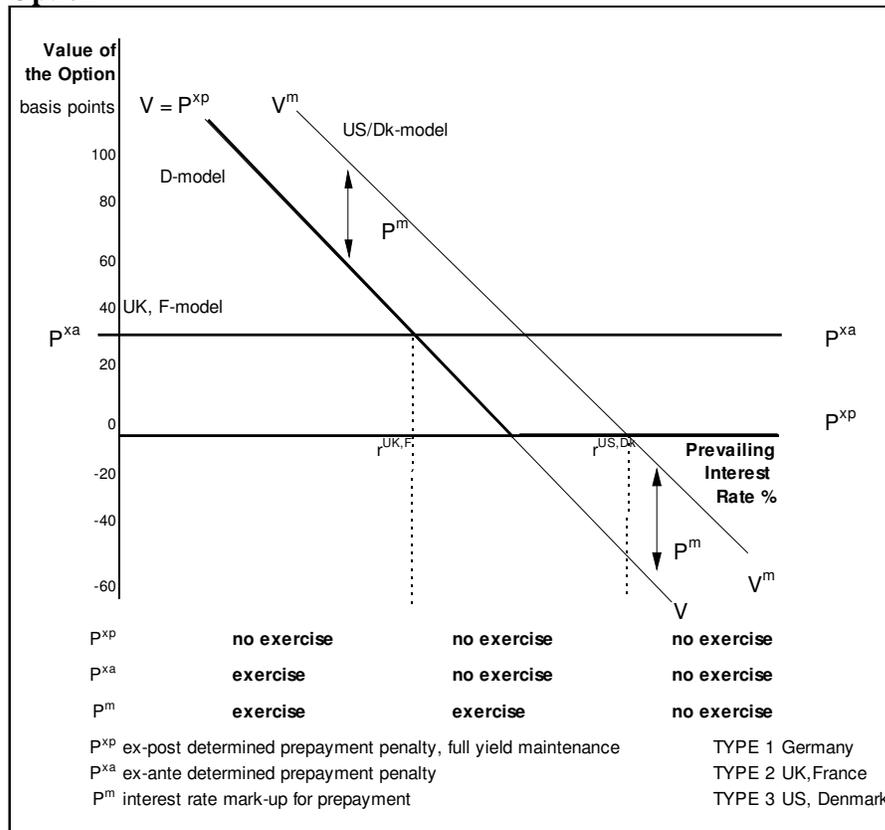
Note: Graph truncates maturities at year 10.

The only contractual alternative, aside from exclusion, that would safeguard a predominantly non-callable bond structure would be a yield maintenance prepayment penalty, implying that mortgage cover is replaced by substitute cover. The main legal obstacle for German mortgage banks would be §6 Abs. 5 Hypothekbankengesetz which limits the substitute cover to 10%. (allowed are: government bonds and government guaranteed bonds, cash, and deposits with the Bundesbank). However, it is likely that yield maintenance prepayment penalties can not be fully enforced, leaving the non-callable bond lender with prepayment risk. Waiver or reduction of penalties typically takes place in cases of internal refinancing. Political risk of capping penalties comes on top of these aforementioned considerations. Matched funders would in all likelihood have only limited control over this situation.

6. Alternatives in Contract Design

Table 5 gives an overview of the principal alternatives in contract design and pricing, showing fundamentally different outcomes for the consumer. Four main contract, or product, types emerge that exist today in Europe, combined sometimes with special refinancing techniques, and should be considered if thinking about a transposition of the Consumer Credit Directive to mortgage lending:

Table 5 Basic Economic Structure of the Three Contract Types Including the Prepayment Option



Note: All loci are functions of the coupon interest rate level. The graph therefore shows the situation for a specific coupon level only.

- Type 1: Contract with prepayment option and ex-post determined yield maintenance prepayment penalty, with or without net margin compensation (specified for a period of time). This implies the calculation of a compensation for the lender.
- Type 2: Contract with prepayment option and ex-ante determined prepayment penalty. This is the case of lump-sum ex-ante compensation or market price for exercising the option.
- Type 3: Contract with prepayment option, but without explicit prepayment penalty and instead ex-ante fee or/and interest rate premium compensating the lender for the costs of the option.
- Type 4: Contractual exclusion of the prepayment option for a specified period of time. This contract type cannot be displayed in the graph.

Note that a special treatment of personal hardship cases is relevant for *all* contract types, except contract type 3, i.e., not only in case of exclusion. We abstract here largely from a further differentiation of cases of personal hardship and the sales situation, as addressed in some national legislations. The correct way would be probably to separate personal hardship cases as intrinsic default cases from any formulation of rules on early repayment. The examples of France, Belgium and the Netherlands show, however, that in practice credit risk and market risk aspects are blended in law-making.

If there was only one legally admitted contract type in the economy, only contract types 1 and 2 would allow for borrower self-selection. A complete range of the 4 contract types may be easily offered in an economy, given that the legal structures are in place, allowing for borrowers to self-select according to their interest-rate risk preferences. This leads to the requirement to structure each of the four contract types in a way that sufficiently safeguards the interests of the consumer and strikes a balance between costs and benefits.

Type 1: Contract with with Prepayment Option and Ex-post Determined Yield Maintenance Prepayment Penalty, with or without Net Margin Compensation

As we have seen above, these contracts are practiced (at the minimum) in Sweden, The Netherlands, Finland, Germany, and implicitly in Denmark (non-callable mortgage bonds). The definition entails that the penalty is calculated at the time prepayment occurs, following a model that incorporates the spread and, what will be discussed below, the margin of the bank.

With a yield maintenance prepayment penalty, the price for exercising the prepayment option, P^{xp} is a variable, as it exactly matches the value of the option, V , that itself is a function of the prevailing interest rate relative to the coupon rate, as well as other variables neglected here. As a result, there will be no financial advantage of exercising the prepayment option, as the option is not in the money. However, borrowers have variable opportunity costs of refinancing, plus there may be additional intangible and tangible utilities of having the option (e.g., for personal hardship cases).

Ex-post penalties as they exist in reality allow for a bit more than a full compensation of the lender, as in the case when the prevailing interest rate lies *above* the contract rate the lender can under the typical legal concept expect a gain from prepayment.

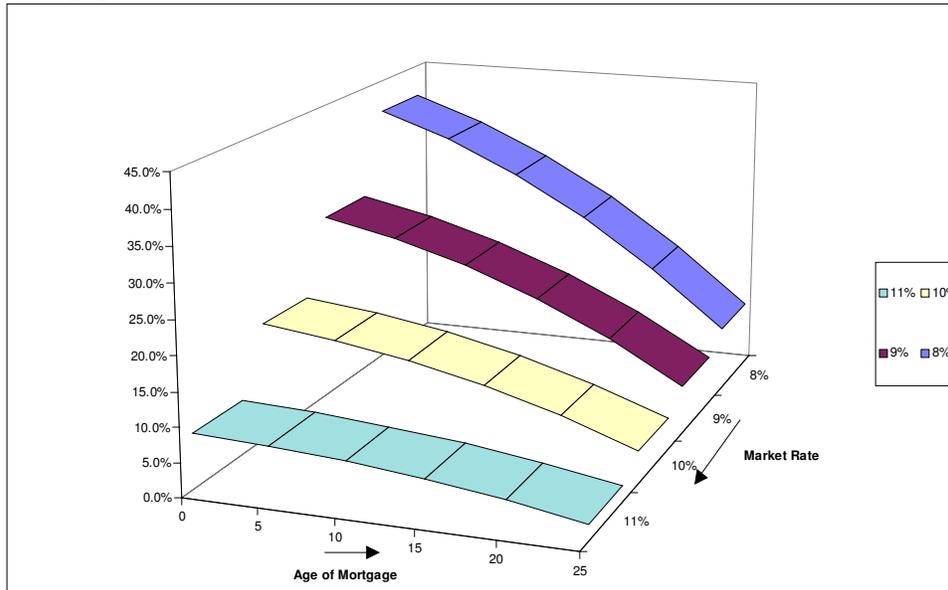
Problem 1: Maximum duration over which the penalty may be charged

There are problems with yield maintenance penalties if remaining mortgage terms are long, as Figure 11 shows for a US example. Note that these problems are intrinsically the same as under exclusion of the option, as the financial outcome for the borrower is (nearly) equivalent.

If indeed a yield maintenance prepayment penalty is charged, the value of the penalty swiftly increases with remaining maturity. A market reaction to a yield maintenance penalty could be hence a shortening of maturities, unless, as in the German case, maximum interest rate binding period and maturity are separated by law. Limiting the maximum interest rate binding period introduces an element into an otherwise elegant approach that must be determined arbitrarily.¹⁴ A 10 year maximum period over which penalties would be charged, could be one line of a European compromise.

¹⁴ However, the German law does not restrict the maximum interest rate binding period to a particular borrower group, ie. there is no explicit consumer protection motivation.

Figure -11 Prepayment Penalty on a 12% Fixed-rate Mortgage Providing Complete Mortgage Call Protection (Yield Maintenance)



Source: Simulation by Lea (1986).

Problem 2: Appropriate calculation benchmark

There is a heated discussion between mortgage lenders and consumer protection organizations over what is the appropriate benchmark to calculate a yield maintenance penalty.

The two principal pricing alternatives are a comparison of the coupon rate with the prevailing mortgage lending rate (*asset-asset-comparison*) or comparison of the coupon rate with the prevailing refinancing rate (e.g., the mortgage bond issuance yield, *asset-liability-comparison*), corrected by some measures of saved operating costs and risks for the lender (net margin).

The latter involves a compensation of the net margin of the lender. If the lender is not compensated for the margin loss, he will price the expected loss, given his prepayment model, into the mortgage rate or the up-front fees. This would be the case for a Danish non-callable mortgage bond, as the lender is not entitled to charge a net margin compensation. In Germany, the Civil Supreme Court is expected to rule in the near future on the size of the net margin that may be charged in a compensation payment.

Table 6 abstracts for simplicity from the administration costs. It shows also another point, namely that lenders and borrowers will have different values associated to the event of prepayment, depending on their respective opportunity costs.

Table 6 Mechanics of the Ex-Post Prepayment Penalty

	Ex.	Lender's View		Borrower's View	
				new credit	own funds
Old Lending Rate	9%				
Yield maintenance (asset-asset comp.)					
New Lending Rate	7%	minimum	maximum	minimum	maximum
plus net margin compensation* (asset-liab.-comp.)					
New Refinancing Rate	6%	loss	loss*	profit	profit**
After-tax Asset Return for Borrower's Investments	4%				

*gross margin, net of saved operating costs and risk premia
 **assumption: no tax deductibility of mortgage rates

Note: figures for illustration only.

The table shows that with a net margin compensation, there might be situations where the borrower makes a loss (internal or external refinancing, for the “new lending rate“), or a profit (refinancing with own funds, e.g., an inheritance). However, lenders should not charge margin compensation for internal refinancings, leading to a discrimination between internal and external refinancing. The point for consumer protection here is to avoid double charging by the same lender, while double charging of the net margin in the case of changing the lender is hardly avoidable, because, if banned, the first lender would charge the expected margin loss simply another way. The British discount war has shown that new lenders will reimburse prepayment penalties in the form of incentives given to the switching borrower, so this might not be a particular problem.

Type 2: Contract with Prepayment Option and Ex-ante Determined Prepayment Penalty

Here, the penalty is fixed in advance either as a formula as a specific amount. An example is the use of the formula “6 months interest up to 3% of mortgage balance“, typical in the United Kingdom, or the Loi Scrivener maximum amounts in France. Table 5 shows that the price for exercising the prepayment option which becomes a constant for any given coupon level, P^{xa} , leaves the lender ex-ante with high uncertainty whether the option will be exercised, or not. He still takes the basic interest rate risk, as French lenders have discovered.

In designing contracts with P^{xa} , the lender must counterweigh the profits¹⁵ that the lender makes upon exercise of the option if the interest rate is higher than r^{UF} with the loss that he makes when the interest rate is lower than r^{UF} . As the probability of exactly matching the economic value of the prepayment option with an ex-ante penalty is low, the anticipation of P^{xa} necessarily becomes a trial-and-error process. This might well result in a prohibitive level of P^{xa} , as the case of British lenders has demonstrated. The outcome depends on a complicated market process.

The graph highlights two important points for consumer protection. First, the level of the penalty, or contractually determined market price, P^{xa} is in principle arbitrary, as the true costs of prepayment are almost never exactly met. It therefore leaves the potential of high gains from exercising the prepayment option on either side, a situation that might also lead to individual bargaining.

15 Some countries have banned this situation (eg. Netherlands) while others have not (eg. France).

Secondly, an ex-ante determined penalty may very easily become economically prohibitive, for instance if coupon rates drop and prepayment penalties are not adjusted downwards, or simply are set at a prohibitive level. The lag structure evolving from the interaction between banks and borrowers on one hand, and the capital market development on the other hand, is likely to give very volatile signals for prepayment, changing from prohibitive pricing to insignificant pricing. This characteristic is not changed significantly by the fact that the penalty itself is often formulated as a function of the contract rate.

By the same token, consumers wishing to prepay in a below par situation, as when the interest rate lies above $r^{UK,F}$ pay a much higher penalty. In fact, contract type 2 may become more similar to the traditional form of contract type 4 (exclusion), which embeds a second contract with a freely negotiated market price, than contract type 1. It is important to realize that the ex-ante penalty therefore particularly punishes the hardship cases which occur with the same likelihood in below par situations.

Type 3: Contract with Prepayment Option and without Prepayment Penalty, but an Interest Rate Premium Compensating for the Value of the Option

This is the standard contract in the United States. In Europe it only exists in Denmark. As a result of pricing the option as a mark-up, the cost of prepayment are levied unconditionally on all borrowers alike, regardless of their probability to prepay at some point in time, or their interest-rate risk preference respectively.

The most difficult problem arising with mark-up pricing is that it can lead to higher prepayment rates sui generis since the refinancing incentive rises. This process is clearly detectable in Table 5, where the graph $V^m - V^m$ denotes the new break-even range for the prepayment option. As a result, the range of prevailing interest rates where prepayment is profitable will rise vis-a-vis contract type 2 and - of course - contract type 1. Furthermore, as we will see below the mark-up will be variable for different coupon levels and hence over time.¹⁶ Charging no prepayment penalty as in contract type 2 is not simply equivalent to setting P^{sa} to zero level as the borrower gets an additional prepayment incentive through the higher interest rate coupon.

The partial self-defeating character of mark-up pricing adds to the cyclicity of the interest rate spread that mainly results from the different prepayment potential of the different level of coupon. It requires a certain overshooting of the mark-up if interest rates are high. While a yield maintenance prepayment penalty has a cyclical character as well, the main difference is that it is an exact price required. Potential instability of interest rates and the high price of the option should be a concern for consumer protection, while hardship cases are less problematic here (although more defaults are caused due to the higher debt burden generated by the interest-rate markup).

16 Example: Say that in period 1 a 10% coupon will bear a 1% prepayment premium over a full yield maintenance penalty contract of 9%. Suppose that ex-ante the expected cumulated prepayment premium is exactly equivalent to a full yield maintenance penalty. Assume furthermore that in period 2 a new interest rate level will give a yield maintenance penalty contract of 7%, but for lower conditional probabilities of prepayment the prepayment premium is only 50bp. Hence the interest differential for the full yield maintenance penalty contract is only 200 bp, while for the premium contract it is 250bp, increasing the conditional probability of prepayments.

Type 4: Contractual Exclusion of the Prepayment Option.

This mortgage contract/product is the standard in Germany and Austria, where in both cases the maximum exclusion period is limited to 10 years while the median exclusion period chosen by borrowers is about 5 years. For this time period, the borrower takes the downward interest rate risk (but still no upward interest-rate risk as e.g., in an ARM contract).

At its face value, the contractual exclusion of prepayment appears as economically equivalent to an infinite prepayment penalty (which can not be displayed in Table 5) as due to the exclusion there is no obligation of the lender to conclude a second contract (“Aufhebungsvertrag“). However, in German economic practice, two key issues are relevant and a matter of discussion between lenders and consumer protectors.

- The right of the borrower to obtain a second contract in personal hardship cases and the case of sale. Our research has shown that lenders will in general agree on a second contract in personal hardship cases, however not in general in case of a sale. The open question in the German system is whether a common interpretation will be found, possibly through common law. This is similar to the discussion in the Conseil Nationale du Credit in France.
- The discussion about concept and size of the prepayment penalty in case of a second contract is about to come to an end: the previously dominant notion of a market price that is only confined by general civil code rules on usury, etc., will in all likelihood be replaced soon by a compensation calculation along the lines discussed above (asset-liability comparison).

As a result, the German exclusion contract converges to a contingent contract, with the main open question being on whether the contingencies must be stated already in the contract. The penalty solution will be as in contract type 1, and will not be arbitrary as in contract type 2.

Why then not simply abolish the exclusion contract and switch to a yield maintenance penalty contract?

The similarities are indeed great, as in both cases the asset value will be left unchanged in the same economic manner, giving also rise to the same decision about limiting the period of exclusion as well as of compensation payment.

However, there are arguments which justify the co-existence a different contract, even if the alternative is not contract type 3, but contract type 1:

- There is a risk that waiver of the prepayment penalty by market forces could lead to financial losses and indiscipline. There are conflicting signals on this point: while in Britain lenders despite strong competition have raised penalties over time, anecdotal evidence from France and also Germany suggests frequent waivers, at least in internal refinancing. In the absence of a general underpricing, frequent waivers of penalties would bid up the interest rates of yield maintenance penalty contracts vis-a-vis exclusion and create a cost advantage of exclusion contracts.
- More importantly there is political risk that, once a Europe-wide yield maintenance contract would become mandatory, maximum penalties could be politically capped, other than what is implied by capping the maximum exclusion period. If call protection is gradually removed in a political bargaining process, a non-callable bond refinancing system as the Pfandbrief-System would be jeopardized even under the concept of a yield maintenance penalty contract.

- Exclusion will also bear systematically lower interest rates compared to the yield maintenance penalty contract from a transaction costs standpoint: first, the lender saves the costs of substituting the mortgage loan in the mortgage bond cover. For instance in the case of German mortgage banks, where substitute cover restrictions laid down in the Mortgage Bank Act would have to be relaxed. Secondly, the borrower will have to be compensated for the lower utility of not being able to prepay in case of prepayment with own funds, where he makes a net profit even under a yield maintenance prepayment penalty.

It is important finally to note that exclusion cannot be criticised in general with the argument of personal economic hardship cases, unless one wishes to eliminate all contracts with the exception of type 3. The standard procedures to be applied are renegotiation, default procedures and finally consumer bankruptcy. The standard ex-ante instruments include life and other insurances.

6. Adjustable-rate mortgages contracts

The value of a universal prepayment option without penalty charges in adjustable-rate mortgages contracts is low, if compared to its value in long-term fixed rate mortgage contracts. However, it is not zero, as the foregone expected net margin on the loan will remain uncharged. Hence, lenders will try to anticipate the loss from adjustable-rate mortgages prepayments and issue the loan at a discount or charge as much profit as possible up-front (by overstating up-front costs). It is interesting to note that in the United Kingdom, where adjustable-rate mortgages are dominating the market, prepayment penalties are lawful and common, while in Germany prepayment is universal (up to 3 months notice) and penalties are banned! Hence, a discount war between lenders, for the benefit of consumers, could not take place in Germany.

8. European Synthesis - One European Contract Type versus a Complete Market?

European lawmakers might be tempted to choose one contract type, type 3, as a uniform model for Europe, allowing for universal prepayment and discarding prepayment penalties. In fact, the Danish mortgage bank system, which is the only European banking industry offering this contract, is typically cited in this context. This is partially incorrect, however, as Denmark also has (at least) contract type 1.

Selecting *only* contract type 3 would have the advantage of avoiding more detailed regulations on personal hardship cases, achieving somewhat lower default rates and a slight decrease in callable loan rates (through low-prepayment risk borrowers getting pooled with high-prepayment risk borrowers). It would have, however, a serious negative, if not even destructive, impact on the European mortgage bond markets and the banking system. Table 7 summarizes the arguments.

Table 7 Tangible and Intangible Costs and Benefits from Transposing a Universal Prepayment Option w/o Compensation to the Lender

	Benefits	Costs
tangible	marginal decrease in credit costs for callable loans marginally lower default rates limited cross-border effects	strong increase in credit costs for prev. non-callable loans (30-100bp) pot. breakdown of non-callable fixed-rate debt refinancing
intangible	improved treatment of personal hardship cases	no self-selection of high- and low prepayment risk borrowers incomplete mortgage market

The cost of mortgage credit would rise from between 20-30 bp (France) to 40-70 bp (Germany) while remaining largely the same in Denmark. The borrower would be deprived of saving these costs by taking up some or all interest-rate risk over a limited time period. Inefficient pooling of borrowers with different tastes would take place.

In those countries with well-developed wholesale funding systems, a switch from non-callable to callable bond refinancing would be necessary. This could affect the United Kingdom (up to 5 years), and particularly Germany, where the Pfandbrief would have to become callable. Countries without well developed wholesale funding mechanisms may have delayed development of their mortgage markets and may be forced to go to securitization which is a more costly and complex than non-callable bond issuance.

The second alternative of accepting a yield maintenance penalty would have less serious direct consequences for lenders, but still jeopardize the non-callable bond system as it stands today, in particular in the light of political risk.

The economically most acceptable and certainly legally and politically most feasible way is to

- *accept* that different borrower types exist in Europe, having different interest-rate risk preferences and processing capabilities;
- *structure* the four basic contract alternatives such that they are consistent for all contingencies and safeguard the most important aspects from a material consumer protection standpoint: the treatment of personal hardship cases and, potentially, the definition of a maximum exclusion period and a cap on prepayment penalties;
- and *provide* furthermore a complete market with different contract models and lender types competing with each other.

8. REFERENCES

- BEAR STEARNS, 1995, "Modelling French Mortgage Prepayments", mimeo, Paris.
- BORIO, C, 1995, "The Structure of Credit to the Non-government Sector and the Transmission Mechanism of Monetary Policy: A Cross-country Comparison", BIS Working Paper No.24, Bank for International Settlements: Basle.
- BOULIER, J., LEVY, M, AND J. DESPOUX, 1996, "Valuations of the Prepayment Option and Optimal Choice of Structure for an Asset-Backed Securities Fund". CCF Recherche & Innovation, Paris.
- CENTRE D'INFORMATION SUR L'ÉPARGNE ET LE CREDIT, 1995, "La Péréquation: un Pari Perdu d'Avance", in Bulletin Mensuel Nov-Déc 1995, Paris.
- COMMISSION BANCAIRE, 1994, "Rapport de la Commission Bancaire pour l'Année 1994", Paris.
- CONSEIL NATIONALE DU CREDIT, 1996, "Indemnité de Remboursement Anticipé des Prêts Immobiliers", Report of the President, Paris.
- DAVIS, E.P. 1995. An International Comparison of the Financing of Occupational Pensions. LSE Financial Markets Group Special Paper Series No. 62
- DANMARKS NATIONALBANK, 1993/1994/1995, "Annual reports 1994 and 1995", Copenhagen.
- DEVANEY, M, PICKERILL, K, AND F. KRAUSE, 1992, "Cointegration and Causal Relations in Mortgage and Capital Markets", in: Journal of Financial Services research Vol 5.
- DEUTSCHE BUNDESBANK, 1995a, "Verbriefungstendenzen im deutschen Finanzsystem und ihre geldpolitische Bedeutung", in: Deutsche Bundesbank Monatsbericht April 1995: Frankfurt am Main.
- DEUTSCHE BUNDESBANK, 1995b, "Die Entwicklung des Wertpapierbesitzes in Deutschland seit Ende 1989", in: Deutsche Bundesbank Monatsbericht August 1995: Frankfurt am Main.
- DEUTSCHE BUNDESBANK, 1996. "Kapitalmarktstatistik", Statistisches Beiheft zum Monatsbericht 2: Frankfurt am Main.
- DICKINSON, A. and HEUSON, A.J. 1992. Mortgage Prepayments: Past and Present. Mimeo.
- DÜBEL, A, PFEIFFER, U., ET AL. 1995, "Risk Based Capital Requirements and Commercial Mortgage Credit Risk in Europe", Schriftenreihe des Verbandes deutscher Hypothekenbanken: Bonn.
- ENGLAND, R.S., 1993, "Wall Street's Costly Quest", in Mortgage Banking, June 1993.
- EUROPEAN MORTGAGE FEDERATION, 1995, "Hypostat 1983-1993", Brussels.
- FABOZZI, F. 1996. "Bond Markets, Analysis and Strategies". Prentice Hall International Editions: Englewood Cliffs, New Jersey.
- GOEBEL, P., AND C. MA, 1993, "The Integration of Mortgage Markets and Capital Markets", in: Journal of the American Real Estate and Urban Economics Association 1993, V21, 4:pp 511-538
- GRAVEN LASÉN, B., 1993, "The Yield Differential Between Mortgage-Credit and Government Bonds", in: Monetary Review - August 1993, Danmarks Nationalbank: Copenhagen.
- GREEN, J. AND J. SHOVEN, 1986, "The Effects of Interest Rates on Mortgage Prepayments", in Journal of Money, Credit and Banking, Vol 18, No.1.

- HU, J, 1996, "Prospects for Recovery", in: Mortgage Banking, January 1996.
- HULL, J., 1989, "Options, Futures, and Other Derivative Securities", Prentice Hall International Editions: Englewood Cliffs, New Jersey.
- JAKOBSON, S. 1994a. "A Mixture Approach to the Valuation of Mortgage Backed Securities", Working Paper D 95-2: The Aarhus School of Business.
- JAKOBSON, S. 1994b. "Prepayment and the Valuation of Danish Mortgage-Backed Bonds", Working Paper D 92-2: The Aarhus School of Business.
- KAU, J. AND D. KEENAN, 1995, "An Overview of the Option-Theoretic Pricing of Mortgages", in: Journal of Housing Research, Vol 6, Issue 2.
- KENDALL, L., 1995, "A Time for Retooling", in: Mortgage Banking, October 1995.
- KNEESHAW, N, 1995, "A Survey of Non-Financial Sector Balance Sheets in Industrialised Countries: Implications for the monetary policy transmission mechanism", BIS Working paper No.25, Bank for International Settlements: Basle.
- LEA, M., 1986, "Striking a Balance", in: Secondary Mortgage Markets, Summer 1986.
- MILES, D., 1994, "Fixed and floating-rate finance in the United Kingdom and abroad", Bank of England, Quarterly Bulletin, February 1994, pp. 34 - 45.
- MINISTERE DU LOGEMENT, 1994, "Le Compte du Logement, Rapport à la Commission des Comptes du Logement", Paris.
- MORTGAGE BANKERS ASSOCIATION OF AMERICA, 1996, "White Paper - The Future of Mortgage-Related Securities - Is there a Need for Call Protection?", Paper for the 1996 National Secondary Market Conference, Chicago.
- MOUILLART, M., 1995, L'Endettement Immobilier des Ménages: Tendances Récentes et Perspectives", mimeo, Université de Paris X Nanterre.
- MOUILLART, M., 1995, "SACHEM: Un Modèle d'Analyse de l'Encours des Crédits à l'Habitat versés aux Ménages", mimeo, Université de Paris X Nanterre.
- NYKREDIT A/S, 1995, "Danish Mortgage Bonds", Copenhagen.
- O'KEEFE, M. and R. VAN ORDER, 1990, "Mortgage Pricing: Some Provisional Empirical Results", in: AREUEA Journal, Vol. 18, No. 3, 1990.
- PANNELL, B., 1996, "Remortgage Activity - The Implications for Lenders", in: Housing Finance - The Quarterly Economic Journal of the Council of Mortgage Lenders: London.
- QUIGLEY, J.M. and R. VAN ORDER, 1990, "Efficiency in the Mortgage Market: The Borrower's Perspective", in: AREUEA Journal, Vol. 18, No. 3, 1990.
- QUIGLEY, J.M., 1987, "Interest Rate Variations, Mortgage Prepayments and Household Mobility", in: The Review of Economics and Statistics.
- RONN, E., RUBINSTEIN, P, AND FUNG-SHINE PAN, 1995, "An Arbitrage-Free Estimate of Prepayment Option Prices in Fixed-Rate GNMA Mortgage-Backed Securities", in: Real Estate Economics, V 23.
- ROSENBLATT, R, 1994, "Refi Wave Soaks Servicing" in: Mortgage Banking, February 1994.

RYDING, J., 1990, "Housing Finance and the transmission of Monetary Policy, Federal Reserve Bank of New York, Summer 1990, pp. 42 - 55.

SCHWARTZ, E.S. and TOROUS, W.N. 1989, "Prepayment and the Valuation of Mortgage-Backed Securities". The Journal of Finance 44, No.2 (June 1989), 375-392.

UNIBANK SECURITIES, 1995, "Collateralized Mortgage Obligations Denmark 95-1 A/S - Prepayment Behaviour of Collateral", Mortgage Research.

VAN ORDER, R, 1990, "Estimating Prepayments", in: Secondary Mortgage Markets, Winter 1990/1991.

WHITMAN, D. A., 1993, "Mortgage Prepayment Clauses: An Economic and Legal Analysis", in: UCLA Law Review, Vol. 40, pp. 851 - 929.