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# Mortgage Prepayment and Call Protection in Europe

Model review and regulatory approaches

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## **Background, earlier studies**

- 1997 Prepayment study for VdP
- 1997 DG Sanco study on transposition CCD
- 2003 MOW study for EMF
- 2005 LE study for DG Markt
- 2005 Prepayment indemnity study for VdP

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## **Structure of the presentation**

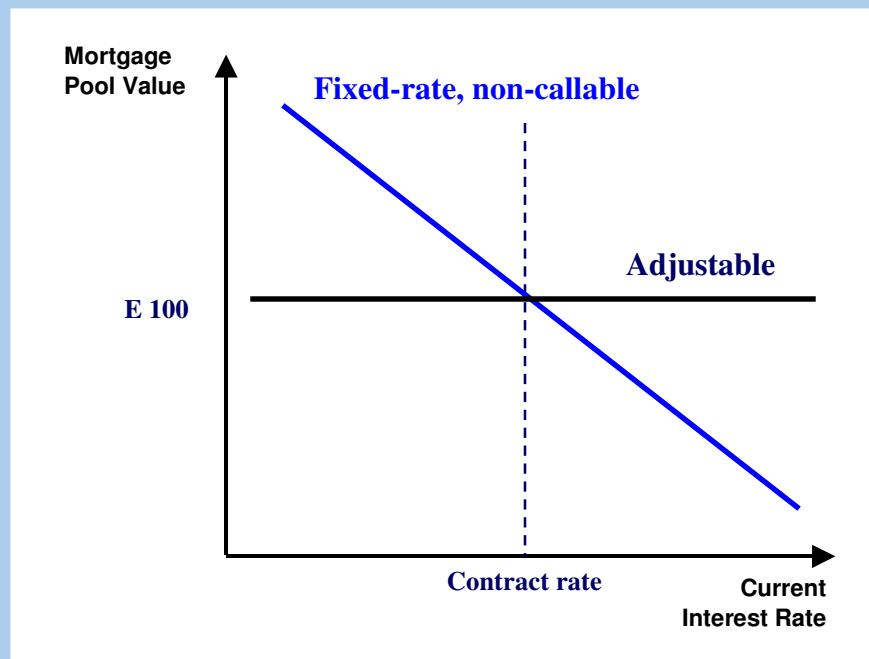
- I. Types of mortgage products and prepayment (call) protection features in Europe
- II. Empirical assessment of prepayment (call) protection mechanisms and of the prepayment option value in Europe
- III. Conclusions for the EU consumer protection debate and proposal

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# **I. Types of mortgage products and prepayment (call) protection features in Europe**

# Basics – fixed-rate and adjustable-rate mortgage loans

## Pricing of mortgage loan pools



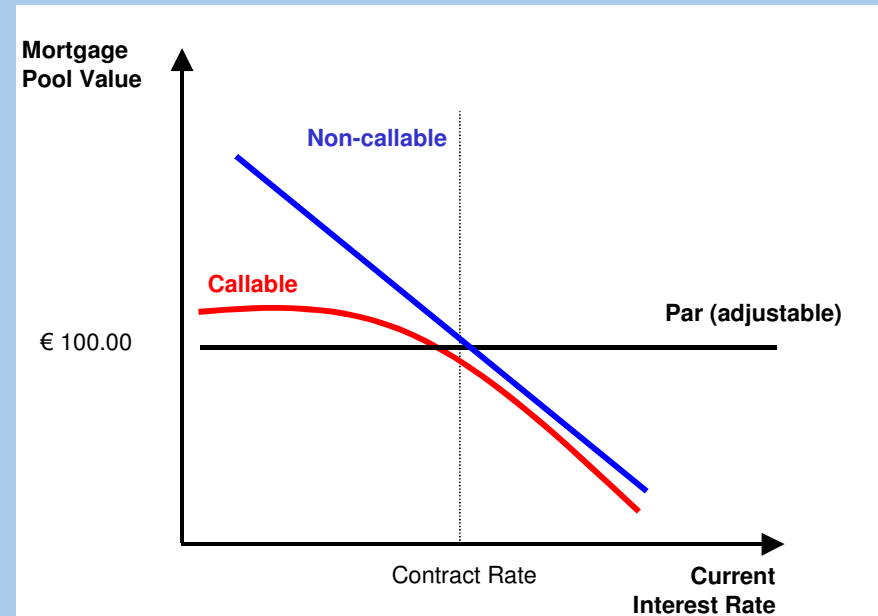
Source: Finpolconsult

- **Fixed-rate** mortgage loan pools in principle price like fixed-rate government bonds
  - Rates rise above contract rate, bond price falls below E 100
  - Rates fall below contract rate, bond price rises above E 100; *if they are call protected/non-callable.*
- **Adjustable-rate** mortgage loan pools are always priced around E 100, as their contract rate varies with the market rate.
- Fixed-rate mortgage loan pools that price like government bonds can be efficiently funded by similar **corporate bonds (e.g., Pfandbriefe, Cedulas etc..)**.
- Adjustable-rate mortgage loan pools can be efficiently funded by **short-term deposits or floating-rate bonds.**

## Loans prepayable at par (callable) add a third, hybrid asset category

- **Callable** mortgage loan pools price like non-callable fixed-rates when interest rates rise, and like adjustable-rates when interest rates fall (convexity).
- Callables fetch an **interest premium** over non-callables to cover two main risks for investors:
  - **reinvestment loss** if rates drop below the contract rate, and
  - **loss of future net servicing income** through truncation of cash flow.
- **Funding** of callables is a **problem**, since their duration varies strongly.
- Financiers of call risk **mix** short-term and long-term debt (U.S. GSEs) and/or issue **callable debt** (Denmark).

### Interest rate mechanics of 3 principal products



Source: Finpolconsult

# Housing finance markets globally are incomplete with regard to use of the main products

	FIXED-RATE		ADJUSTABLE-RATE
	Without call protection	With call protection	
<b>EUROPE</b>			
Germany	O	X	X
Great Britain	O	O	X
France	X	O	X
Netherlands	O	X	X
Spain	O	O	X
Denmark	X	X	X
<b>WORLD</b>			
USA	X	O	X
Japan	O	X	X
Canada	O	X	X
Australia	O	O	X

LEGEND	Dominant
	X
	Widely used
	X
	Not widely used or missing
	O

Reasons: institutional history (esp of funding instruments), public intervention, interest and real estate environment factors

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## Prepayment protection mechanisms applied in Europe – the pure forms

- Note: there is a difference between callability in **legal** (universal prepayment option) and **economic** (no call protection) **interpretation**.
- **Callable loans**, BOTH legally & economically
  - Fixed-rate loans in DENMARK, *also U.S.* (fixed to maturity 20/30 yrs)
  - Fixed-rate loans GERMANY, for interest rate binding periods in excess of 10 years, after 10 years have elapsed.
  - Adjustable rate loans almost EU-wide, with the exception of teaser fixed-rate periods
- **Non-callable loans**, BOTH legally & economically
  - Non-callable, except against a revocation contract & price freely agreed with lender GERMANY (interest rate binding periods under 10yrs)
  - As above, but repurchasable by the consumer at the market price through the so-called 'delivery option' DENMARK (in practice for 5yr fixing periods and below)



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## The majority of European mortgage products are legally callable, but economically call protected

- Fixed-rate loan callable against **yield-maintenance indemnity (YMI)**, minimizing the financial gain from exercising the prepayment option: GERMANY (for moves & sales, otherwise legally non-callable), SWEDEN
- As above, however with **statutory or case law limitations on the YMI**: NETHERLANDS (movers exempt), FRANCE, BELGIUM (statutory caps)
- As above, however with **limitations set by industry practice** rather than by law: SPAIN (Central Bank & industry cap), ITALY
- Callable against (arbitrary) **ex-ante defined indemnities** UNITED KINGDOM (esp. for teaser periods)
- Implicit call protected through **discount issuance/points** DENMARK (*also very common in the U.S.*)
- Adjustable rate loans with **prepayment fees** in SPAIN, PORTUGAL

## Indicative prepayment option costs for fixed-rate loans, pure and mixed pricing strategies

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

- Related to their historic capital market funding dominance, Denmark, Germany, Sweden apply **pure pricing strategies** for reinvestment losses
  - Pure pricing strategy: charge either options OR exercise price
- Other EU countries apply **mixed pricing strategies** for reinvestment losses
  - Mixed pricing strategy: charge both, options AND exercise price
- Under pressure through legal change or competition, some even **migrated** from pure pricing to mixed pricing strategies ( (X) → X).

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## Legal and economic treatment of loss of servicing income through prepayments

- The principal **pricing strategies** are
  - Indemnity covering lost servicing income (gross margin less costs) over the remainder of the loan maturity or fixed-rate period;
  - Lump-sum fee or administration cost charge;
  - No additional fee.
- Comprehensive **legal review** so far inexistent. However even the treatment in countries with pure reinvestment loss pricing strategies is diverse:
  - Denmark allows only flat administration fees charged upon prepayment.
  - Germany allows charging a net margin indemnity over the residual duration of the fixed-rate period by subtracting assumed administration and saved risk costs from gross margins.
  - Sweden allows charging a margin damage, limited to the difference between the loan rate and the government bond rate plus 1%.
- Additional indemnities or fees seem outlawed in numerous EU legislations, including in the case of Denmark, Sweden and Germany for adjustable-rate loans.

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## **II Empirical assessment of prepayment (call) protection mechanisms**

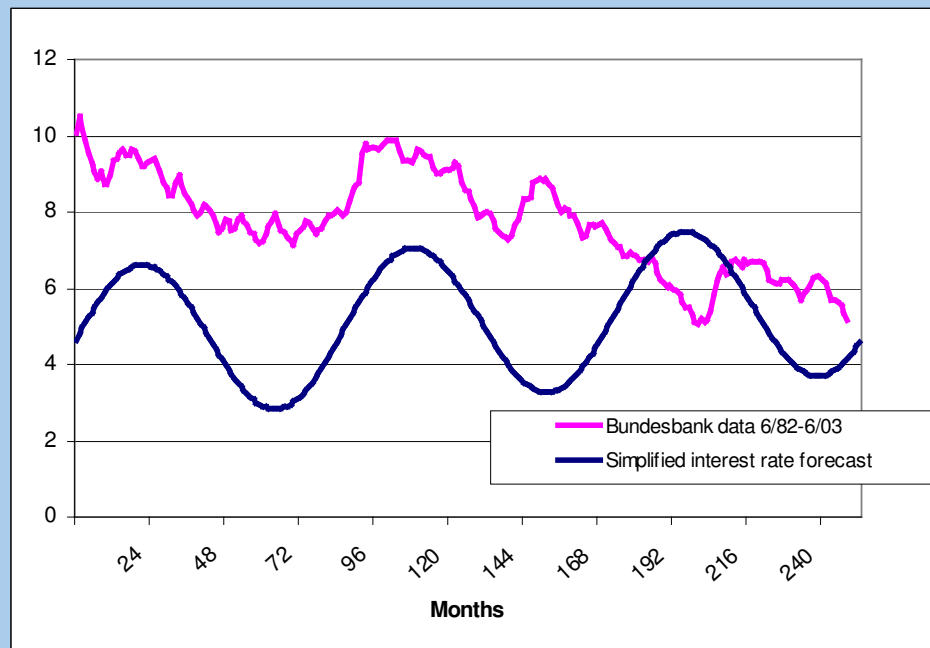
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## Simulation of prepayment indemnities in the historical and future interest rate context

- Starting point was 2004 **study by IFF** Hamburg claiming significantly higher exercise costs in Germany than elsewhere.
- **Simulation model** was prepared with monthly Bundesbank mortgage rates ranging from 6/1982 – 6/2003 (hereafter ECB stats, not comparable)
- **Main assumptions:** loan volume E 100,000, 10 year interest rate fixing period, 1% initial amortization
- The model **output**
  - delivers the reinvestment loss/gain and lost servicing income for lender by origination date/cohort and under
  - three exercise assumptions – prepayment by the consumer after
    - 3 years (residual interest rate fixing period is 7 years)
    - 5 years (residual interest rate fixing period is 5 years)
    - 8 years (residual interest rate fixing period is 2 years)

# Historic mortgage rates and illustrative trend assumption

## 10 year mortgage interest rates – historic Bundesbank data and assumption

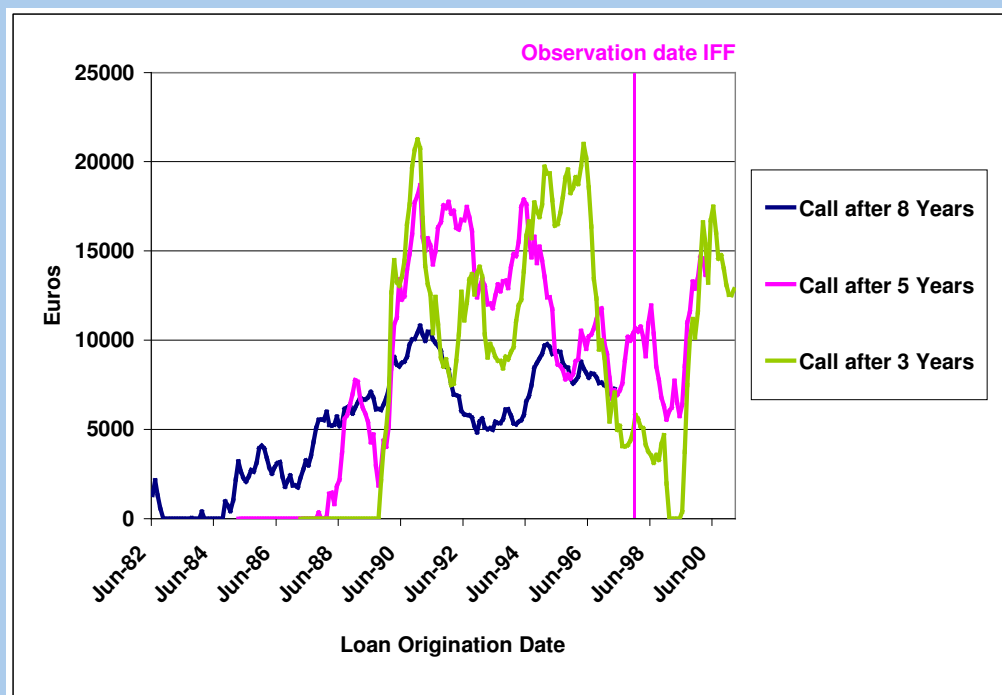


Source: Finpolconsult

- Simulation model **flexible** to incorporate any interest rate path assumption, **future trend assumption purely illustrative.**
- **Historic** Bundesbank rates can be seen as **representative for ECB policy.**
- However, they were historically **not representative for independent EU central bank policies**
  - German 10 yr fixed mortgage rates dropped from 10.1 % in June 1982 to 4.8 % in June 2003;
  - French 15 yr fixed mortgage rates dropped from ~16% to 4.6% in the same period !

# Yield maintenance indemnity levels - disinflation phase 1982-2003

## YMI simulation results, unconstrained



Note: includes indemnity for lost net servicing income (Germany).

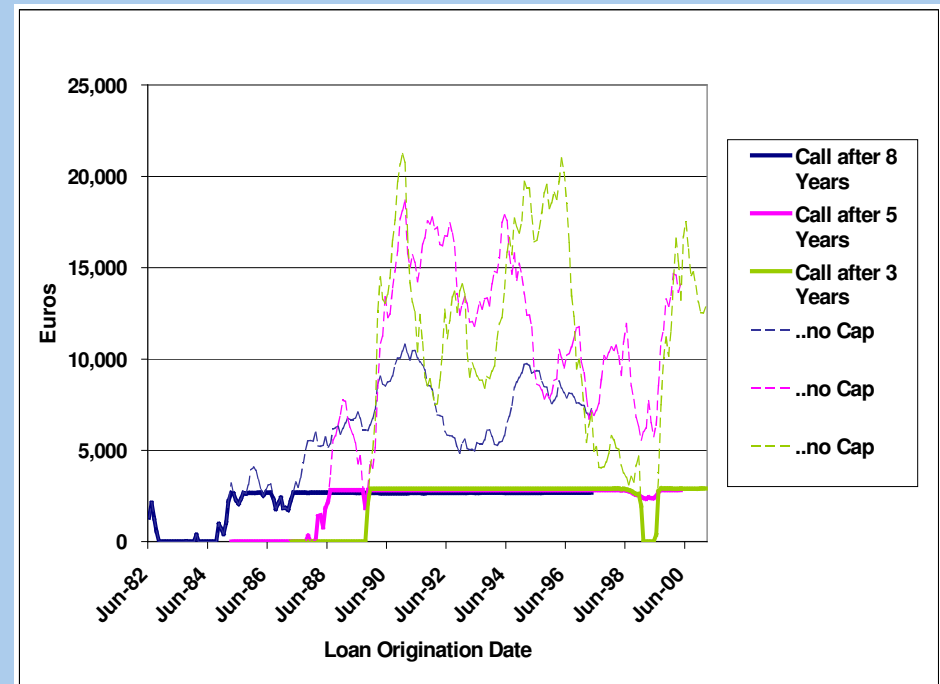
Source: Finpolconsult

- Indemnity levels **vary over time** with origination date (cohort), interest rate cycle amplitude and wave length.
- **Max levels do not differ much between 7 and 5 years** of residual duration, the reason is interest rate cycle wave length.
- There were phases with zero indemnity levels during which **lenders made small reinvestment gains**.

# Capped Yield Maintenance Indemnities – the Impact of France’s Scrivener Law

- 1979 law **capping indemnity** to the lower of
  - 6 months interest payment or
  - 3% of exposure at prepayment
- **Motivation:** avoid default risk at high levels of interest rates (18-20%).
- **Immediate consequence:** losses assigned to lenders, contributed to
  - breakdown of Marché Hypotecaire in mid-1980s
  - lender collusion against switching borrowers, fines in late 1990s.
- **Mid-term consequence:** lender recoup losses through mixed pricing strategy - both options costs and exercise price up to cap level are charged.

**YMI simulation results, capped**

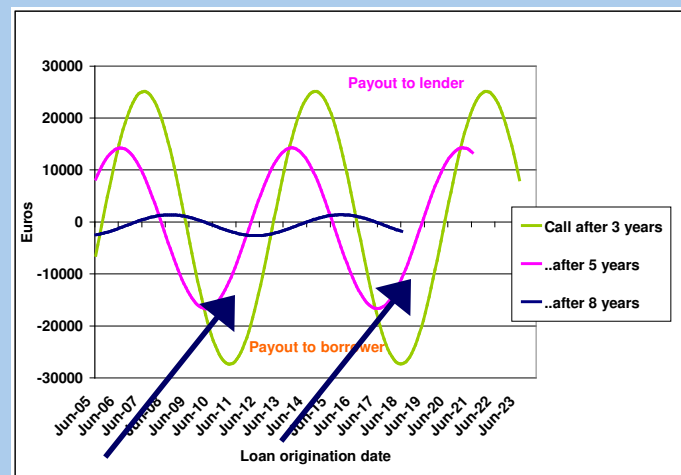
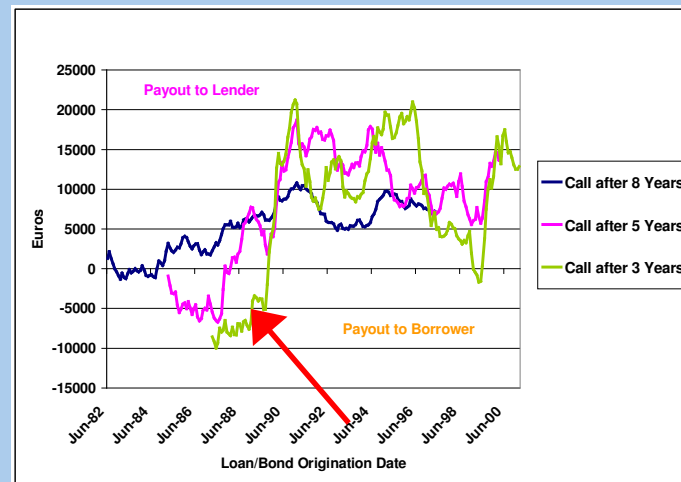


**Source: Finpolconsult**



# Potential misspecification of the indemnity model due to reinvestment gains

- Historic: mostly **reinvestment losses**  
→ indemnity model matches payout structure
- Future trend assumption: more frequent **reinvestment gains** → indemnity model leads to margin discounts → mixed pricing strategy
- Long-term solutions to realize **symmetric payouts**:
  - deliver the loan to the investor at the market price, which falls with house prices (Denmark) → new issuance model;
  - or mark the loan to market over bond benchmark → market price model with payout TO borrower.
- Short-term: **Waiving** the indemnity for movers (NL courts) is **no solution**. But **simplifying loan assumption** (no due-on-sale) could be.

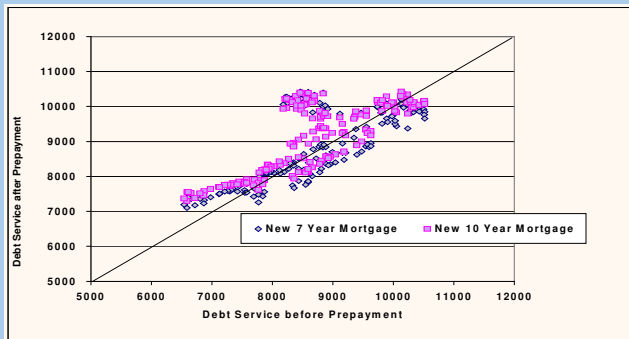


# Lock-in effect imposed by yield maintenance prepayment indemnities (non-callables)

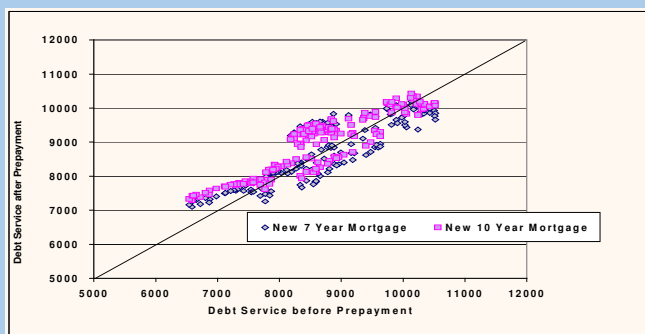
## Debt service before & after prepayment

## Comments

### Indemnity model



### Market price model

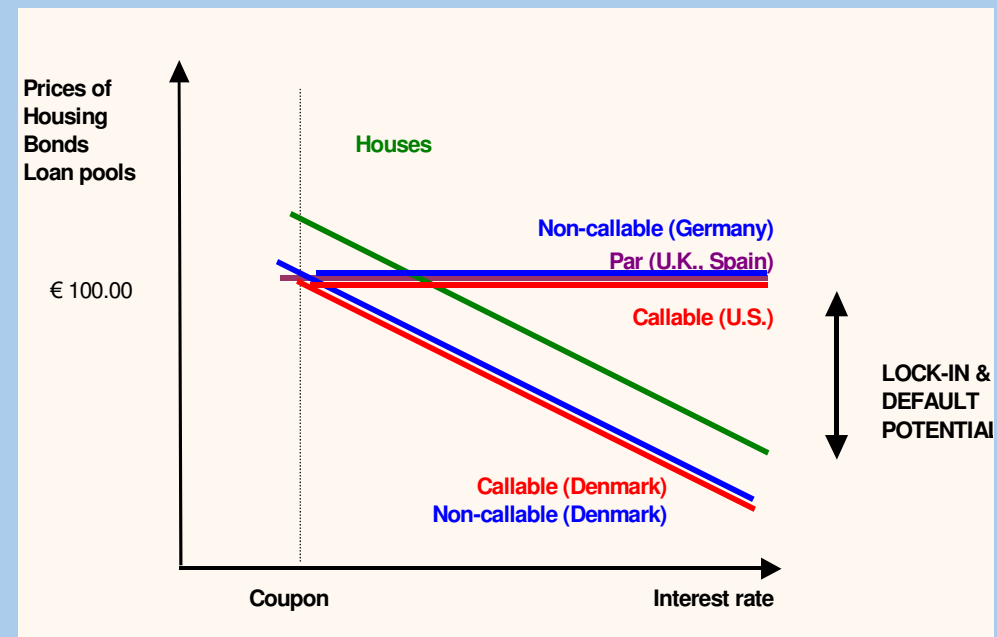


- Market price model superior pricing policy over indemnities; stimulates bond markets.
- Especially as rates must be expected to stay flat or rise in the decades following the historic disinflation; indemnities create distortions.
- Lock-in imposes potential threat to labour market adjustment in a growing economy.

# Macro issues – symmetric payouts better match house prices and loan values

- Mechanics:
  - If interest **rates rise**, usually **house prices fall**.
  - If **house prices fall** and the market value of the debt remains par, there is **risk of lock-in**.
  - If there is lock-in, borrowers may **either not move or default**.
- Empirics:
  - Floating: UK default crisis 1989-9X, and perhaps 05-0X??
  - Fixed: U.S. S&L crisis 80s, 05 upcoming new crisis?
  - Denmark: delivery option of BOTH callable and non-callable avoids lock-in. Lower extension risk than in the U.S.!!
  - Germany: yield maintenance prepayment indemnity generates par structure

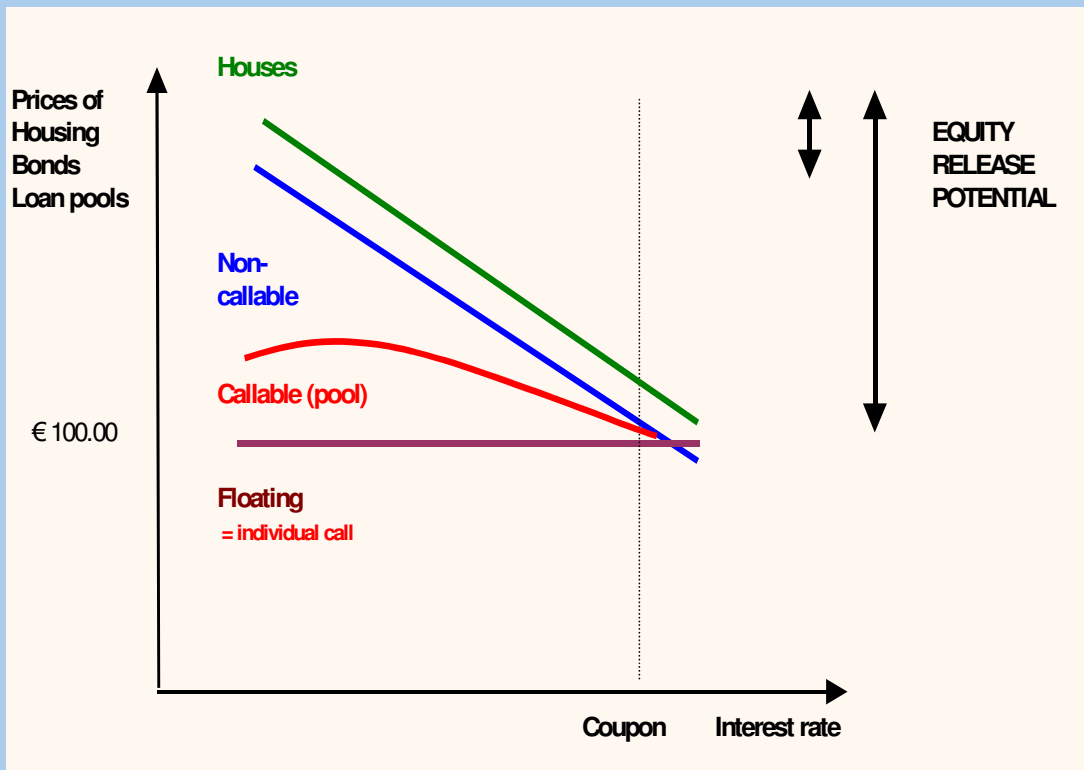
## Market values of house prices and different mortgage loan products



Source: Finpolconsult

# Macro issues – the Equity Release promise

## Price impact of interest rate decline

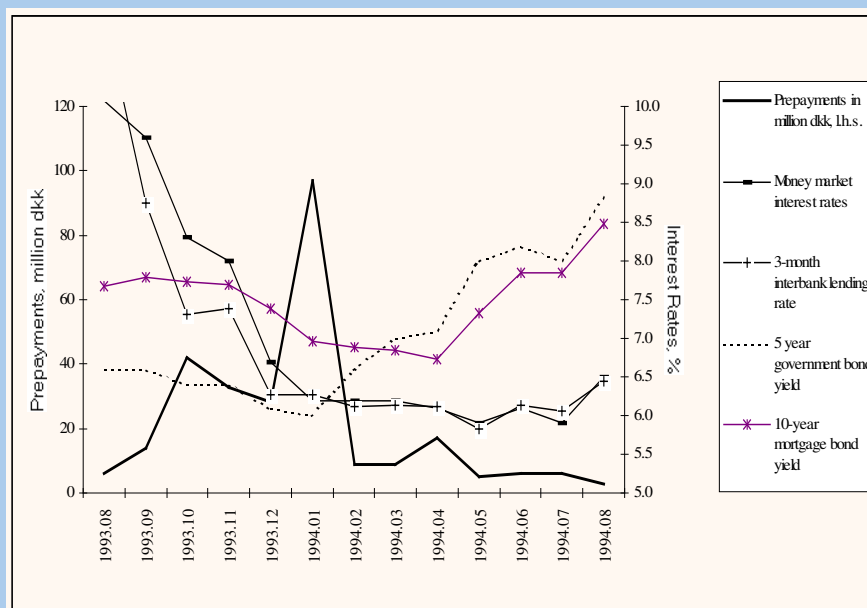


## Empirics

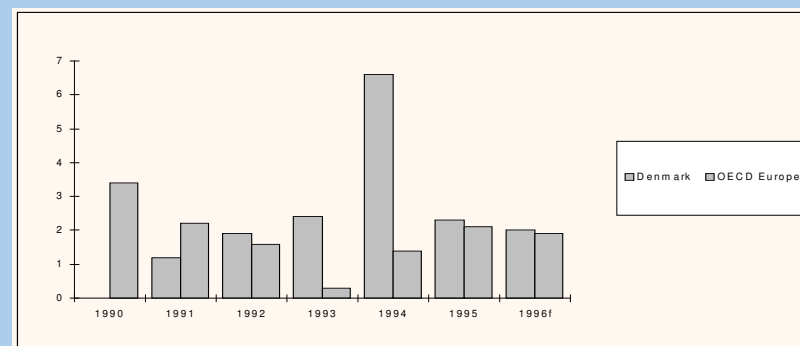
- Allan Greenspan's consumption and house price boom in the U.S. 02/4. In 03, 60% of new mortgages were due to prepayments (callables dominant)
- Floating rate market booms in Europe (Spain, Ireland, U.K.) 02/4
- German house price diet (non-callables dominant)
- and a nice historic Danish case..

# Example: Denmark's Equity Release boom in 1994

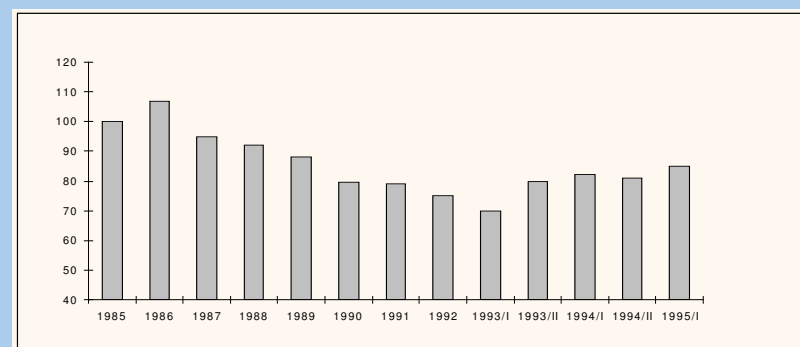
## Rates and prepayments 1993-94



## Gdp change 1990-96



## House price index, 1985-95



- Incoming government provided some additional fiscal stimulus (est at 1% of GDP for '94).
- Prepayment seen as major factor supporting '94 boom, turn-around of moribund housing market.

Source: Dübel and Lea (2000)

## How expensive is the prepayment option?

- **Complex American call option** whose valuation requires assessment of
  - interest rate dynamics and
  - borrower characteristics.
- Standard Black/Scholes **symmetry assumption violated** because of competing options (default, prepayment) → value is cyclical.
- **Ex-post assessments are often distorted** by data issues (coupons, seasonality pool selection)
- At times, invites for **political manipulation** to pump-prime the economy (U.S.00s, Denmark mid-90s) → adds to volatility
- No comprehensive European assessment exists; only approximations → **more research needed.**

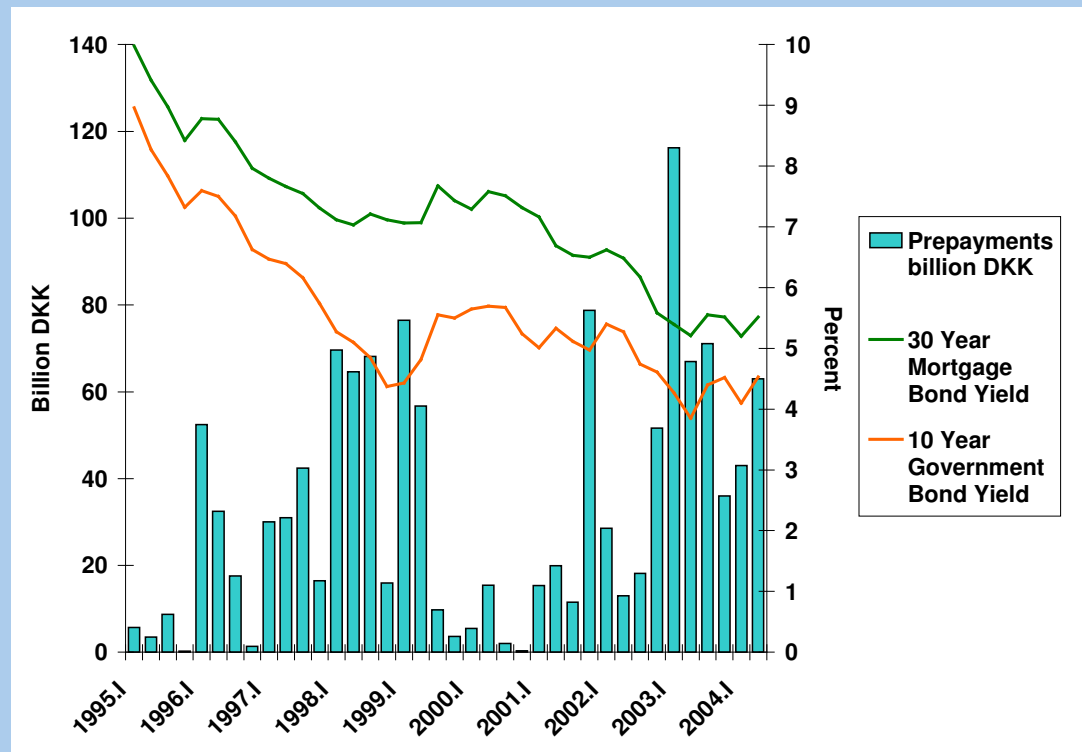
### Prepayment option values, best assessment for EU mkts (2003)

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

**Source: MOW study for EMF, Finpolconsult**

Note: pools ALL loan classes, including ARM

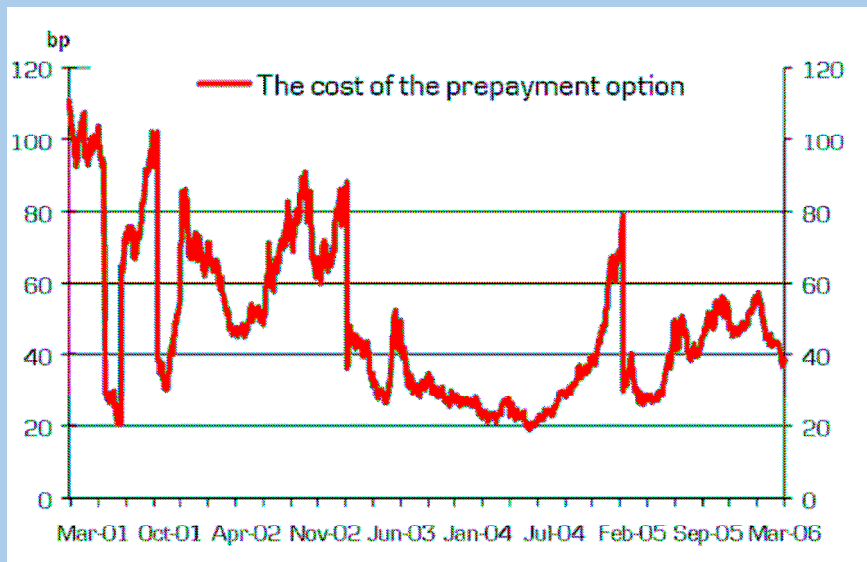
# Denmark: prepayments, mortgage bond spreads over government bonds as proxy for the price



Source: Finpolconsult, data provided by Nykredit

# Denmark prepayment options costs estimate

## Prepayment option values Denmark

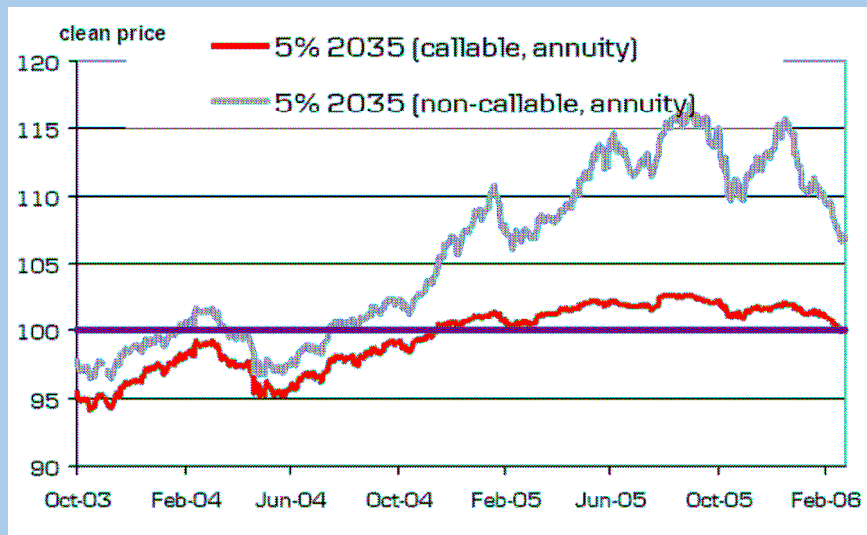


Source: Realkredit Danmark

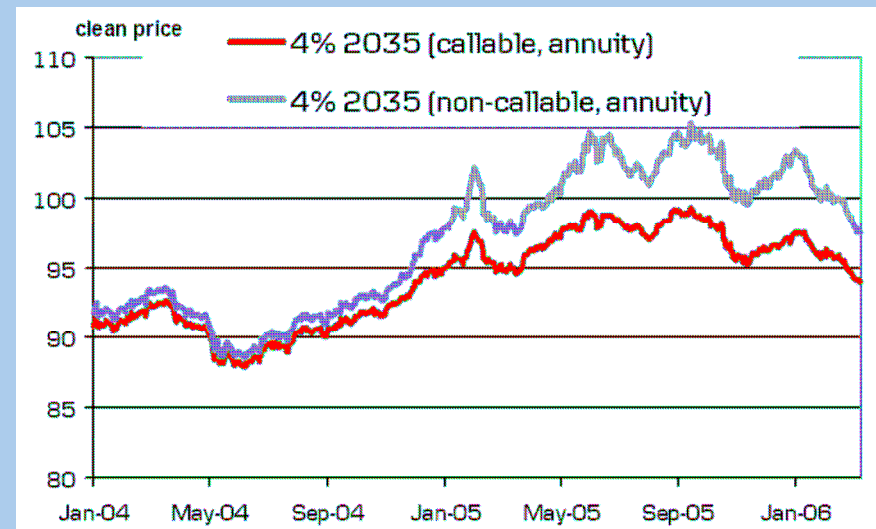
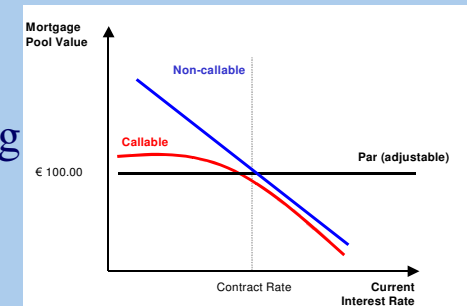
- Derived from computing the options-adjusted spread with the help of prepayment risk models and comparing with mortgage bond yields.
- The costs have been estimated between 20 and 80 bp in the past years.
- However, volatility has been high – due significant prepayment ‘surprises’ 2001-3 (similar events in U.S.)
- Current low of 30bp related to interest rate low, volatility low.



# Denmark – prices of callable and non-callable bonds by depth of discount

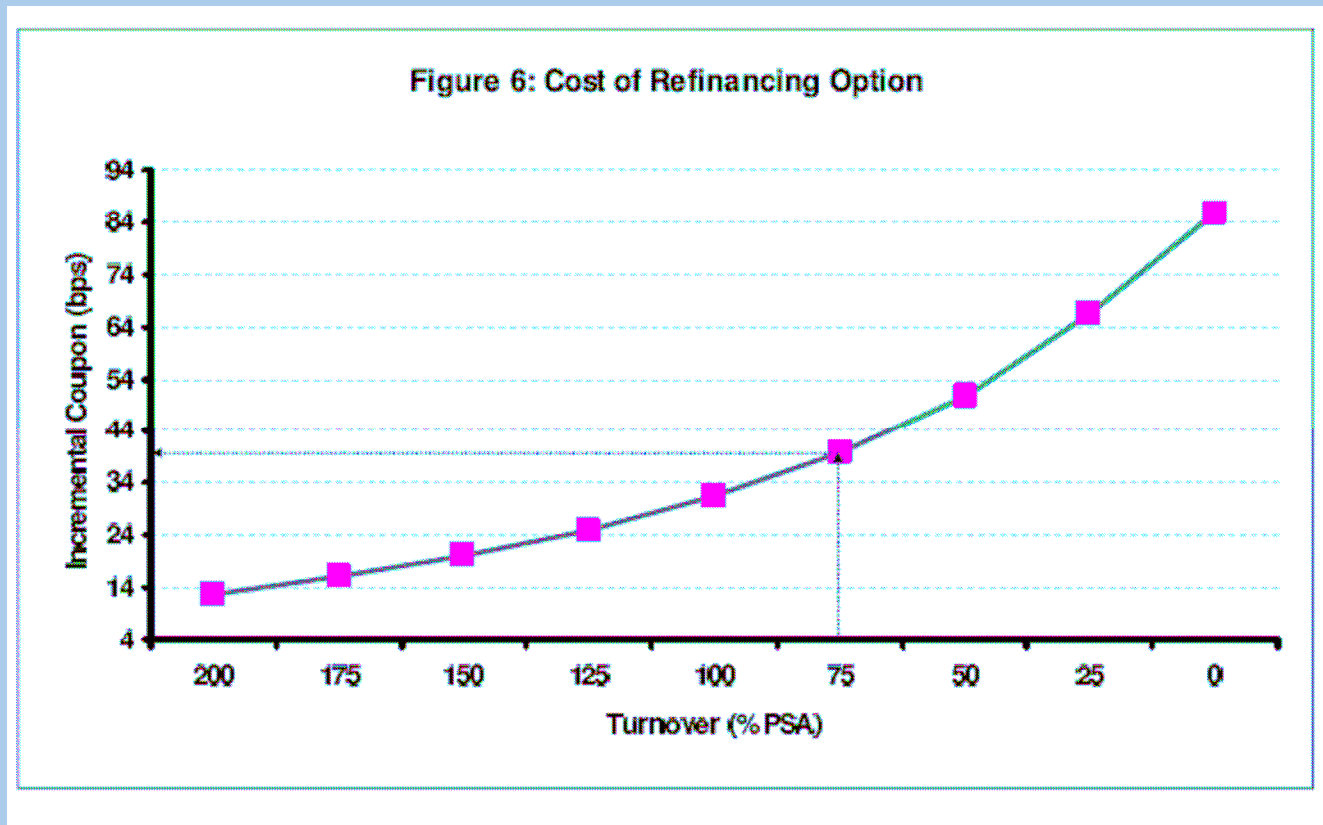


Compare with generic asset pricing chart!!



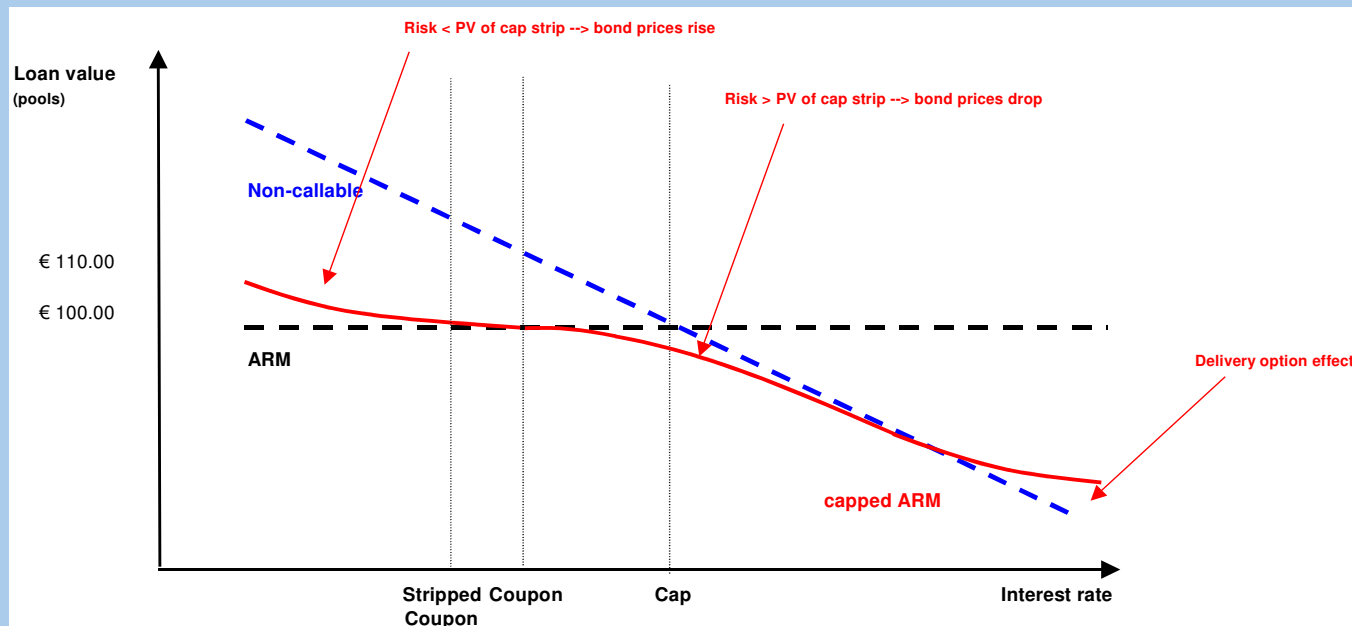
Source: Realkredit Danmark, Finpolconsult

## U.S. Kalotay model for fair prepayment option value



Turnover: other loan terminations due to sales or default; PSA: Public Securities Association

# Alternative hybrid product: capped ARMs



- Product has some convexity, but saves the investor the costs of assessing prepayment behaviour. Rather straightforward interest rate risk modelling.
- Product costs low under low volatility – 10 – 30 bp.

## Denmark: capped ARM and floating to fixed, 2006

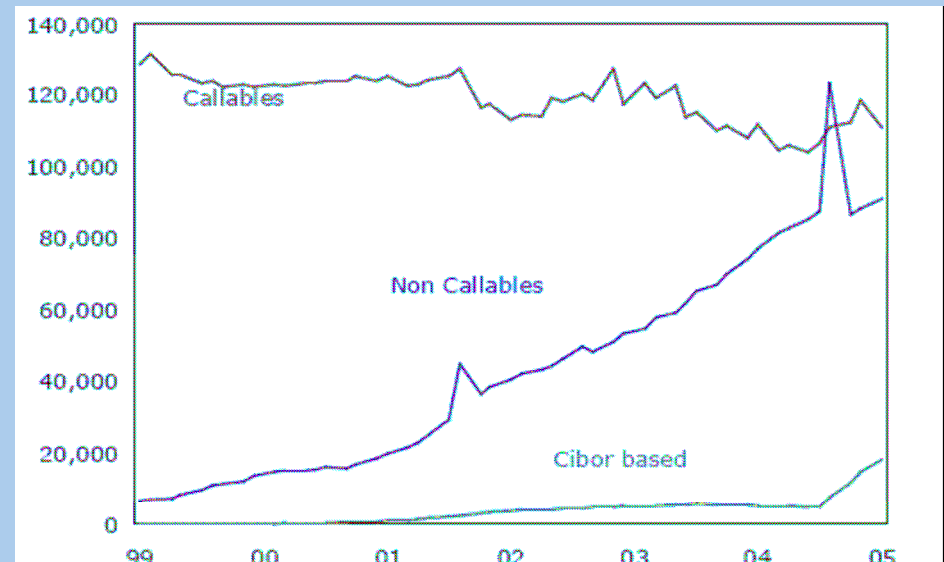
	FF (6% cap)		CF (5% cap)	
Issuer	RD, BRF, Nordea		All major issuers	
Type	FRN, knock in to callable (Floating-to-Fixed)		Capped FRN	
Maturity	2038	2016 (only NYK/TOT)	2028 (only NYK/TOT)	2038
Interest rate	6 M cibor + 50 bp	6 M cibor + 25 bp	6 M cibor + 75 bp	6 M cibor + 80/85 bp
Basis	Knock In: 6 M Cibor=5,5%	Cap 6 M Cibor=4,68%	Cap 6 M Cibor=4,18%	Cap 6 M Cibor=4,15%
Fixing dates	1/4 and 1/10		1/1 and 1/7 (NYK/TOT) or 1/4 and 1/10 (RD/BRF/NOR)	

**Source: Realkredit Danmark**

## Variations of the prepayment option value may lead to product substitution – the Danish case

- DK non-callable market **growing**, reflecting rises in options costs and yield curve effects.
- Initially only **limited substitution into adjustables**. Non-callables proved reasonable compromise between costs and protection level.
- Lenders **now offer ARM with caps**, with superior cost-benefit-ratio to callable FRMs, gaining rapidly market share.

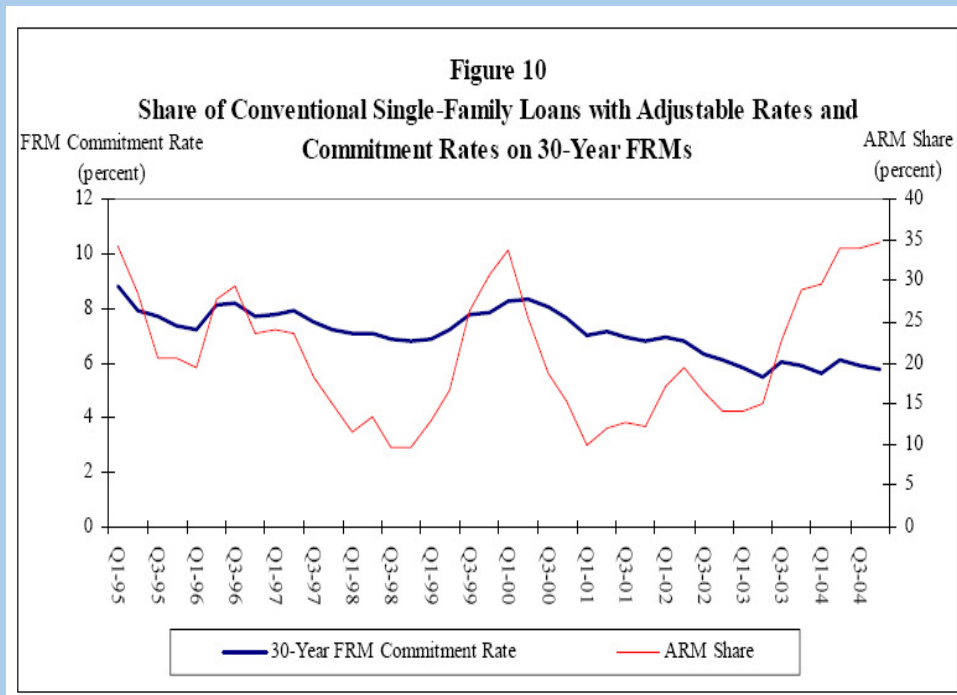
**Change in market share of main Danish mortgage products 99-05**



**Source: Nykredit**

# Product substitution II – U.S. 30 year fixed rates and adjustable-rate shares

## Change in market share of U.S. ARM products 95-05



- Very strong substitution effects; 25% of the market swings between FRM and ARM
  - No real mezzanine protection product like the European non-callable; fixed-rate periods of 'hybrid ARMs' (first fixed, then float) are generally short.
  - In particular **low-income household switch**. Switchers save both
    - Yield curve and
    - Prepayment options costs
- However, switching to uncapped ARM is an extremely risky strategy
- Analogies in Europe, e.g. Spain

Source: OFHEO

# There is no free lunch – lower price, higher risk

INSTRUMENT BY PROTECTION LEVEL	PRICE, INITIAL PAYMENT			RISK OF FUTURE PAYMENT SHOCK	
	Price impact	Marginal	Cumulative	Protection level	Protection impact Risk level
FRM callable			650 bp	HIGHEST	
FRM, non-callable	Prepayment option costs	50 bp	600 bp		
Capped ARM	Full yield curve costs	120 bp	480 bp		
ARM	Cap costs (high level, term)	30 bp	450 bp		
Forex ARM	Negative amort of principal	100 bp	350 bp		
Option ARM	Negative amort of interest	50 bp	300 bp		
Payment holiday	No payment	300 bp	0 bp	LOWEST	

- Mezzanine protection products such as European non-callable fixed-rates establish an important risk-price compromise vis-à-vis expensive callables.
- Also caps on ARMs – very inexpensive at current low volatility levels!
- Beware of balloon products, which may cover up borrower insolvency at going house price levels (except in ‘stable high-inflation’ economies)

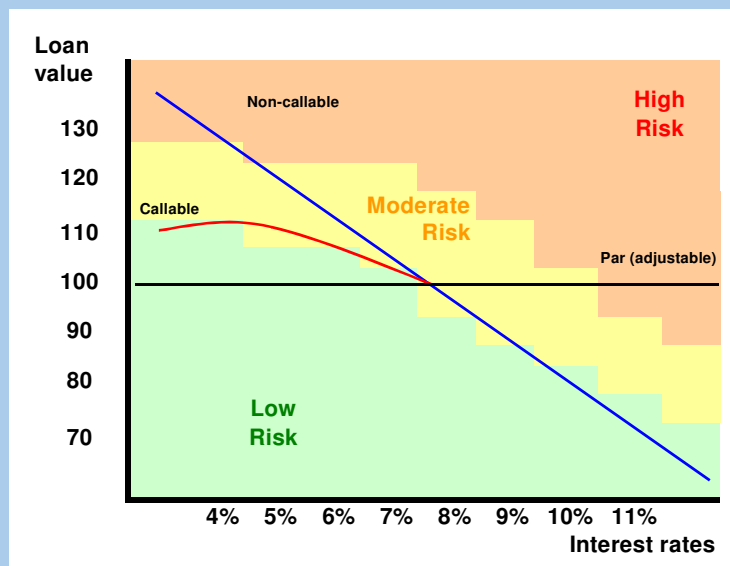
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## **III Conclusions for the EU consumer protection debate and proposal**



# Credit risk exposure of consumers and scope for intervention

## Credit risk profiles of 3 principal products



Interest Rates	Loan Market Values			Debt Service Market Values		
	ARM	NC FRM	C FRM	ARM	NC FRM	C FRM
10%	100	70	70	10.0	4.9	4.9
9%	100	80	80	9.0	5.6	5.6
8%	100	90	90	8.0	6.3	6.3
7%	100	100	100	7.0	7.0	7.0
6%	100	110	105	6.0	7.7	7.4
5%	100	120	105	5.0	8.4	7.4
4%	100	130	102	4.0	9.1	7.1
		Call Premia		No	No	Yes

All three principal mortgage products carry credit risk in extreme constellations.

- **Non-callable** fixed-rate mortgages may become expensive, if rates decline and income growth slows. Problems in Norway (90s) and France (80s).
- **Adjustable-rate** mortgages may experience strong upward rate shocks. Problems in U.K. (90s).
- **Callable** fixed-rate mortgages warrant high options premia that may enhance spread volatility and raise initial debt burdens. Problems in U.S. (90s, early 00s).

## Possible intervention into red areas

- High non-callable bond prices → limit indemnities by time, level
- High adjustable interest rates → require caps

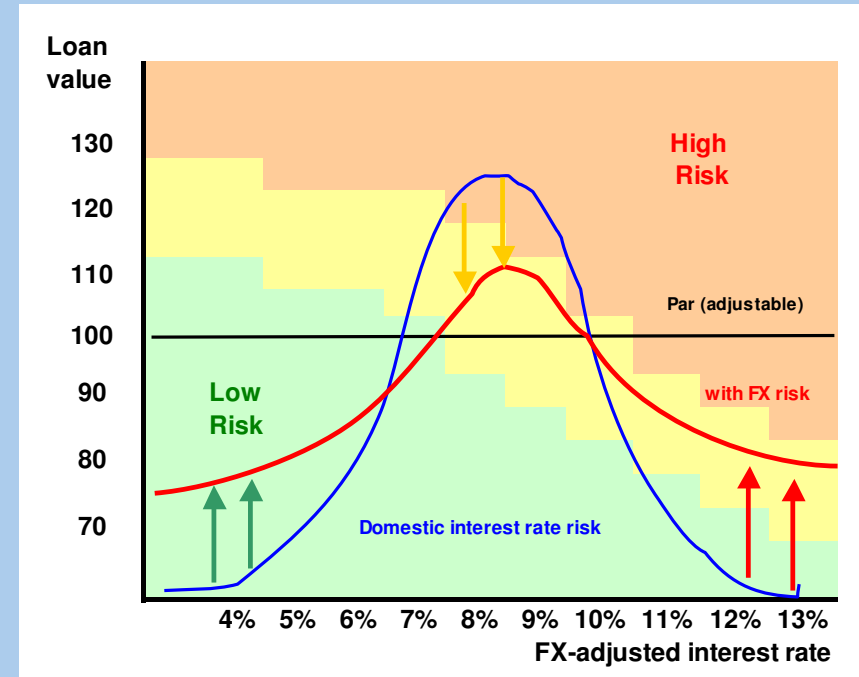
But beware of substitution effects provoked by an incomplete reform!

# Graduated regulatory response to product riskiness

Intervention should be guided by analysis of **mortgage market failure!** Consumer amnesia viz interest rate risks valid example.

- Traffic light system proposal
  - Demand sufficient risk disclosure & simulation for all products
  - Demand enhanced risk disclosure and warn consumers about extreme situations that may arise with products carrying higher risk. E.g. with a PD and/or LGD (e.g. Value at Risk) concepts.
  - Possibly restrict the use of products that may generate extremely volatile debt service or carry the risk of residual debt after maturity (e.g., FX, see example).

**FX-indexation of outstandings creates fatter tails of ARM debt service distributions**



ARM candidate for yellow or red  
FX-indexed ARM candidate for red

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## A possible solution to the current stalemate in the consumer protection debate

- **Status quo:** Member State protects consumer (Rome Convention), European Union protects competition (Treaty). Antagonistic conflict.
- How **NOT** to solve the conflict:
  - U.S. subprime market started w. federal deregulation (usury, etc) in the 1980s, then state re-regulation in the 1990s reacting to high defaults. Endless cycle?
- **Proposal:** the European Union
  - Defines a common empirical methodology to assess the credit risk impact of mortgage products (analogy to Basel II use of credit risk models)
  - Defines minimum material consumer protection rules based on empirical calibrations (maximum harmonization on the minimum level)
  - Allows for Member State autonomy to require heightened disclosure for certain products & practices (yellow, minimum harmonization), regular review and recommendations by EU to Member State
  - Defines a process for the Member State to apply for imposing material restrictions for certain products & practices (red, new interaction process in analogy to Article 87/88 on state aid)

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**END**

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