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COLLATERAL DAMAGE: HOW REFINANCING CONSTRAINTS EXACERBATE REGIONAL RECESSIONS

Andrew Caplin
Charles Freeman
Joseph Tracy

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ABSTRACT

In the current structure of the U.S. residential mortgage market, a fall in property values may make it very difficult for homeowners to refinance their mortgages to take advantage of falling interest rates. In this paper, we explain the institutional background for this effect and quantify its importance. We confirm that this form of collateral constraint has greatly reduced recent refinancing in states with depressed property markets. We also point to the many ways in which the reduction in refinancing may have inflicted additional damage in these already recession-hit states. Finally, we show that relatively minor institutional changes could have neutralized the damaging effects of the collateral constraints, and we discuss why the institutions have their current structure.

Andrew Caplin
Department of Economics
International Affairs Building
Columbia University
New York, NY 10027
and NBER

Charles Freeman
Chemical Bank
380 Madison Avenue
New York, NY 10017

Joseph Tracy
Department of Economics
Columbia University
New York, NY 10027

When adverse economic shocks cause property values in a region to fall, the damage to the collateral makes it difficult or impossible for many homeowners to obtain new mortgages. In the recent period, this has meant that homeowners in depressed regions have been unable to refinance their mortgages to take advantage of falling interest rates. This inability to refinance has further economic impacts on the region such as lowering wealth and liquidity, increasing delinquencies and generally amplifying the damaging effects of the initial regional shock. In this paper, we describe in detail the institutional features of the U.S. mortgage market that give rise to these effects and begin to quantify their importance.

The U.S. residential mortgage market for 1-4 family dwellings totals 3.9 trillion dollars.[1] Much of the mortgage debt is in the form of 30-year mortgages with the interest rate fixed for the life of the contract. These mortgages can be prepaid without penalty at any time. For the vast majority of borrowers, paying off the original loan involves refinancing with a new loan. Given the drop in interest rates over the past few years, it is not surprising that there has been a massive boom in refinancing.

In order to refinance a mortgage, the borrower must first qualify for a new mortgage. As we describe in Section 2, the current qualification standards are set in such a way that a fall in property values may make it very difficult to qualify for the new loan. Given the big differences in house price dynamics across different states, this suggests that there may be important geographic patterns in refinancing activity. Until now, there has been very little systematic effort devoted to gathering evidence and assessing the importance of this form of constraint on refinancing activity.[2]

We provide the first quantitative assessment of the impact of constraints arising from regional property market dynamics on refinancing activity. To accomplish this, we use a new data set on more than 35,000 individual mortgages. Our analysis of this data confirms both the qualitative and the quantitative importance of property market behavior in determining differences in refinance rates across states. In particular, we estimate that in our sample of states with weak property markets the rate of refinancing was reduced by 50% relative to the rate in the remaining states in our sample.

The reduced rate of refinancing has a wide variety of negative ramifications for the affected regions. By reducing wealth and liquidity, the low level of refinancing holds back consumer spending in the region, and consequently lowers state and local tax receipts. In addition, for those experiencing financial difficulties, the inability to refinance and lower their

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[1]Federal Reserve Bulletin, Vol. 79, June 1993, Table 1.54, pg. A37.

[2]For example, the prepayment model of Richard and Roll (1989) does not incorporate geographic constraints. However, the topic is just beginning to get attention in the mortgage trade literature, as in Monsen (1992).

monthly installment payments may increase the probability that they will go delinquent on their mortgage. For this reason, collateral constraints on refinancing may play a significant role in boosting delinquencies in troubled regions.

There is also an important interaction between regional constraints on refinancing and attempts at the federal level to stimulate the economy through monetary policy. The constraints on refinancing imply that reductions in interest rates will have more of an expansionary effect in regions that have robust property markets. The refinancing constraints make it hard for the monetary authorities to get liquidity to those regions of the economy that need it the most.

By confirming the importance of collateral constraints in the residential housing market, our work contributes to the growing literature on the interaction between fluctuations in the net worth position of borrowers' and economic activity, as surveyed by Gertler and Hubbard (1989). The idea that collapses in borrower net worth may have damaging effects on the economy was first proposed by Irving Fisher in his "debt deflation" theory of the Great Depression. Fisher argued that the deflation of the early 1930's resulted in a greatly increased real burden on debtors, causing both increased bankruptcy and reductions in the volume of new loans. More recently, Hubbard and Kashyap (1992) argued that reductions in agricultural land values reduced farmers' collateral so much that real investment in agriculture was significantly reduced.

There is an important difference between our analysis of collateral constraints and earlier studies of the impact of borrower net worth on investment. Earlier work focuses on cases in which borrower net worth constrains the level of investment due to asymmetric information. For example, in the model of Bernanke and Gertler (1989) the larger the borrowers' stake in the projects the easier it is to trust them to select only good projects, and to put sufficient effort into these projects. However, the incentive problems are all but irrelevant to the issue of whether or not an individual should be allowed to refinance an existing 30-year mortgage. In the case of refinancing a mortgage, the risks inherent in financing the "project" of the owner purchasing their own home have already been accepted by the financial sector. The constraint on refinancing simply makes it impossible for the borrower to take advantage of a fall in project costs: the project has been undertaken regardless.

Viewed in this light, the presence of a collateral constraint on refinancing should be seen as resulting from incompleteness in the mortgage contract, rather than representing a response to problems of asymmetric information. Indeed, it would be simple to rewrite the mortgage contract in such a way that reductions in property values would not prevent the borrower from taking advantage of declining interest rates. For example, the initial contract could contain a clause that permits an automatic resetting of the interest rate for the payment of a

fixed fee. Such a contract would have the desirable feature that it would help to insure borrowers' against the double misfortune of falling house prices and higher than necessary payments of interest, as opposed to the current system that additionally penalizes individuals who live in economically depressed regions of the country.

Overall, our results suggest that the current institutional structure of the U.S. mortgage market may cause considerable and unnecessary damage to regions that are experiencing hard times. In seeking to understand why the mortgage market is structured as it is, we believe that it is important to analyze the various roles taken on by the Federal Government and other institutions active in the mortgage market. In this as in so many other areas of the financial markets, we find that a market structure initially inspired in large part by experiences in and around the Great Depression has had unintended implications at a much later date.

The remainder of the paper is structured as follows. In Section 2 we outline important structural features of the U.S. residential mortgage market, focusing in particular on a detailed description of the process of qualifying to refinance a mortgage. Section 3 outlines our database of 30-year fixed-rate mortgages, and also explains our statistical methodology. Section 4 presents the model estimates and quantifies the impact of the constraints on refinancing. Section 5 discusses the broader impact of the refinancing constraints that we have identified, and contains speculation on why the institutional structure prevents simple improvements in the form of the contract. Section 6 contains concluding remarks and outlines directions for further research.

2 The Refinance Application Process

The first step in building an empirical model of the decision to refinance is to gain an understanding of the refinancing process. In this section, we discuss the various steps involved in the process of refinancing a mortgage. In particular, we focus on why collateral constraints may prevent a homeowner from refinancing at a lower interest cost.

Following a drop in general interest rates, a homeowner may consider the merits of refinancing an existing fixed-rate mortgage. The benefits of refinancing are the reductions in monthly interest payments in the future. The present value of the interest savings depends critically on the homeowner's expected future tenure in the house. The costs of refinancing include the transactions costs involved in obtaining a new mortgage. These involve time costs, loan application fees, legal fees, and any up front points for the new mortgage. An industry standard is that the transactions costs average from 1-3 percent of the value of the

mortgage (excluding any up front points paid to the lender).[3] A schematic diagram of the refinance application process is given in Figure 1.

After selecting a specific lender and mortgage product, the homeowner pays the lender an application fee in order to begin the approval process. At this time, the "price" on the potential new mortgage is set. Lenders such as Chemical Bank that deal only in A-credit loans do not individually negotiate rates with the borrower.[4] Instead, they offer a menu of prices for their mortgage products which vary by rate, closing costs, and points given the maturity, rate type, property type, ownership type, loan size, and level of documentation submitted. The borrower makes a selection and the lender then decides whether to approve or disapprove the loan. If approved, the lender implicitly sets the maximum loan amount.

As the schematic indicates, the lender applies three basic screens in its underwriting process: credit tests, debt/income tests, and loan-to-value (LTV) tests. If the loan application fails any of these three screens, the application is likely to be rejected by the lender. This screening process and the method of calculating the ratios is standardized across all major lenders dealing in A-credit mortgage lending. The real differentiating items between lenders are how each defines the inputs to the ratios.[5]

In the credit test, the borrower and co-borrower's credit records are pulled and reviewed according to several criteria. For lenders such as Chemical Bank, the purpose of this screen is to determine if the borrowers still have an A-credit rating. Lenders do this using either a judgmental credit review by one of their underwriters who evaluates the information in the credit report against the lender's credit "guidelines"[6]; or, alternatively, they can set upper and lower bounds for the credit "scores" reported by the credit bureau. Credit scores are summary statistics produced by the credit bureau based on statistical analysis of the same

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[3]See Table A3 for a detailed listing of these costs for the NY/NJ/CT area. Up front points paid on a refinance mortgage are more expensive than points paid on a mortgage for a home purchase. The latter are deductible from the homeowner's Federal income tax while the former are not deductible. Lenders also offer no point refinance mortgages that charge on average a premium of 3/8ths of a point in the rate.

[4]Second-tier lending institutions that deal in below A-credit paper will negotiate rates with the borrower. See Table A4 for a definition of the various credit grades.

[5]For example, in the debt/income screen lenders may differ in how they define income; that is, how to treat bonuses, commissions, overtime, alimony, welfare, etc..

[6]The guidelines are set by the lender's credit policy in relation to the credit bureau information such as the number of serious delinquencies (derogs), bankruptcy filings, the number and utilization of credit lines, income, occupation, and the number of recent applications for new credit (interrogatories).

Refinance Application Process

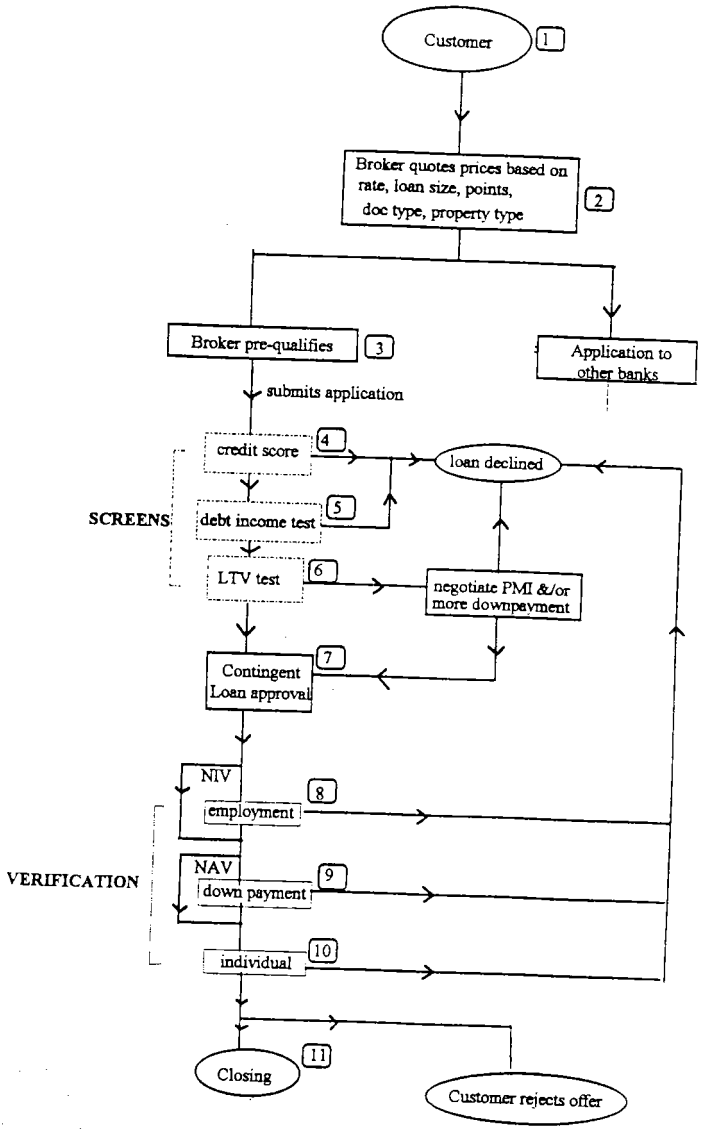

Figure 1

credit bureau information used in the lender's guidelines. Applications with credit scores above the upper bound are passed on to the next screen; those with credit scores below the lower bound are rejected; while those between the two bounds are reviewed further in an effort to find compensatory factors.

Applicants judged as A-credit are then given a debt/income test. The test is comprised of two ratios which are called the "front-end" and the "back-end" debt ratios. The front-end ratio is calculated as the borrowers' monthly principal, interest, taxes and insurance (PITI) divided by the monthly pre-tax income. The back-end ratio is the PITI plus any recurring monthly obligations (debt or lease payments) divided by the monthly pre-tax income. Applications with front and/or back-end ratios above the set limits (i.e. 28/36) are generally rejected.

Applications passing both the credit test and the debt/income test are put through one final screen.[7] The lender hires an appraiser to value the property. The lender uses the appraised value to calculate the loan-to-value ratio (LTV). A loan application with an LTV below 80% is routinely accepted. Applications passing the earlier two screens and with an LTV in the 80-90% region will generally be asked by the lender to reduce the LTV to 80% by making a higher down payment, or to apply for private mortgage insurance (PMI). PMI companies typically charge a 25 basis point rate premium and one point up front for every five percentage point increase in the LTV above 80%. The PMI policy typically insures the lender on the first 25% of the loan amount.

The above three screens are common across all major lenders active in the A-credit mortgage market. The degree of standardization reflects the role of the secondary market for mortgages. Only "conforming" mortgages can be sold by a lender on the government agency secondary market (i.e. Government National Mortgage Association (GNMA), Federal National Mortgage Association (FNMA), and the Federal Home Loan Mortgage Corporation (FHLMC)). The credit, debt/income, and LTV screens are all necessary conditions for a mortgage to be conforming. Nonconforming loans are generally held in the lenders own portfolio.[8] As a consequence, the cost of providing leeway on any of these criteria is that a

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[7]Borrowers that fail the credit and/or the debt/income screen may reapply for a refinance with a lender that deals with below A-credit paper. These institutions charge a premium over the A-credit lenders in the form of up front points. Loans with B-level credit generally will pay 5-7 points as compared to 2-3 points for A-level credit.

[8]Lenders typically charge a rate premium (i.e. 3/8ths) for holding a nonconforming loan in portfolio. Lenders can pool together nonconforming loans and secure pool insurance from a PMI company. The pool insurance is used as a substitute for the government agency guarantee of principal payment. PMI companies often request a few years of performance information on the

lender must hold the underwriting risk for a period of time. This imposes a great deal of discipline on the application process.

Applications that pass the three screens are given a contingent approval. Three contingencies must be resolved prior to the closing: employment verification, down payment verification, and identity verification. The level of documentation required for each verification is a feature of the mortgage product. In the past, some lenders have offered mortgages with minimal or no verification (so called Limited Docs, NIVs, and/or NAVs).[9] When all three contingencies are resolved to the lender's satisfaction, the lender is ready to close on the mortgage. The homeowner is free to drop the application process at any time up until the closing.

To summarize, a homeowner must requalify for a new mortgage in order to refinance an existing mortgage. In regions suffering from adverse economic conditions, the ability to refinance will likely be constrained by declining property values. As LTV's increase into the 80-90% region, the costs of refinancing increase due to the need for PMI. As LTV's increase past 90%, homeowners may be completely rationed out of the refinance market. In addition to increasing LTV's, adverse regional shocks can also constrain mortgage refinancing by depressing incomes and/or damaging credit profiles, thereby making it more difficult for homeowners to pass the credit and/or debt/income screens.

3 Empirical Specification

In this section, we discuss the basic characteristics of the data we use in our analysis. Measuring the incentive to prepay facing a mortgage holder involves several issues which we discuss in light of our data. Incentives to prepay can be constrained by deteriorating equity positions in housing markets suffering from declining prices. We discuss how we capture this housing market effect through disaggregating our overall sample into four subsamples. Finally, we discuss why we estimate the model using a hazard function methodology.

An important point to stress is that having access to individual mortgage data greatly enhances our ability to study the refinance decision. The empirical literature on refinancing is based almost entirely on models estimated using pool data derived from the secondary

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mortgages before offering pool insurance.

[9]Limited Doc's refer to shorter (i.e. easier) verification of income through the use of pay stubs in lieu of direct written inquiries from the lender to the employer. NIV refers to no income verification at all. NAV refers to no asset verification in lieu of three months of bank statements.

market.[10] The *Bond Buyer*, a subsidiary of International Thomson Publishing Corporation, holds the distribution rights for all data on GNMA, FHLMC, and FNMA mortgage pools. Their pool data contains a pool identifier, the original pool balance, the current prepayment factor, the pass-through rate, the issue date, the latest loan maturity date, the original and current weighted average maturity (WAM), the original and current weighted average coupon (WAC), and lender information. No appraisal information is available, making it impossible to compute a weighted average LTV for the pool. Prepayment models are estimated using the percent of the pool which has prepaid at any point in time. It is clear that the high quality and level of detail in our data give us a significant informational advantage for estimating the impact of refinancing constraints.

3.1 Data Description

We focus our empirical analysis on fully documented (no NIV's or NAV's) 30-year fixed-rate conventional conforming mortgages for 1-4 family dwellings (excluding Coops).[11] The sample consists of all mortgages serviced by Chemical Bank with originations between June 1989 and May 1992. The sample includes mortgages whose servicing was purchased by Chemical Bank, and excludes mortgages whose servicing was sold by the bank. This results in a total of 35,865 mortgages involving a total of 626,376 monthly observations. Mortgage servicing involves collecting the monthly principal and interest payments from the borrower, and remitting this to the investors in the pool in return for a fee. Mortgage servicing data is very accurate as a result of its use for billing.

For each mortgage, we observe the following information: the origination date, balance, and interest rate on the mortgage; and the location and original appraised value of the property. When a mortgage prepays, we do not observe in our data if the house was sold or the mortgage was refinanced. We use the original appraised value and original loan balance to calculate the original loan-to-value ratio (LTV_0). For each month the mortgage is in the sample, we calculate the current loan balance using the loan amortization and any partial prepayments. The resulting sample is quite consistent throughout the period of study. Table A1 presents summary statistics for our sample disaggregated into six month intervals. The average LTV_0 remained roughly unchanged at 73-75%, while the average loan size remained in the ninety five thousand dollar range.

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[10] An exception is Green and Shoven (1986). See also Hayre, Lauterbach and Mohebbi (1989) and Schorin (1992).

[11] Conventional mortgages exclude government insured FHA and VA mortgages.

The prepayment experience within the Chemical Bank portfolio mirrors the refinancing observed in the overall market. Figure 2 shows the similarity of the prepayment pattern between our sample and the Mortgage Bankers Association (MBA) overall mortgage refinance index (base period: 3/16/90 = 100). This establishes that the prepayment cycle in our data is driven by refinancing not home sales. We also expect that our qualitative findings will quite easily generalize to the broader market for A-credit mortgage refinancing.

3.2 Empirical Model

The aim of our empirical model is to quantify the determinants of the decision to fully prepay a mortgage.[12] The homeowners' decision to refinance a mortgage involves weighing the benefits versus the costs. As discussed in Section 2, the costs of refinancing a mortgage are roughly proportional to the size of the loan. The appropriate formulation for the incentive to refinance, then, is a function of the origination rate relative to the current rate. If the costs of refinancing were primarily fixed in nature, then the incentive would be best measured as a function of the difference in rates.

Following Richard and Roll (1989), we use the Principal/Value (PV) ratio as our basis for measuring the incentive to refinance. The PV_t is defined to be the mortgage principal outstanding at time t divided by the present value of the current mortgage payments using the "current rate" at time t.

$$PV_t = \frac{r_t}{r_o}\left[\frac{1 - (1 + r_o)^{t-360}}{1 - (1 + r_t)^{t-360}}\right].$$

If the current rate, r_t, is the same as the origination rate on the mortgage, r_o, then $PV_t = 1$. If r_t is below the origination rate, then $PV_t < 1$ and there is a positive incentive to refinance. Note that for young mortgages, PV_t is well approximated by the ratio of the current to the origination interest rate.

The mortgage prepayment option is similar to an implied call option. Consequently, option pricing models are a common starting point for building empirical models of the refinance decision. However, unlike a standard call option, mortgages that are "out-of-the-money" may still prepay due to a home sale. The option effect suggests that in periods of high interest rate volatility there is an incentive to delaying refinancing. In an attempt to control for this option effect, we fit a GARCH(1,1) model for the conditional variance of the

[12]We view this as a zero/one event; that is, we do not model the decision to partially prepay a mortgage.

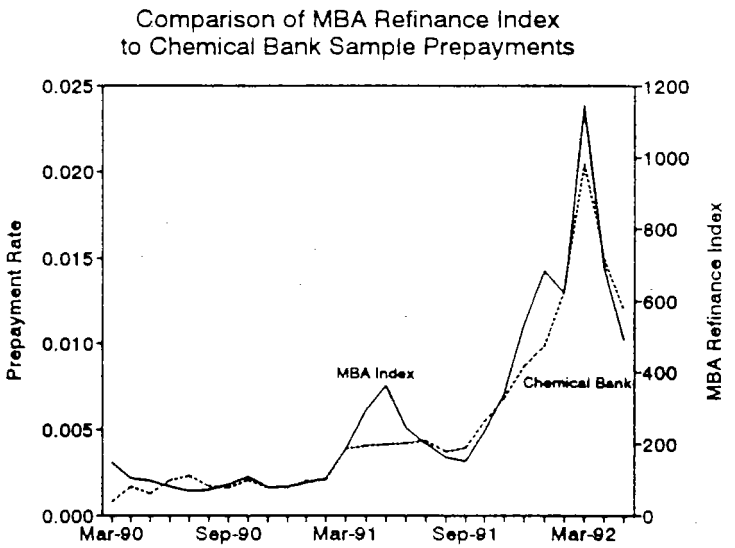
Comparison of MBA Refinance Index
to Chemical Bank Sample Prepayments
Prepayment Rate
MBA Refinance Index
0.025
0.020
0.015
0.010
0.005
0.000
1200
1000
800
600
400
200
0
MBA Index
Chemical Bank
Mar-90
Sep-90
Mar-91
Sep-91
Mar-92

Figure 2

monthly time series of average mortgage interest rates.[13] We use the predicted conditional variance as our measure of volatility. Controlling for PV, we find no additional explanatory power associated with our measure of interest rate volatility. As a consequence, we drop the variable from the analysis.

An immediate issue we must confront is that we never observe the rate at which a homeowner is able to refinance. This is a result of the interest rate heterogeneity that exists in our sample. For a typical quarter in our sample, the inner quartile range in origination rates is 100 basis points. This dispersion reflects more than just regional rate differences. Looking at an analysis of variance, we find that regressing the origination rate on a set of dummy variables for time (measured quarterly) and state explains only 21% of the total variance in rates.

We estimate the model using a variety of assumptions regarding the current rate. The qualitative results are similar across definitions. For the results we present in this paper, we use the following approach to estimate the current rate. Using the month in which a mortgage is booked, we calculate the spread between the origination rate on the mortgage and the national average rate as reported by GNMA, $\Delta = r_o - r_{go}$. We then assume that for this mortgage the current rate t periods after it is booked is the GNMA rate for that period plus that mortgage's initial spread, $r_t = r_{gt} + \Delta$. This definition of the current rate initializes each mortgage to have a PV equal to one in the month it was booked.

A second issue in defining the current rate involves the lags in processing a mortgage refinance application. If a homeowner responds to an incentive to refinance in period t (based on r_t), the actual refinance will not show up in the data until the loan closes in period t+2 or t+3. For this reason, we assume a two month processing lag when constructing the current rate. Our findings are robust to the choice of a lag of two or three months.

The final specification issue regarding PV_t is how we treat those mortgages that are "out of the money"; that is, those mortgages with $PV_t > 1$. This occurs when the current rate is higher than the origination rate. While we will still see in our data prepayments of mortgages with $PV_t > 1$ due to home sales, we would not expect to see **any** refinances. Since we want PV to capture the pure incentive to refinance, we decided to truncate PV_t at one. That is, once r_t is greater that r_o, further increases in r_t have no additional disincentive effects.

Our measure of PV_t does an excellent job of tracking prepayments in our sample. Figure 3 plots the sample prepayment experience and the average PV_t. As the average PV_t in the sample falls below one due to a drop in general rates, prepayments accelerate. In

[13]See Engle (1982) and Bollerslev (1986) for detailed discussions of GARCH models.

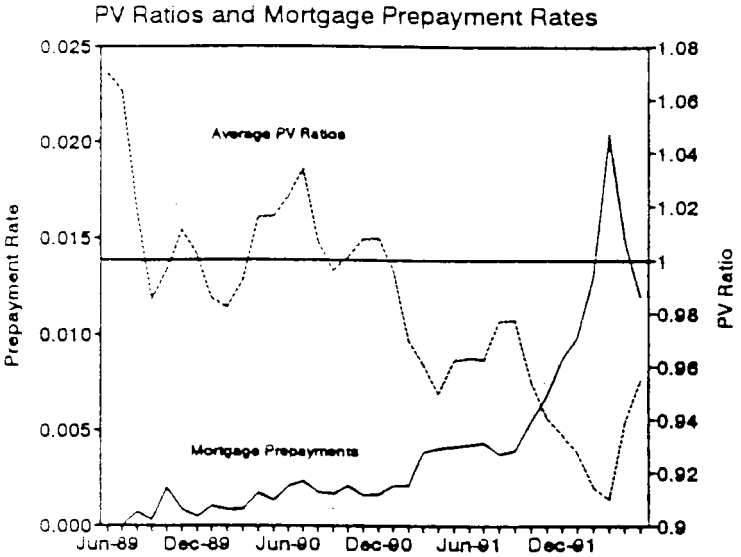
PV Ratios and Mortgage Prepayment Rates
Prepayment Rate
PV Ratio
Average PV Ratios
Mortgage Prepayments
0.025
0.020
0.015
0.010
0.005
0.000
1.08
1.06
1.04
1.02
1
0.98
0.96
0.94
0.92
0.9
Jun-89
Dec-89
Jun-90
Dec-90
Jun-91
Dec-91

Figure 3

Section 4, we will demonstrate that this strong correlation survives in a multivariate analysis where we control for a mortgage's age, LTV_o, and original loan size.

A final key issue in the empirical model is how to formulate the collateral constraints. As we discussed in Section 2, loans with high LTV_t's will be more costly to refinance. In our data we observe the LTV_o based on the original appraisal value and original loan balance. LTV_t depends on the current loan balance and the current appraisal value of the property. We observe the current loan balance in our data. To determine a mortgage's LTV_t we would need an appraisal index; that is, an index that would predict the change in appraisal values in a particular housing market over time. No such appraisal index exists. The difficulty with using one of the many existing house price indices as a substitute is that they all suffer from a variety of different biases.[14] We feel that much more work needs to be done to produce an index suitable for determining current LTV's.

Lacking a reliable measure for LTV_t's, we split our data into four subsamples each meant to capture a varying degree of collateral constraint. The subsamples are defined by the LTV_o and location. We divide the sample into LTV_o "constrained" and LTV_o "unconstrained" mortgages based on whether the LTV_o is above or below 80%. The rationale for using 80% as the line of demarcation is based on the PMI requirement. A loan with an LTV_o above 80% pays a premium for PMI insurance. If the homeowner has any additional free capital at closing, then the total financing costs could have been lowered by buying down the LTV_o to 80%, thereby avoiding the cost of PMI. Evidence for this argument can be seen in Figure 4 in the bunching of LTV_o's in our sample at 80%.[15] This suggests that borrowers taking out mortgages with LTV_o's above 80% generally are financially constrained at the time of closing. These financial constraints may be expected to persist into the future limiting the borrowers' ability to finance a refinance.

We also divide the sample into locationally "constrained" mortgages originated in states with weak property markets and "unconstrained" mortgages originated in states with relatively stable property markets. We use two criteria to determine if a state should be allocated to the location constrained or unconstrained samples. We rank states by their average percent change in the SMSA median house prices from 1990 to 1992, and by their ratio of high LTV_o to low LTV_o prepayment rates. The rationale for the second criteria is that if collateral constraints are binding in a particular market, then we expect that they will

[14]See Haurin and Hendershott (1991) for a summary of the various indices and their problems.

[15]The high LTV loans listed in Figure 4 all have PMI insurance and have been sold by Chemical bank onto the secondary market.

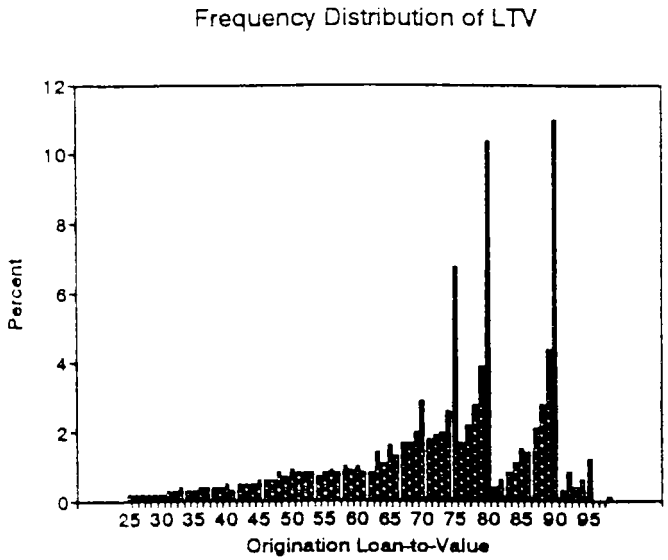
Frequency Distribution of LTV
Percent
0
2
4
6
8
10
12
25 30 35 40 45 50 55 60 65 70 75 80 85 90 95
Origination Loan-to-Value

Figure 4

affect the high LTV_o loans disproportionately. The data suggest that the location constrained set of states consists of Connecticut, Florida, Massachusetts, New Jersey, New York, and Rhode Island. Table A2 reports the subsample values for these selection criteria. Note that the overall prepayment rate in the location constrained states is **half** the prepayment rate in the location unconstrained states.

The resulting four subsamples consist of: (1) unconstrained low LTV_o non-CT,FL,NJ,NY, & RI mortgages; (2) LTV_o constrained mortgages with LTV_o's above 80% originated outside of CT,FL,NJ,NY, & RI; (3) locationally constrained mortgages with LTV_o's below 80% originated in CT,FL,NJ,NY, & RI; and (4) locationally & LTV_o constrained mortgages with LTV_o's above 80% originated in these same states. The concentration of the Chemical Bank portfolio in the Northeast ensures a reasonable size for our locationally constrained subsamples. Table A2 gives summary statistics for each subsample.

3.3 Econometric Specification

We model the conditional probability that a mortgage prepays in a particular month using a hazard function. This is a natural choice for several reasons. The hazard rate measures the probability of prepayment in a month given that a mortgage has not prepaid in a prior month. This is exactly the conditional probability we are interested in estimating. Hazard models also allow us to incorporate time-varying covariates such as PV_t in a natural way. This is clearly critical to relating current prepayments to current incentives in the market. Finally, hazard models can handle censoring of spell durations. Many mortgages in our sample have not prepaid by the end of the sample period. Their duration time until prepayment is censored. Hazard models allow us to keep these mortgages in the sample, and to use the information on their current duration to help in estimating the effect of observed heterogeneity in mortgages on prepayment probabilities.

We use the proportional hazard specification developed in Flinn and Heckman (1983).

$$h(t \mid X,\theta) = \exp(\gamma_o + X_t\beta + \sum_{k=1}^{K} \gamma_k (t^{\lambda_k} - 1)/\lambda_k + c\theta)$$

where t = current duration of mortgage,
X = vector of exogenous variables,
θ = mortgage-specific unobserved heterogeneity,
c = factor loading on unobserved heterogeneity.

One advantage of this specific functional form for the empirical hazard is that it embeds many different forms of duration dependence as special cases. For example, this hazard

specification can be specialized to the Weibull, Gompertz, and the Quadratic hazards. This flexibility facilitates the selection of an appropriate parametric form for the duration dependence. Testing between these hazard formulations can be carried out using standard likelihood ratio tests. In addition, we can easily incorporate unobserved heterogeneity into the estimation using the Heckman and Singer (1984) methodology.

The first topic of investigation is exploring the fit for various specifications of the "baseline" hazard. This baseline captures the pure "seasoning" effect for a typical mortgage in our sample; that is, the effect of the age of the mortgage on prepayment rates holding all other observed factors constant. In a proportional hazard framework, the covariates measuring the observed heterogeneity among mortgages in our sample affect prepayment rates by proportionally shifting this baseline prepayment rate.

The Weibull baseline hazard results if $\lambda_k = 0$ for all k and $\gamma_k = 0$ for $k \geq 2$. The Gompertz baseline corresponds to $\lambda_1 = 1$, $\lambda_k = \gamma_k = 0$ for $k \geq 2$. When we estimate λ_1 for the unconstrained sample we get a value of -0.13 with an associated standard error of 0.09.[16] The data for the unconstrained sample of mortgages, then, do not reject the Weibull specification. Further, we can not reject the Weibull formulation in any of our three samples of constrained mortgages. We also estimated a Quadratic baseline and found no significance evidence of curvature in the rate of seasoning. Table 1 summarizes our findings for each group of mortgages. The data do indicate that the rate of seasoning increases as the degree of constraints facing homeowners is relaxed. Figure 5 compares these differential seasoning patterns.[17]

4 Empirical Findings

A basic question is to what extent the 50% reduction in prepayment rates in the constrained states is due to differences in the characteristics of the mortgages originated in those states. To answer this question, we used the model estimates to calculate the predicted monthly prepayment rates for each mortgage originated in a constrained state. We then calculated the predicted monthly prepayment rates for the same mortgages assuming that they were originated in an unconstrained state. We took the ratio of these predicted prepayment rates and averaged them over all of mortgage months in the constrained samples. We find

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[16]We thank James Heckman for providing us with the CTM software that we use to estimate the hazard specifications.

[17]We used the Heckman and Singer methodology for controlling for unobserved heterogeneity. In each subsample, the data rejected even two points of support for the unobserved heterogeneity distribution.

Table 1 - Mortgage Prepayment Hazard Estimates

	Unconstrained[a]	LTV Constrained[b]	Location Constrained[c]	Location & LTV Constrained[d]
Variable	(1)	(2)	(3)	(4)
Constant	19.86	27.71	33.53	18.42
	(5.24)	(9.73)	(9.12)	(26.71)
Gamma	0.87	1.15	1.13	1.34
	(0.05)	(0.09)	(0.08)	(0.30)
Original LTV	-0.007	-0.03	-0.01	-0.10
	(0.002)	(0.01)	(0.002)	(0.03)
Loan Size	0.05	0.05	0.04	0.01
	(0.005)	(0.01)	(0.01)	(0.03)
PV_t	-42.54	-58.63	-78.65	-28.59
	(11.45)	(21.03)	(19.88)	(58.03)
PV_t^2	14.73	24.77	36.86	8.49
	(6.25)	(11.43)	(10.79)	(31.46)
-Log Likelihood	11,421	3,603	4,565	790

Notes: Standard errors are given in parentheses.

[a]Non-CT,FL,MA,NJ,NY&RI / $LTV_0 < 0.8$.

[b]Non-CT,FL,MA,NJ,NY&RI / $LTV_0 \geq 0.8$.

[c]CT,FL,MA,NJ,NY&RI / $LTV_0 < 0.8$.

[d]CT,FL,MA,NJ,NY&RI / $LTV_0 \geq 0.8$.

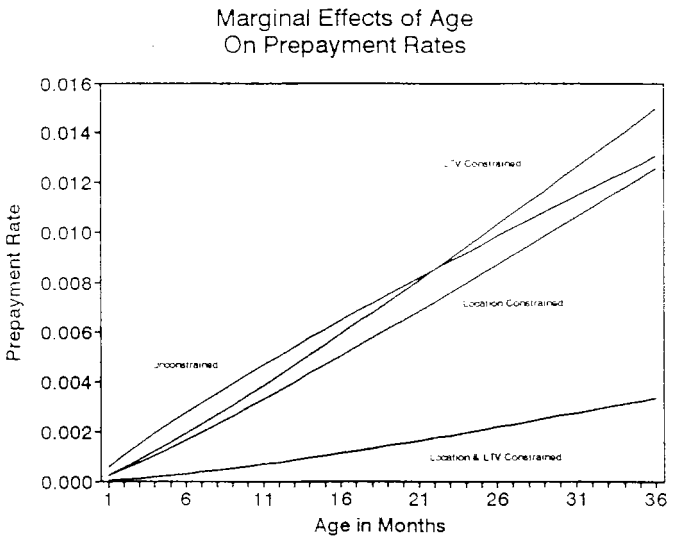
Marginal Effects of Age
On Prepayment Rates
Prepayment Rate
0.016
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
1
6
11
16
21
26
31
36
Age in Months
LTV Constrained
Location Constrained
Unconstrained
Location & LTV Constrained

Figure 5

that nearly all of the 50% reduction in prepayment speeds is attributable to differences in the coefficient estimates across the constrained and unconstrained models; not to differences in the characteristics of mortgages originated in the constrained and unconstrained states. At this basic level, then, the empirical findings suggest an important role for prepayment constraints in explaining prepayment behavior. To further address the empirical importance of prepayment constraints, we need to specify how they are manifested in our empirical model.

For each homeowner, we assume that there is a critical value for the PV_t that will induce a refinance of the existing mortgage. That is, the individual's demand for refinancing is a step function with the step occurring at the critical PV_t value. This critical value is determined by the individual's specific cost of refinancing, which we have no direct measures of in our data. We assume, though, that a distribution of refinance costs exist in a specific housing market. This distribution induces a smooth market demand for refinancing that is swept out as the PV_t falls. As we move from our unconstrained to our constrained samples, we assume that the constraints shift outward the distribution of refinance costs. As a consequence, we expect to see an inward shift in the demand for refinancing; that is, the level of prepayments for a given PV_t should be lower in the constrained samples.

The data strongly support this hypothesis. For the unconstrained sample of mortgages, we find a very strong effect of PV_t on prepayment rates. Decreases in PV_t below one are associated with a rapidly rising payoff rate. Holding other variables constant at their mean values, a decline in PV_t from 1 to 0.8 results in a four percentage point increase in the monthly prepayment rate. This is illustrated in Figure 6 along with the incentive effects for the three constrained samples of mortgages. As we move from the unconstrained to the constrained samples, we find that the constraints significantly diminish the effect of a given PV_t on the likelihood of prepayment. In our location and LTV constrained sample, decreases in PV_t have only a ***negligible*** effect on the speed of prepayment.

The fact that the constraints significantly diminish the effect of PV_t on prepayments is clear from Figure 6. The relative importance of the credit, income, and collateral constraints is more difficult to establish. As we will argue below, making this distinction is irrelevant for our main policy recommendation. However, the results in Figure 6 are suggestive that the collateral constraint plays a primary role.

To see the importance of the collateral constraint in reducing prepayments consider a PV_t of 0.9. The predicted total effect of the credit, income, and collateral constraints combined is a 1% reduction in the monthly prepayment rate as shown in Figure 6 by the movement from point A to point D. Recall from Figure 4 the bunching of LTV's at the 80% level indicating the advantages of avoiding PMI if financially feasible at the origination of the mortgage.

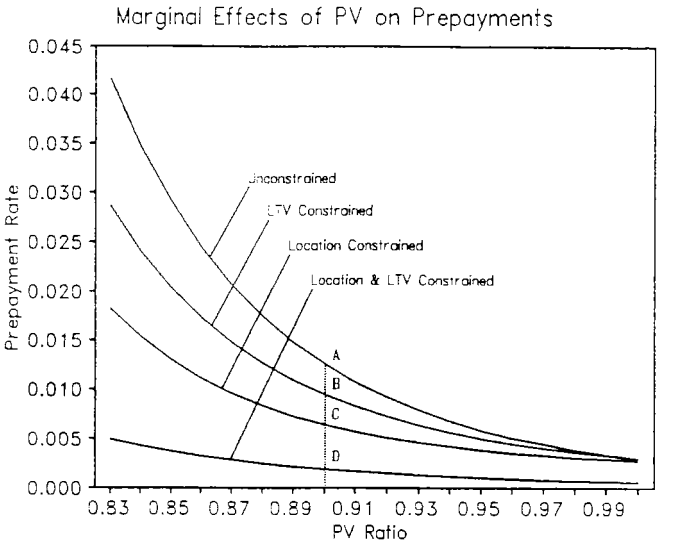
Marginal Effects of PV on Prepayments
Prepayment Rate
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
Unconstrained
LTV Constrained
Location Constrained
Location & LTV Constrained
A
B
C
D
0.83 0.85 0.87 0.89 0.91 0.93 0.95 0.97 0.99
PV Ratio

Figure 6

This suggests that the impact of the income and credit constraints can be measured by comparing low LTV_0 to high LTV_0 mortgages in a stable property market. This effect is a reduction in the monthly prepayment rate of 0.3% as shown in Figure 6 by the movement from point A to point B. This decomposition implies that 70% of the reduction in the effect of PV_t on prepayments is due to the collateral constraint.[18]

Two characteristics that are observed at the outset of the mortgage help to explain subsequent prepayment rates. Within each sample, increases in LTV_0 are associated with slower prepayment rates. This effect is largest in magnitude for the constrained samples of mortgages. Figures 7 & 8 illustrate the impact of changes in LTV_0 on the monthly prepayment hazard holding constant all other variables at their mean values. The data indicate that with the exception of the location and LTV constrained sample, higher initial loan balances are associated with faster prepayment rates. In contrast to the effect of LTV_0, the loan size effect is roughly constant across the three samples of mortgages. Figure 9 illustrates the impact of loan size on the monthly prepayment hazard holding constant all other variables at their mean values.[19]

To check how well our model fits the data, we compare predicted to actual prepayment rates for our portfolio of mortgages. For each mortgage, we use the model to predict the conditional probability the mortgage prepays for each month that the mortgage is in our sample. These predictions take into account the original LTV and original loan balance, the effect of seasoning, and the effect of changing incentives through variation in PV_t. For each month, we average the mortgage specific predicted hazard rates to arrive at a predicted prepayment rate for the portfolio. This rate reflects the predicted percent of outstanding mortgages that will prepay in that month.

There are two types of goodness of fit measures that we are interested in examining. The first is how well the model fits the in-sample portfolio prepayment pattern. The second is how well the model fits an out-of-sample portfolio prepayment pattern. To address both

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[18]That is, this decomposition measures the effect of the collateral constraint by comparing high LTV_0 mortgages across stable and weak property markets, as shown in Figure 6 by the movement from point B to point D. It is unlikely that this effect measures some other unrelated long term regional effect. Becketti and Morris (1990, pp. 42 Table 15) report median prepayment rates by selected states for the period 1982-1988. The weighted average median prepayment rate in FL, NJ, NY and MA was 3.56% while for IL, MO, OH, and PA it was 2.49%.

[19]Our model does not incorporate the feature that prepayments may be a function of the history of incentives facing the borrower, known as "burnout" in the mortgage trade literature. This reflects the relatively short time period covered by our study.

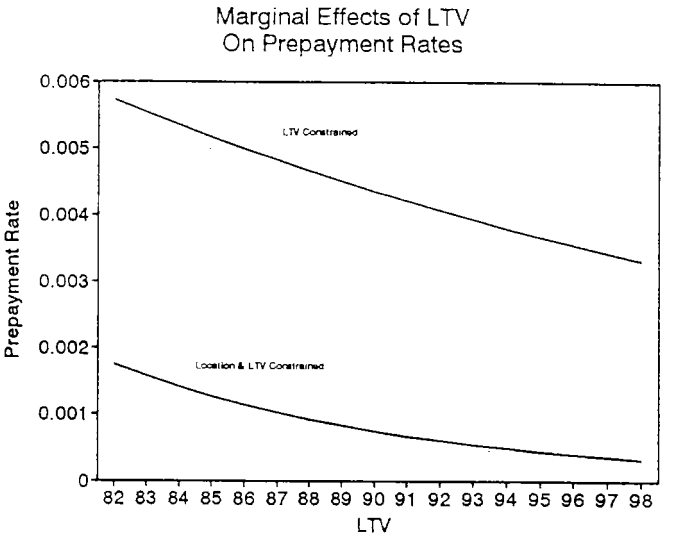

Figure 7

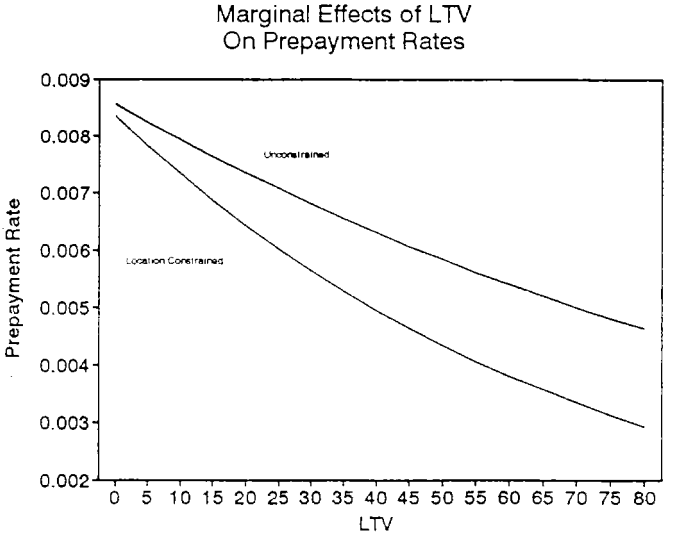

Figure 8

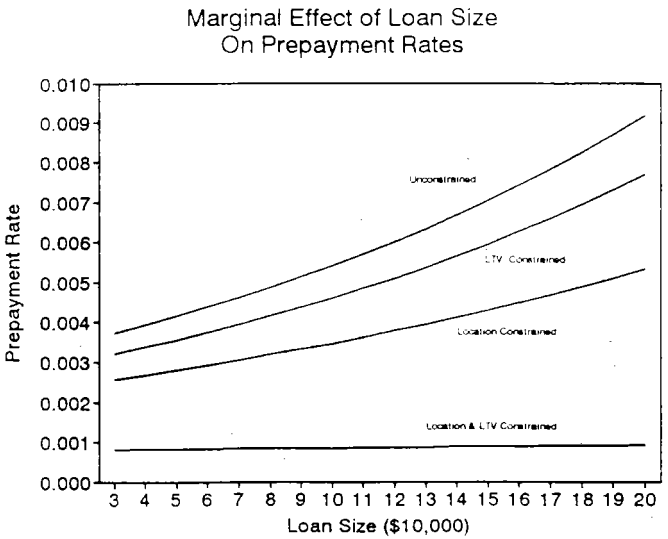
Marginal Effect of Loan Size
On Prepayment Rates
Prepayment Rate
0.010
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0.000
Unconstrained
LTV Constrained
Location Constrained
Location & LTV Constrained
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Loan Size ($10,000)

Figure 9

issues, we withheld the most recent eleven months of data from the sample used in estimation. This allows us to evaluate the out-of-sample fit of the model for the period from June 1992 to April 1993. Figure 10 plots the actual and predicted portfolio prepayment rates. If we regress the actual monthly prepayment rate on the predicted monthly prepayment rate we end up with an R^2 of 91%. The out-of-sample R^2 is 68%. As indicated, the model fits the data well both in and out of sample.

5 Refinancing Constraints and Regional Economic Fluctuations

In this section, we consider the broader economic impact of the constraints on refinancing in Connecticut, Florida, Massachusetts, New Jersey, New York, and Rhode Island. We also outline how housing market institutions could be amended to lessen the significance of refinancing constraints. Finally, we speculate on the reasons that the current institutions are structured in a manner that gives rise to the effects that we have identified.

From 1987 to 1991 roughly 2.4 trillion dollars of fixed-rate mortgages have been originated. HUD (1993) data indicates that our locationally constrained states have accounted for roughly 19% of the total originations, or roughly 460 billion dollars. During this period, refinancing accounted for approximately 25% of total originations.[20] Making the conservative assumption that the collateral constraints did not depress home sales and using the model's estimate of a 50% reduction in prepayment rates, refinances would account for 14% of total originations in our constrained states. We conclude that somewhere in the order of 65 billion dollars worth of residential mortgages did not refinance that would have done so had the property market not collapsed.[21]

The most direct effect of the low level of refinancing on the regional economy is that homeowners in the constrained states end up paying a higher interest rate on aggregate mortgage debt than would otherwise be the case. This high mortgage rate in turn inhibits other forms of spending in the region through the multiplier effects on local expenditure and income. Unfortunately, it is difficult to assess the extent of the reduced expenditure induced by the refinancing constraints, since it depends on the interest rate and the terms of the new loan which we are unable to observe in our data.

Using FHLMC data on the recent refinancing boom, Lekkas (1993) shows that of those who refinanced roughly 40% refinanced into 30-year fixed-rate mortgages. The majority of these refinances resulted in the borrower making lower monthly interest payments as a result.

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[20]See Lekkas (1993).

[21]This is a crude approximation presented to convey the first-order magnitude of this effect.

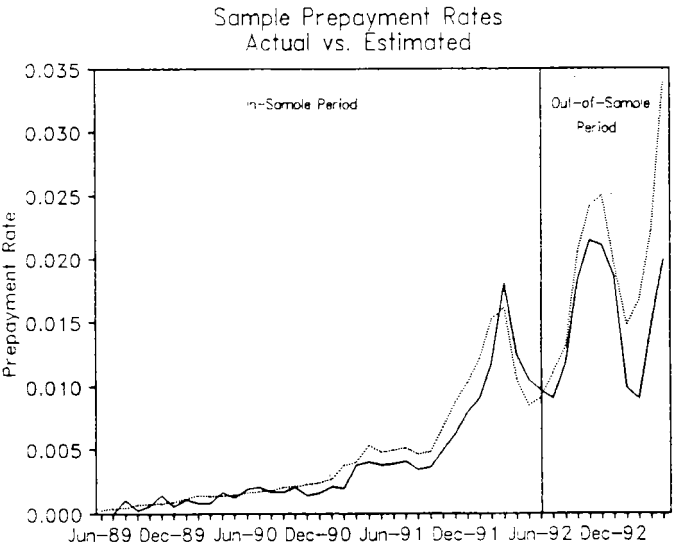
Sample Prepayment Rates
Actual vs. Estimated
In-Sample Period
Out-of-Sample Period
Prepayment Rate
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
Jun-89 Dec-89 Jun-90 Dec-90 Jun-91 Dec-91 Jun-92 Dec-92

Figure 10

In these cases, it is likely that the lower interest payments were largely diverted into consumption of other goods, and may even have allowed increases in other forms of debt. The consumption effect will tend to be smaller for the households that refinanced into 15-year fixed-rate mortgages (this comprises another 40% of the refinances analyzed by Lekkas). For this group, the effect on consumption may arise more from the wealth increase caused by the refinance rather than any increase in liquidity. Finally, there are a large number of households that take additional cash out when they refinance (roughly 25% of the refinances analyzed by Lekkas involved loan amounts that were at least 20% higher than the original loan size). For these individuals, the additional expenditure may exceed even the pure interest effect as a large portion of the additional wealth gets spent immediately on such capital goods as home improvements, education, and consumer durables. While it is not possible to provide a quantitative assessment of the consumption effect of the low refinancing rate in our locationally constrained states, we conjecture that it adds up to a significant negative impact in these states.

Another important effect of the low refinance rate is that it may have increased the number of delinquencies in the constrained states. Among those who wish to refinance but are constrained from doing so, there may be many who are experiencing economic hardship. Indeed, this widespread hardship may be one of the underlying reasons for the property market collapse. These individuals are at risk of going delinquent on their mortgage. The advantage of being able to refinance is that it may reduce monthly payments enough to allow the individual to avoid delinquency.[22] There is, therefore, an interesting interaction between prepayment and delinquency.

Given that the collateral constraints on refinancing raise delinquency rates on mortgages in an area, this in turn gives rise to further knock-on effects. The presence of a significant stock of houses in the process of being "worked out" by lenders does further damage to property values in an area, and may contribute to the depth of the real estate slump itself. It takes a considerable amount of time for a lender to repossess delinquent real estate, during which time the property can deteriorate significantly due to neglect by the owner. Furthermore, repossessed real estate adds to the stock of vacant properties in the housing market which creates more downward pressure on prices.

The refinancing constraints in depressed regions also have important feedback effects on fiscal and monetary policy. The reduction in disposable income due to higher than necessary interest payments in depressed areas may lower state tax revenues prompting either a

[22]Lenders will occasionally "modify" the interest rate on a loan they hold in portfolio to allow borrowers who can demonstrate severe temporary hardship a chance to avoid delinquency.

reduction in state services or an increase in tax rates. Moreover, the presence of the refinancing constraint means that monetary policy stimuli in the form of interest rate reductions will have a very hard time in getting additional liquidity through to those regions of the economy in the greatest need. This means that monetary stimuli have the potential to exacerbate differences in regional economic performance.

While we have developed our analysis in the context of the residential mortgage market, there is a very similar story that applies to the case of investor properties, and also to commercial mortgages. This means that the collateral constraints that we have identified in the mortgage market may have far broader impact on the commercial life of the region than simply damaging residential real estate markets. At the broadest level, the mechanism we are investigating is simply one manifestation of the general phenomenon of debt deflation surveyed by Gertler and Hubbard, and exemplified in the Hubbard and Kashyap study of the connection between land values and investment in agriculture. Hubbard and Kashyap show that collapses in the value of land constrain real investment in agriculture: with less land value to use as collateral, there are increased incentive problems involved in loans to farmers.

The critical feature that differentiates collateral constraints on refinancing of mortgages from the standard form of debt deflation is that in the case of refinancing, the financial system is already absorbing the risks associated with the loan. The decision on whether to refinance the loan for the original lender is simply one of whether to allow the borrower to take advantage of a cost reduction, not one of whether to absorb additional default risk. Indeed a refusal to refinance raises rather than lowers the risk of borrower default. Overall, the fact that the borrower is denied the right to take advantage of a cost reduction when their home falls in value represents an absence of insurance rather than a rational attempt to reduce incentive problems.

It would be a simple matter to add the missing insurance to the mortgage contract, and thereby remove the collateral constraint on refinancing. If the mortgage contract contained a clause stipulating that during the term of the loan the rate could be reduced to a market rate for a set fee, then homeowners wishing to refinance would be insulated from property market dynamics. Borrowers would likely pay a premium for such a clause, since it helps them in circumstances in which they may already be in financial difficulty: the correlation between falling property values and other regional economic problems suggests that such a clause would have beneficial insurance properties.[23] A social benefit of such a modification clause is that it would eliminate the need to devote the resources involved in the refinance application process which serve no insurance purpose. This raises the intriguing issue of why

[23]See Azfar (1993) for a discussion.

no such contract form exists, which in turn calls for a broader perspective on the structure of the U.S. housing market.[24]

The Federal Government has played a dominant role in the U.S. mortgage market since Congress founded the Federal Housing Administration (FHA) in 1934. The FHA offered default insurance on mortgage applications that met its underwriting standards. But in order to qualify for insurance, the FHA insisted that the mortgage be of a specific form: a fixed-rate, level payment, fully amortized mortgage. The reason that the FHA chose to promote this form of mortgage was to avoid the perceived problem with balloon mortgages during the Great Depression. With a balloon mortgage, the borrower needs a new loan in order to repay the remaining principal at the end of the first mortgage. But with the fall in property values in the Depression, many home-owners were unable to obtain new loans to pay off the last balloon loan and went into delinquency.

For our purposes, the key point to note is that the FHA was the first agency to standardize the form of the mortgage contract and the criteria for qualifying for the mortgage. While the market has evolved a great deal since the founding of the FHA, it is still the case that there are standardized contract forms and qualification criteria, and that these standards themselves are kept relatively rigid in the face of significant changes in the surrounding environment. Viewed in this evolutionary perspective, the absence of an automatic refinancing contingency is not surprising given that it requires the combination of falling interest rates and falling property values. Although there has been little pressure for reform, there still remains the broader puzzle of the limited responsiveness and foresight shown in designing contract forms in the U.S. residential mortgage market.

The success of the secondary market in residential mortgages may provide part of the answer to the question of why there is such inflexibility in the mortgage contract design. The Federal Government has taken an extremely active role in promoting the development of the secondary mortgage market ever since the founding of the Federal National Mortgage Association in 1938. At the time, the chief role of FNMA was to buy FHA-insured mortgages in order to increase the liquidity of the mortgage market. This marked the birth of the secondary market in mortgages. In the early days of FNMA, the agency generally bought mortgages and held them in its own portfolio. Since that time, Congress founded GNMA and FHLMC in large part to foster further development of the secondary mortgage market.

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[24]See Fabozzi and Modigliani (1992) and Jones and Grebler (1961) for further historical background.

The modern secondary market involves large pools of loans that typically are insured by one of the agencies, and then divided into various derivative securities that are sold off to third party investors. This is now a massive market with a total of some $1.26 trillion of securitized mortgage debt outstanding as of March 31, 1992.[25] As we discussed in Section 2, many major lenders routinely sell off their conforming loans to the secondary market which translates into generally lower rates on these loans. While there is an active market in privately insured mortgage pools, the three Federal Agencies remain the dominant players in the secondary market. While this form of standardization does not inherently rule out changes in the contract form, it does add one additional institutional hurdle for those seeking to develop innovative contracts.

We are not the first to note the rigid nature of contract forms in the U.S. mortgage market. An earlier example of a change in the economic environment that failed to produce obvious revisions in the contract form was the high inflation and high nominal interest rate environment of the 1970's. Fixed-rate mortgages are amortized using a level nominal payment schedule, which in an inflationary environment results in a front-loading of real interest payments. In such settings, it is natural to suggest some form of price-level-adjusted mortgage, which involve monthly payments that are constant in real terms rather than in nominal terms. As Fabozzi and Modigliani point out, such a contract form has not been used in the United States despite the fact that it has been used for decades in many other countries. They have no doubt where to place the responsibility for the absence of such a contract in the U.S.: "..no innovation in home financing has been possible without some sanction from government regulators, and regulators have been unimaginative...." (Fabozzi and Modigliani, pp. 131-2).

The secondary market plays another subtle role in reducing the extent of refinancing in depressed property markets. The key issue here is that when a bank sells a mortgage into the secondary market, it faces very different incentives in terms of whether or not to accept an application to refinance the loan. In order to sell the loan back into the secondary market, the loan has to pass the various qualification criteria laid out in Section 2. If the loan does not pass these criteria, the bank has open to it the alternative of bending the qualification criteria to some extent, and issuing a non-conforming loan that it retains in its own portfolio. However in the current climate of regulatory control over bank risk taking, it is almost inconceivable that the bank would choose to take a loan that it has sold and therefore presents no capital risk, and replace it with a new loan which it retains on the books thereby assuming the risk. The situation is different for the bank on loans that it has kept in portfolio in the

[25]See Secondary Mortgage Market Database, Spring-Summer 1992.

first place. For such loans the risk is already on the books, and it can be argued that refinancing such a loan lowers bank risk by reducing the risk of delinquency. For this reason, we suspect that refinancing activity in depressed regions will be higher for loans retained in portfolio than for sold loans.

In summary, it appears that the current structure of the residential mortgage market involves at best a slow adaptation of contract forms to changes in the economic environment. It is plausible that simple and standard contract forms were necessary in order to establish the current vibrant secondary market in mortgages. Since the market is now well established, it may be time to pay more attention to possible enhancements of the current contract form.

6 Concluding Remarks

In the current structure of the U.S. residential mortgage market, a fall in property values may make it very difficult for individuals to refinance their mortgages to take advantage of falling interest rates. In this paper, we explain the institutional background for this effect and quantify its importance. We confirm that this form of collateral constraint has greatly reduced refinancing in Connecticut, Florida, Massachusetts, New Jersey, New York, and Rhode Island. We also point to the many ways in which the reduction in refinancing may have inflicted additional damage in these already recession-hit states. Finally, we show that relatively minor contractual changes could have neutralized the damaging effects of the collateral constraints.

One of the most important steps in this work was a detailed study of the institutional structure of the U.S. residential mortgage market. This analysis identified the evolution of the market institutions that gave rise to this collateral constraint. Given that simple changes could remove the collateral constraint and its damaging effects, we conclude that the self-correcting mechanisms in the mortgage market are inadequate. Further economic analysis of institutions is vital both to improve our understanding of how the economy functions and to improve economic efficiency by strengthening the incentives for institutional change.

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Table A1 - Summary Statistics: By Six Month Intervals

Variable	Time Period					
	6/89-12/89	1/90-6/90	7/90-12/90	1/91-6/91	7/91-12/91	1/92-6/92
Number of Mortgage Months	7,132	5,687	5,723	4,601	7,933	4,789
Original Interest Rate	10.14	10.30	10.13	9.65	9.22	8.61
	(0.58)	(0.54)	(0.41)	(0.38)	(0.50)	(0.38)
Original LTV	74.64	73.58	72.73	72.99	73.77	72.74
	(14.80)	(14.59)	(14.40)	(14.27)	(14.14)	(14.04)
Loan Size	97,434	76,734	95,140	96,868	97,922	96,774
	(41,016)	(40,281)	(40,839)	(41,230)	(41,464)	(41,286)

Notes: Sample consists of Chemical bank 30-year fixed rate conventional conforming mortgages.

Table A2 - Summary Statistics: By Location/LTV Subsamples

Variable	Unconstrained[a] (1)	LTV Constrained[b] (2)	Location Constrained[c] (3)	Location & LTV Constrained[d] (4)
Number of Mortgages	21,916	10,455	14,569	5,782
Number of Mortgage Months	283,283	99,952	164,949	81,999
Original Interest Rate	9.85	9.95	9.99	10.51
	(0.51)	(0.56)	(0.68)	(0.81)
Original LTV	68.36	89.31	66.56	88.66
	(12.11)	(3.41)	(13.59)	(2.77)
Loan Size	88,289	93,959	102,585	118,600
	(40,566)	(37,121)	(41,207)	(35,713)
PV_t	0.96	0.96	0.96	0.96
	(0.04)	(0.04)	(0.04)	(0.04)
Prepayment Rate	13.05	11.37	7.51	2.59

	Location Unconstrained	Location Constrained
Prepayment Rate	12.63	6.06
High LTV_0 / Low LTV_0 Prepayment Rate	0.84	0.32
% Change in Median House Prices[e]	6.55	1.62

Notes: Counts or sample means are listed with sample standard deviations given in parentheses.

[a]Non-CT,FL,MA,NJ,NY&RI / $LTV_0 < 0.8$.

[b]Non-CT,FL,MA,NJ,NY&RI / $LTV_0 \geq 0.8$.

[c]CT,FL,MA,NJ,NY&RI / $LTV_0 < 0.8$.

[d]CT,FL,MA,NJ,NY&RI / $LTV_0 \geq 0.8$.

[e]Average of % change in median house prices from 1/90 to 4/92 for SMSA's in each set of states.

Table A3 - Estimated Closing Costs and PMI Costs

Closing Costs:

Area	Closing Costs	Title Insurance	Origination Fee (2 points)	Total (percent of loan)
Connecicut	1,482	550	3,100	5,132 (3.31)
New Jersey	1,457	1,068	3,100	5,625 (3.63)
New York	2,619	1,112	3,100	6,831 (4.41)
New York City	4,169	1,112	3,100	8,381 (5.41)

PMI Costs:

	Loan-to-Value		
25 bps in rate	80-85%	85-90%	90-95%
Points	1.90	2.55	3.80

Notes: Dollar costs based on a non Co-op loan of $155,000. Closing costs include fees for attorney, apraisal, credit report, recording, lein search, UCC-1 filing, documentation preparation, mortgage tax and 15 interim interest.

Table A4 - Example of Industry Mortgage Credit Grades

Credit Grade	Time on File	Number of Trade Lines	Number of Inquiries	Lender Delinquency	Retail Delinquency	Current Status of Trade Lines	Legal Filings	Explanation Letter
"A" Credit	>8 years	≥8	Few open inquiries in past 12 months	None in past 12 months	No major retail in past 24 months	Must now be current on all accounts	None	Not needed
"B" Credit	≥5 years		Few open inquiries in past 12 months	Few minor 30 day delin.s in past 12-18 months	No major 60+ delin.s in past 24 months	Must now be current on all accounts	None	Not needed
"B-" Credit	≥5 years		Few open inquiries in past 12 months	Several 30+ and a few 60+ delin.s in past 12-18 months	A few major 60+ delin.s in past 24 months	Must now be current on all accounts	None	Needed
"C" Credit	<5 years		Numerous open inquiries in past 12 months	Several 30+ and a few 60+ delin.s in past 12-18 months	A few major 60+ delin.s in past 24 months	Must now be current on all accounts	None	Needed
"D" Credit	<5 years		Numerous open inquiries in past 12 months	Many delin.s in past 24 months	Many Delin.s in past 24 months	May now be current on all trade lines	None	Needed
"E" Credit	<3 years		Numerous open inquiries in past 12 months	Many 60+, some 90+	Many 60+, some 90+	May now be current on all trade lines	Has a filing for a bankruptcy, reposition or other legal action	Needed

Notes: Chemical Bank originates only "A" credit paper.