LOAN COMPARISON AND ANALYSIS

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ABSTRACT

This paper describes the capabilities of the new SAS/ETS procedure LOAN. The top vote-getter in the 1989 SASware Ballot for SAS/ETS was "Provide the ability to analyze variable rate mortgages." The development of PROC LOAN was the Institute's response to this request. The LOAN procedure can analyze variable rate, as well as buydown rate, fixed rate, and balloon payment loans. It can incorporate initialization costs, downpayments, and prepayments. Furthermore, PROC LOAN offers economic comparison of different loans at different times during loan lives.

INTRODUCTION

In the process of obtaining a loan, you might have some of the following questions:

- What are my alternatives?
- What would my payment schedule look like under different alternatives?
- Can I afford the payments?
- How will the different loans affect my taxes?
- If I plan to sell in a few years, what would the outstanding balance be on my loan?
- How much of the money I pay will go towards paying interest?

And, after all, which loan is best for me? The LOAN procedure intends to answer such questions. Given any three out of four parameters (interest rate, life of the loan, principal amount, and periodic payment), it calculates the fourth one for fixed rate, adjustable rate, buydown, and balloon payment loans. Prepayments and costs at the initialization of the loan, such as downpayment, discount points, and other initialization costs, are incorporated into the analysis and comparison.

Multiple loans can be processed and compared in terms of economic criteria such as after-tax or before-tax present worth of cost and true interest rate, breakeven of periodic payment and of interest paid at different periods in time. The best alternative, in terms of the specified economic criterion is selected for each loan comparison period.

PROC LOAN OUTPUT

Loan amortization schedule, loan summary and loan comparison information can be printed or output into SAS datasets. You can look at all or one of these to answer your particular question.

The loan summary information includes the total payment and interest, the initial nominal annual and effective interest rate, payment and compounding intervals, the life of the loan, the start and end dates, a list of nominal and effective interest rates, and periodic payments through the life of the loan. A list of balloon payments for balloon payment loans and a list of prepayments are printed

with their respective periods.

The loan amortization schedule, contains the year and period within the year (or date), principal balance at the beginning of the period, total payment, interest payment, principal repayment for the period, and the principal balance at the end of the period for each payment period throughout the life of the loan.

The loan comparison report contains the results of economic analysis of the loan(s). The quantities reported can include the outstanding principal balance, after-tax or before-tax present worth of cost and true interest rate, periodic payment, and the interest paid throngh the report period for each loan. The best alternative is indicated in the printed output.

TYPES OF LOANS

The LOAN procedure can analyze and compare four types of loans:

- Fixed Rate Loan (FIXED statement)
- Balloon Payment Loan (BALLOON statement)
- Buydown Rate Loan (BUYDOWN statement)
- Adjustable Rate Loan (ARM statement)

A *fixed rate* loan is a conventional loan where the interest rate to be charged on the loan and the payments are fixed at the initialization of the loan. A *balloon payment* loan is a fixed rate loan with balloon payments (i.e., lumpsum payments) in excess of the periodic payments. *Buydown rate* loans are similar to adjustable rate loans, but the interest rate adjustments are predetermined at the initialization of the loan (usually, by paying interest points at the time of loan initialization). For an *adjustable rate* loan, the future interest rates are not known for certain but will vary within specified limits according to terms stated in the loan agreement. In practice, the adjustment terms vary. These terms usually specify the adjustment frequency (how often the rate will be adjusted), maximum rate adjustment allowed each adjustment period (i.e., periodic cap), and maximum rate adjustment allowed through the life of the loan (life cap). As an alternative to the life cap, the loan agreement may specify the maximum and minimum allowable rates. In PROC LOAN, the future interest rates of an ARM loan are calculated assuming one of these four cases:

ADJUSTMENT CASE	ADJUSTMENT STRATEGY FOR THE INTEREST RATE
Worst case	reach its maximum allowed limits as soon as possible
Best case	reach its minimum allowed limits as soon as possible
Fixed case	constant over the life of the loan
Estimated case	follow the interest rates specified by the user

In the *Estimated case* analysis, if the terms of the loan are known, they are used to bound the rate adjustments estimated by the user. The *Estimated case* can specify adjustments that cannot fit into the *Best, Worst,* or *Fixed cases,* as well as be used for 'what-if' type analysis. For example, if the initial nominal rate for a loan is 10% and the rate adjustment terms of the loan specify that the rate will be adjusted every six months, the periodic cap is 0.5% and the life cap is 2%. Also, assume that you estimate the rates to be 10.6% as the of 5th period and 11.2% as of the 22nd period. Table 1.1 illustrates of the nominal interest rates charged on the loan based on the cases described above.

Table 1.1 Nominal Interest Rates Assuming Different Rate Adjustment Cases

Adjustment Case	0-5th period	6-11th period	12-17th period	18-23rd period	24th period on
Worst case	10.0%	10.5%	11.0%	11.5%	12.0%
Best case	10.0%	9.5%	9.0%	8.5%	8.0%
Fixed case	10.0%	10.0%	10.0%	10.0%	10.0%
Estimated case	10.0%	10.5%	10.5%	10.5%	11.0%

Example: Fixed Versus Adjustable Rate Loan

Two alternative loans for the amount of $100,000 are:

- fixed rate (9.5%) and you need to pay 1.5 discount points ($1500) at the closing (December 1990).
- adjustable rate starting at 8.125%, the rate will be adjusted with an annual cap of 1%, and a life cap of 4% (i.e., the rate will never exceed 12.125%), and you will pay 2 discount points ($2000) at the closing (December 1990).

For the adjustable rate loan, we are assuming the rate will be adjusted to the maximum as fast as it is allowed in the contract (i.e., the worst case analysis). You want to see the payment schedule for each loan. The SAS code and loan summary information for each loan is shown below.

```
proc loan start= 1990:12;
   fixed amount=100000 rate=9.5 life=360 points=1500
        label= 'Fixed rate loan ';
   arm amount=100000 rate=8.125 life=360 points=2000 caps= (1,4)
        worstcase label= 'Adjustable rate loan';
   run;
```

Output 1.1 Loan Summary for the Fixed Rate Loan

```
                    The SAS System                          1

                    LOAN Procedure

                Fixed Rate Loan Summary

                     Fixed rate loan

Downpayment:                0.00   Principal Amount:     100000.00
Initialization:             0.00   Points:                 1500.00

Total Interest:       202715.48    Nominal Rate:              9.50%
Total Payment:        302715.48    Effective Rate:            9.92%

Pay Interval:           MONTHLY    Compounding:             MONTHLY
No. of payments:            360    No. of compoundings:         360

Start date:             DEC1990    End date:                DEC2020

     List of Rates and Payments for Fixed rate loan

       Date       Nominal Rate  Effective Rate        Payment

       DEC1990          9.50%          9.92%          840.85
```

Output 1.2 Loan Summary for the Adjustable Rate Loan - Worst Case Analysis

```
                    The SAS System                                  1

                    LOAN Procedure

      Adjustable Rate Loan: Worst Case Analysis Summary

                 Adjustable rate loan

Downpayment:                0.00  Principal Amount:      100000.00
Initialization:             0.00  Points:                  2000.00

Total Interest:        261017.12  Nominal Rate:               8.13%
Total Payment:         361017.12  Effective Rate:             8.43%

Pay Interval:            MONTHLY  Compounding:             MONTHLY
No. of payments:             360  No. of compoundings:         360

Start date:              DEC1990  End date:                DEC2020


        List of Rates and Payments for Adjustable rate loan

        Date       Nominal Rate  Effective Rate        Payment

        DEC1990          8.13%          8.43%         742.50
        JAN1992          9.13%          9.52%         812.41
        JAN1993         10.13%         10.61%         883.21
        JAN1994         11.13%         11.71%         954.67
        JAN1995         12.13%         12.82%        1026.61
```

You can see from Output 1.2 that with the fixed rate loan you will have a monthly payment of $840.85 for thirty years. With the adjustable rate loan, your monthly payments would be less than with the fixed rate loan for the first two years.

LOAN COMPARISON

In economic comparison of alternatives, the decision criterion is one of the following: maximization of outputs (benefits) when the input (cost) of all alternatives are equal; minimization of inpnt (cost) when the output (benefits) of all alternatives are equal; and maximization of profit (benefits - costs or output - input) when the input and output of alternatives are variable.

In comparing alternative loans, all the loans are for acquiring the same (equal valued) asset(s) (i.e., the output (benefit) is fixed). Therefore, the economic selection criterion is the minimization of costs (input). The effects of taxes on different alternatives must be accounted for when these vary among different alternatives. Since interest costs on certaiu loans are tax deductable, the comparison for those loans is made based on the after-tax cashflows.

In order to compare the costs of different alternatives, the input cashflow must be represented in a comparable equivaleut value. Equivalent value of a cashflow accounts for the time-value of money. That is, it is preferable to pay the same amount of money later than now, since the money cau earn interest for you while you keep it. The MARR (Minimum Attractive Rate of Return) reflects the cost of capital or the opportunity cost of money, that is, the interest that would have been earned on the savings which is foregone by making the investment. The MARR can vary for each person (organization) and for each investment. The equivalent value of alternatives discounts the cashflow to a fixed point in time using the MARR.

Present worth of cost reflects the equivalent amount at the present time (at loan initialization) of the loan cashflow discounted at MARR not accounting for inflation. Present worth of cost accounts for the downpayment, initialization costs, discount points, periodic payments, and the principal balance at the end of the comparison period. Therefore, it reflects the present worth of cost of the asset, not the loan. It is only meaningful to use minimization of present worth of cost as a selection criterion if the assets (downpayment plus loan amount) are of the same value for all alternatives.

Another economic selection criterion is the rate of return, *true interest rate,* of the alternatives. Since you borrow the money and are paying interest in this case, the best alternative is the one that minimizes the rate of return. The true interest rate reflects the effective annual rate charged on the loan based on cashflow including the initialization cost and the discount points.

The other three selection criteria offered by PROC LOAN are minimization of the outstanding balance, periodic payment, and interest paid. For example, if you plan to sell the house before the end of the loan life (which is usually the case), you might want to select the loan with the minimum principal balance at the time of the sale since this balance will have to be paid at that time.

Different objectives may lead to the selection of different alternatives. In PROC LOAN, the COMPARE statement specifies the periods and desired analysis types for loan comparison. The default analysis is the outstanding principal balance, breakeven of payment, breakeven of interest paid, and before-tax true interest rate at the end of the life of the longest loan.

Example: Comparison of 4-year and 5-year Auto Loans

You are interested in buying a particular car and would have to finance about $12000 of the purchase price. The current interest rate is 11%, and you had originally considered a 60-month loan. You want to know what the savings in total interest would be if you went to a 48-month loan, and how much the payment would increase.

```
proc loan;
   fixed amount=12000 rate=11.5 life=60 label= '5 year loan' noprint;
   fixed amount=12000 rate=11.5 life=48 label= '4 year loan' noprint;
   compare breakpayment breakinterest;
   run;
```

Output 1.3 Output from the COMPARE Statement

```
                    The SAS System                                  1

                    LOAN Procedure

                Loan Comparison Report

        Analysis through Payment Number 60

                      Ending                Interest
Loan Label        Outstanding   Payment       Paid

5 year loan              0.00    264.01    3834.70
4 year loan              0.00    312.99    3027.28
```

If you get a 48-month loan instead of a 60-month loan, you end up paying $313 a month instead of $264, but you have paid less on interest, $3027 instead of $3835. You would get similar results if you compared a 15-year mortgage to a 30-year mortgage.

Example: Comparison of Alternative Types of Loans

The following are your alternatives for a $100,000 loan to buy property:

- 9.5% fixed rate 30-year loan with 1.5 discount points
- 8.125% adjustable rate 30-year loan with 2 discount points
- 9.875% loan with a balloon payment of $10000 at 42nd month.

You want to compare these alternatives at 2, 4, and 5 years assuming the interest paid on the loan is tax deductable and that you would have invested your money in a savings account earning 7.75% if you did not invest it in this property.

```
proc loan start= 1990:12;
   fixed amount=100000 rate=9.5 life=360 points=1500
         label= 'Fixed rate loan ';
   arm amount=100000 rate=8.125 life=360 points=2000 caps= (1,4)
         worstcase label= 'Adjustable rate loan';
   balloon amount=100000 rate=9.875 life=360 balloonpayment= (42= 10000)
         label= 'Balloon payment loan ';
   compare all at= (24 48 60) marr=7.75 taxrate=.33;
   run;
```

Output 1.4 Comparison of Alternative Loans at 2nd, 4th, and 5th years

```
                          The SAS System                          4

                          LOAN Procedure

                      Loan Comparison Report

                      Analysis through DEC1992

                          Ending    P.W. of                Interest    True
Loan Label             Outstanding     Cost     Payment       Paid    Rate

Fixed rate loan          98705.64  98461.56      840.85   18886.04    7.13
Adjustable rate loan     98456.83  97699.37      812.41   17115.75    6.68
balloon payment loan    100425.71  97901.72      806.80   19788.91    6.82

   Note: "Adjustable rate loan" is the best alternative based on present
         worth of cost analysis through DEC1992.

                      Loan Comparison Report

                      Analysis through DEC1994

                          Ending    P.W. of                Interest    True
Loan Label             Outstanding     Cost     Payment       Paid    Rate

Fixed rate loan          97141.59  96313.26      840.85   37502.39    6.86
Adjustable rate loan     97190.59  96699.94      954.67   37904.07    6.99
balloon payment loan     90439.95  96138.62      806.80   39166.35    6.82

   Note: "balloon payment loan " is the best alternative based on present
         worth of cost analysis through DEC1994.

                      Loan Comparison Report

                      Analysis through DEC1995

                          Ending    P.W. of                Interest    True
Loan Label             Outstanding     Cost     Payment       Paid    Rate

Fixed rate loan          96241.33  95369.65      840.85   46692.33    6.81
Adjustable rate loan     96624.88  96955.11     1026.61   49657.68    7.23
balloon payment loan     89654.37  95419.28      806.80   48062.37    6.82

   Note: "Fixed rate loan " is the best alternative based on present worth
         of cost analysis through DEC1995.
```

Based on the after-tax analysis shown in Output 1.4, you can conclude that the adjustable rate loan is the best alternative if you want to keep the loan two years or less, but between two and five years the balloon payment loan is the most desirable. If you intend to keep the property five years or longer, the fixed rate loan is the best choice.

SELECTED OPTIONS FOR ALL TYPES OF LOANS

PROC LOAN allows many options to be specified for all types of loans. Below is a brief discussion of a few of these options.

PROC LOAN assumes monthly payments and monthly interest compounding. You can change the payment and compounding intervals to semimonthly, monthly, quarterly, semiannually, and yearly. In addition to these, the compounding interval can also be continuous or daily.

If you are analyzing more then one loan you may want to label each loan so that in all output you can identify each loan by the character string you labeled it with. You can also specify an initialization date for each loan (or all loans). Futhermore, the number of decimal places that the monetary amounts are rounded to can be specified (the default is 2.)

Whether or not to make prepayments is a common concern. The prepayments are principal payments in excess of the periodic payment amount that reduce the outstanding loan balance. You can incorporate a uniform prepayment (paid with each periodic payment) or lumpsum prepayments at certain period(s) in your analysis when using PROC LOAN.

There are three options related to the costs you incur during loan initialization that may affect your choice of a loan: principal downpayment, the discount points (usually paid to reduce the nominal interest rate charged on the loan), and the loan initialization costs other than the discount points and downpayment, such as legal fees, loan initialization costs, and inspection.

Example: Justifying the Cost of Discount Points

You are trying to choose between two buydown loans to finance your new house. Both of them are $100,000 30-year loans. Here are the terms of each loan:

- First buydown: 2 discount points at closing, rate is 8.125% initially, 9.125% the second year, and 10.25% 3-30 years.
- Second buydown: 1.5 discount points at closing, rate is 8.375% initially, 9.375% the second year, and 10.375% 3-30 years.

The basic difference between the two is that the extra 1/2 discount point keeps the interest rate .25% lower the first two years and .125% lower the rest of the loan life. You want to find out whether or not to pay extra money for the discount point and how the monthly payments would look in each loan.

```
proc loan start= 1990:12;
   buydown amount=100000 rate=8.125 life=360 points=2000
      buydownrates= (12=9.125 24=10.25) label= '2 discount points ';
   buydown amount=100000 rate=8.375 life=360 points=1500
      buydownrates= (12=9.375 24=10.375) label= '1.5 discount points ';
   compare all at= (24  36) marr=7.75 taxrate=.33;
   run;
```

The comparison reports through the second and third year of the loan, shown in Output 1.5, indicate that you should buy the extra discount point (i.e., 2 instead of 1.5) if you intend to keep the loan for three years or longer.

Output 1.5 Comparison of 2 and 1.5 discount points

```
                    The SAS System                                  3

                    LOAN Procedure

                Loan Comparison Report

               Analysis through DEC1992

                   Ending    P.W. of                Interest    True
Loan Label      Outstanding     Cost    Payment       Paid      Rate

2 discount points   98481.87  97803.54     892.42   17292.03    6.75
1.5 discount points 98554.00  97768.77     902.09   17784.78    6.73

   Note: "1.5 discount points " is the best alternative based on present
         worth of cost analysis through DEC1992.

                Loan Comparison Report

               Analysis through DEC1993

                   Ending    P.W. of                Interest    True
Loan Label      Outstanding     Cost    Payment       Paid      Rate

2 discount points   97837.51  97091.27     892.42   27356.71    6.85
1.5 discount points 97924.52  97123.57     902.09   27980.38    6.87

   Note: "2 discount points " is the best alternative based on present worth
         of cost analysis through DEC1993.
```

The list of rates and payments for each loan shown in Output 1.6, as expected, that the monthly payments will be lower over the life of the loan if you pay 2 discount points.

Output 1.6 List of Rates and Payments for the Two Buydown Loans

```
   List of Rates and Payments for 2 discount points

Date       Nominal Rate  Effective Rate       Payment

DEC1990          8.13%          8.43%        742.50
DEC1991          9.13%          9.52%        812.52
DEC1992         10.25%         10.75%        892.42


   List of Rates and Payments for 1.5 discount points

Date       Nominal Rate  Effective Rate       Payment

DEC1990          8.38%          8.70%        760.07
DEC1991          9.38%          9.79%        830.66
DEC1992         10.38%         10.88%        902.09
```