'No recourse' and 'put options':
Estimating the 'fair value' of US mortgage assets

CEPS Commentary/23 September 2008
Daniel Gros[*]

A key issue for the $700 billion bail out plan now being finalised is the pricing of the 'toxic assets' the US Treasury should buy. The main target of the Paulson plan is the market for securities based on low quality mortgages (sub prime and 'Alt A' mortgages). This subclass of the general universe of RMBS or residential mortgage based securities has become illiquid. How should these securities be priced? In the few market transactions still taking place their value has often been less than 50 cents to the dollar of face value. But it is difficult to establish a reliable market price. Are there any other ways to assess their value?

This note shows that there is a simple way to look at the value of mortgages in the US, which might greatly help in establishing a fair price for these securities. Preliminary calculations suggest that the value of securities based on lower quality mortgages might indeed be very low.

The starting point is a key feature of the US mortgage market, namely that most loans are *de facto or de jure* 'no recourse'. This means that the debtor cannot be held personally liable for the mortgage even if, after a foreclosure, the bank receives only a fraction of the total mortgage outstanding from the sale of the house.

With a 'no recourse' mortgage (or any other such loan, e.g. the latest MMMF facility of the Fed) the debtor effectively receives a 'put option' to sell the asset that serves as a security to the creditor at par (or rather for the amount of the loan still outstanding). This implies that US households with a mortgage debt hold at the same time a put option to sell their house to the bank for the amount of the remaining mortgage balance. Banks (or other mortgage lenders) are 'short' this option, but this is not recognised in the balance sheets of banks, which in most cases report mortgages at face value – at least for all those mortgages on which payments are still ongoing.

All RMBS, especially all securities based on low quality mortgages should also take this put option into account in their pricing. It appears that this had not been done when these securities were issued. In particular it appears that the ratings agencies neglected this point completely

[*]**The author is Director of CEPS.**

when evaluating the complex products build on bundles of mortgages. A key input in banks balance sheets and the pricing of RMBS should thus have been a valuation of the put option given to US households.

Given certain basic data, it is actually fairly straightforward to calculate the value of the put option in a standard 'no recourse' mortgage.

The following calculations are for a mortgage of $100, which has an implicit put with a strike price equal to the loan to value ratio (LTV) because this is the amount for which the owner of the house can 'sell' his house to the bank. Most of the key inputs needed for the pricing of this option are in fact relatively straightforward. In the following it is assumed that mortgages run for 10 years, and that the risk less interest rate is 2% (but the interest rate on mortgages is 6%).

However, it is more difficult to put a number on a key input in the value of any option, namely the (expected) volatility in the price of the underlying asset. Recent data might be misleading, since prices had been steadily increasing until 2006, but then started to decline precipitously. Over a longer horizon the standard deviation of the Case Shiller index has been around 5% p.a., but over the last few years the volatility has greatly increased, to about 10%, if one looks only at the years since the start of the bubble (2002/3). The following will concentrate on the low volatility case (5 % standard deviation). It turns out, however, that this parameter is not as significant as one might first think. Under the high volatility case (10 % standard deviation) the losses would be under most circumstances only moderately higher.

Applying the usual Black-Scholes formula to a typical sub prime loan with an LTV ratio of 100% yields the result that the value of the put option embedded in the 'no recourse' feature is 26.8% of the loan, even in the low volatility case. For a conforming loan (a loan that could be insured by Fannie or Freddie) with a loan to value ratio of 80%, the value of the put option would still be close to 14% (still in the low volatility case). This implies that all sub prime loans (and other mortgages with a high LTV) were worth much less than their face value from the beginning. It is evident that the risk of a mortgage going into negative equity territory diminishes sharply with the loan to value ratio. For example, with an LTV of 60% the put option is worth only 2.8%.

In reality it is not the case that all mortgages with negative equity (where the present value of mortgage payments is higher than the value of home) go immediately into default since a default on a mortgage (and a subsequent foreclosure) still has a cost to the household in terms of a poor credit record, some legal costs, etc. This fact could be taken into account by just adjusting the strike price by the implicit cost of a worse credit history, etc, maybe by around 10 %. However, a foreclosure usually leads to rather substantial costs for the bank, which can be a multiple of the amount of negative equity that is calculated by using standard house prices indices. A sheriff sale often fetches a much lower price than a normal sale in which the time pressure is not that great. The loss to the mortgage lender is often far in excess of 10 % of the value of the home. These two effects thus tend to offset each other and the second might even be larger. It is thus likely that the value of the option as calculated here does appropriately reflect the risk for banks, and might even constitute a slight under estimation.

Given the high value of the put option on mortgages with high LTV ratios (i.e. especially sub prime) it is not surprising that the value of the securities build on these mortgages should be rather low. The first loss tranches (e.g. first 10 % loss) are obviously worthless when the put option is worth already close to 28 %. Taking this put option feature properly into account shows why all except the 'super senior' tranches of an RMBS based on sub prime mortgages can easily fall in value below 50 cents to the dollar.

Another implication of the approach proposed here concerns the 'fair value' accounting of the 3.6 thousand billion of mortgages still on the balance sheets of US banks. The value of the put option granted to US mortgage debtors should reflect approximately the amount of capital the

US banking system would need in order to cover itself against further fluctuations in house prices.

Little is known about the quality of the mortgages that are still on the balance sheets of US banks. It must be assumed that most of them are not conforming to the standards (limits on LTV, documentation, size, etc.) set by the (now) state-owned mortgage financing institutions Fannie Mae and Freddie Mac, since banks could make substantial savings on regulatory capital by re-financing conforming loans. It is thus likely that the mortgages still on the balance sheets of US banks are either jumbo loans (Fannie and Freddie refinance-only mortgages of up to around $400 thousand) or lower quality ones. Assuming a realistic distribution of loan to value ratios, the average value of the put option embedded in all mortgages would be around 9.5% in the low volatility case and 12.7% in the high volatility case (10% standard deviation for house prices). Given that the overall stock of mortgages still outstanding on the balance sheets of commercial banks is around $3.6 thousand billion, this implies that the US banking system would need between $340 and $460 billion just to cover itself against the variability in house prices. Under 'fair value' accounting this is the amount of losses the US would have to book today if they recognised the put option as being implicit in the 'no recourse' mortgages on their books.

The total stock of mortgages outstanding in the US is about $10 thousand billion. However, the market value of these mortgages (whether still on banks' balance sheets or securitised and embedded in RMBS (residential mortgage based securities)) is in reality lower by $1-1.2 thousand billion, if one takes into account the value of the put option granted to US households.

Why was the value of this option not recognised earlier? One simple reason might be that as long as the housing bubble lasted it was generally assumed that house prices could only go up, as they had over the 1990s. The average annual increase in house prices had been about 5% in the 15 years to 2006. If that number is projected into the future the value of a put option even on a sub prime mortgage with an LTV of 100% would have been below 5%, as compared to the 26.8% mentioned above, if one uses the standard assumption that the price of the underlying (house prices) follows a random walk without drift. Viewed from the perspective of ever-increasing house prices, the risk of negative equity seemed minor. Expectations about house prices have now changed completely, however. If one were to assume that house prices will decline by 3% annually over the next decade, the value of the put option would be even higher than calculated so far. For a sub prime mortgage with an LTV of 100% the value of the put option would be over 40% of the mortgage, and even for a conforming loan (80% LTV) the put option would still be worth 30 cents to the dollar. The value of the put options on which the US banking system is short would then be above $900 billion, and the total losses on all US mortgages could amount to over $2 thousand billion.

If expectations of future house price declines are now appropriate the value of all the securities build on sub prime mortgages might indeed be close to zero. It remains to be seen what pricing, and thus what underlying hypothesis is going to be used for the 700 billion rescue plan

Annex

Details for the calculation of value of a put option embedded in 'no recourse' feature of US mortgages.

Underlying Price	Loan to value ratio
Exercise Price	100
Time until expiration	10 years (mortgages tend to be long term)
Risk free interest rate	2%
Yield	6%
Volatility	5 % (low volatility case) and 10 % (high case).

Distribution of mortgages by loan to value ratio

Table 1.Value of put option under low volatility case.

LTV	Weight	Value of option (in cents on the dollar) under different expected future house price changes		
		+ 5 % p.a.	Zero	-3 % p.a.
100	0.1	4.7	26.8	43.4
90	0.1	1.8	20.8	38.9
80	0.2	0.4	13.8	33.4
70	0.2	0.1	6.7	26.8
60	0.2	0	1.8	17.7
50	0.2	0	0.2	7.6
Average		0.8	9.3	25.3

Source: Own calculations based on options calculator from www.option-price.com.