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MONETARY POLICY AND HOUSEHOLD MOBILITY: THE EFFECTS OF MORTGAGE INTEREST RATES

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E C O N O M I C S B U L L E T I N

Monetary Policy and Homeowner Mobility: The Effect of Mortgage interest Rates

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Abstract

This paper tests the "lock−in" effect of mortgage contract terms and establishes the link between changes in market interest rates and homeowner mobility. The analysis is based on the Panel Study of Income Dynamics during 1990−1993, when mortgage interest rates declined by almost 30 percent

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I. Introduction

When interest rates vary, the value to a homeowner of a fixed-rate mortgage varies as well. In particular, if mortgages are not fully assumable, then when interest rates increase, the value of a pre-existing mortgage contract increases as well. Thus, homeowners have an incentive to postpone moving in response to other economic incentives. Similarly, when interest rates decrease, households who had previously postponed moving now have this disincentive removed. The only empirical evidence on the magnitude of this effect is based upon analyses of the Panel Study of Income Dynamics (PSID) during 1979-1981, a period of unusual volatility and increasing interest rates during 1979-1981. (Potepan 1989, Quigley 1987)

This paper investigates the importance of these mortgage contract terms upon mobility during a more typical environment, the early 1990s, when much lower interest rates declined even further. Thus, it investigates the implications for mobility of a decline in the "lock in" effect of mortgage contracts. We analyze household behavior, also using the PSID, but during the 1990-93 period when mortgage yields on new purchases declined by almost 30 percent (from 10 to a little over 7 percentage points). Any incentive to delay residential moves due to unfavorable mortgage terms declined during this period of analysis.

We find strong evidence that certain demographic factors and market conditions -- changes in the head of household, an increase in family size, appreciation in house values -- affect family mobility prospects. The evidence about the importance of mortgage contracts upon mobility is more ambiguous. In a simple proportional hazards framework, there is little evidence of a relationship in these more recent data. However, when the model is extended to investigate non proportional responses -- that is, when the mobility response to changes in mortgage conditions is allowed to vary with the household's current length of tenure -- a systematic pattern emerges. For households who have lived in their current dwellings for more than a decade, a decline in the financial value of a mortgage significantly increases the probability of household mobility. These effects are small relative to demographic influences upon household mobility however.

II. Mortgage Terms and Household Mobility

The financial conditions underlying home mortgages may represent substantial transactions costs, inhibiting residential mobility. Beyond prepayment penalties, households may incur losses whenever they hold mortgages whose coupon interest rates are higher than those charged for new mortgages of equivalent maturities. If mortgage contracts were assumable and if their financial terms were fully capitalized into house prices, then current homeowners could always realize the financial advantages of favorable mortgage terms upon selling the house. Neither of these conditions holds (See Durning and Quigley, 1985).

The financial advantage arising from ownership of a mortgage at contract interest rate i, when the interest rate charged on new first mortgages is r, depends upon the monthly payment P for debt service and the remaining term to maturity η. With fixed-rate, level-payment mortgages, the present discounted value (PDV) of a mortgage on favorable terms (i<r) is merely

$$(1) \qquad \mathrm{PDV}(P,i,\eta,r) = \sum_{j=1}^{\eta} \frac{P}{(1+i)^j} - \sum_{j=1}^{\eta} \frac{P}{(1+r)^j} = B - \sum_{j=1}^{\eta} \frac{P}{(1+r)^j} = g[Y]$$

where B is the unpaid balance of the mortgage at time j=1 and Y is a vector of contractual terms and interest rates, Y(P,B,i,r, η).

Of course, the financial incentives summarized by the g[ ] function are not the only reason, or even the most important reason, why mobility rates vary across homeowners. Housing demand and residential mobility vary with a wide range of sociodemographic characteristics of households (Quigley and Weinberg, 1977). Let the conditional hazard of mobility, h(t), depend upon *Y* and a vector *X* of sociodemographic characteristics, i.e.,

$$(2) \qquad h(t,x,y) = h_0(t)\pi(X,Y) \quad ,$$

where h_0 is the baseline hazard, a function of duration alone. Assume further π is separable in the form

$$(3) \quad \pi(\mathrm{X},\mathrm{Y}) = \exp(\beta_1 \mathrm{X} + \beta_2 \mathrm{g[Y]}) = \mathrm{t}^{\beta_3 \mathrm{g[Y]}} \exp(\beta_1 \mathrm{X} + \beta_2 \mathrm{g[Y]})$$
$$= \exp(\beta_1 \mathrm{X} + \beta_2 \mathrm{g[Y]} + \beta_3 \log \mathrm{t}\ \mathrm{g[Y]})$$

where the β's are parameters. As indicated in (3), it may be reasonable to presume that the importance of mortgage terms and interest rates is not independent of tenure time. For example, if households' attachments to neighborhoods increases over time (see Dynarski, 1985), then the same increase in the transactions costs of moving may affect the mobility incentives of households (and their hazards of moving) quite differently depending upon length of tenure. The proportionality assumption can be tested in a straightforward manner, by testing the hypothesis that $\beta_3 = 0$ in equation (3).

This specification was estimated using the 1979-81 PSID to evaluate the effects of mortgage terms upon homeowner mobility (Results are presented in Quigley, 1987, page 639).

III. New Results from the 1990s

During 1991 and 1992, the PSID survey asked household respondents to indicate their remaining mortgage balances and the remaining term to maturity of their mortgages. The survey also asked households to indicate their gross monthly payments and the portion of payments reserved for insurance and property taxes. In principle, this identifies the contractual interest rate.

Despite the care taken in verifying data by PSID researchers, it was necessary to exclude a substantial fraction of the sample of homeowners from the statistical analysis. Of the 4,871 homeowner households surveyed in 1991, it was possible to obtain consistent information on 2085; of the 5079 homeowners surveyed in 1992, complete data were available for 2,662. (The steps taken to verify data and to eliminate observations are reported in Quigley, 2001).

Of course, these samples include a substantial fraction of households -- about forty percent -- who have no mortgages at all. For those households, the mortgage premium is zero (and is unaffected by interest rates). Table 1 indicates the distribution of mortgage premia, and shows a substantial mass point at zero.

Table 2 reports the results of a series of hazard models that include household demographics as well as the financial variables whose distribution is summarized in Table 1.

Table 1
Distribution of Mortgage Premium

A. Premium in Dollars

	1991		1992	
Premium	Frequency	Percent	Frequency	Percent
<-$10,000	155	7.43%	306	11.94%
-$10,000 to -$5,000	144	6.91%	244	9.52%
-$5,000 to -$2,500	154	7.39%	160	6.25%
-$2,500 to -$1,000	112	5.37%	148	5.78%
-$1,000 to -$0.01	96	4.60%	93	3.63%
$0	898	43.07%	1091	42.58%
$0.01 to $1,000	107	5.13%	100	3.90%
$1,000 to $2,500	83	3.98%	112	4.37%
$2,500 to $5,000	111	5.32%	111	4.33%
$5,000 to $10,000	110	5.28%	109	4.25%
>$10,000	115	5.52%	88	3.43%
Total Observations	2,085	100.00%	2,562	100.00%

B. Premium/Value

	1991		1992	
Premium/Value	Frequency	Percent	Frequency	Percent
<-0.25	35	1.68%	79	3.08%
-0.25 to -0.10	153	7.34%	272	10.62%
-0.10 to -0.05	155	7.43%	240	9.37%
-0.05 to -0.0001	318	15.25%	360	14.05%
0	898	43.07%	1091	42.58%
0.0001 to 0.05	292	14.00%	321	12.53%
0.05 to 0.10	115	5.52%	105	4.10%
0.10 to 0.25	100	4.8%	78	3.04%
>0.25	19	0.91%	16	0.62%
Total Observations	2,085	100.00%	2,562	100.00%

Note: Mortgage Premium is defined in equation (1) as the PDV of the mortgage at the contract rate minus the PDV at the current rate for new mortgages.

Table 2
Basic Hazard Models of Household Mobility
(asymptotic t-ratios in parentheses)

Covariate	Model A		Model B		Model C		Model D	
Mortgage Premium ($x10^4$)	000.9 (1.52)							
Premium/House Value			0.487 (0.704)					
Premium* Dummy for positive ($x10^4$)					0.067 (0.59)			
Premium* Dummy for negative ($x10^4$)					0.112 (1.22)			
(Premium/Value)*(Dummy for pos)							0.637 (0.58)	
(Premium/Value)*(Dummy for neg)							0.388 (0.72)	
Increase in Family Size (number)	0.662 (9.80)	*	0.662 (9.81)	*	0.661 (9.76)	*	0.663 (9.85)	*
Decrease in Family Size (number)	0.097 (0.62)		0.094 (0.60)		0.095 (0.61)		0.095 (0.61)	
Family Income (1,000's of dollars)	0.001 (0.51)		0.001 (0.49)		0.001 (0.57)		0.001 (0.47)	
Age of Head (years)	-0.016 (2.24)	*	-0.016 (2.23)	*	-0.016 (2.26)	*	-0.016 (2.18)	*
Education of Head (years)	0.055 (1.66)	**	0.054 (1.65)	**	0.056 (1.67)	**	0.054 (1.65)	**
Family Size (number)	0.012 (0.27)		0.012 (0.27)		0.013 (0.28)		0.012 (0.27)	
Black Household (1=yes)	-0.366 (1.72)	**	-0.364 (1.70)	**	-0.365 (1.71)	**	-0.366 (1.71)	**
Other NonWhite Household (1=yes)	0.081 (0.19)		0.078 (0.19)		0.086 (0.20)		0.072 (0.17)	
New Family Head	1.330 (6.53)	*	1.336 (6.57)	*	1.331 (6.54)	*	1.336 (6.59)	*
Chi-Square	273.62		269.83		274.88		271.67	

* Significant at the 5% level
** Significant at the 10% level

These demographic variables are identical to those used in the previous analysis of PSID data. The pattern of these coefficients is very similar to previous results. Increases in family size are significantly related to household mobility, but decreases in family size have no statistically significant impact. Younger households and those with more education are more likely to move in any given year. Neither the level of income nor the size of the family is significantly related to household mobility. There is some evidence that, holding other factors constant, black homeowners are less likely to move than whites.

Although the Chi squared statistic indicates that each of the models is highly significant, there is little evidence that mortgage financial terms affected household mobility during this period of declining interest rates.

Table 3 reports the results from an expanded set of variables. First, in Models E through H we delete the four demographic variables which are clearly insignificant in the models reported in Table 2. Second, following Keil (1994) we include a measure of the one-year house price appreciation experienced by each household. This is computed from the self-assessed house values reported for each homeowner. Third, following Wu (1997) we include measures of the current loan-to-value ratio for each household as well as its monthly housing payment-to-income ratio. Wu argues that these two variables help identify those constrained households who cannot refinance in response to interest rate declines. Fourth, we estimate models which relax the assumption of proportionality in the relationship between mortgage terms and household mobility.

The Chi squared statistics reported in Table 3 are larger than for the previous models, reflecting the increased statistical significance of the results. There is strong evidence that household mobility decisions are related to increases in family size, the existence of a new head of household, the age, education, and race of the head of household, and is sensitive to recent appreciation in housing prices. There is no indication that mobility decisions are responsive to loan-to-value ratios or to payment-to-income ratios.

Allowing for a non proportional relationship between the valuation of mortgage terms and household mobility significantly increases the statistical power of the models. Moreover, the coefficient on the non proportionality term is consistently negative and is of the same order of magnitude as the coefficient on the proportionality term. This suggests that, after only a few years of tenure, the possession of a mortgage on terms more favorable than the current market does cause households to postpone moving decisions. The possession of mortgages on favorable terms does affect mobility decisions, but its effect varies with the length of household tenure in its dwelling.

IV. Implications and Conclusions

When the effect of favorable mortgage terms on mobility behavior is allowed to vary with length of tenure, the results from the reanalysis of the PSID are quite consistent. After a few years of living at the same address, households become less likely to move as the value of their mortgages is larger relative to the cost of a new mortgage at current interest rates.

This result persists when value of the mortgage premium is measured in dollars or as a fraction of the value of the house. This general result is found in simple models (not reported here) that measure only the effects of mortgage terms upon mobility patterns and also in more complex models that measure household demographics as well.

The magnitude of these effects can be simulated using these statistical models. Consider, Model F, the preferred specification. Define the "base case" as the cumulative household

Table 3

Expanded Non-Proportional Hazard Models of Mobility

(asymptotic t-ratios in parentheses)

Covariate	Model E		Model F		Model G		Model H	
A. Proportional Component								
Mortgage Premium ($x10^4$)	0.157 (2.07)	*						
Premium/House Value			1.864 (1.78)	**				
Premium* Dummy for positive ($x10^4$)					0.077 (0.56)			
Premium* Dummy for negative ($x10^4$)					0.341 (1.45)			
(Premium/Value)*(Dummy for pos)							0.700 (0.36)	
(Premium/Value)*(Dummy for neg)							3.096 (1.43)	
Increase in Family Size (number)	0.678 (9.87)	*	0.676 (9.91)	*	0.676 (9.77)	*	0.676 (9.78)	*
Age of Head (years)	-0.015 (1.88)	**	-0.015 (1.84)	**	-0.015 (1.86)	**	-0.015 (1.83)	**
Education of Head (years)	0.058 (1.81)	**	0.058 (1.82)	**	0.060 (1.82)	**	0.058 (1.81)	**
Black Household (1=yes)	-0.347 (1.63)		-0.369 (1.72)	**	-0.345 (1.62)		-0.358 (1.65)	**
New Family Head	1.370 (6.73)	*	1.377 (6.79)	*	1.360 (6.73)	*	1.364 (6.68)	*
Household Value Appreciation (in$$) ($x10^4$)	0.019 (1.96)	**	0.021 (2.15)	*	0.021 (2.29)	*	0.021 (2.18)	*
Loan to Value Ratio	0.029 (0.11)		0.030 (0.12)		0.052 (0.20)		0.084 (0.30)	
Payment to Income Ratio	-0.111 (0.19)		-0.197 (0.35)		-0.071 (0.13)		-0.218 (0.39)	
B. Non-Proportional Component								
Premium * In tenure ($x10^4$)	-0.067 (1.13)							
Premium* Dummy for positive* In tenure ($x10^4$)					-0.021 (0.21)			
Premium* Dummy for negative* In tenure ($x10^4$)					-0.164 (1.23)			
(Prem/Val)* In tenure			-1.173 (1.70)	**				
(Prem/Val)* Dummy for positive* In tenure							-0.582 (0.40)	
(Prem/Val)* Dummy for negative* In tenure							-1.738 (1.68)	**
Chi-Square	296.99		296.99		296.99		296.99	

* Significant at the 5% level
** Significant at the 10% level

mobility rate estimated from Model F assuming that a household of the sample average demographic characteristics takes out a level-payment 30-year mortgage to finance 80 percent of the purchase price of the average house, obtaining a 7 percent mortgage. For years 13 (the mean tenure of homeowners) through 30, the cumulative changes in mobility arising from changes in age and mortgage balances can be computed.

For comparison with this base case, we can compute the mortgage premium, assuming that interest rates change in year 13 and then remain constant. The stream of payments for the remaining 17 years is valued using the new interest rate. The mortgage premium $\boldsymbol{P_i}$ associated with the new interest rate r for each remaining year of tenure, $\boldsymbol{i}$=13, 14,..., 30 is calculated as

$$(10) \qquad P_i = C_i - \sum_{j=13}^{30} \frac{D}{(1+r)^{i-12}}$$

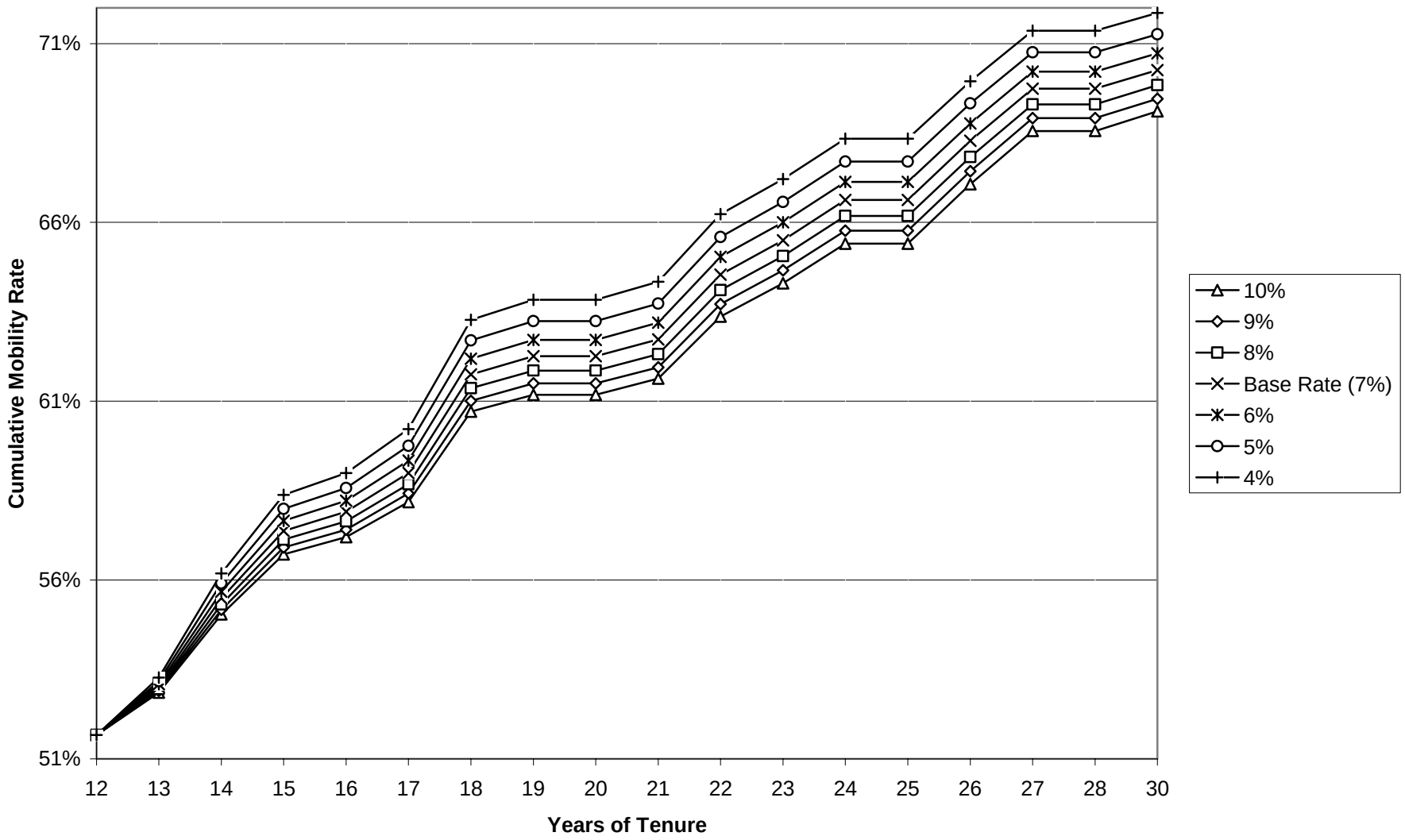
where $\boldsymbol{C_i}$ is the unpaid mortgage principal remaining at year **i**, and $\boldsymbol{D}$ is the annual mortgage payment. Given these computations, the coefficients of Model F can be used to estimate mobility rates.

Figure 1 illustrates these mobility responses graphically. As indicated in the figure, the differences in mobility rates are small. They suggest that a 6 percentage point swing in interest rates is associated with about a 3 percentage point change in cumulative mobility rates over the remaining life of the mortgage.

Overall, the quantitative results confirm the effects of interest rate changes on homeowner mobility in the housing market. Increases in interest rates do inhibit the mobility of the holders of residential mortgages. Declines in interest rates reduce the transactions cost of adjustments in housing consumption by homeowners.

Figure 1

Effect of Mortgage Interest Rate Changes on Cumulative Homeowner Mobility Rates



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