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## An analysis of SAM pricing in the UK

### Abstract

This paper investigates the pricing and valuation of Shared Appreciation Mortgages (SAMs) issued in 1997 in the UK. The analysis indicates a high expected value of returns to the lenders that was clearly apparent ex-ante, with extremely high upside potential and virtually no material risk of loss to the investors. Since SAMs had been invented decades before, the high returns to the UK lenders do not represent pay for financial engineering a new innovative product. Instead, the high effective interest rates on the SAMs appear to represent compensation for misleading repackaging of a product existing elsewhere.

**Keywords:** shared appreciation, mortgage, SAM, asset pricing, fraud, UK.

**JEL Classification:** G21.

### Introduction

Shared Appreciation Mortgages (SAMs) provide cash to homeowners in return for a promise to repay principal and a percentage of the appreciation of the homes subsequent to the origination of the mortgage at an interest cost that is less than available on traditional mortgages. SAMs provide interesting opportunities for homeowners, mortgage lenders, and investors, but volume has dried up for different reasons in the two major markets in which they were initiated.

SAMs were originally developed in the United States (US) in the 1970s during periods of very high double-digit interest rates in order to permit home buyers to purchase houses with a significantly lower explicit fixed interest charge. SAMs thereby allowed some people to buy homes that they might not otherwise have been able to afford at the high interest rates prevailing at the time. SAMs also gave homeowners the ability to reduce their concentrated investment in their own houses (permitting diversification into other assets) by transferring shares of the appreciation in those homes to lenders/investors, who potentially could enjoy diversification benefits to their portfolios thereby. At the same time, the SAMs provided lenders with a reasonable rate of expected return that could be extracted from the appreciation in housing prices that had been expected to continue from the inflationary 1970s.

However, the US SAM market largely collapsed when both inflation and nominal interest rates fell in the mid-1980s. The lower inflation had an especially negative effect on the market. In particular, inflation lower than expected decreased returns to lenders, who began to shy away from SAMs due to bad past experiences with SAMs (that yielded less ex-post than conventional mortgages). The lower inflation also resulted in a reduction in the explicit interest savings to home owners/buyers, who could now

afford regular mortgages at the lower interest rates existing in the environment of lower inflation.

While traditional mortgage lenders like commercial banks and savings institutions may not find SAM investments suitable for their traditional fixed-income portfolios, investment into shares of pooled individual houses/homes represents one very interesting source of potential diversification for other investors. In fact there are a few investment companies in the United Kingdom (UK) that were created in the 1997-98 period for the very purpose of enabling investors to participate in home appreciation there. However, ownership in these pools is closely held by a few institutions, and there has been no attempt to make the shares in these asset-backed securities available to the public.

Residential housing represents one of the last classes of investment assets to be securitized. The UK SAMs, the first of which were initially offered in late 1996, were fairly standardized, thereby facilitating their packaging into pools, in which investors could take positions (*Euroweek*, 1996). However, as opposed to being made available for individual investors through a public offering, much of the securitisation in debt instruments in Europe is designed to transfer risk from one bank to another and thereby allow lenders to diversify across the banking markets that had historically been highly segmented by country. The UK SAM pools do not appear to have been an exception, insofar as it was originally stated that the pools were designed for institutional investors and had large investment minimums (Lumsden, 1997). The potential demand for such investments in the institutional market alone remains large long after the termination of the UK SAM offerings according to a research report written by UBS (*Sydney Morning Herald*, 2004), which was an initial promoter of the UK SAMs (Lumsden, 1997). Despite sales of the SAM pools to affiliates and business partners and reporting to the London Stock Exchange (that essentially permitted listing for secondary trading if the lenders/investors

ever needed cash), there was no certain serious attempt to market the SAM pools to retail investors, initiate a public offering of them to investors in general, or develop an active secondary market for the shares.

Although a few of the issued UK SAMs pay explicit interest on the mortgage principal, most in the UK are 0% coupon rate mortgages. While SAMs can seemingly be attractive to both homeowners and investors, the UK SAMs have been marred by allegations of fraud and extortionate interest charges (Dyson, 2003). On the other hand, lenders have indicated the pricing was fair, asserted they had advised borrowers to seek legal independent advice before signing, and claimed that nothing could be done *ex-post* in any event since the loans had been sold to other investors (Dyson, 2002). Recently, an attempt has been made by one SAM lender to settle the dispute by granting existing SAM homeowners interest-free loans for the purchase of a new home or home improvements (Dyson, 2007).

### 1. Background on the UK SAMs

The UK SAM market exploded in 1997 amidst an environment of increasing securitisation of many different assets. Equity positions in real estate were being especially targeted for securitisation in order to reduce the illiquidity of such investments that normally entail large transaction costs to trade. By enabling investors to take positions in real estate at lower transaction costs, the number of real estate buyers can be increased, thereby raising real estate prices through increasing demand and lowering the premium returns required investors for buying illiquid assets (Murphy, 2000b). Much of the worldwide boom in real estate prices in the late 1990s may have been related to this securitisation which, however, focused on commercial real estate.

Within this environment, UK lenders began offering SAMs of two major types in November 1996: those that paid explicit interest (typically 5.75%) and those which did not (0% coupon SAMs that represented a majority of the market). The 5.75% SAMs usually gave the lender a share in the appreciation of the mortgaged home in an amount that exactly equaled the ratio of the mortgage loan to the appraised value of the home, thus giving the lender 100% participation in the appreciation of the portion of the home covered by the mortgage. The 0% SAMs offered 300% participation, insofar as the lender was due to receive a share of the appreciation of the home price equal to three times the ratio of the mortgage loan's value to the original appraised value of the home. The SAMs were promoted for a period of about a year and a half without any change in the pricing, and the market completely dried up in

1998 after over a billion dollars worth of SAMs were issued. A total of 15,000 of these mortgages were originated in the UK by two financial institutions, Bank of Scotland (BOS) and Barclays, before the offerings were terminated (Dyson, 2002).

This research is undertaken in order to objectively examine the UK SAMs, which had some very unique features compared to prior SAMs that led to both their initial attractiveness and to subsequent problems/complaints (Sanders and Slawson, 2005). One of the major complaints with the UK SAMs is that the lender's participation in the home appreciation was far too high (Dyson, 2002). This allegation will be investigated by computing a participation rate that is appraised to have allowed the SAMs to sell at equilibrium prices in an efficient market at their loaned principal value. The UK SAMs are valued using the Murphy (1990a) model, although a simpler framework is also employed to illustrate the intuition behind the results.

This study is useful for providing further detailed information on how SAMs can be evaluated and priced. Employing very conservative estimates of parameter values based on prior studies, minimal estimates of the SAM values are obtained that far exceed lenders' fixed prices. The substantial overpricing and possibly misleading marketing to unsophisticated consumers/homeowners apparently led to consumer dissatisfaction and the eventual demise of the market that might not have occurred if fair offers of SAMs had been provided.

### 2. Valuing the UK SAMs

The fair value of the UK SAMs to knowledgeable investors can be appraised using the fact that a SAM has payoff like a convertible bond. Such debts can be divided into: a fixed income component (the promised principal and interest), a call option component (the participation in the house appreciation), and the possibility of redemption prior to maturity (the prepayment right/obligation). To value these assets, The Murphy (1990a) model, which was based on an earlier French and Haney (1984) SAM model, and which uses the identical mathematics of the Murphy (1989) model of convertibles that incorporates both mandatory and optional prepayments before maturity and that was found to be consistent with market prices in the US, will be employed for this purpose.

The call option for SAMs has both a strike price and initial underlying asset price equal to the loan principal times the appreciation share, so that it is initially at the money. The underlying asset price or value is assumed in the Murphy (1990a) model to follow a truncated normal distribution, so that the

option value of the appreciation rights on SAMs is therefore determined by the mathematics defined by Murphy (1990b). The latter research showed that such an assumption leads to model values being as accurate as the Rubinstein (1976) version of the Black and Scholes (1973) theory in empirically explaining market prices of options on even stocks, which have distributions that are more lognormal distributions than for fixed-income securities. The Murphy (1990a) model adjusts both the strike price and the underlying asset value on the SAMs for expected prepayments. The latter cash flows are also incorporated into the model's valuation estimate of the fixed-income component of SAMs that is computed as a simple present value of expected principal and interest payments.

Implementable models of convertible bonds or SAMs require an estimate of the yield on the asset received annually by the owner until conversion or maturity. For this purpose, the home property is assumed to have a net marginal effective annual yield to the homeowner equal to the difference between the expected appreciation on the house and the required return on an asset with the same contribution to portfolio risk as that of a house. This implicit yield includes the consumption, psychic, and other benefits of home ownership to the homeowner (not available to the mortgage lender) net of any costs/headaches (none of which are assumed to accrue to a lender)<sup>1</sup>. Houses can therefore be expected to appreciate at rates different from a market required rate of return due to this net implicit yield to the homeowner (where, if positive, this net implicit yield, like an explicit cash dividend, leads to average appreciation rates below the required return on the house).

**2.1. Estimating model parameters.** For purposes of analyzing the UK SAMs, the statistical expected value of home appreciation is assumed to be 2% above inflation rates. This rate represents a conservative estimate insofar as it was below the past real

<sup>1</sup> The costs would also include those associated with the illiquidity of homes. The implicit yield would therefore be reduced by a transaction cost premium associated with the normal explicit expenses of selling a home (annualized over the number of years in residence), as well as by the typical costs related to the time delay required to obtain a price near appraised value as well as any price discount from that estimated value. The indivisibility of the home investment that reduces homeowner portfolio diversification (and therefore lowers expected returns for the same level of overall risk of a homeowner's total portfolio) would also add to the cost of homes and reduce their net implicit yield (and all these costs together could sometimes cause the net implicit yield to actually be negative). To the extent that SAMs provide a means of reducing those illiquidity costs, they would increase the net implicit yield, driving up the demand for houses and increasing home prices to the point, where the expected appreciation was reduced to the difference between the required return on housing and the raised net implicit yield. A mass offering of SAMs would therefore have been expected to initially raise UK home prices quite substantially (leading to expected home appreciation and SAM returns significantly above what is assumed in this research), and speculation on such an effect may very well contributed to the large rise in actual UK housing prices very soon after the initial offerings of the SAMs.

home appreciation in the UK and was estimated by one SAM issuer at the time (*Euroweek*, 1999). Aggregate UK housing price data (available from the Council of Mortgage Lenders in the UK) indicate an 11.2% average annual increase in housing prices in the UK over the 1970-1996 period that was actually 2.5% above retail inflation in the UK (as reported by the Office of National Statistics in the UK). A figure above these averages could certainly be justified given the increasing liquidity of worldwide real estate investments around this time<sup>2</sup>, including homes in the UK through the securitisation of the SAMs. However, rounding down to a 2% figure is useful to obtain conservative estimates of SAM values. Inflation in the UK itself can be objectively estimated ex-ante to equal the difference between the market yield on long-term UK government bonds (or gilts) that are not indexed to inflation and the real market yield on long-term gilts that are indexed to inflation (Murphy, 2000b).

The time-series standard deviation of the mean housing price index (i.e., of the cross-sectional average price in the aggregate) was 10.7% in the UK over the 1970-1996 period. Given cross-sectional variation in home prices, a time-series annual standard deviation for *individual* home prices of 20% seems reasonable since the aggregate average or median home price smoothes out the unsystematic variation in individual home prices. A 20% estimate is consistent with the Sanders and Slawson (2005) findings that, for a sample of SAMs that prepaid within 27 months of origination, the cross-sectional standard deviation of annualized return equaled 21.12% and 14.27% for individual mortgages with 300% and 100% participation rates, respectively. Their limited sample that did not include enough time periods to incorporate much time-series variation and therefore largely reflected merely cross-sectional variation in home prices. Cross-sectional variation in housing prices combined with time-series price volatility in the aggregate might likely make the true standard deviation in excess of 20%, just as the standard deviation of the typical individual stock is more than twice that of the stock market in the aggregate (Murphy, 2000b). The 20% figure is utilized to ensure a conservative (or minimum) estimate of value for the UK SAMs.

<sup>2</sup> A reduction in asset illiquidity decreases required returns and thereby increases asset prices (Murphy, 2000b). While investors could always purchase residential real estate directly (and then rent the houses, as many do), buying shares in a SAM pool permits investment at much lower transaction costs (and with greater diversification), thereby potentially lowering required returns on house investments and raising home prices. The increase in the securitisation of regular mortgages in the UK might also have contributed to a later boom in housing prices since the liquidification of traditional UK mortgages may have reduced the mortgage rates investors required on such loans (once again, via a resulting reduction in illiquidity premiums), thereby increasing demand for UK housing by making it more affordable to more people.

Public Securities Association (PSA) prepayment rates, which represent standardized frequencies of autonomous mortgage prepayments/redemptions that have historically occurred in an environment without refinancings related to interest rate declines, are conservatively assumed for SAM redemptions. The PSA figures, which begin with a 1% annual prepayment rate and have the rate rise 1% each year until it stabilizes at 5%, are roughly consistent with early data on UK SAM prepayments published by Sanders and Slawson (2005). They are, however, slightly less than the long-term data on prepayments implied from the annual reports of the SAM pools, which indicate 21% of all SAMs were redeemed within 4 years of origination, and 55% were redeemed within 8 years.

The average age of the borrowers cited by Sanders and Slawson (2005) is 69, and so the PSA prepayment rates could have reasonably been forecasted ex-ante as a minimum given the relatively high probability of death for people of that age. In particular, since complete mortgage prepayment or redemption is automatically required on the SAMs upon the death(s) of the mortgagor(s), and since death rates (reported in the *Annual Abstract for Statistics* for the UK) are over 2% for people in the 65-74 age group and rise to over 6% after 5 years in the next age group 75-84, the PSA prepayment rates are therefore lower than the death rates implied by the death rate tables for the average SAM borrower. Because higher prepayment rates lower SAM values (as will be shown), the use of low estimates leads to conservative appraisal values for the SAMs.

Traditional refinancings above PSA frequencies due to lower interest rates that occur on both conventional mortgages (Murphy, 2000a) and convertibles (Murphy, 1989) would not apply in the same fashion for the UK SAMs, whose own coupon rate never did fall (and could not fall in the case of the 0% SAMs). The questionable value of a mortgagor prepayment/redemption option is therefore not incorporated into the model, although such voluntary redemptions and their effects are discussed later.

To value the components of a convertible or SAM, various other parameters must also be estimated (Murphy, 1989). Because the UK SAMs required the initial loan-to-value ratios to be at or below 75% (and at 25% or below for the 0% SAMs), they clearly have very minimal default risk (*Euroweek*, 1999). An assumption of a Aaa rating, with a 0.10% annual chance of default, a 60% recovery of loan principal in default (net of legal costs), and a 0.03 beta (Murphy, 2000b) is therefore appropriate, and a

beta of 0.1 for the underlying home price represents a conservative estimate<sup>1</sup>.

Discount rates in the Murphy model are estimated using Sharpe's (1964) widely-employed Capital Asset Pricing Model (CAPM). In this model, risk-free rates available on government bonds denominated in the domestic currency (here the UK pound) are added to a premium required for bearing risk. An assumption of an annual 5% premium return per unit of beta risk is fairly standard based on past long-term, compounded annual returns on proxies for the risky market portfolio (Murphy, 2000b) and is consistent with recent findings on systematic premiums in the fixed-income markets (Elton, Gruber, Agrawal, and Mann, 2001). The required return on the home therefore equals  $0.1 \times 5\% = 0.5\%$  above the risk-free interest rates on British pound government bonds that are called gilts.

## 2.2. Other factors affecting the value of SAMs.

Without citing prior literature on SAM pricing, Sanders and Slawson (2005) have developed an alternative valuation model of SAMs that focused on the incentives that SAM homeowners have to underinvest in their homes. Their model, which doesn't allow for the forced mortgage redemptions/prepayments that the UK SAMs mandate at the death of the mortgagors<sup>2</sup>, leads to the bizarre conclusion that the minimum required interest rate explicitly charged on a SAM in "equilibrium" will be only trivially impact by the appreciation share granted to the lender(s). The Sanders and Slawson (2005) model even implies that there would be no reduction in that explicit coupon rate paid by the homeowner for offering the lender appreciation shares above 20%. Under these circumstances, it is unclear why "rational" mortgagors would consent to appreciation shares over 20%, much less the extreme participation rates in home appreciation of 100-300% charged in the UK (nor even why lenders would demand such rates).

<sup>1</sup> The beta of an asset represents the contribution of the asset to the risk of a diversified portfolio for which investors require compensation in the form of a higher return that raises the discount rate employed to compute the present value of cash flows from the asset (Sharpe, 1964). A home beta, which measures the average percentage movement of the home price for any given percentage movement in the market portfolio of investment assets, was estimated statistically as -0.1 in a simple regression of UK housing price changes (from the Council of Mortgage Lenders) on UK stock market changes (the FTSE all share performance index). A home beta of 0.1, which indicates the house price moves on average by 1/10 of the return on the market portfolio, seems fundamentally more reasonable, since a low positive beta is typical for unlevered real estate returns (Murphy, 2000b), and it is also more conservative, leading to higher discount rates and lower values for the SAMs. The debt beta of .03, as well as the other debt parameters, are estimated from Murphy (1988) based on an assumption of the highest credit rating, as is consistent with the Aaa rating given the SAM pools (Lumsden, 1998), as it is also roughly consistent with loss data on low loan-to-value mortgages (Murphy, 2000b), and as might be expected to be even lower on loans with explicit interest rates and mortgage payments below market rates (and even no periodic prepayments on the 0% SAMs).

<sup>2</sup> Forced redemptions can have significant effects on the maturity, value, and returns to the SAM lender(s), especially given the average age of the SAM borrowers in the UK of nearly 70, as the subsequent analysis will indicate.

While lender participation in home appreciation can indeed reduce monetary incentives for the homeowner to maintain and insure the home, the SAM contracts indicate any failure to do so that can lead to the lender engaging in these tasks and adding the resulting costs and damages to the lender's share of the appreciation in the home. In addition, the SAM contracts provide for home improvements above 10,000 British pounds (about \$15,000) to be considered for at least partial payment by the lender, so that incentives exist to both maintain and improve the property<sup>1</sup>.

Sanders and Slawson's (2005) own empirical data provided no indication that the homes underlying UK SAMs had below-average appreciation. Moreover, the average annual appraised appreciation on homes with redeemed 0% SAMs, as reported in UK SAM pool annual reports, has been approximately the same as for UK home prices in the aggregate 1998-2006 at about 11%. Thus, there is little evidence that any underinvestment incentive negatively affects home appreciation rates.

In addition, there are clauses in the SAM contracts that give the lender the right to choose the appraisers for measuring home appreciation, and that right alone may offset the effect of any underinvestment incentive<sup>2</sup>. However, a modest impact for an underinvestment effect is implicitly incorporated into the valuation model employed in this study by using an expected appreciation rate for UK houses that is slightly less than the average past real appreciation rate of homes there.

<sup>1</sup> In addition, the homeowner does still retain a portion of the home appreciation and is financially motivated (even without the maintenance clauses) to keep up and improve the home as long as the costs don't exceed the homeowner's share of any lost appraised value resulting from a failure to invest into the home. Moreover, the fact that the mortgagor lives in the house certainly provides many non-financial incentives to invest in the house. Regardless, it is unclear whether underinvestment rates of the extreme magnitude assumed by Sanders and Slawson (2005) were motivated, probably, or even possibly under the UK SAM contract terms. It is also highly questionable whether the mortgagors would have been able to afford the sophisticated financial advisors needed to figure out the optimal prepayment behavior on the mortgages to maximize their underinvestment option that Sanders and Slawson assumed in their model – even for much simpler conventional mortgages in the U.S., homeowners on average make rather suboptimal prepayment decisions that significantly affect mortgage rates and market prices (Murphy, 2000a), and to assume otherwise for the complex UK SAMs could only defy reality, especially given that the homeowners generally didn't even bother to consult with an expert upon initial signing of the mortgage for an amount that far exceeded any possible limited and uncertain gain from an optimal prepayment scheme.

<sup>2</sup> Actually, it is quite likely that the provision in the SAM contracts permitting the lenders to choose the appraiser upon mortgage redemption may more than offset any underinvestment incentive. Appraisal bias in favor of the lenders could easily occur if the mortgagees chose appraisers with a reputation for conservative valuations initially for the appraisal at mortgage origination, while they selected appraisers with a history of providing relatively high valuations upon mortgage redemption. Even the same appraisers might also be motivated to bias the valuations in the direction clearly known to be preferred by the lender if further appraisal business with the lender was desired. Given a large range of feasible values that can result from an appraisal, even "honest" appraisers would, at least subconsciously, have clear incentives to bias the appraisals to provide maximum return to the lender.

**2.3. Voluntary prepayments.** This Murphy (1989) model was designed to be applied to cases, where any option of the convertible/SAM issuer to prepay/refinance the debt would be optimally exercised based on ex-ante statistical probabilities and iterations. However, most homeowners are known to delay years after an optimal refinancing point on a conventional mortgage before actually prepaying on it (often due to a temporary lack of awareness of the changes in interest rates or total financial ignorance), and so standard models of non-convertible debt, such as Murphy (1988), have been adapted to the valuation of home mortgages by assuming only a portion of homeowners are aware of the refinancing situation at any time and by assuming permanent ignorance/inability to prepay for some (Murphy, 1991). Such models continue to be state-of-the-art in terms of pricing accuracy (Murphy, 2000a).

As will be explained subsequently, the optimal time to prepay on the UK SAMs was upon mortgage origination because of the excessive appreciation shares granted to the lenders. This fact alone implies total financial ignorance for the SAM mortgagors. As a result, it is reasonable to assume permanent financial ignorance for the UK SAM homeowners and assume any voluntary prepayments to be included in the assumed PSA rates.

Instead of assuming total financial ignorance, it is also possible to assume that SAM mortgagors faced extremely high costs for alternative financing. As will be shown subsequently, the present value of the 0% SAMs upon mortgage origination is over 50%, implying alternative financing costs at least high to justify the homeowner entering into the SAM. As it will also be shown subsequently, the highest expected annual returns exist in the earliest years of the SAMs, thereby implying that the large difference between the SAM prepayment prices (which rise with the appreciation on the home) and their present value (if not prepaid) would be expected to go down over time after the highest initial returns are earned. As a result, the high alternative financing costs needed to justify entering into a SAM for a rational borrower would make refinancing the SAM mortgages permanently impossible and hence lead to the same modeling conclusion of incorporating all effects of mortgage prepayment rights/obligations into the PSA rates.

### 3. Data and analysis

Data on risk-free gilt interest rates were obtained from the *Financial Times* for the last day of the month for each of the 12 months of 1997 during

which time originations in UK SAMs were concentrated. Yields to maturity on 1-, 2-, 3-, 5-, 7-, 10-, and 20-year gilts for each of those days are used to interpolate necessary risk-free discount rates for each year in the future using the Murphy (1991) algorithm for estimating the true 0-coupon term structure.

**3.1. SAM values and fair appreciation rates.** The results of valuing the mortgages over the 12 months of 1997 are shown in Table 1. Efficient markets (Fama, 1970) and fair pricing would imply a value of 100% of principal. Columns 4 and 5 of Table 1, however, indicate the valuations for both the 0% and 5.75% SAMs that are far in excess of fair prices.

Table 1. Valuation analysis of SAMs in the UK<sup>a</sup> (end of the month data, 1997)

1	2	3	4	5	6	7
Month	Forecasted inflation <sup>b</sup>	10-year mortgage rates <sup>c</sup>	0% SAM value <sup>d</sup>	5.75% SAM value <sup>d</sup>	Participation to price at principal <sup>e</sup>	
					0% SAM	5.75% SAM
January	3.97%	8.74%	158.0	125.0	151%	34%
February	3.90%	8.76%	159.3	127.1	146%	30%
March	4.09%	8.70%	155.9	123.9	152%	37%
April	3.95%	8.71%	156.1	125.0	151%	34%
May	3.53%	8.69%	154.0	125.6	152%	30%
June	3.46%	8.69%	155.6	126.7	149%	28%
July	3.40%	8.39%	158.6	128.3	145%	25%
August	3.44%	8.37%	156.8	127.3	147%	27%
September	3.20%	8.14%	162.6	132.4	136%	15%
October	3.36%	8.03%	167.5	133.9	130%	15%
November	3.22%	7.72%	165.4	133.3	132%	15%
December	3.20%	7.71%	169.2	135.8	127%	11%
AVERAGE	3.95%	8.39%	159.8	128.7	143%	25%

Notes: <sup>a</sup> Analysis of the 0% SAMs (with 300% participation) and the 5.75% coupon SAMs (with 100% participation) sold in the UK in 1997. <sup>b</sup> Estimated as the difference between the yields on fixed-rate 20-year gilts and 20-year inflation-indexed gilts. <sup>c</sup> Average end-of-the-month mortgage rates on residential mortgages with 10-year fixed rates, modest prepayment penalties (like 3-9 months interest), and 75% loan-to-value ratios that were issued by banks and building societies in the UK. <sup>d</sup> Value as a percentage of mortgage principal estimated using the Murphy (1990a) model. <sup>e</sup> Estimated minimum participation in the appreciation of the home of the mortgagor in order for the mortgage to be worth the principal value.

The 0% SAMs were the best deals for the lenders. The net present value (NPV) of expected excess profits above those that would be available in an efficient market (i.e., above 100%) averaged 59.8% of the loan principal and ranged between 54.0% and 69.2% over the sample. The lower NPV for the 5.75% SAMs averaged 28.7% of principal and ranged between 23.9% and 35.8% over the sample. The latter profit margin implies a lower difference between the actual SAM appreciation participation rate and the rate that will exist with fair pricing of the SAMs.

While columns 4 and 5 of Table 1 show that the homeowners with SAMs were overcharged by a substantial amount, columns 6 and 7 of Table 1 indicate how much of the home appreciation the mortgagors should have had to pay if they had only been charged enough to make the SAMs worth their loaned principal value upon issue. In an efficient market with fully informed borrowers and lenders, columns 6 and 7 indicate that the true participation rates should be 143% and 25% for the 0% and 5.75% SAMs, respectively. The appreciation participation on the 5.75% SAMs exceeds an estimate that would value the SAMs at their principal value by a huge 100% - 25% = 75%. That figure actually

compares modestly to the apparent 300% - 143% = 157% overcharging on the 0% SAMs.

Table 1 indicates falling interest rates and rising SAM values. Despite this fact, SAM prices remained fixed across lender and time. The possibility of price fixing as well as price gouging would seem to be consistent with the data<sup>1</sup>. The pricing remained unchanged in 1998 as interest rates fell further (not shown) and as home prices rose dramatically, leading to a drying up of SAM originations in the first half of that year.

Many of the SAMs were sold by the mortgage originators in asset-backed pools to institutional investors. The present value of the profit to the lenders from overcharging the borrowers may have

<sup>1</sup> The fact that the high appreciation shares were fixed across time and lender may imply some form of collusion, price-fixing, and restraint of trade that could possibly still be prosecuted in the UK. Regardless, it would seem that the abnormal profits listed in columns 4 and 5 of Table 1 (plus interest at the relevant bond rates for corporations with the same ratings as the lending institutions) should, at least according to ethical theory, be returned to the SAM mortgagors as a reduction in the contractual appreciation rate). While the lenders continue to answer homeowner complaints with statements that the sale of the SAMs to other investors makes it useless for them to even consider adjusting the SAM terms, the contracts may turn out to be unenforceable due to the lenders' possible violation of some credit disclosure laws.

therefore been realized fairly quickly. In fact, since the sale at fair value would generate a return of over 50% on the 0% SAMs and over 20% on the 5.75% SAMs in the short period it might take to sell them, the annualized return would be astronomical (e.g., if the SAMs were sold near fair value for a 50% profit within a month of loan origination, the annualized return would be over 600% even without compounding).

The transaction costs of forming the new SAM pools, along with their possible illiquidity, might provide a justification for higher returns being required on the SAMs and SAM pools than might exist on more liquid instruments. However, the extremely high ratio of intrinsic value to price (and the fixed prices, which actually resulted in a rise in that ratio over time) makes rather questionable any hypothesis of transaction costs explaining such large expected returns. In addition, since the SAM product itself was not actually new, innovative, or difficult to copy, the high expected returns can't represent reasonable compensation for innovation (especially since any initial abnormal profits should have been expected to fall over time if they had merely represented justifiable compensation for the initial "innovative marketing" of the SAMs in the UK).

While prices in an active, liquid, and competitive securities market can provide relevant information on the values, there is a very little transaction information on secondary market transactions on SAM pools. It even remains unclear whether the SAM asset-backed securities were priced far above the principal value, whether special deals were offered to the originators of the SAM pools (in return for lucrative returns to the final investors), or whether they were "sold" to affiliates of the lending banks (thereby permitting effective retention of the profits to the original lenders). In fact, the size of the profit from the sale of these securities may have been partially split with the buyers, possibly in return for unspecified benefits (such as special access to offerings of the buyers' own lucrative asset pools of other sorts, and such as subsidized financing or trade of other pools below appraised value).

Moreover, the extremely high returns to the SAMs in the pool were initially disguised by combining the SAMs with Guaranteed Investment Contracts (GICs). Asset-backed securities sold by the SAM investment companies were obligated to pay a rate that varied with the British pound London Inter-Bank Offering Rate (LIBOR) in addition to the appreciation share on the SAM mortgages held by the

pools (Salmon, 1996)<sup>1</sup>. According to the first two 0% SAM pool offering circulars (BOS2 and BOS4), the investment companies initially set up to buy the SAMs from the lenders sold asset-backed notes that were promised an interest rate equal to 60% of LIBOR -0.30%, plus the appreciation share on SAMs, whose principal are equaled to 34% of the notes' principal. The expected return on these asset-backed securities was publicly stated to be 9% in late 1997 (Lumsden, 1997) and 7.8% in early 1999 (*Euroweek*, 1999). Since British pound LIBOR rates were 7.75% and 5.75% at those respective times, the expected annual return on the SAM component of the pools would have had to be 13.32% at both those points in time (e.g.,  $9\% = [.60 \times \{7.75\% - 0.30\% \}] + [.34 \times 13.32\%]$ ).

**3.2. Decomposing SAMs into their fixed-income and option values.** Although, the model utilized in Table 1 makes the Murphy (1989) assumption of a truncated normal distribution for the home price, similar results are obtained by employing the Rubinstein (1976) option pricing model, which assumes a lognormal distribution and is essentially identical to the Black and Scholes (1973) model except that it adjusts for the expected yield (explicit or implicit) on the underlying asset<sup>2</sup>. For illustration of the detailed characteristics of the 0% SAMs (which represent the vast portion of the UK SAM market and were unique in requiring any periodic payments whatsoever), a decomposition of the value to the lenders using this popular model is provided in Table 2 for the approximate midpoint in the sample, July 1997.

<sup>1</sup> Because the pools were over-collateralized (with the interest paid on the note principal being less than that received on the GIC principal backing by  $[.10 \times \{\text{LIBOR} - .50\% \} - \{.90 \times .20\% \}]$  until 2008), the owners/administrators of the SAM investment companies took a share of the excess profits derived from the origination of the SAMs. At LIBOR rates of 7.75%, that comes to an annual 0.55%, which is earned net on a principal amount equal to about twice that of the SAM principal in the pool. In addition, because the GICs offered annual returns 0.5% below market LIBOR rates (that represent the effective borrowing rates for large banks like the SAM lenders), the GIC vendors, which consisted of a lender affiliate and the Swiss bank promoter of the SAMs, received subsidized financing that took a portion of the lenders' excess profits from the SAMs, once again on a principal equal to about half that of the SAM principal. Total annual net earnings/savings equaled over 2% of the SAM principal that might be worth over 20% of SAM principal in present value. However, the rest of the enormous profits derived by the lenders from the SAM originations accrued to the investors in the SAM asset-backed securities. Although at least one issue of SAM-backed securities was sold at a price only slightly above par value. It is unclear whether the SAM note investors had to pay, in some other form (such as via side deals/financing), for the resulting high expected excess returns. One pure 0% SAM pool was apparently sold (without the GIC component) to a subsidiary of the mortgage originator. In addition, with respect to one pure 5.75% SAM pools, a portion of the excess profits was created off via payments of only 4.5% on the pool noteholders, who did still receive the huge appreciation share (although, given that an annuity of 1.25% that might have a present value equal to over 10% of the principal, and given the NPV of the 5.75% was only about 25%, much smaller excess profits accrued to the noteholders of this 5.75% pool).

<sup>2</sup> See Murphy (1990b) for a general comparison of the two modeling assumptions. Murphy (2000a) has shown his modeling framework and its assumed truncated normal distribution to be more efficient and accurate in valuing debt securities with embedded options.

Column 4 of Table 2 supplies an estimate of the component of the 0% SAM value created by the final principal payment, while a separate component value for the lender's share in the home appreciation is provided in columns 2 and 3. The appreciation component value estimate remains based on the assumption inherent in the Murphy (1990a) model that a SAM is really just a bond convertible into the house (with cash settlement), where the conversion or participation feature of SAMs is therefore like a call option on the house with a strike price initially at the money.

For July 1997, the expected annual inflation rate over the next 20 years (as incorporated into nominal and real yields on 20-year gilts) was 6.93%-3.53% = 3.40% (equaling the difference between the yields on gilts that are not and that are indexed to inflation). Assuming the same 2% appreciation rate above inflation rates as before, the expected house price appreciation is therefore 3.40% + 2% = 5.40% (for that point in time). Given the assumed beta of 0.1 and the 5% premium return required for such relevant risk, assets with betas similar to housing would have an expected gross

rate of return over 20 years equal to 6.93% + {5% $\times$ 0.1} = 7.43%. The net explicit (implicit) annual yield on the house accruing only to the homeowner at the end of July 1997 was therefore 7.43% - 5.40% = 2.03% per year. The latter figure represents the difference between the required return and the actual appreciation expected on the house that would have to exist at the margin in equilibrium.

Table 2 indicates that the present value of the excess profits to the lenders increases for every extra year that the SAMs are owned for the first 18 years<sup>1</sup>. With a present value to the lender of over 123% of principal if the homeowner prepaid in a year, and with the present value of the expected payoff to the lender rising to over 168% of principal in 18 years before leveling off at longer maturities, the mortgages would optimally be prepaid on the day they were taken out<sup>2</sup>. However, if the homeowners had known this fact, they would have never signed up for the loans, which generated additional loan origination costs to the mortgagors. The latter conclusion implies an inefficient market of uninformed, or misinformed borrowers.

Table 2. Approximate decomposition of the value of the 0% SAMs (at the end of July 1997)

1 Year From Origination	2 0% SAM App. Rate	3 Component Value of:				5 Present Value <sup>c</sup>	6 Percent Prepay This Year <sup>d</sup>	7 Max Future Value <sup>e</sup>
		100% Appreciation Participation <sup>a</sup>	+	Fixed Principal <sup>b</sup>	=			
1	[3x]	10.19]	+	93.14	=	123.7%	1%	311.6%
2	[3x]	15.41]	+	86.86	=	133.1%	2%	425.1
3	[3x]	19.63]	+	81.00	=	139.9%	3%	529.0
4	[3x]	23.23]	+	75.50	=	145.2%	4%	631.3
5	[3x]	26.34]	+	70.41	=	149.4%	5%	734.5
6	[3x]	28.99]	+	65.90	=	152.9%	5%	838.4
7	[3x]	31.31]	+	61.74	=	155.7%	5%	945.1
8	[3x]	33.46]	+	57.74	=	158.1%	5%	1059.1
9	[3x]	35.41]	+	53.98	=	160.2%	5%	11798
10	[3x]	37.13]	+	50.52	=	161.9%	5%	1305.8
11	[3x]	38.73]	+	47.21	=	163.4%	5%	1442.0
12	[3x]	40.18]	+	44.12	=	164.7%	5%	1586.9
13	[3x]	41.48]	+	41.23	=	165.7%	5%	1741.1
14	[3x]	42.64]	+	38.54	=	166.5%	5%	1905.7
15	[3x]	43.65]	+	36.08	=	167.0%	5%	2078.1

<sup>1</sup> The weighted summed value in Table 2 is slightly different from the July, 1997 appraised value in Table 1 (160.9 vs. 158.1) for two reasons. For simplicity of illustration, the Table 2 option values are computed by keeping constant the net implicit yield of 2.03% across all maturities, whereas it automatically varied slightly with the yield to maturity at each maturity for the Table 1 value (i.e., for the Table 1 value estimates, the expected annual implicit yield on the house was varied with the difference between the expected annual home appreciation of 5.40% in July, 1997 and the yields on gilts of different maturities plus 0.5%. In addition, the Black-Scholes/Rubinstein model assumes a lognormal distribution for home prices that leads to slightly different figures than the Table 1 model values, which come from the Murphy (1990a) model that utilizes an assumption of a truncated normal distribution. Because the differences in value estimates are not material, and because the Black-Scholes model is widely recognized and available for those seeking to verify these results, only the latter separated results are reported for the illustration of the component values of SAMs.

<sup>2</sup> The table actually implies that, after extensive price appreciation on the homes underlying the SAMs (such as after 19 years of average price increases), the value drops slightly if redeemed later (such as in 20 years instead of 19). The reason is that 200% of the 300% participation share does not compound on itself, resulting in the extra participation share being more than offset by the compounding of only a fraction of that share. Thus, there can be a point at which it might not be optimal for homeowners to redeem the mortgages voluntarily. While this situation might normally exist only after 19 years of average appreciation, large home appreciation in early years can lead to the large appreciation on the homes only exist on SAMs that are grossly underpriced. For other SAMs, optimal voluntary redemptions would follow the same rules as for convertible bonds, such as refinancing, when interest rates have fallen sufficiently (Murphy, 1989).

Table 2 (cont.). Approximate decomposition of the value of the 0% SAMs (at the end of July 1997)

1	2	3				4	5	6	7
Year from origination	0% SAM app. rate	Component Value of:				Present value <sup>c</sup>	Percent prepay this year <sup>d</sup>	Max future value <sup>e</sup>	
		100% Appreciation participation <sup>a</sup>	+	Fixed principal <sup>b</sup>	=				
16	[3x	44.59]	+	33.73	=	167.5%	5%	2265.1	
17	[3x	45.42]	+	31.55	=	167.8%	5%	2465.0	
18	[3x	46.16]	+	29.50	=	168.0%	5%	2678.6	
19	[3x	46.82]	+	27.59	=	168.0%	5%	2907.0	
20	[3x	47.35]	+	25.86	=	167.9%	5%	3145.1	
21	[3x	47.85]	+	24.20	=	167.8%	5%	3405.7	
22	[3x	48.28]	+	22.65	=	167.5%	5%	3684.6	
Weighted sum <sup>d</sup>	[3x	38.21]	+	46.24		160.90%		1821.7	

Notes: <sup>a</sup> These values were computed using the Black and Scholes (1973) option pricing model, using the Rubinstein (1976) adjustment for dividend yield that is assumed to equal the difference between the risk-free rate and the expected house appreciation. <sup>b</sup> These values were computed using the Murphy (1988) model assuming the Aaa rating. <sup>c</sup> Note that the weighted summed total value is slightly more than the 158.1 amount listed in Table 1 for reasons mentioned in the text. The weights are determined by the percent of the mortgage pool prepaid according to the standard historical PSA prepayment schedule (i.e., 1% for year 1, adding 1% for each year thereafter until the amounts stabilize at 5% in year 5 and thereafter), as denoted in column 6. <sup>e</sup> The maximum feasible future value of the payoff (including principal and 300% appreciation rights) to the lender as a percentage of the original principal with a 99.9% confidence level (so that there is only a 0.1% chance of a larger payoff).

Spreading the geometric mean of the net present value (NPV) in column 5 (implied by loan proceeds to the homeowner borrowers equal to 100% of principal) over the time to redemption  $T$  provides an estimate of the excess annual return per year to the SAM investors above required returns in an efficient market in equilibrium. In particular, this computation of the  $1 + NPV$  raised to the  $1/T$  power indicates an average *abnormal* compounded return per year to the lender above market rates between  $1.675^{1/22} - 1 = 2.4\%$  (for prepayment/death in 22 years) and  $1.237^{1/1} - 1 = 23.7\%$  (for prepayment/death in 1 year)<sup>1</sup>. Taking the annual interest rates of 6.9% on long-term gilts and 7.1% on short-term risk-free UK bonds for July 1997, again assuming an expected premium annual return of 0.5% for the beta risk of the SAMs, and adding in the abnormal returns of 2.4% and 23.7%, respectively, the expected annual cost of the loans to the homeowners ranged between  $6.9\% + 0.5\% + 2.4\% = 9.8\%$  and  $7.1\% + 0.5\% +$

$+ 23.7\% = 31.3\%$ <sup>2</sup>. Obviously, the lenders expect to earn a higher rate of abnormal profit with early prepayments but generate high abnormal rates of return regardless. Utilizing  $\{1 + NPV\}^{1/T}$  to estimate abnormal annual returns, using the sum of the midpoint 7% gilt yield for July 1997 and the 0.5% risk premium as the required annual return, and employing the PSA prepayment rates to weight the sum across the 22 different redemption dates, the average expected return on the 0% SAMs was computed (not shown) to be  $7.0\% + 0.5\% + 5.2\% = 12.7\%$  per annum. This expected return is similar to the expected returns implied from yield estimates on SAM pools (computed previously in this research as 13.32%) that were reported to the press.

**3.3. Risks to SAM lenders.** There was very little risk on SAMs for the initial lenders/investors. For instance, although cross-sectional variation in house price appreciation enhances value and expected returns to SAM lenders (as volatility increases the value of any option, including appreciation shares), it has little effect on total portfolio return volatility for lenders/investors due to the diversification of

<sup>1</sup> Note that the expected return on the 0% SAMs (and the effective cost of the loans to the borrowers) exceeds the return that will exist if the actual home appreciation equaled the expected or average value of the appreciation on the homes. In particular, as shown in column 5 of Table 2, if the 0% SAMs prepay in 1 year, the lender receives an average abnormal return of 23.7% above the required return of  $7.1\% + 0.5\% = 7.6\%$ , or  $23.7\% + 7.6\% = 31.3\%$ . Those average returns would be across an entire portfolio of SAMs redeemed in one year (with most providing more or less than this average). In contrast, on those homes appreciating at the expected or average appreciation rate of  $3.4\% + 2\% = 5.40\%$  (from Table 1) and being prepaid in full in 1 year, the return to the SAM lenders/investors is  $16.2\%$  ( $= 3 \times 5.4\%$ ). The reason for the difference between the actual average return to the lender and the return in the case of the average home appreciation rate of 5.4% reflects the option value of the appreciation rights that prevent the lender from suffering any loss of principal claim on any individual SAM whose underlying home declines in price.

<sup>2</sup> Note that the computations for the total annual returns measured here slightly underestimate the actual returns since they do not incorporate the compounding between the abnormal and the required returns. For example, the actual annual return for SAMs redeemed in 22 years is  $\{1.024\}^{1/22}(1.069) - 1 = 9.9\%$ , as opposed to the 9.8% roughly estimated in the text for simplicity of exposition. The exact equation is derived from the fact that  $(1 + NPV)(1 + R)^T$  is the amount to which the column 5 value can grow to in  $T$  years at market equilibrium or required rates of return  $R$ . Raising that figure to the  $1/T$  power yields the equation for the average annual return of  $(1 + NPV)^{1/T}(1 + R) - 1$ . The column 5 value represents the amount for which the SAMs can, in an efficient market, be sold in the present (given the present value of cash flows expected from them).

their portfolios<sup>1</sup>. While there was some aggregate time-series risk of average returns being limited due to low inflation in the economy or due to average home appreciation below the inflation rate, such risks were not extremely large.

In addition, the time-series risk of inflation being lower than expected could be simply hedged in the UK with short positions on gilts indexed to inflation combined with long positions on unindexed gilts if the SAM investors chose to do so. However, such hedges were likely not made. In particular, inflation and inflationary expectations incorporated into gilt prices were already very low. Moreover, the SAMs provided virtually total protection against nominal losses with their claim on the fixed principal as a minimum, even in the case of an actual decline in home prices (including real ones). Some risk of subpar nominal returns on SAMs that are below the lenders' own financing costs do exist, but that limited risk is mitigated by the securitization of the SAMs, which can easily be sold before the returns (including capital gains upon sale) were ever to fall close to the lenders' own refinancing rates. Thus, there was no actual downside risk to hedge<sup>2</sup>.

The probability of house prices being below the inflation rate over an extended period was also

likely quite low. Even in a country like the US with its substantial tracts of vacant and unused land, real estate prices tend to rise at least with inflation rates over extended periods of time (Shiller, 2005). While a peak in a real estate bubble can be followed by deflated prices for a few years, even this possibility seemed remote in 1997 given 6 years of home price deflation in the early 1990s in the UK that clearly indicated the market was not at a bubble peak (and that would, more likely, lead to home prices bouncing off a bottom and a reversal to positive real house appreciation after 1996). Home price appreciation equal to expected inflation therefore seems to be the minimum rate that is feasible. Even with an assumption of home appreciation equal to the expected inflation/deflation rate, the 0% SAMs would still have provided present values of cash flows (not shown) that ranged between 12.7% and 25.9% over the loan principal and averaged 17.6% over the sample (thereby providing for a sizeable cushion against expected declines in home prices before any required sale of the SAMs to prevent loss to the lenders). Thus, even in an extremely adverse environment for SAM lenders/investors, the SAMs offered sizeable abnormal profits to the lenders/investors (equaling 10-20% per month, or several hundred percent annually, if they were packaged into a pool and sold within 30 days).

On the other hand, the upside potential return on the SAMs to the lenders/investors, and the potential costs to the homeowners, was enormous. Column 7 of Table 2 shows the maximum return to the lender on an individual SAM if the house price rises by 3.09 standard deviations above the mean expected appreciation. Given that return distributions tend to be fat-tailed, the probability of such a high return estimate may be far greater than 0.1%, as the latter figure is based on a potentially unrealistic assumption of normality in housing prices<sup>3</sup>. It was entirely feasible that the SAM investors would earn annualized returns between 17.8% (on the SAMs that prepaid in 22 years) and 211.6% (on the SAMs that prepaid in one year) that represented annualized returns in excess of a thousand percent if sold to other investors quickly. While the lenders should have been well aware of these statistical facts ex-ante, it is very unlikely the SAM borrowers had any idea the cost of that the loans could approach anywhere near such levels.

<sup>1</sup> Appraisal error, for which Sanders and Slawson (2005) observed some evidence, including possibly with respect to one home that was appraised to have appreciated at an annualized rate of 88% three weeks after origination, would add to the volatility that increases option values. Note that such additional value (which can be very significant) has not been included into the model, values, and returns estimated in Tables 1 and 2. Such additional value to the lender would probably more than offset any possible underestimation of the effect of homeowners' incentives to underinvest in their homes, especially since the appraisal error would likely be in the lender's favor given the SAM contract specification that the lender chooses the appraiser. Appraisal bias also would have likely much more than offset any self-selection agency problem hypothesized by Sanders and Slawson (2005), who (without any supporting evidence) asserted that homeowners expecting their houses to appreciate less than others would be the ones more likely to borrow via SAMs (the hypothesis that the SAM homeowners had any expert knowledge or forecasting skill in predicting home prices seems to be discredited by the actual huge appreciation in their homes ex-post, as discussed in section 3.5 subsequently).

<sup>2</sup> For instance, if the lenders/investors decided not to hedge the inflation risk, and if the expected aggregate economic inflation rate fell to zero, the 0% SAMs would still have been worth (not shown) between 68.0% and 86.3% of principal in present value terms over the sample interval (for an average of 74.9%). However, if predicted inflation actually fell to 0%, interest rates on non-indexed gilts would undoubtedly fall, causing the discount rate on the cash flows to the lenders/investors in the SAMs to decline and thus likely keeping the present value of the expected cash flows far above the principal value (thereby permitting sale at a sizeable profit at any time regardless). In particular, in case of actual deflation, interest rates would likely fall close to 0% (as they have been in Japan for the last decade), thus making the principal payments upon redemption of the SAMs scarcely discounted in present value terms. In the latter case, the equilibrium values of the SAMs would probably remain well above their principal amount because the option values of the appreciation rights would continue to have significant value due to the cross-sectional variation in home prices (i.e., even though some SAMs would only be worth their principal value at redemption because of home price declines, others would have redemption values in excess of that amount because at least a few homes would rise in price even within a deflationary environment).

<sup>3</sup> Even aggregated stock market returns don't tend to be normally distributed, and so the probability of extreme returns using an assumption of normality is far less than is really the case (Ho, Burridge, Cadle, and Theobald, 2000). For example, the mere existence of a varying variance can lead to the probability of the column 7 maximum return to rise from 0.1% to 5%, as Murphy (2000b) essentially assumes for diversified security portfolios that would tend to exhibit less kurtosis than individual home prices.

**3.4. Reasons homeowners may have agreed to the SAM terms.** The findings reported in this research make it worthwhile to speculate on why homeowners entered into the SAM contracts. Most importantly, the homeowners were clearly unaware of the risks of the loans to themselves that column 7 of Table 2 has illustrated. Some form/variant of the information in the latter table should have been revealed to them by the lenders prior to signing for real truth in lending.

In addition, homeowners apparently were not informed of even the *expected* cost to themselves of the loans. SAM promotional material typically showed only a 4.5% annual appreciation rate, which, given the objective market forecasted inflation rate listed in Table 1, was even lower than the 2% real rate publicly estimated by one SAM lender.

The promotional materials of the SAM lenders also did not indicate that, even with only a 4.5% annual home appreciation, the annual effective cost of the loans would be higher than for the illustrated case of redemption in 20 years, if the mortgagor(s) died before then. In particular, if the mortgagor(s) died in a year (thereby forcing redemption/prepayment according to the SAM terms), the effective annual cost of the 0% SAMs would have been 13.5% even with only a 4.5% rise in the value of the home. Perhaps not coincidentally, this 13.5% rate almost exactly equals the expected return implied by the publicly cited expected return on the mixed SAM pools if a normal 0.15% servicing fee mentioned in the pool offering circular is taken out (i.e., 13.5% - 0.15% = 13.35% is off by only a possible rounding error of 0.03% from the 13.32% implied rate computed earlier in this research). However, this expected rate of return is 4.8% above the annual cost of 8.7% widely promoted by SAM lenders to homeowners that was only valid in the single unusual scenario cited in much of the promotional materials. That promotional scenario assumed the unlikely case of homeowners living (and not moving) for 20 years as well as property values increasing only 4.5% annually. Given the advanced age of most SAM borrowers, the annual loan cost to the borrowers of only 8.7% quoted in the typical SAM promotional materials was rather unlikely (and extremely deceptive as an illustration)<sup>1</sup>.

Even assuming prepayment probabilities as low as the very conservative PSA rates would indicate approximately a 50% chance of a mortgage redemp-

tion within 15 years (that is actually far less than the probability of death given annual death rates of 6% for the median borrower 5 years after origination). Using this median figure and the 5.4% expected house appreciation at the end of July, 1997, it is possible to compute a more likely annual cost for the 0% SAMs as  $[\{(1.054^{15} - 1)3\} + 1]^{1/15} = 10.7\%$ , which represents a conservative estimate of the median cost of the SAMs. It is unclear why the SAM lenders would choose parameter values that have a very low probability of occurrence and that imply far lower costs, unless of course they were deliberately trying to entice/mislead the homeowners into mortgages, which the lenders most assuredly knew had abnormally high expected returns with little risk to themselves. Since the expected returns cited publicly on the SAM pools implied an expected gross annual return on the SAMs of 13.32% (that is roughly consistent with the 12.7% expected gross annual return that has been estimated in this research), it would seem that such an estimated cost should have been disclosed to homeowners.

Prior to 1997, the UK housing market had just been through a protracted period of actual price deflation, with the average home price falling over the prior 7 years. Most of the homeowners, lacking sufficient financial expertise to even find the inflation-indexed yields in the *Financial Times* (much less make reasonable forecasts of future inflation and home prices), probably were expecting more price declines that would have resulted in a 0% cost to them for the loan. A spokesperson for SAM mortgagors has stated that many homeowners saw the lenders' promotional illustrations and the 4.5% annual rise in home prices as a worst possible case for the borrower (especially those who saw the promotional material illustrating no other possibility)<sup>2</sup>. In any event, in the environment of falling housing prices, most homeowners probably perceived the SAM cost would be far below the widely promoted 8.7% effective rate for the 0% SAMs<sup>3</sup>.

The latter promoted cost was competitive with long-term mortgage rates in the UK that were at or above that cost in the initial four months of 1997 and that

<sup>1</sup> The fact that the lenders' NPV and profit upon the sale of SAMs into pools increased with time to death should possibly also have been disclosed to the homeowners, who had to sign agreements allowing for such sales.

<sup>2</sup> One UK lender even formerly capped the participation in the home appreciation at 5% (Sanders and Slawson, 2005), perhaps reflecting homeowners' widespread expectation of this rate as an attractive worst case. SAM originations collapsed after 1997, however, as mortgage rates fell (thereby making the SAMs with the 5.75% coupon rate especially unappealing) and as the dramatic rise in house prices made homeowners aware of the far worse cases that unfolded for many.

<sup>3</sup> The fact that SAM origination volume dried up once homeowners realized the substantial housing appreciation in 1997 provides more evidence that SAM mortgagors were mistakenly extrapolating past housing appreciation into the future.

averaged (at 8.39%) only slightly less than the 8.7% over the entire year (as shown in column 3 of Table 1). The fact that the annualized rate on the 0% SAMs would most likely be several percent higher than the 8.7% was not explained to the homeowners. Within this “promotional” environment, an allegation seems reasonable that many homeowners had perceived a scenario of an extremely low total interest cost on the SAMs (even 0%) to be the most likely case (although sophisticated analysis indicates the true likelihood of such a scenario was very small). On the other hand, since the possibility of an extreme in the opposite direction (i.e., of costs well above expectations as illustrated in column 7 of Table 2) was not disclosed, homeowners could not possibly have been aware of the risks. It therefore can be concluded that the lenders were quite successful in deceiving the homeowners.

The deception was made easier by the fact that people may be less diligent with respect to analyzing or investigating risks of post-mortem events or cash flows (such as payoffs on SAM redemptions at their own death), which they cannot experience, and over which they may feel they have little control. In addition, at least some homeowners may not have perceived amounts owed upon redemption of the SAMs to be as important or valuable as mortgage payments prior to their own death (i.e., a pound to their heirs might be worth less than a pound to the mortgagors while still living). In the latter case, the lenders may have only defrauded the children or other heirs of the homeowners.

Further contributing to the homeowners’ motivation to sign the SAM contracts was the lack of viable fixed-rate mortgage alternatives in the UK. In particular, most mortgages in the UK are variable-rate in nature, with even the fixed-rate ones listed in column 3 of Table 1 switching to a variable rate after 10 years (although they do have the advantage to the mortgagor of being prepayable). Since UK interest rates had risen to very high double-digit levels in the recent past, many homeowners may have more clearly seen (and experienced) the risks of high costs on the widespread alternatives to SAMs. Without experience or expertise, homeowners naturally relied on lender counseling and examples on SAMs that were misleadingly made to appear competitive with other mortgages and much more attractive than the possibility of eventual double-digit rates on the standard variable-rate loans. The fact that, unlike with variable-rate mortgages, any higher cost to the homeowners resulting from home appreciation in the case of SAMs would also

be simultaneously increasing the net worth of the homeowner was no doubt a very attractive feature<sup>1</sup>.

**3.5. The actual ex-post cost of the UK SAMs.** Data obtained on a survey sample of 0% SAMs indicated that the actual effective cost of SAMs, whose principal had been paid off in full within the first decade after issuance (generally forced due to the death of the mortgagor) averaged 22.48% per annum. This cost is in excess of the average annual return of 12.7% that should have been expected ex-ante but is easily within the feasible range indicated by Table 2. The cause of the deviation from the 12.7% expected value is the large home appreciation that occurred in the UK shortly after the launch of the SAM product. A survey indicated the average annual appreciation on the homes, whose SAM mortgages had been redeemed exceeded 11%<sup>2</sup>.

As previously mentioned, Sanders and Slawson (2005) had already measured the initial returns to one group of SAM loans within 27 months of origination. Annualized returns ranged between 0% and 88%, with an average of 23.21%. These returns are very close to those that would have been expected ex-ante, as implied by column 5 of Table 2 and the analysis in section 3.2. In addition, they all remain within the range implied by column 7 of Table 2, and so the actual annual costs that have been incurred on matured SAMs are not an anomaly or outside the realm of ex-ante feasible predictions.

Assuming more normal appreciation rates in the UK in the future, the annual return on the SAMs that continue to be owed by homeowners will fall<sup>3</sup>. Nevertheless, as section 3.2 indicated a higher NPV to lenders (and greater loss to homeowners) can occur even with a lower computed annual return, and any reduction in homeowner NPV losses from holding

<sup>1</sup> The limited set of mortgage options in the UK made the indivisibility of home ownership represent not only a cost associated with reduced homeowner portfolio diversification (see footnote 1, p. 92) but also with further liquidity problems. In particular, many homeowners (especially more elderly ones on fixed incomes but large home equity) were desperate for current liquidity but were averse to creating the large future liquidity risk caused by variable-rate mortgages that have cash interest payments increase in periods of rising inflation and interest rates. Since SAMs exploited this market well, it should not have been difficult to forecast even higher appreciation on UK homes (and even higher expected returns on SAMs) upon mass offering of the loans (as the implicit costs of home ownership would be reduced, thereby increasing the implicit yield to the homeowner and raising the demand/prices of houses (once again, see footnote 1, p. 92).

<sup>2</sup> The appreciation on the few redeemed 5.75% SAM in pools has actually exceeded 13%, although the total return on the 5.75% SAMs has been less (at 16%) than for the 0% SAMs (due to the lower 100% appreciation share for the 5.75% SAM pools).

<sup>3</sup> The enormous appreciation in the homes underlying the SAMs, with the house values “usually” being asserted to have doubled just a few years after mortgage origination (Sanders and Slawson, 2005), represented a feasible worst case for the SAM borrowers that indicate it might currently be optimal to never voluntarily prepay the mortgages, resulting in the SAMs being redeemed only upon the death of the mortgagor(s).

the SAMs for an extremely long period of time is rather small. In addition, while the large initial appreciation in home prices could not have been anticipated with any certainty by the lenders, while ex-post annualized returns on SAMs maturing in the future might be lower than over the past ten years, and while financial participants providing new products/services (or repackaging existing ones) might deserve some premium return for innovation, the SAMs were clearly mispriced at mortgage origination. In addition, the failure to disclose the median cost, the expected cost, and feasibility of extremely large costs, as well as the fixing of UK SAM prices across lenders and time at rates that exceeded normal market returns for bearing risk, makes accusations of unfair lending practices credible.

## Conclusion

The SAMs offered in the UK in 1997 benefited the lenders/investors enormously to the detriment of the homeowners persuaded to sign up for them. To the sophisticated financial institutions making or investing in the SAM loans, the expected return would have been clearly recognized ex-ante to be extremely high relative to risk to anyone with an understanding of the Black-Scholes (1973) option pricing model. The fact that the annualized loan costs could exceed 100% (and did in some instances) should also have been obvious to the lenders/investors prior to the mortgage originations.

SAMs have extraordinary potential for homeowners and investors. However, the apparently misleading marketing and possible price gouging by the UK lenders may have created an atmosphere of mistrust there that will take a great deal of effort to overcome. Fortunately, the US, which may have more stringent

consumer protection laws and enforcement, does not have the same unfortunate reputation/history to overcome<sup>1</sup>. This research provides a framework for analyzing SAMs and evaluating their pricing that would be useful to lenders, investors, homeowners, and financial advisors in a market that could, if priced fairly, be quite attractive to both long-term investors and mortgagors (as well as short-term).

In addition to representing a beneficial mortgage type for traditional homeowners, SAMs might also present an opportunity for a cheaper solution to mortgage defaults than foreclosure. For instance, although not analyzed in this research, SAMs could potentially be offered to mortgagors in default, thereby permitting them to continue to own and live in their own homes while providing lenders with a less costly method of resolving mortgage payment problems than liquidating the collateral<sup>2</sup>. In particular, SAMs offer the opportunity to lower monthly payments to very low levels in return for lender participation in the home appreciation that could itself be sold in packages/pools to investors, who might be more interested in taking positions on residential real estate than traditional lenders holding defaulting mortgages. The resulting reduction in expected future lender costs associated with mortgage defaults might also very well increase the value of existing mortgages. In a competitive market for mortgage originations, reduced default losses for lenders would eventually lower interest rates on new mortgages, including the traditional ones that offer no home appreciation shares to the lenders. The crisis of mortgagees and the housing market caused by large default rates such as currently exists in the U.S. due to problem subprime loans (Bayer, 2007) might thereby be mitigated.

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<sup>1</sup> Even the problem of dealing with SAM appraisals and home improvements can be addressed with less administrative costs and more motivation to the borrower to make valuable improvements by having all improvements appraised by an independent third party at the redemption of the SAM, as proposed by Freiberg (1982).

<sup>2</sup> Renegotiating loan terms upon mortgage payment default is not uncommon, but it tends to be far more frequent for mortgages insured by the FHA government agency (Dunham, 2007). SAMs provide a potentially useful option in such renegotiations for all lenders.

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