

MBS and ABS Research

Borrower Characteristics and Mobility

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SUMMARY

- We provide a methodology to quantify two important effects on turn-over—the shape of the yield curve at origination and the pre-seasoning of mortgage pools. The methodology is transparent and is based on easily accessible data.
 - We use the method to analyze mobility rates on 1998-1999 origination Conventional 30-year cohorts. We expect these vintages to turn over about 1% CPR higher than historical benchmarks for two reasons; the migration of short horizon borrowers into 30-year mortgages due to a flat yield curve and the high refinance share of origination.
 - The valuation impact of these effects is worth an incremental 28-33 OAS on discount POs backed by these cohorts; or a $^{31/32} - ^{36/32}$ price impact on a constant OAS basis.
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BORROWER CHARACTERISTICS AND MOBILITY

I. INTRODUCTION

With par-coupon yields in the 7.40s, discounts dominate the mortgage index. Much of the discount universe was produced in 1998 and the first half of 1999; periods of high refinancing activity. As indicated in Figure 1, unseasoned (WALA < 30 months) discounts account for about half the 30-year fixed rate conventional sector; unusually high for this decade. With unseasoned discounts constituting such a large proportion of the mortgage universe, extension risk is the concern *du jour*.

Good turnover estimates are the key to gauging extension risk. In Figure 2, we show that if the long-term (weighted average life method) turnover on FHLMC 1998 production 6.5s is 1% CPR higher than model projections, the OAS increases by 10 bp. The effect is amplified for mortgage derivatives. The 1% CPR higher turnover would reduce the IO OASs on the same collateral by 82 bp.

Figure 1. Unseasoned Discounts are Currently a Large Proportion of Conventional 30-year Collateral

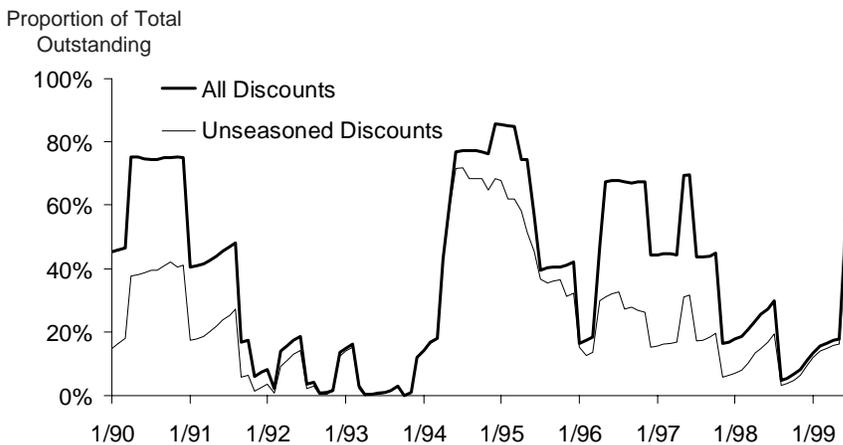


Figure 2. Turnover Sensitivity: Fixed Rate Collateral*

1998 Production	Coupon	WALA	Price	OAS	Price Impact of 15 PSA Shift (¹ / ₃₂)	OAS Sensitivity of 15 PSA Shift (bp)
30-year (TBA)	6.50	13	93-23	89	13	10
PO FHT-194	6.50	17	62-03	68	56	56
IO FHT-202	6.50	17	32-10	117	-39	-82

*Prices as of September 2 and current coupon yield 7.42%.

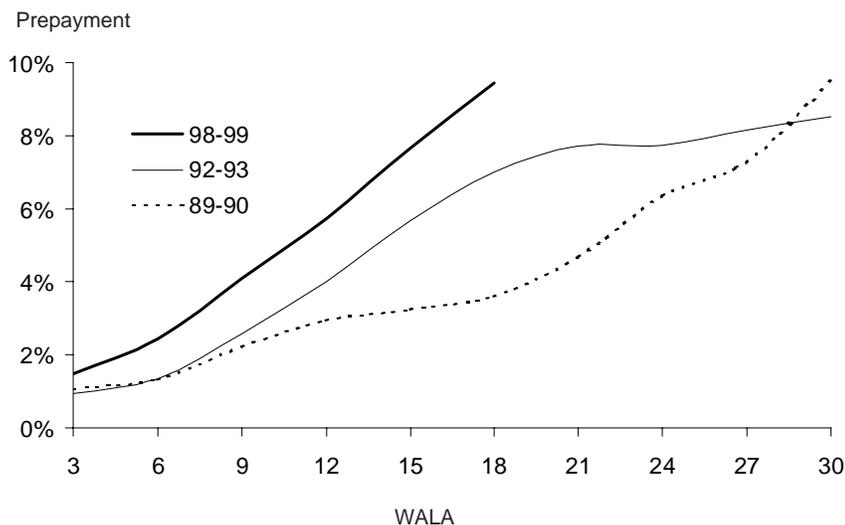
Do we observe seasoning differences of this magnitude across vintages? Certainly. Figure 3 shows the seasoning profile of several cohorts. In particular, the 1998-99 origination cohorts are at least 2% CPR higher at each point on the seasoning curve than 1992-1993 originations. A part of this variation is due to differences in economic conditions; the 1998 cohorts are seasoning in a particularly robust housing market. A substantial part of the prepayment difference will persist even if economic activity subsides, however, because it reflects differences in the mobility of borrowers underlying the two cohorts. Specifically, the flat yield-curve environment in 1998 encouraged some short horizon (and high mobility) borrowers to choose 30-year mortgages in preference to ARMs and balloons. The 1998 originations will turn over faster until these borrowers leave the mortgage pools due to higher attrition.

In this piece we provide a method to quantify the impact of two significant effects on turnover; the shape of the yield curve at origination and the pre-seasoning¹ of cohorts. The methodology is transparent and is based on easily accessible data.

The study is organized in the following four sections. Section II contains a simple framework to link borrower mortgage selection to the expected mobility rates on different mortgage products; the issuance mix of difference

¹ Pre-seasoning refers to the time the borrower has spent in the current home. More details in the paragraphs to follow.

Figure 3. **Observed Seasoning Differences for Different 30-year Conventional Vintages**



mortgages being the key data. In Section III, we enrich the analysis by considering the impact of affordability and refinance share of originations on mortgage choice. In Section IV, we apply the methodology developed to show that a large part of the observed seasoning difference between the 1992-1993 and the 1998-1999 vintages can be attributed to the differences in the mortgage mix originated in the two periods. We conclude in section IV by highlighting relative value in 1998 and 1999 origination discount POs.

II. BORROWER HORIZON, CHOICE OF MORTGAGE CONTRACT AND TURNOVER RATES

A mortgage borrower is presented with several rate/term mortgage combinations. At one extreme is a 30-year fixed rate mortgage; at the other a 1-year ARM where the rate is fixed only for a year. Borrowers will base their choice of mortgage product on their expected horizon (or expected duration of stay) in the house, the uncertainty in that horizon and the relative mortgage rates corresponding to different contracts. Given a term structure of mortgage rates, the maturity mix of mortgage originations will reflect the distribution of borrower horizons and risk aversion.

If the term structure changes, so will the maturity mix. For instance, if the term structure steepens, some short-horizon borrowers will no longer be willing to pay the higher rate for longer maturity mortgages and will migrate to shorter maturity contracts. A flattening of the yield curve would have the opposite effect. Since shorter horizon borrowers will turn over quicker, this migration pattern will affect the turnover rates of the various mortgage products created. The example below shows how we use changes in the origination product mix to anticipate changes in turnover rates.

Mortgage Mix and Average Mobility—A Simple Example

In this simple world, the population consists of three types of borrowers – with average horizons 15 years, 8 years and 4 years. The average turnover rates are 5% CPR, 9% CPR and 18% CPR, respectively.² Fully amortizing 30-year and 15-year mortgages as well as 7-year balloons are the available contracts. The borrowers face no credit constraints, i.e., they can qualify for any mortgage contract. As discussed above, these borrowers will arrange themselves into different maturity contracts based on their risk aversion and the mortgage term structure. Suppose the average product mix, reflecting the typical mortgage term structure, is 60%, 25% and 15%. In this allocation, all 15-year type borrowers choose 30-year mortgages, all 8-year borrowers choose 15-year mortgages and all 4-year borrowers choose balloons (see Figure 4).

² The numbers are for illustration only. These prepayment rates ensure that half the mortgage pool will prepay by the expected life of the borrower. For instance half the 30-year average horizon borrowers will prepay by the fifteenth year.

Suppose further that in a particular year the mortgage term structure is flatter, biasing the allocation towards the 30-year sector. By comparing this product mix to the average mix, we can infer the average horizon and turnover rate for each product type. The borrower migration from balloons to 15-year and from 15-year to 30-year increases the average mobility of borrowers underlying 15-year and 30-year mortgages. For instance, compared to the average, the 30-year cohorts in this environment have about a 1% CPR higher turnover rate. (See Figure 4 for computational details).

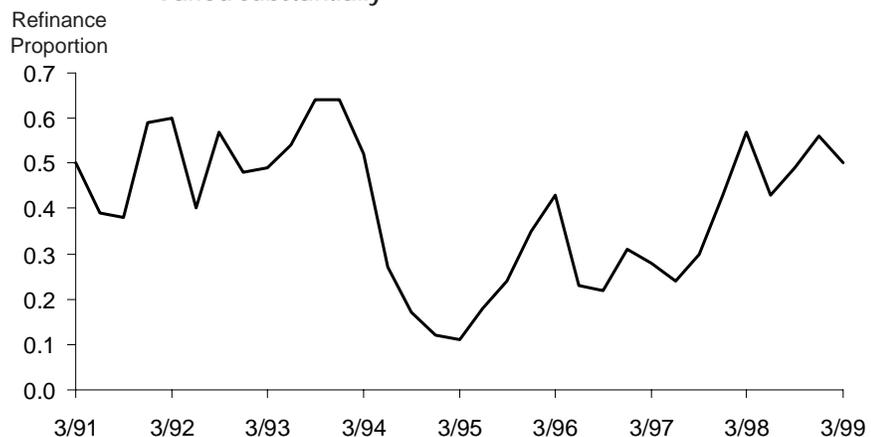
Limitations of the Simple Methodology

Two issues complicate the link between the origination product mix and turnover rates. First, borrower horizon distribution changes over time because of variations in the refinance share of originations (see Figure 5).

Figure 4. Inferring Average Mobility from the Mortgage Origination Mix

	Mortgagor Tenure		
	7-year	15-year	30-year
Origination Mix			
Average	15%	25%	60%
Flat Yield Curve	5	20	75
'Migration'	10	15	(15)
	(to 15-year)	(to 30-year)	
Horizon			
Average	4 years	8 years	15 years
Flat Yield Curve	4	6	13.6
		$(\frac{1}{2} * 4) + (\frac{1}{2} * 8)$	$(\frac{1}{5} * 8) + (\frac{4}{5} * 15)$
Mobility			
Average	18% CPR	9% CPR	5% CPR
Flat Yield Curve	18	13.5	5.8
		$(\frac{1}{2} * 18) + (\frac{1}{2} * 9)$	$(\frac{1}{5} * 9) + (\frac{4}{5} * 5)$

Figure 5. The Refinance Proportion of Conventional Issuance Has Varied Substantially



Source: FHMLC

Since refinance borrowers have been in their homes longer than purchase borrowers, their mobility will reflect this pre-seasoning.

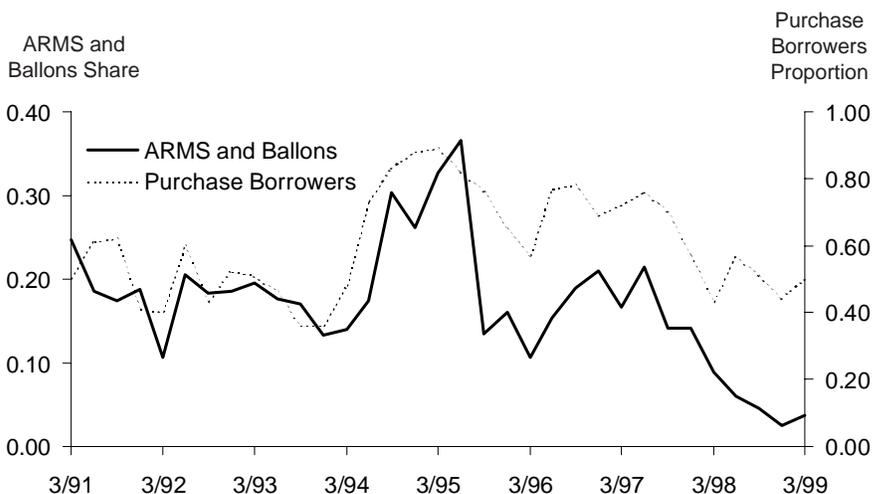
Second, borrower mortgage choice reflects concerns other than time horizon. In Figure 6 we show the positive correlation between the ARM and balloon issuance percentage and the proportion of purchase borrowers in the issuance population. This is an unlikely outcome in an unconstrained borrower world—purchase borrowers should have *longer* horizons than the average borrower. The positive correlation indicates purchase borrowers, who are more credit constrained than refinance borrowers, often choose ARMs for the low initial teaser rates.³ This breaks the convenient one-to-one relationship between the mortgage term structure and origination mix and therefore mobility. For example, ARMs/balloon origination could increase even if the curve steepens, if the purchase share of production increases simultaneously. In the methodology described below, we make adjustments for both effects when computing the average mobility of borrowers underlying 30-year mortgages.

II. A METHODOLOGY

First, we estimate the average seasoning profile for the different product groups for the period under study, January 1991 to June 1998. We then

³ Loan level data indicates that purchase borrowers have higher LTVs than refinance borrowers.

Figure 6. ARM/Balloon Issuance Percentage Moves with Purchase Share of Conventional Issuance



Source: FHLMC & Lehman Brothers

determine the product seasoning profiles for any particular origination year in two steps. First, we alter the average seasoning profile to account for borrower migration across product types in that year. To estimate borrower migration, we compare the adjusted product mix in that year to the average mix; the adjustment accounting for the easier affordability of short-maturity mortgages. Second, we advance the altered seasoning curve from step one by the estimated monthly pre-seasoning difference for the origination year relative to the sample average.⁴ The steps are explained below. In the next section we compute the seasoning profile for 1993 and 1998 production to illustrate the methodology.

Average Seasoning Profile

Figures 7a-c contain the seasoning curves for each product type, estimated over the period January 1990 to June 1999. The estimates are based on weighted par-coupon prepayments.

Adjustment for Changing Purchase Proportion

In Figure 8, we list the annual issuance proportions of different mortgage maturities. The ARM category includes ARMs, hybrids and balloons. Similarly, the 15-year category includes 30-year mortgages, which turn over similar to 15-year pools. We also list the median 30- to 15-year and 30- to

⁴ If the pre-seasoning for the year is less than the sample average, we recede the seasoning profile.

Figure 7a. 30-year Average Seasoning Curve*

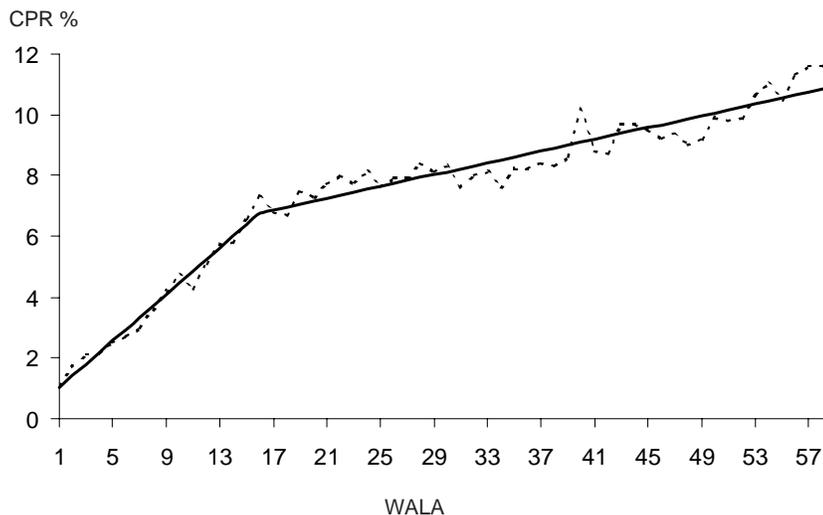


Figure 7b. 15-year Average Seasoning Curve*

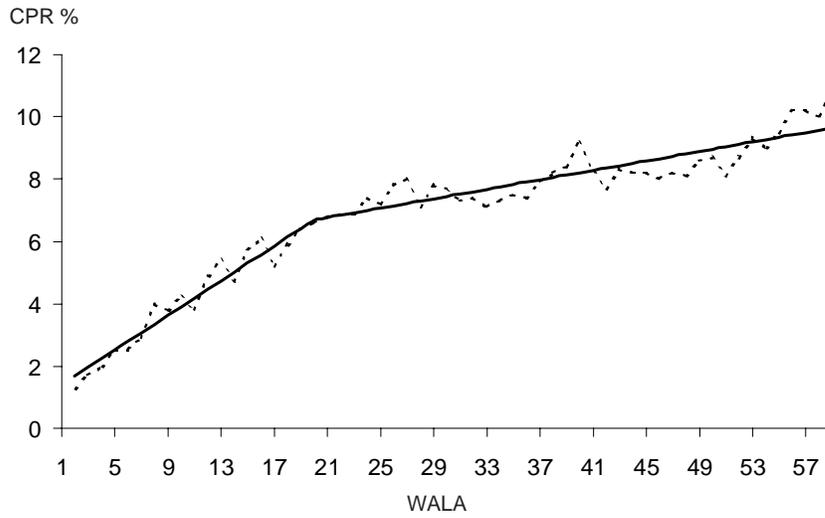
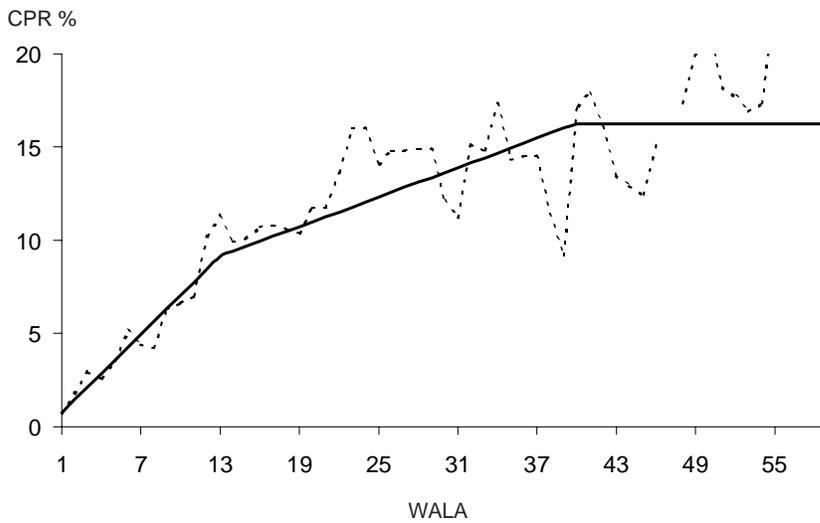


Figure 7c. ARM and Balloon Average Seasoning Curve*



*Estimated over the period January 1991-July 1999, using prepayments on cohorts with WAC 0-50 bp below the prevailing mortgage rate

1-year ARM rate spreads for the relevant periods. These were computed for each quarter and then weighted by the issuance pattern within the year.

The issuance patterns respond to the term structure of mortgage rates. For instance the yield curve was flatter in 1998 than in 1993. This shows up in the much lower proportion of ARM issuance. However, as mentioned earlier, there are confounding influences. The ARM issuance was higher in 1995 than in 1993, despite a flatter yield curve, probably due to the unusually high proportion of purchase borrowers in 1995 (75% vs 41% in 1993).

To account for the changing proportion of purchase borrowers, we estimated (using quarterly data) the sensitivity of ARM issuance to the rate spreads as well as the proportion of purchase borrowers. We then adjusted the actual ARM issuance proportion in any year for the changing purchase proportion. Figure 9 shows the adjusted short-maturity issuance. For each quarter, the amount adjusted from the ARM and balloon share, whether positive or negative, was added to the 15-year and 30-year proportions. The allocation ratio matched the relative shares of these sectors in refinancings from ARMs and balloons (as reported in the FHLMC refinance transition matrix).⁵ Figure 10, which contains the adjusted numbers, represents the pure yield curve impact on mortgage choice.

⁵ The assumption here is that the refinance and purchase borrowers make the same choices while migrating. This is almost certainly not true. For instance, purchase borrowers are likely to be more credit constrained. This means that more ARM purchase borrowers would have migrated to the 30-year mortgages than to 15-year compared to ARM refinancers. The assumption will overstate the migration of ARM borrowers to the 15-year sector.

Figure 8. **Conventional Maturity Mix Responds to Mortgage Term Structure**

Year	ARMs & Balloons	Issuance Proportions (%)			Median Spread from 30-year Mortgage Rate (bp)		Pre-Seasoning
		15-year	30-year	Purchase Share	1-year ARM	15-year	
1991	19%	17%	64%	54%	221 bp	23 bp	11 months
1992	17	31	51	50	263	37	13
1993	16	31	53	41	292	39	14
1994	19	22	59	66	289	39	9
1995	22	15	63	75	177	38	5
1996	16	19	65	70	181	41	6
1997	16	17	67	68	182	38	7
1998	5	22	73	49	100	28	13
1999	4	27	69	50	56	33	14
Average	16	22	63	58	196	35	10

Source: Mortgage Bankers Association, FHLMC and Lehman Brothers.

Notice that the 1998 ARM and balloon share is adjusted upwards from 5% to 8%. Without this adjustment, we would have attributed the entire 11 point reduction (16%-5%, see Figure 8) in short maturity issuance to yield curve effects. We estimate that about 3 points of this reduction is due to the decline in purchase proportion from an average 58% to 49%; only the balance 5 points of shift have implications for borrower mobility.

Adjustment for Pre-seasoning

In the last column of Figure 8, we show the estimated pre-seasoning of the borrower population in each year.⁶ We assume that refinance borrowers have shorter horizons than purchase borrowers; the extent of shortening is

⁶ The computation details are available from the authors on request.

Figure 9. Conventional Short-Maturity Issuance Adjusted for Affordability

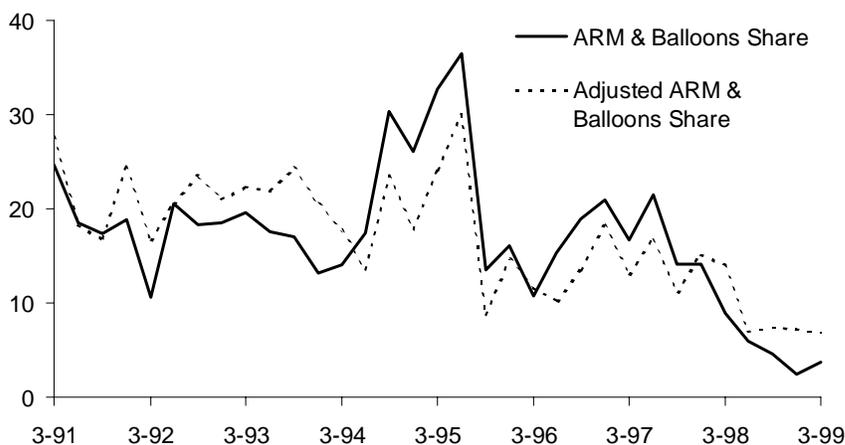


Figure 10. Adjusted Issuance of Single Family Conventional Mortgage

Year	Adjusted Issuance Share (%)			Pre-Seasoning (months)		
	ARMs & Balloons	15-year	30-year	15-year	30-year	All Mortgages
1991	21	16	63	15 months	9 months	11 months
1992	21	30	50	16	9	13
1993	22	29	49	17	11	14
1994	18	22	60	13	6	9
1995	17	16	67	6	4	5
1996	13	20	67	7	4	6
1997	14	18	68	9	5	7
1998	8	21	70	19	11	13
1999	7	26	67	18	11	14
Average	16	22	62	13	8	10

proxied by the length of stay in the current home, or pre-seasoning. Purchase borrowers have zero pre-seasoning, by definition. Borrowers who refinance more than ten quarters after origination are all considered thirty months seasoned. In general, the higher the refinance percentage, the greater the pre-seasoning of a cohort.

The computed number in Figure 8 reflects the average pre-seasoning for the entire borrower population. However, the average seasoning will differ across mortgage products because of differences in the refinance share of origination. For instance, larger proportions of 30-year borrowers refinance into 15-year mortgages than vice-versa. This makes the refinance proportion of 15-year issuance larger than that for 30-year pools. Using the FHLMC refinance transition matrix, the estimated dollar volume of refinancing and gross issuance by mortgage maturity, we computed the refinance proportion for each mortgage product. We used these estimates to compute the pre-seasoning by mortgage product. The last three columns of Figure 10 summarize the results. The pre-seasoning for the 15-year sector is higher than the 30-year sector since refinancers form a larger part of its issuance.

III. AN APPLICATION OF THE METHODOLOGY— COMPARING THE PROJECTED SEASONING PROFILES FOR 1993 VS 1998 ORIGINATION 30-YEAR PRODUCT

First, we estimate borrower migration across product types in any particular year by comparing the issuance pattern in that year to the average pattern (from Figure 10) and use the migration pattern to compute the borrower mix underlying the 30-year product. We then compute a preliminary 30-year seasoning profile for each year as a weighted average of the 30-year, 15-year and ARM/balloon seasoning profiles shown in Figure 7; the weights based on the borrower migration pattern estimated above. Finally, we advance the preliminary seasoning curve for each year by the estimated monthly pre-seasoning difference for that origination year relative to the sample average. The details are provided below.

Borrower Migration

In the top panel of Figure 11, we report the deviations from the average issuance pattern for origination years 1993 and 1998. The data clearly shows the yield curve impact on product selection. In the flat yield curve environment of 1993, the adjusted ARM issuance was 6% above the historical mean, while in 1998 it was 8% below.

To determine where these ARM borrowers went, we used the FHLMC refinance transition matrix for the relevant years. The matrices are reproduced in Figure 12. In a typical yield curve environment the ARM proportion would have been 16% (the average over the 1990s). In 1998, this dropped to 8%, with 8% of potential ARM borrowers migrating to longer-maturity

contracts. We allocated the ARM migration between the 15-year and the 30-year product in a 66:31 ratio, mirroring the pattern of ARM refinancing in that year (Figure 12). 1993 saw the opposite pattern.

Pre-seasoning Adjustment

Last, we adjusted the turnover profiles for pre-seasoning. Specifically we advanced both the 1993 and 1998 turnover curves by three months, respectively, reflecting the difference between the cohort-specific and average pre-seasoning (see Figure 10, last columns). In this specific instance, both years, being high refinance periods, had a high pre-seasoning relative to an average year.

Figure 11. Mortgage Choice and Borrower Transition in the Conventional Sector

Adjusted Issuance Proportions (%)			
	ARMs & Balloons	15-year	30-year
Average	16%	22%	62%
Variation From Historical Average			
1993	+6 pts	+7 pts	-13 pts
1998	-8	-1	+8
Borrower Migration			
From	To		
	ARMs & Balloons	15-year	30-year
1993			
ARMs & Balloons	0 pts	0pts	0 pts
15-year	3	0	0
30-year	3	10	0
1998			
ARMs & Balloons	0	2	5
15-year	0	0	3
30-year	0	0	0

Figure 12. FHMLC Refinance Matrix, %

Original Product	New Product		
	SFFR-30	SFFR-15 + SFFR-20	ARM + Balloons
1993			
SFFR-30	52	36	12
SFFR-15	8	84	9
ARMs	40	17	44
1998			
SFFR-30	63	37	0
SFFR-15	21	78	0
ARMs	66	31	3

Source: FHMLC.

The Final Seasoning Profiles

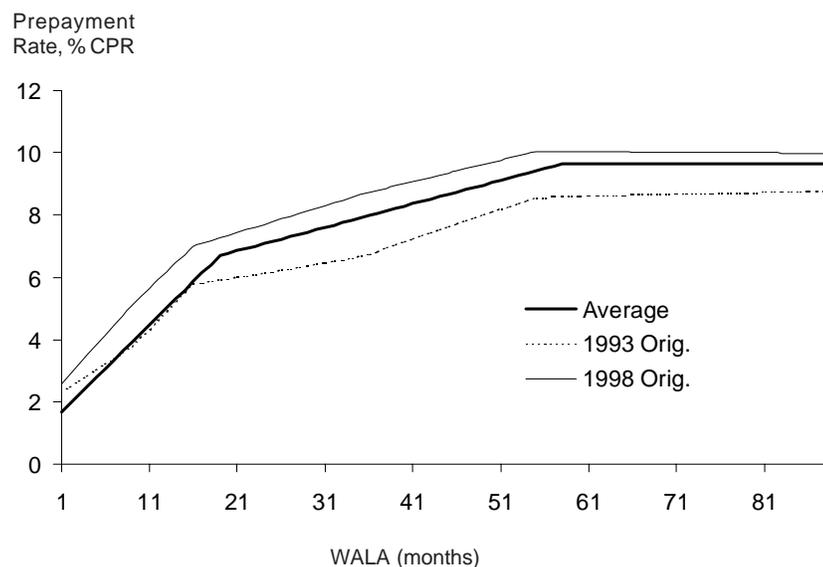
Figure 13 contains the computed seasoning profiles for the 1993 and 1998 vintages. For reference, the average 30-year seasoning profile is also included. The seasoning ramp for both vintages begins in the above the average ramp because of a higher pre-seasoning. The 1993 vintage profile dips below the average curve after at about 17 WALA, as the impact of the borrower mix (the 1993 vintage has a smaller proportion of high mobility borrowers than the average cohort) overwhelms the pre-seasoning effect. The 1998 vintage ramp is consistently above the average ramp as the pre-seasoning and borrower mix work in the same direction; increasing mobility relative to the average. There is a slow reversion to the mean for both vintages as their borrower mix converges to the average.

The predicted difference between the seasoning profiles for the 1993 and 1998 vintages is similar to the observed differences in Figure 3; the long-term prepayment rate for the 1998 vintages is higher by 1.3% CPR.

IV. VALUATION IMPACT

Our production prepayment model does not account for yield curve and pre-seasoning effects. To quantify their impact on new vintages, we adjusted the

Figure 13. Projected Seasoning Profiles for Conventional 30-year Product, 1993 versus 1998 Origination



seasoning profiles for 1998 and 1999 (first two quarters) vintages using the above methodology. Figure 14 contains the impact on POs backed by these borrower cohorts. PO OASs increase by $2^8/36$ bp. The impact is the greater for 1999 vintages—the 1998 cohorts have higher WAL and have already benefited partly from the higher turnover. At constant OAS, the higher mobility is worth $3^1/32$ and $3^6/32$ on the 1998 and 1999 vintage POs, respectively.

Figure 14. Valuation Impact of High Mobility on Discount POs*

Security	Collateral Characteristics			Valuation			Change in Valuation**	
	Coupon	WALA	WAC	Price	OAS	OAD	OAS	OAD
FHT-203	6.5	5	7.02	61-04	15	12.4	+36	-0.4
FHT-194	6.5	18	7.08	63-10	33	11.2	+28	-0.3

*Prices as of September 2 and current coupon yield 7.42%.

** Changes reflect impact of the line adjusted seasoning profile.



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