

Two-step Mortgage and Home Equity

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VERY PRELIMINARY

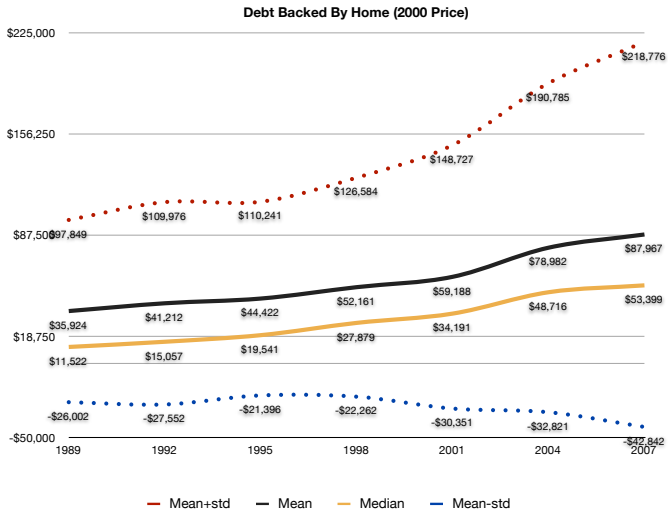
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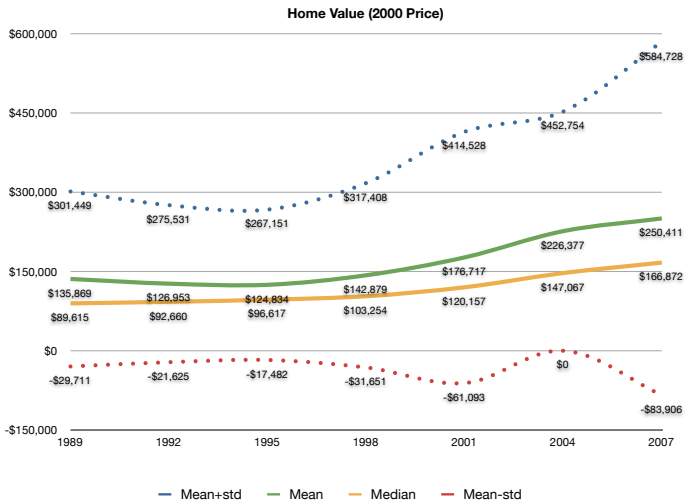
Motivation

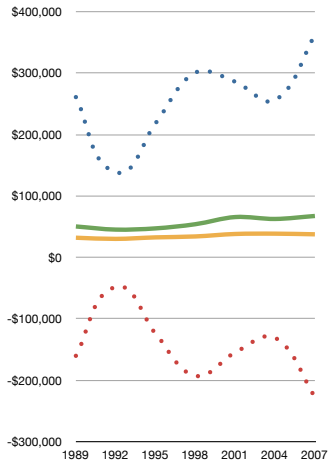
- ▶ Why do people accumulate equity in their houses?
 - ▶ Precautionary saving
 - ▶ Bequest motives
 - ▶ (Against?) Tax incentive
- ▶ Then why mortgages with “teaser rate”, which would allow for a very low accumulation of equity, are attractive?
 - ▶ Poor and/or young households
 - ▶ Relying on upward trend in housing prices
- ▶ Alternative: Households do not like accumulating equity in their houses, specially when they're old, but they have to.
- ▶ Teaser rates allows households to pay less for using their houses, and refinance upon the end of the initial rate (before the rate hike), conditional on being credit worthy and having a good quality house

Two-Step Mortgage

- ▶ A mortgage that offers an initial fixed-interest rate for a period of time (usually 5 or 7 years) after which, at a predetermined date, the interest rate adjusts according to current market rates.
 - ▶ At the adjustment date, the borrower might have the option of choosing between a fixed-interest rate (based on current market rates) for the remaining term of the mortgage, or a variable interest rate structure for the remaining term of the mortgage.
- ▶ Many two-step mortgage borrowers plan on refinancing or moving before the initial fixed-interest rate period ends.

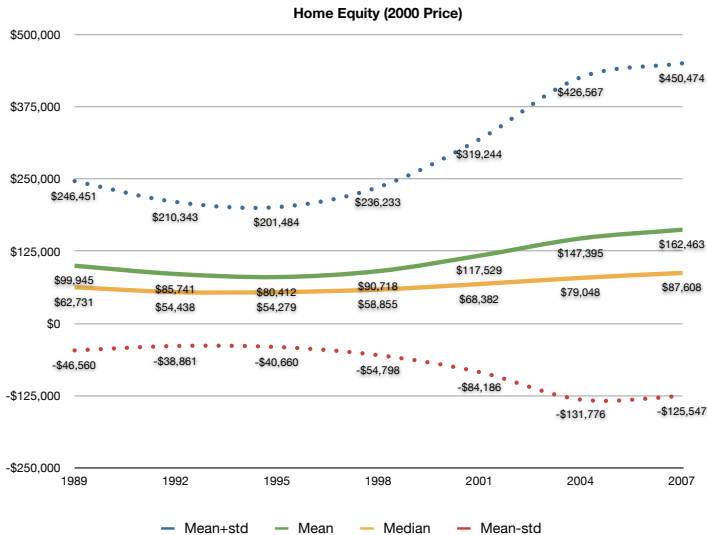


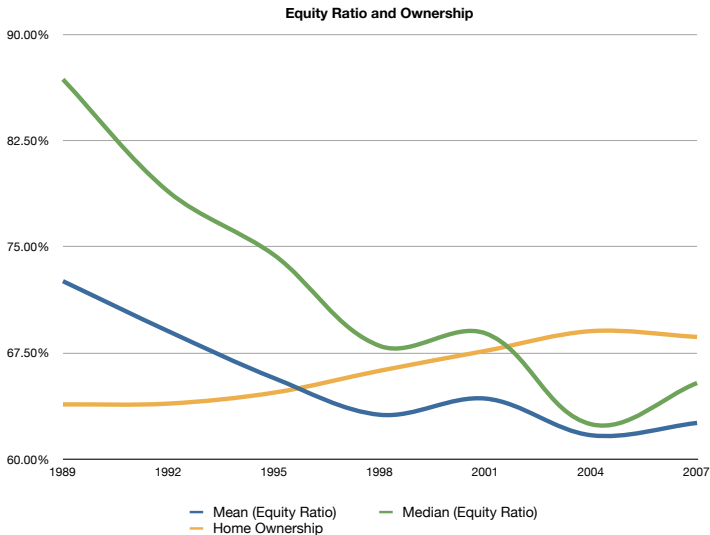


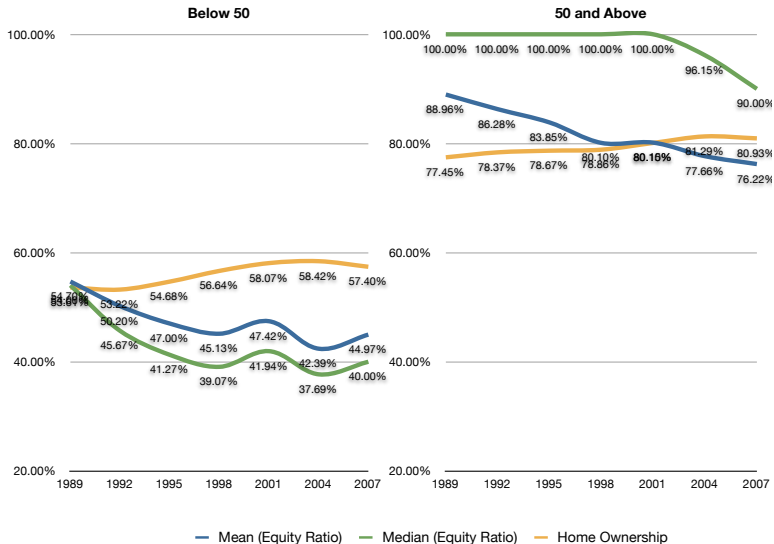


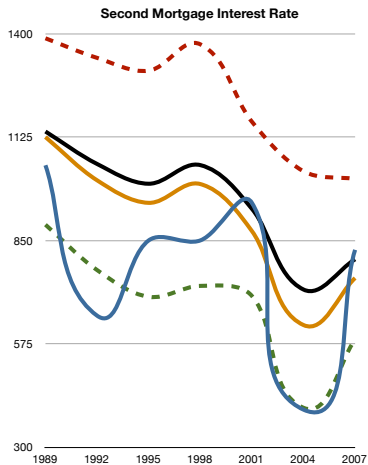
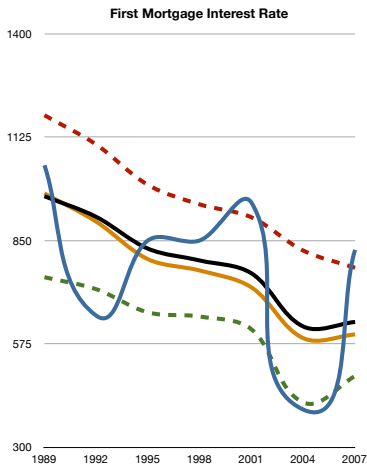
— Mean+Std — Mean — Median — Mean-Std



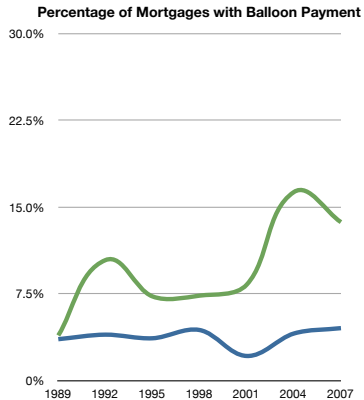
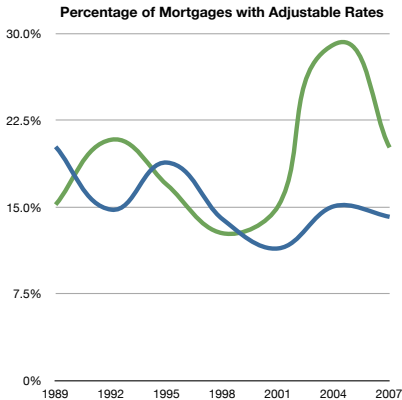








— Prime Rate — Mean+Std — Mean — Median — Mean-Std



— First Mortgage — Second Mortgage



Renting versus Owning

- ▶ Occupier of a house has better technology to take care of the house than the property manager companies
 - ▶ Most of renters live in apartments rather than houses
- ▶ The quality of house might be more important for sale price of the house compared with the valuation of the residence
 - ▶ Once the furniture is moved out the walls might crumble!
- ▶ Accumulation of equity is a method of giving incentive to households to take care of their houses
- ▶ As it became cheaper to monitor and rewrite contracts, banks can generate house quality dependent contracts by allowing for refinancing after the first-step (teaser) rate phases out, conditional on the house maintaining its good quality

Collateralized Debt with Moral Hazard

- ▶ Mortgage is a collateralized debt, but not only the borrower's ability to repay might decline, the collateral's quality might decline as well.
- ▶ The collateral's quality depends on the occupier's effort, and is not easily observable.
- ▶ At any point in time, the bank has to provide enough incentive for the borrower to exert effort for maintaining the quality of house as well as the ability to repay.

Simple Model

- ▶ Three periods $t = 0, 1, 2$ with discount factor β .
- ▶ Populated by *agents* and risk neutral *banks*.
- ▶ Endowment of agents $y_t \in \{\bar{y}, \underline{y}\}$ depends on the *Job Quality*,
 $J \in \{G, B\}$, $y_t = \begin{cases} \bar{y} & J_t = G \\ \underline{y} & J_t = B \end{cases}$
- ▶ Agents reside in homes, oblivious to the *Home Quality*,
 $H \in \{G, B\}$
- ▶ Market value of home in the last period = $\begin{cases} P & H = G \\ 0 & H = B \end{cases}$
- ▶ Lifetime utility of agents:
 $\{u(c_0) - e_0^j - e_0^h\} + \beta \cdot \{u(c_1) - e_1^j - e_1^h\} + \beta^2 \cdot w(c_2)$
 - ▶ c_t : period t consumption, $e_t^j \in \{0, \bar{e}^j\}$ and $e_t^h \in \{0, \bar{e}^h\}$:
unobservable effort for maintenance of Job and Home qualities.

Simple Model

- ▶ Agents start with $J = G$ and homes start with $H = G$.
- ▶ $\Pr(J_t = G | J_{t-1} = G, e_{t-1}^j) = \begin{cases} s_g^j & e_{t-1}^j = \bar{e}^j \\ s_b^j & e_{t-1}^j = 0 \end{cases}$
 - ▶ $s_g^j \gg s_b^j$.
- ▶ $\Pr(H_t = G | H_{t-1} = G, e_{t-1}^h) = \begin{cases} s_g^h & e_{t-1}^h = \bar{e}^h \\ s_b^h & e_{t-1}^h = 0 \end{cases}$
 - ▶ $s_g^h \gg s_b^h$.
- ▶ $J = B$ and $H = B$ are absorbing states.
- ▶ Assumptions:
 - ▶ Endowments up to \underline{y} are exempt from *garnishment*.
 - ▶ $u'(\bar{y}) > w'(\underline{y})$ (i.e. agents do not like equity)
 - ▶ High effort is socially optimum.

Incentive for High Effort

- ▶ Denote $t = 1$ values by V_{J_1, H_1} and the second period values by $V_{J_1 J_2, H_1 H_2}$
- ▶ Incentive for choosing $e_t^j = \bar{e}^j$ for $t = 0, 1$:

$$s_g^h(V_{G,G} - V_{B,G}) + (1 - s_g^h)(V_{G,B} - V_{B,B}) \geq \frac{\bar{e}^j}{\beta(s_g^j - s_b^j)}$$

$$s_g^h(V_{GG,GG} - V_{GB,GG}) + (1 - s_g^h)(V_{GG,GB} - V_{GB,GB}) \geq \frac{\bar{e}^j}{\beta(s_g^j - s_b^j)}$$

$$V_{GG,BB} - V_{GB,BB} \geq \frac{\bar{e}^j}{\beta(s_g^j - s_b^j)}$$

Incentive for High Effort

- Incentive for choosing $e_t^h = \bar{e}^h$ for $t = 0, 1$:

$$s_g^j(V_{G,G} - V_{G,B}) + (1 - s_g^j)(V_{B,G} - V_{B,B}) \geq \frac{\bar{e}^h}{\beta(s_g^h - s_b^h)}$$

$$s_g^j(V_{GG,GG} - V_{GG,GB}) + (1 - s_g^j)(V_{GB,GG} - V_{GB,GB}) \geq \frac{\bar{e}^h}{\beta(s_g^h - s_b^h)}$$

$$V_{BB,GG} - V_{BB,GB} \geq \frac{\bar{e}^h}{\beta(s_g^h - s_b^h)}$$

State Verification and Mortgage Contracts

- ▶ Agents have exclusive *mortgage* contracts with banks they choose from a competitive market
- ▶ *Case 1*: Although the endowments are observable, the quality of homes are not observable
 - ▶ It is not possible to enforce contracts with allocations dependent on the quality of the home
- ▶ Mortgage Contracts:
 - ▶ m_t^n : Payment by agents in period $t = 0, 1$
 - ▶ D_G^n : Outstanding debt in period $t = 2$ if $y_1 = \bar{y}$
 - ▶ D_B^n : Outstanding debt in period $t = 2$ if $y_1 = \underline{y}$
 - ▶ Note: $J_0 = H$ hence $y_0 = \bar{y}$.

$$V_{GG, BB}^n = V_{GG, GB}^n = w(\max\{\underline{y}, \bar{y} - D_G^n\})$$

$$V_{GG, GG}^n = w(\bar{y} + P - D_G^n)$$

$$V_{BB, GG}^n = w(\underline{y} + P - D_B^n)$$

$$V_{GB, GB}^n = V_{GB, BB}^n = V_{BB, GB}^n = V_{BB, BB}^n = w(\underline{y})$$

State Verification and Mortgage Contracts

- ▶ Case 2: Endowments and quality of homes are observable
- ▶ Mortgage Contracts:
 - ▶ m_0^o : Payment by agents in period $t = 0$ (Note: $J_0 = H$)
 - ▶ m_G^o, m_B^o : Agent's payment in $t = 1$ for $H \in \{G, B\}$
 - ▶ D_{J_1, H_1}^o : Debt in $t = 2$ (For $(J_1, H_1) \in \{(G, G), (G, B), (B, G)\}$)

$$V_{GG,GB} = w(\max\{\underline{y}, \bar{y} - D_{G,G}^o\})$$

$$V_{GG,BB} = w(\max\{\underline{y}, \bar{y} - D_{G,B}^o\})$$

$$V_{GG,GG} = w(\bar{y} + P - D_{G,G}^o)$$

$$V_{BB,GG} = w(\underline{y} + P - D_{B,G}^o)$$

$$V_{GB,GB} = V_{GB,BB} = V_{BB,GB} = V_{BB,BB} = w(\underline{y})$$

Effect of State Verification on Mortgage Contracts

- ▶ State verification results in increase in lower repayment and lower equity:
 - ▶ $m_0^o < m_0^n$
 - ▶ $m_G^o < m_1^n$ (under certain conditions: $m_B^o < m_1^n$)
 - ▶ $D_{G,G}^o > D_G^n$ (under certain conditions: $D_{G,B}^o > D_G^n$)
 - ▶ $D_{B,G}^o > D_B^n$
- ▶ Note: In the unobservable case, only the consumption can depend on the quality of the home.
- ▶ In the unobservable case, the incentive constraint will be binding for $t = 0$ but not $t = 1$, while in observable case, they are binding for both periods.

Costly Monitoring/Rewriting Contract

Switching from unobservable to observable case can result from

- ▶ A lower cost of monitoring the quality of house
- ▶ Lower cost of rewriting new contract/switching to another bank:
 - ▶ State contingent contracts could be very difficult to enforce, but switching to another contract (if the conditions of a particular state hold) could implement the same allocation.

Current Extensions

- ▶ Continuous time version with random exit
- ▶ Continuous time version with random arrival of opportunity of exit
- ▶ Unobservable/Observable Job Quality, J_1 , and state dependent random endowment: $\Pr(y = \bar{y} | J = B) > 0$.
 - ▶ Importance of *credit worthiness* for refinancing.