

# The Tradeoff between Mortgage Prepayments and Tax-Deferred Retirement Savings

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“Neither a borrower nor a lender be;  
For loan oft loses both itself and friend,  
And borrowing dulls the edge of husbandry.”  
– William Shakespeare

# Motivation

- ▶ Many households are reluctant to participate in financial markets
  - averse to holding financial assets and
  - accelerate paydown of mortgage debt
- ▶ Usually it is difficult to disentangle various motives in play: liquidity constraints, transaction costs, preferences
- ▶ Look at those who are already saving:
  - mortgage prepayment or retirement account contributions?
  - maximize wealth or satisfy non-pecuniary preferences?
- ▶ We find that a significant number of households forgo an arbitrage strategy by prepaying their mortgage and by not contributing to a retirement account

# Some Peculiarities of the U.S. Tax Code

- ▶ Interest payments on mortgage loans are generally tax-deductible
  - The effective borrowing rate is  $(1 - \tau)r_B$
  - Deductibility is limited by income and tax status
  
- ▶ Earnings on contributions to Tax-Deferred Retirement Accounts (TDA) are tax-exempt
  - In a typical employer-sponsored TDA earnings on pre-tax contributions are taxed on withdrawal
  - Contributions are capped
  
- ▶ The tax law subsidizes borrowing to finance home purchase and subsidizes investment to finance retirement
  - Both a borrower and a lender be ...

# Tax Arbitrage Strategy

- ▶ Choice A: Contribute to a Tax-Deferred Retirement Account (TDA)
  - Investments in TDA earn before-tax returns  $r_L$
- ▶ Choice B: Prepay the Mortgage Loan
  - Tax-deductible mortgage debt costs  $(1 - \tau)r_B$
- ▶ Tax Arbitrage
  - Contributing to a retirement account is generally superior to prepaying a mortgage if  $r_L > (1 - \tau)r_B$
  - This strategy requires no additional savings
  - This strategy generally lowers the risk of the overall asset portfolio

# Research Questions

- ▶ Do households take advantage of this tax arbitrage?
- ▶ If not, how common and how costly is the mistake?
- ▶ Why do some households leave money on the table?

## Main Results

- ▶ At least 4 million households (or 38% of those who prepay) could potentially benefit from the tax arbitrage.
- ▶ These households forgo 11-17 cents per dollar of mis-allocated savings or \$1.5 billion annually.
- ▶ Rational reasons are unlikely to explain the magnitude of this mistake
  - liquidity and default risks
  - stochastic interest rates
  - moving-related prepayment risks
  - tax regime risks
- ▶ Some investors forgo substantial tax benefits because of “debt conservatism,” similar to corporations (Graham 2000).

# Literature Review

## ▶ Mortgage Payments

- Dunn and Spatt (1985, 1999); Quigley (2002); Campbell and Cocco (2003); and Hurst and Stafford (2004);

## ▶ Retirement Savings

- Poterba, Venti and Wise (1995); and Benartzi and Thaler (2001); Madrian and Shea (2001); Cunningham and Engelhardt (2002); Agnew, Balduzzi, and Sunden (2003); Duflo and Saez (2003); Choi, Laibson, and Madrian (2004, 2005); Mitchell, Utkus, and Yang (2005); and Huberman and Jiang (2006).

## ▶ Asset Location

- Black (1980); Tepper (1981); Barber and Odean (2004); Bergstresser and Poterba (2004); Dammon, Spatt, and Zhang (2004); Poterba, Shoven, and Sialm (2004); Shoven and Sialm (2004); Amromin (2004); Huang (2005); and Garlappi and Huang (2006);

## ▶ Behavior Biases

- Tversky and Kahneman (1981); Shefrin and Thaler (1988); Odean (1998); Grinblatt and Keloharju (2001); and Ivkovich, Poterba, and Weisbenner (2005);

# Model

## Main Assumptions

- ▶ Mortgage interest is tax-deductible.
- ▶ Each dollar of prepayment in the current year affects year  $T$  cash flow only and reduces the after-tax mortgage payment by  $(1 + (1 - \tau)r_B)^T$ .
- ▶ Investors remain in the same marginal tax bracket.
- ▶ The mortgage has a fixed known remaining horizon  $T$ .
- ▶ The household pays a fixed rate  $r_B$  on the mortgage and earns a constant rate  $r_L$  on the tax-deferred savings for the remaining  $T$  periods.
- ▶ Withdrawals from a TDA face a penalty  $\kappa = 10\%$  if households are younger than  $59\frac{1}{2}$ .

## Tax Arbitrage Strategy - Mechanics

1. Decrease the mortgage prepayment by \$1.
2. Contribute an additional  $\$X$  to the TDA,

$$X \equiv \frac{1}{1 - \tau - \kappa} \left( \frac{1 + (1 - \tau)r_B}{1 + r_L} \right)^T$$

3. The additional contribution of  $\$X$  to the TDA grows to  $\$X(1 + r_L)^T$ .
4. The mortgage balance in year  $T$  increases by  $\$(1 + (1 - \tau)r_B)^T$ .
5. Withdraw  $\$(1 - \tau - \kappa)X(1 + r_L)^T = \$(1 + (1 - \tau)r_B)^T$  from TDA in year  $T$  to cover the additional mortgage payment.

## Tax Arbitrage Strategy - Summing Up

- ▶ The Marginal Arbitrage Profit (MAP) measures the marginal benefit of each dollar moved from mortgage prepayments to TDA contributions:

$$MAP \equiv 1 - X + \tau X = 1 - \frac{1 - \tau}{1 - \tau - \kappa} \left( \frac{1 + (1 - \tau)r_B}{1 + r_L} \right)^T.$$

- ▶ The Total Arbitrage Profit (TAP) measures total forgone tax benefit for each household from following the wrong strategy:

$$TAP \equiv MAP \times \min\{\text{Mortgage prepayment}, \text{Contribution gap}\}.$$

## Data

- ▶ 1995, 1998, and 2001 Surveys of Consumer Finances (SCF) provide information on home ownership, mortgage and other financial characteristics of households.
- ▶ Yields on 15- and 30-year current coupon agency mortgage-backed securities (MBS) and 10- and 30-year Treasury bonds, and the average initial contract rates on new commitments for 15- and 30-year conventional fixed-rate mortgages with 80% loan-to-value ratios (Fannie Mae and Freddie Mac) from Bloomberg.
- ▶ Marginal tax rates (MTR) derived from TAXSIM calculations based on SCF income data.

## Variables

### ▶ Two definitions of Pre-Payments:

- Discretionary Pre-Payments:

- \* Derived from household responses to the SCF question on whether they are ahead, behind, or on time with their mortgage payments.
- \* The prepayment amount is backed out from the expected date of full repayment.

- Short Mortgage Pre-Payments:

- \* The difference between the required payment on the existing mortgage and a required payment on a hypothetical 30-year mortgage.

## ▶ TDA Contributions

- We can identify TDA-eligible households and we know how much they contribute to employer-sponsored retirement accounts.
- However, we do not know the specific details on the retirement accounts, such as investment options and contribution limits.
- We make the following assumptions:
  - \* The investment options include either Mortgage-Backed Securities (MBS) or Treasury bonds.
  - \* The contribution limit is the lower of 10% of wages and the statutory contribution limits.

## Summary Statistics

- ▶ We look at households eligible for employer-sponsored TDAs that hold fixed-rate mortgages
- ▶ They cover about 22% of all households or 57% of all homeowners with outstanding mortgages.
- ▶ They are on average wealthier, younger, and better educated than the rest of the population.
- ▶ Credit card balances are (un)surprisingly similar across different types of households

Table 1: **Characteristics of All Households**

| Variable                | All Households    | All Eligible Households | All Eligible HHs w/FRM |
|-------------------------|-------------------|-------------------------|------------------------|
| Number of Observations  | 13,046            | 8,569                   | 2,684                  |
| Number of Households    | 102.7M            | 46.6M                   | 22.8M                  |
| Normal Income           | 54,211            | 71,887                  | 85,174                 |
|                         | [19,267 - 61,675] | [34,949 - 79,149]       | [45,069 - 92,512]      |
| Federal Tax Bracket     | 16.5              | 22.2                    | 24.1                   |
| Liquid Financial Wealth | 85,276            | 78,061                  | 81,399                 |
|                         | [870 - 36,720]    | [2,100 - 40,800]        | [4,200 - 58,000]       |
| Retirement Wealth       | 36,216            | 54,075                  | 66,673                 |
|                         | [0 - 18,100]      | [80 - 43,000]           | [2,200 - 65,000]       |
| Credit Card Balance     | 1,699             | 2,362                   | 2,572                  |
|                         | [0 - 1,300]       | [0 - 2,650]             | [0 - 3,100]            |
| Net Worth               | 280,689           | 285,841                 | 314,458                |
|                         | [9,700 - 205,600] | [24,600 - 222,980]      | [58,080 - 287,800]     |

Table 2: **Household Prepayment and Contribution Behavior**

| Variable   | <u>No Contributions</u> |         | <u>Contributions</u> |         |
|--|-------------------------|---------|----------------------|---------|
|  | No Prepay               | Prepay  | No Prepay            | Prepay  |
| <b>Panel A: Prepayment and Contribution Behavior</b> |                         |         |                      |         |
| Number of Households                                 | 4.5M                    | 3.4M    | 7.8M                 | 7.1M    |
| Contribution   |                         |         | 4,966                | 5,506   |
| Contribution Gap                                     | 5,257                   | 6,149   | 2,770                | 2,864   |
| Total Prepayments                                    |                         | 2,712   |                      | 3,345   |
| <b>Panel B: Household Characteristics</b>            |                         |         |                      |         |
| Liquid Financial Wealth                              | 8,400                   | 17,350  | 12,710               | 28,810  |
| Retirement Wealth                                    | 0                       | 4,900   | 25,000               | 40,000  |
| Home Equity  | 36,000                  | 60,000  | 40,000               | 60,000  |
| Net Worth  | 78,400                  | 133,300 | 111,800              | 190,850 |
| Mortgage Rate (in %)                                 | 8.00                    | 7.81    | 7.87                 | 7.59    |
| Loan-to-Value Ratio (in %)                           | 58.5                    | 45.9    | 61.8                 | 50.1    |
| Federal Tax Bracket (in %)                           | 21.7                    | 23.8    | 24.2                 | 25.7    |
| Share with employer TDA match                        | 21.5                    | 23.9    | 79.1                 | 74.7    |
| Median Credit Card Balance                           | 2,400                   | 2,000   | 3,000                | 3,000   |
| Median Credit Card Interest Rate                     | 14.3                    | 12.0    | 14.0                 | 12.5    |

Table 3: **Forgone Tax Benefits**

|   | No Contributions |        | Contributions |        |
|---|------------------|--------|---------------|--------|
|   | No Prepay        | Prepay | No Prepay     | Prepay |
| <b>Panel A: Using MBS Rate for TDA investments</b>    |                  |        |               |        |
| Number of Households with $MAP > 0$                   | 2.2M             | 1.5M   | 4.5M          | 3.5M   |
| Proportion of Households with $MAP > 0$ (in %)        | 48.9             | 43.4   | 58.2          | 48.8   |
| Mean $MAP \mid MAP > 0$ (in %)                        | 21.4             | 17.2   | 22.9          | 16.6   |
| TAP from All Prepayments (in \$)                      |                  | 394    |               | 375    |
| Aggregate TAP =                                       | \$1.528 Billion  |        |               |        |
| <b>Panel B: Using T-Bond Rate for TDA investments</b> |                  |        |               |        |
| Number of Households with $MAP > 0$                   | 1.1M             | 0.9M   | 2.7M          | 2.1M   |
| Proportion of Households with $MAP > 0$ (in %)        | 26.3             | 28.6   | 35.1          | 30.0   |
| Mean $MAP \mid MAP > 0$ (in %)                        | 16.0             | 10.9   | 14.6          | 10.4   |
| TAP from All Prepayments (in \$)                      |                  | 281    |               | 240    |
| Aggregate TAP =                                       | \$0.637 Billion  |        |               |        |

# Some Potential Caveats

(could this strategy fail because of ...)

- ▶ Liquidity risks
- ▶ Default risks
- ▶ Stochastic interest rates and refinancing risks
- ▶ Moving-related prepayment risks
- ▶ Tax regime risks

## Liquidity Risks

Would investors forego the arbitrage strategy in order to build up home equity in anticipation of future liquidity needs?

- ▶ The strategy only affects the transaction costs of raising funds.
  - home equity loans: higher interest rates, and may not be available
  - withdraw from TDA: at most 10% penalty.
  - expected cost differential  $<$  MAP.
  
- ▶ The strategy provides a hedge against housing price fluctuations.
  - $P \uparrow$ : sufficient home equity even without prepaying.
  - $P \downarrow$ : insufficient home equity even after prepaying.
  - Saving in TDA is more effectively in meeting liquidity needs.

## Default Risks

- ▶ Following the tax-arbitrage strategy is unlikely to increase the probability of default.
  - Default risks are extraordinary liquidity needs.
  - Saving in TD is at least as effective as (if not more than, considering housing price risks) prepaying the mortgage in preventing default.
  
- ▶ In the event of personal bankruptcy, households are generally better off had they followed the tax-arbitrage.
  - TDA savings are always exempt from personal bankruptcy.
  - Homestead exemptions vary by state, with some states (e.g. Pennsylvania, New York) allowing only a token amount.

## Stochastic Interest Rates

- ▶ Base case: both  $r_B$  and  $r_L$  are constant.
  - $r_B$  is constant for a fixed-rate mortgage that never refinances
  - $r_L$  is constant if buy and hold  $T$ -year Treasury bonds in TDA.
  
- ▶ The base case is likely to provide a lower bound on MAP.
  - if refinance in year  $S < T$  at rate  $r'_B$  (for decreasing rates), then  $r'_B < r_B$  implies a lower mortgage balance and did not affect TDA balance, hence increases the arbitrage profits.
  - allowing TDA contributions to be invested in a pass-through security like MBS matches the risk on mortgage investing and increases the MAP further.

## Moving-Related Prepayment Risks

- ▶ If interest rates stay constant, the arbitrage remains valid as long as households can roll over their mortgage debt into the new house.
  
- ▶ If both the interest rate and moving risks are present,
  - if move when the interest rate goes down, MAP is increased. (OKAY)
  - if move when the interest rate goes up, then MAP may become negative, and investors may be worse off following our strategy. However, the overall loss from replacing a lower-rate mortgage is very large, and may deter investor from moving. Hence, the expected impact on moving risk on arbitrage profit is small.

## Tax Regime Risks

Table 4: **Foregone Tax Benefits under Alternative Scenarios**

| Scenarios                             | #Households<br>if MAP > 0<br>(in Mlns) | Mean MAP<br>if MAP > 0<br>(in %) | Aggregate<br>TAP<br>(in \$B) |
|---------------------------------------|--|----------------------------------|------------------------------|
| (1) Base Case Scenario                | 3.9                                    | 17.2                             | 1.53                         |
| (2) 25% increase                      | 2.7                                    | 14.7                             | 0.87                         |
| (3) 25% decrease                      | 5.3                                    | 19.8                             | 2.36                         |
| (4) 50% increase                      | 1.5                                    | 12.9                             | 0.40                         |
| (5) 50% decrease                      | 6.3                                    | 22.8                             | 3.23                         |
| (6) Including Employer Match          | 5.6                                    | 38.1                             | 2.64                         |
| (7) Excluding Withdrawal Penalty      | 5.5                                    | 16.3                             | 2.01                         |
| (8) Including State-Tax Deductibility | 5.6                                    | 19.4                             | 1.93                         |

## Additional Benefits of Tax Arbitrage

- ▶ Employer matches
- ▶ Exclusion of IRAs and other tax-sheltered accounts
- ▶ Deductibility of mortgage interest from state income taxes
- ▶ Avoidance of early withdrawal penalty
- ▶ Decrease in search costs to participate in financial markets
- ▶ Optimal timing of contributions and withdrawals

## Who Leaves Money on the Table?

- ▶ Households who gain from our tax arbitrage have the following characteristics:
  - lower mortgage rates
  - higher tax rate
  - older households (less subject to 10% withdrawal penalty)
  
- ▶ In addition, these households tend to have high liquid financial wealth, high home equity, and low loan-to-value ratios. This suggests that liquidity concerns are unlikely to be the reason for forgoing this tax arbitrage.

Table 5: **Characteristics of Households Which Gain from Arbitrage**

| Variable  | No Contributions |         | Partial Contributions |         |
|---|------------------|---------|-----------------------|---------|
|   | Gain             | Loss    | Gain                  | Loss    |
| <b>Panel A: Main Determinants of Total Benefits</b> |                  |         |                       |         |
| Number of Households                                | 1.5M             | 1.9M    | 2.5M                  | 3.0M    |
| Age   | 48.3             | 44.5    | 44.6                  | 41.0    |
| Mortgage Rate (in %)                                | 7.22             | 8.26    | 7.20                  | 7.97    |
| Mortgage Spread (in %)                              | -0.19            | 0.84    | -0.10                 | 0.52    |
| Federal Tax Bracket (in %)                          | 27.3             | 21.1    | 27.3                  | 23.1    |
| <b>Panel B: Financial Characteristics</b>           |                  |         |                       |         |
| Liquid Financial Wealth                             | 142,063          | 51,609  | 92,145                | 56,980  |
| Retirement Wealth                                   | 93,869           | 27,151  | 87,401                | 58,091  |
| Home Equity   | 125,490          | 68,463  | 93,058                | 72,056  |
| Loan to Value Ratio (in %)                          | 48.9             | 43.5    | 53.6                  | 48.8    |
| Net Worth   | 551,529          | 220,216 | 371,231               | 250,537 |

# Why Do They Leave Money on the Table?

- ▶ Constrained by their liquidity or consumption needs
  - look at credit availability and family composition
- ▶ Information required for making this choice is costly to obtain or process
  - look at education and help in financial decision-making
- ▶ Choices are distorted by specific preferences over the form of saving
  - look at self-reported attitudes towards debt and risk

## Regression Specifications

1. Determinants of savings choices (Probits): (i) short mortgages, (ii) Discretionary mortgage prepayments, and (iii) retirement contributions.

$$\begin{aligned} SavingsChoice_i = & \beta_1 MAPComps_i + \beta_2 LiqConst_i + \beta_3 Info_i \\ & + \beta_4 Inst_i + \beta_5 Pref_i + \beta_6 EmpMatch_i + \beta_7 Demo_i + u_i \end{aligned}$$

2. Determinants of the relative propensity to prepay vs. contribute (Tobit):

$$TDAFraction \equiv \frac{TDAContribution}{Prepayment + TDAContribution}$$

## Additional Variables

- ▶ Liquidity-constrained households are defined as those that satisfy one of the following conditions:
  - were turned down for credit at least once during the past five years,
  - were not able to obtain this credit later,
  - have credit card balances in excess of 75% of the borrowing limit.
  
- ▶ Risk aversion: self-reported willingness to take on financial risk
  - ranges from 1 to 4, with the value of 4 indicating “unwillingness to take any financial risks.”
  
- ▶ Debt aversion: taste for carrying revolving credit card debt
  - = 1 if paying off their balances in full “always or almost always”

**Table 6: Determinants of Prepayment and Contribution Behavior**

| Variable                     | Short<br>Mortgage | Discretionary<br>Prepayments | Retirement<br>Contributions |
|------------------------------|-------------------|------------------------------|-----------------------------|
| Mortgage Spread (in ppt)     | 8.78***           | -1.59**                      | -0.76                       |
| Federal Tax Bracket (in ppt) | 0.08              | 0.03                         | 0.34**                      |
| Itemize Deductions           | -8.29***          | 1.03                         | 6.55**                      |
| Liquidity Constrained        | -9.11***          | -6.16***                     | -5.32**                     |
| Log of Net Worth             | 4.72***           | 0.19                         | 0.05                        |
| Risk Aversion                | 2.39*             | -1.60                        | -5.40***                    |
| Debt Averse                  | 6.06***           | 8.82***                      | 0.10                        |
| College Education            | -3.71             | -0.71                        | 1.13                        |
| Use Professional Advice      | -0.78             | 1.85                         | -2.27                       |
| Employer TDA match (in ppt)  | 0.13              | -0.08                        | 2.20***                     |
| Age (in yrs)                 | 0.83***           | -0.23**                      | -0.44***                    |
| Not Subject to TDA Penalty   | -9.04**           | 2.62                         | -8.70*                      |
| Mortgage Insurance (PMI)     | -8.19***          | -1.76                        | 1.19                        |
| High Homestead Exemption     | 0.01              | 1.52                         | 3.05                        |
| Number of Children           | 1.57*             | -1.71**                      | -1.30                       |
| Number of Observations       | 2,647             | 2,647                        | 2,647                       |
| Pseudo R-Squared             | 0.095             | 0.045                        | 0.077                       |

**Table 7: Determinants of the Propensity to Contribute vs. Prepay**

| Variable                    | Short<br>Mortgage | Short<br>Mortgage | Discretionary<br>Prepayments | Discretionary<br>Prepayments |
|-----------------------------|-------------------|-------------------|------------------------------|------------------------------|
| MAP                         | 1.04***           | 0.86**            | -0.33**                      | -1.33**                      |
| MAP*Risk Aversion           |                   | -0.14             |                              | 0.26                         |
| MAP*Debt Aversion           |                   | 0.31              |                              | 0.51*                        |
| MAP*College                 |                   | 0.87**            |                              | 0.15                         |
| MAP*Prof. Advice            |                   | 0.76***           |                              | -0.11                        |
| Risk Aversion               | -0.14***          | -0.15***          | -0.08                        | -0.09                        |
| Debt Aversion               | -0.13*            | -0.12*            | -0.33***                     | -0.36***                     |
| College Education           | 0.08              | 0.14**            | 0.08                         | 0.10                         |
| Use Professional Advice     | 0.04              | 0.01              | -0.07                        | -0.06                        |
| Employer TDA match          | 0.04***           | 0.03***           | 0.06***                      | 0.06***                      |
| Mortgage Insurance          | 0.12              | 0.15**            | 0.07                         | 0.09                         |
| Homestead Exemption         | 0.10              | 0.05              | 0.04                         | 0.04                         |
| Liquidity Constrained       | 0.13              | 0.12              | 0.20                         | 0.19                         |
| Log of Net Worth            | -0.06***          | -0.06***          | 0.05                         | 0.05                         |
| Age (in years)              | -0.02***          | -0.04***          | 0.007                        | 0.003                        |
| Number of Observations      | 2,078             | 2,078             | 1,924                        | 1,924                        |
| # of Non-limit Observations | 462               | 462               | 286                          | 286                          |
| Pseudo R-Squared            | 0.111             | 0.123             | 0.032                        | 0.034                        |

# Conclusion

- ▶ Households leave about 1.5 billion dollars on the table annually by prepaying their mortgage debt instead of saving in their tax-deferred accounts.
- ▶ Rational reasons are unlikely to explain the magnitude of this mistake.
- ▶ Our evidence suggests that the lack of information and debt aversion can explain the results to some extent.