ASSESSING THE COSTS AND BENEFITS OF ACCELERATED PAYMENT MORTGAGES

Calculation of the costs vs. the benefits of accelerated payment mortgages shows that APMs are not always advantageous to home buyers.

by Wynn P. Betty and Douglas Timmons

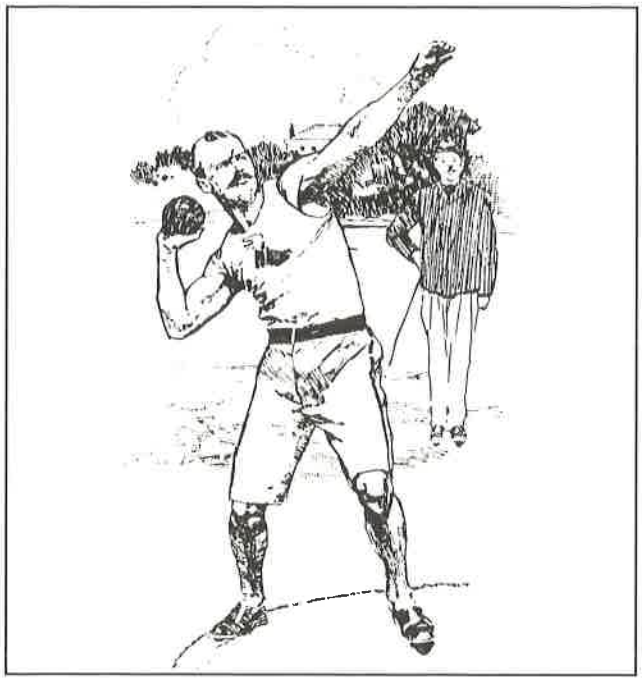
During the past few years, many mortgage lenders have advertised the virtues of accelerated payment mortgages (APMs), particularly 15-year or biweekly payment plans. Lenders suggest that, by paying more each month or by making payments more frequently, the home buyer will own his home quicker and save tens or hundreds of thousands of dollars in interest payments.

While it is true that APM plans do expedite equity buildup in one's home and lower total interest costs over the life of the loan, the financial advantages of these plans versus those of the traditional 30-year mortgage are not as clear-cut as suggested. Although total interest payments are reduced, APMs may actually require larger monthly payments, thereby reducing a home buyer's total net worth and eliminating the opportunity to invest in other assets. The overall potential effect of an APM plan on a borrower's net worth depends significantly on:

1. the borrower's tax rate;
2. differences in interest rates attached to the mortgages;
3. differences in up-front costs (e.g., points and closing costs);
4. the length of time the mortgage is held;
5. the return that may be earned on funds invested elsewhere.

In assessing APMs, all of the above factors must be evaluated by real estate counselors before making recommendations. Evaluation is possible if the following information is provided:

1. the size and frequency of payments on the financing alternatives under consideration;
2. the expected lives of the mortgage loans;



3. total annual payments of the mortgage loans;
4. expected changes in the outstanding loan balances each year;
5. year-end remaining balances projected for the loans.

In addition, estimates are required of the borrower's marginal income tax rate and the after-tax return that may be earned on alternative investments. With this added information, the relative advantages or disadvantages of APMs can be projected.

Costs And Benefits

It should be remembered that, by making higher mortgage payments, the APM borrower is electing to invest in

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a home rather than in alternative investments. The benefit to the borrower is a more rapid paydown of the mortgage debt with a corresponding increase in equity in the home. The cost attached to APMs reflects the lost opportunity to invest in other investments amounts equal to the additional payments APMs require.

Measurement Of Costs And Benefits

The opportunity cost attached to any mortgage may be viewed as the value of an investment fund that would have accumulated had the money earmarked for the mortgage payments been invested in an alternative investment of similar or lesser risk. In attempting to measure such costs, since mortgage payments may be biweekly or monthly, it is convenient to standardize payments as equivalent annualized amounts. The opportunity cost, defined in this manner, can be determined if the following information is provided:

q = the number of mortgage payments made in a year

a = the size of the periodic payment

OPR = the after-tax opportunity rate that may be earned on an alternative investment

To calculate the equivalent annual annuity opportunity cost (r), OPR must be adjusted to reflect the compounding period (payment period) of the mortgage using the following relationship:

$$r = [\sqrt[q]{OPR + 1}\,] - 1$$

Once r is determined, the payment amount associated with each mortgage can be compounded forward for q periods to determine the equivalent annual opportunity cost. In mathematical form, the calculation is as follows:

$$A = a\left[\frac{(1 + r)^q - 1}{r}\right]$$

where:

A = equivalent annuity,

a = size of the periodic mortgage payment

The annuity amount for the APM may be compared to that of other mortgages to define the equal annual annuity opportunity cost difference.

The difference in annual annuity opportunity cost for the APM and any reference mortgage also must be adjusted to reflect differences in tax savings. Interest expenses are tax deductible, and since APM plans lower interest expenses, they also reduce tax savings. To recognize the opportunity cost of tax savings, the annual tax deduction for each mortgage may be viewed as:

$$D = \text{total annual payments} - \left[\text{change in outstanding loan balance during the year}\right]\left[T\right]$$

where:

T = the borrower's tax rate

Because greater tax savings tend to accrue from longer term, fixed rate mortgages than from APMs, the difference in tax savings between the two mortgages, in general, must be added each year as an additional annual cost. Finally, any up-front costs attached to the mortgages must be identified, and any difference must be viewed as an added cost or benefit of the APM.

Once the relative opportunity costs of APMs have been defined as equivalent annual annuities or as single amounts, they may be compounded forward to measure the cumulative cost of an APM over its life. For purposes of discussion, the following definitions are provided:

$A\text{-}A_b$ = the difference in equal annual annuity cost of the APM and the alternative mortgage being considered (an annual annuity cost difference)

$D_b\text{-}D$ = the annual difference in tax savings on the alternative mortgage in comparison to the savings on the APM (calculated for each year during the life of the APM).

UC = the up-front cost difference between the APM and the alternative mortgage (incurred initially)

The projected cumulative opportunity cost of the APM in year "t" is the compound value of the three sets of costs. Since these costs are defined as annual amounts or as equivalent annual amounts, compounding is on a per annum basis at the OPR rate.

In year "t" the projected opportunity cost of $A - A_b$ is the future value of an annuity compounded at the OPR rate for $t - 1$ years. Each year's tax saving difference ($D_b - D$) must be compounded forward as a single amount from the year of the tax difference until year t is reached. Finally, the compound value of any additional up-front costs (UC) for t years is added. For purposes of further discussion, this cumulative cost in year t is denoted as C_t.

The relative benefit of the APM is easily measured as the difference in the outstanding loan balance on the APM in comparison to the reference mortgage. Accordingly:

$$B_t = OLB_b - OLB$$

where:

B_t = the benefit in year t

OLB_b = the outstanding loan balance on the reference mortgage at the end of year t

OLB = the outstanding loan balance on the APM at the end of year t

The cumulative benefit at the end of the life of the APM (B_L) is equal to the remaining balance on the reference mortgage at maturity of the APM. This amount also includes the increase in the borrower's net worth that results from selecting the APM rather than the reference mortgage. This benefit must be compared with the cumulative opportunity cost over the life of the APM (C_L) in order to define the net cost or benefit of the APM over its life.

TABLE 1

Calculation of the Costs/Benefits of Alternative Mortgage Instruments

Cost/Benefit	Mortgage A (30-Year Mortgage Monthly Payment $100,000 Amount 11% Rate per Annum)	Mortgage B (15-Year Mortgage Monthly Payment $100,000 Amount 11% Rate per Annum)	Mortgage C (Biweekly Mortgage Biweekly Payment $100,000 Amount Payment Equal to 1/2 Monthly Payment on 30-Year Mortgage)
Payment amount	$ 952.32	$ 1,136.60	$ 476.16
Total annual payment	11,427.84	13,639.20	12,380.16
Difference in annual payment compared to 30-year mortgage	0	2,211.36	952.32
Total payment over life	342,835.20	204,588.00	247,603.20
Total interest over life	242,835.20	104,588.00	147,603.20
Difference in payment over life	0	138,247.20	95,232.00
Remaining balance on 30-year mortgage at maturity of APM	0	83,786.96	69,133.93

Illustration-Cumulative Costs And Benefits

For purposes of illustration, costs and benefits have been calculated for three mortgages (see Table 1). In making these calculations, it has been assumed that the borrower's tax rate (T) is 28% and the OPR earned on other investments is 7%. It has further been assumed that a fixed rate mortgage (mortgage A) has $2,000 more in up-front costs than an APM of 15 years (mortgage B) and a biweekly APM (mortgage C). Tables 2 and 3 present the resulting costs and benefits projected for APMs B and C under these conditions.

TABLE 2

Relative Cost and Benefit for Mortgage B (15-Year Plan)

Time (Years)	Cumulative Cost (C_t)	Benefit (B_t)	Net Benefit
1	$ 173.55	$ 2,326.25	$ 2,152.69
2	2,574.62	4,921.68	2,347.06
3	5,227.87	7,817.46	2,589.59
4	8,160.66	11,048.33	2,887.67
5	11,403.44	14,653.08	3,249.64
6	14,990.01	18,674.96	3,684.95
7	18,957.96	23,162.25	4,204.30
8	23,349.05	28,168.81	4,819.76
9	28,209.74	33,754.71	5,544.97
10	33,591.67	39,987.01	6,395.35
11	39,552.27	46,940.51	7,388.25
12	46,155.41	54,698.66	8,543.25
13	53,472.14	63,354.57	9,882.43
14	61,581.51	73,012.13	11,430.62
15	70,571.46	83,787.26	13,215.80

Interpretation

Under the assumptions made, a continuous and growing advantage exists for mortgages B and C (the APMs) in comparison to mortgage A (the 30-year mortgage). Mortgage B (the 15-year mortgage) has a net benefit of $13,215.80 after 15 years, and the borrower's equity is greater by this amount because the 30-year loan has an

TABLE 3

Relative Cost and Benefit for Mortgage C (Biweekly Plan)*

Time (Years)	Cumulative Cost (C_t)	Benefit (B_t)	Net Benefit
1	$ (1,123.16)	$ 1,005.60	$ 2,128.76
2	(152.24)	2,128.01	2,280.25
3	923.15	3,380.78	2,457.63
4	2,114.56	4,779.07	2,664.51
5	3,434.85	6,339.78	2,904.93
6	4,898.32	8,081.77	3,183.45
7	6,520.88	10,026.10	3,505.22
8	8,320.26	12,196.26	3,876.00
9	10,316.17	14,618.50	4,302.33
10	12,530.58	17,322.09	4,791.51
11	14,987.92	20,339.70	5,351.78
12	17,715.42	23,707.83	5,992.41
13	20,743.38	27,467.16	6,723.78
14	24,105.57	31,663.16	7,557.59
15	27,839.57	36,346.54	8,506.96
16	31,987.28	41,573.90	9,586.62
17	36,595.32	47,408.43	10,813.11
18	41,715.69	53,920.66	12,204.97
19	47,406.28	61,189.30	13,783.02
20	53,731.60	69,302.21	15,570.61

*Bi-weekly mortgage is paid off in 19.9864 years

TABLE 4

Net Benefit—Sensitivity Analysis
($2,000 Up-Front Costs
on 30-Year Fixed-Rate Mortgage)

Mortgage Maturity*				Net Benefit	
Mortgage Rate	Tax Rate	Investment Rate	15-Year Plan/ Biweekly	15-Year Plan	Biweekly Plan
9%	15%	7%	15/21.9164 yrs.	$ 11,283	$ 14,341
9	28	7		4,051	6,684
9	33	7		1,270	3,740
9	15	11		(11,944)	(6,732)
9	28	11		(20,618)	(16,895)
9	33	11		(23,954)	(20,804)
9	15	13		(26,771)	(21,469)
9	28	13		(36,308)	(33,308)
9	33	13		(39,978)	(37,861)
11	15	7	15/19.9864 yrs.	21,926	25,041
11	28	7		13,216	15,571
11	33	7		9,866	11,928
11	15	11		1,532	5,369
11	28	11		(8,852)	(6,707)
11	33	11		(12,845)	(11,352)
11	15	13		(11,422)	(8,016)
11	28	13		(22,806)	(21,770)
11	33	13		(27,184)	(27,059)
13	15	7	15/18.0709 yrs.	31,914	34,345
13	28	7		21,899	23,678
13	33	7		18,048	19,576
13	15	11		14,399	17,125
13	28	11		2,535	4,010
13	33	11		(2,028)	(1,034)
13	15	13		(3,346)	(5,779)
13	28	13		(9,619)	(8,857)
13	33	13		(14,606)	(14,486)

* Net benefit figures for biweekly mortgages are based upon year-end figures closest to actual maturity date.

TABLE 5

Net Benefit—Sensitivity Analysis
(No Up-Front Costs Differential)

Mortgage Maturity*				Net Benefit	
Mortgage Rate	Tax Rate	Investment Rate	15-Year Plan/ Biweekly	15-Year Plan	Biweekly Plan
9%	15%	7%	15/21.9164 yrs.	$ 5,765	$ 5,480
9	28	7		(1,466)	(2,176)
9	33	7		(4,248)	(5,121)
9	15	11		(21,514)	(26,599)
9	28	11		(30,187)	(36,763)
9	33	11		(33,523)	(40,671)
9	15	13		(39,280)	(50,897)
9	28	13		(48,819)	(62,736)
9	33	13		(52,487)	(67,289)
11	15	7	15/19.9864 yrs.	16,909	17,301
11	28	7		7,698	7,832
11	33	7		4,347	4,189
11	15	11		8,037	(10,755)
11	28	11		(18,421)	(22,832)
11	33	11		(22,415)	(27,477)
11	15	13		(23,931)	(31,062)
11	28	13		(35,315)	(44,816)
11	33	13		(39,693)	(50,106)
13	15	7	15/18.0709 yrs.	26,395	27,585
13	28	7		16,381	16,918
13	33	7		12,530	12,817
13	15	11		4,830	4,037
13	28	11		(7,034)	(9,137)
13	33	11		(11,596)	(14,121)
13	15	13		(9,162)	(12,269)
13	28	13		(22,128)	(26,906)
13	33	13		(27,114)	(32,535)

* Net benefit figures for biweekly mortgages are based upon year-end figures closest to actual maturity date.

outstanding balance of $83,786.96, but the opportunity cost of the accelerated mortgage is $70,571.46. Mortgage C (the biweekly mortgage) also shows a positive net benefit.

The advantages suggested in Tables 2 and 3 are a result of the combined effects of the borrower's tax rate, the OPR assumed, differences in up-front costs, differences in interest rates on the mortgages and the length of time the mortgage is held. If changes in these variables are assumed, the net benefit may be increased or decreased or made to disappear entirely.

Sensitivity Analysis

The net benefits of APMs versus a 30-year mortgage have been calculated over a range of mortgage contract rates, marginal tax rates and investment opportunity rates. Specifically, all possible combinations of these parameters have been tested for mortgage rates of 9%, 11% and 13%; marginal tax rates of 15%, 28% and 33%; and investment opportunity rates of 7%, 11% and 13%. Additionally, these combinations have been tested under the assumptions that the 30-year fixed rate mortgage has no extra up-front costs and that the 30-year mortgage has $2,000 of extra up-front costs. These extra costs may be considered as discount points which are assessed at origination due to greater (longer) interest rate risk exposure. (Refer to Tables 4 and 5 for the results of these calculations.)

Extensive analysis of the net benefit results shown in Table 4 and Table 5 will not be presented. Since each home buyer's specific input date for the three variables (mortgage rate, tax rate and investment rate) are unique, net benefits must be analyzed for each case. A more meaningful insight regarding the usefulness of APMs may be achieved by highlighting apparent generalizations indicated by the output data in the tables.

This data clearly suggests that APMs are not always advantageous. As the home buyer's marginal tax rate increases, the net benefit of APMs decreases; however, when mortgage rates exceed investment opportunity rates, the APMs can be beneficial. Additionally, the larger the spread between the mortgage rate and the investment rate, the greater the impact on net benefit. Obviously, when there is no up-front cost differential in the mortgages, the net benefits of the APMs are decreased.

Conclusion

The approach developed in this article may be useful in assisting home buyers in the selection of a mortgage. Whether an APM is or is not the borrower's best choice depends on his or her specific circumstances. By comparing all the costs and benefits associated with various home financing choices, buyers can make more enlightened mortgage choices.

Of the variables discussed in this article, the only ones that are easy to determine are the contractual interest rates on the mortgages. The borrower's marginal tax rate, though perhaps easy to estimate at the time of financing, is subject to change over the life of the mortgage. Changes in the borrower's income may move him into another tax bracket, or the U.S. Congress may legislate new tax rates. Neither of these possibilities seems unlikely, and if the borrower's tax rate increases, the appeal of APMs decreases. Equally if not more troublesome is the determination of the borrower's investment opportunity rate. Undoubtedly, as this rate increases, APMs become less attractive. In addition to the determination of the above variable inputs, it must be remembered that the 15-year APM always will be more costly from an "out-of-pocket" perspective, and the increased monthly payments may not be affordable.

For many and perhaps most home buyers, the traditional 30-year mortgage is still the most appropriate choice because it is more flexible than accelerated repayment plans. Why should a home buyer lock into higher or more accelerated payments if he already has the right to prepay as most 30-year mortgages allow? The average residential mortgage typically is paid off, for a variety of reasons, prior to maturity, anyway; and a home buyer may replicate the accelerated plans merely by making additional payments and without contractually obligating himself to a more demanding payment schedule.

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