Determinants of Outstanding Mortgage Loan to Value Ratios: Evidence from the Netherlands

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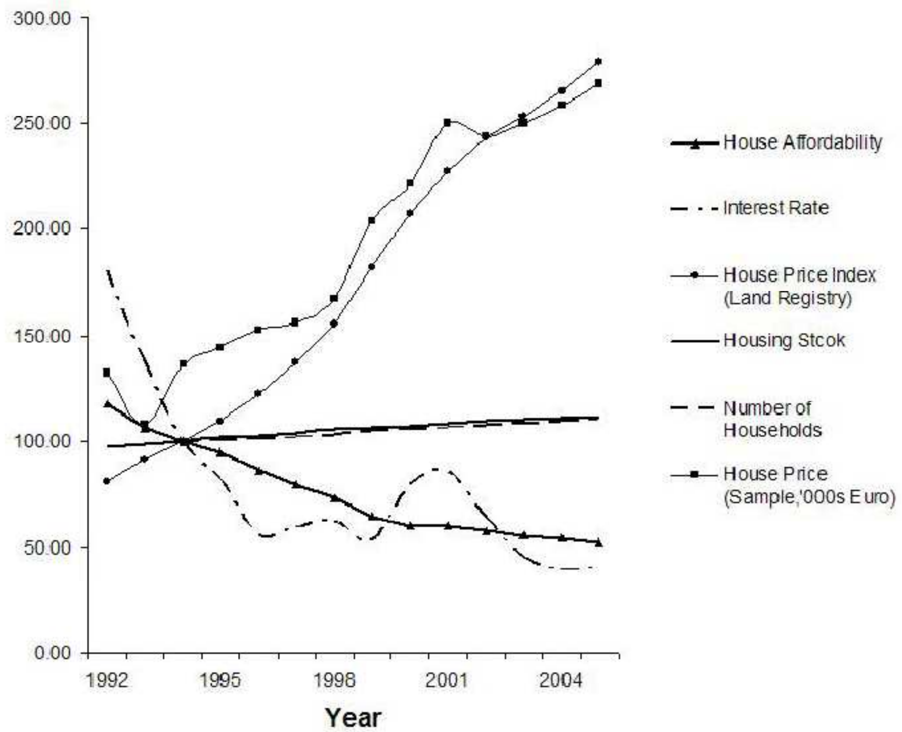
Introduction

- Rise in home foreclosures
  - Subprime mortgage crises
- Housing finance affecting financial markets and global economy
- Mortgage credit risk determined by outstanding LTV
- Key questions:
  - What determines borrowing propensity?
  - What are determinants of outstanding LTV?
  - What is the role of mortgage type?
  - What is the link between homeownership and housing finance?

Data

- DNB Household Survey carried out by CentERdata (Tilburg University)
- Period: 1992–2005
- Rotating panel of 8,867 representative Dutch households (30,803 obs.)
- Why Netherlands?
  - High level of financial sophistication of Dutch households (Alessie, Hochguertel and van Soest (2002))
  - Very well developed mortgage market (Kuijpers and Schotman (2006))
  - Broad scope and high quality of the data (cf. Campbell (2006))
  - Homogenous w.r.t. economic and legal factors

Holland and Housing Trends



Some facts and observations

- Increasing house prices – declining affordability
- Mortgage debt counting for 94% of homeowners' external financing; real estate about 80% of assets
- Primarily fixed rate debt
- Many different mortgage types
- Unlike firms: no stationary LTV target
- Wide variation: $\overline{LTV}_{it}$ = 0.479 (St. dev. = 0.275)
- 20% of homeowners having no mortgage debt
- LTV dispersion increasing with time

Some facts and observations

- LTV declining over mortgage life-cycle:
  - Amortization (influenced by mortgage type)
  - House price appreciation (if no equity release)
- Repayment versus non-repayment mortgages:
  - Outstanding LTV on average higher for non-repayment mortgages (NRPMT)
  - LTV declining faster for repayment mortgages (RPMT)

Some facts and observations

- Mortgage to income ratio:
  - RPMT: constant at 1.7
  - NRPMT: 1.96 (in 1992) to 3.32 (in 2005)
- Outstanding loan to initial loan ratio:
  - RPMT: 0.77
  - NRPMT: 0.96 to 1.05
- Proliferation of NRPMT in recent years:
  - Interest-only mortgages: up from 0% to 36%
  - RPMT: down from 37% to 13%

Regression analysis

1. Model of borrowing propensity: *Prob* (LTV_{it} > 0)
   - Controlling for sample selection (subsample of owners)
2. Model of outstanding LTV_{it} (for mortgage holders)
3. Model of mortgage type: *Prob* (*NRPTM* = 1)

Regression analysis

Borrowing Propensity: $Prob(LTV_{it} > 0)$

- Endogeneity of sample selection taken into account (financing decisions relevant only to owners)
  - Problem modelled using Heckman probit methodology

Regression analysis

Borrowing Propensity: $Prob(LTV_{it} > 0)$

- Model specification:

$$\begin{cases} OWN^*_{it} = X_{1it}\,\alpha + \varepsilon_{it} \\ BORROW^*_{it} = X_{2it}\,\beta + \zeta_{it}, \end{cases}$$

with

$$OWN_{it} \equiv \begin{cases} 1 & \text{if } OWN^*_{it} > 0 \\ 2 & \text{if } OWN^*_{it} \leq 0 \end{cases}$$

and

$$BORROW_{it} \equiv \begin{cases} 1 & \text{if } BORROW^*_{it} > 0 \\ 0 & \text{if } BORROW^*_{it} \leq 0 \\ \text{Not observed} & \text{if } OWN^*_{it} \leq 0 \end{cases}$$

ε_{it}, ζ_{it} – error term drawn from bivariate normal distribution
y^*_{it} – non-observable, y_{it} – observable

Regression analysis

Borrowing Propensity: *Prob*($LTV_{it} > 0$)

- ε_{it} (ζ_{it}) are iid *between* different households over time, but not necessarily for different observations *within* the same household
- Covariance between ε_{it} and ζ_{it} is non-zero
- Adjustment for sample selection is needed (and made)

Regression analysis

Outstanding LTV_{it} and mortgage type (*Prob*($NRPMT = 1$))

- Outstanding LTV_{it}:
  - Fixed effects model (to control for unobserved heterogeneity across households)
  - LTV_{it} at any time t

$$LTV_{it} = \gamma X_{3it} + \eta_{it}$$

- Mortgage type: *Prob*($NRPMT = 1$)
  - Probit model

Results

Sample selection model (Homeownership)

- Dependent variable: Homeownership dummy

Variable	Unit	∆ Prob
Income	EUR 10000	0.015
Net worth	EUR 10000	0.019
Benefits	EUR 10000	-0.052
2nd household member	dummy	0.061
3rd (or more) member	dummy	0.069
Education	dummy	0.032
Low urbanization	dummy	0.039
Housing type	dummy	-0.071
Relative cost of renting	0.1	0.003
Calendar time	year	0.003

Results

Sample selection model (Homeownership)

- Ownership propriety is:
  - Inverted U curve of age (max. at 40)
  - Increasing in average tax rate
  - Lower the highly-urbanized areas

Results

Borrowing model (Prob(LTV >0))

- Dependent variable: Borrowing dummy

Variable	Unit	Δ Prob
Income	0.1	-0.014
Net worth	EUR 10000	-0.010
Benefits	0.1	-0.038
2nd household member	dummy	0.108
3rd (or more) member	dummy	0.121
Education	dummy	0.076
Low urbanization	dummy	0.037
Effective tax rate (untill ’97)	0.1	0.056

Results

Borrowing model (Prob(LTV > 0))

- Income and benefits are scaled by house value
- Borrowing propensity is an inverted U-shaped function of age
- Error terms of both regressions are positively correlated

Results

LTV regression (for *LTV* it > 0)

- Dependent variables: Loan to value ratio

Variable	Unit	Sensitivity
Net worth	EUR 10000	-0.011
Benefits (RPMT)	1	0.592
Benefits (NRPMT)	1	0.369
2nd household member	Dummy	0.022
3rd (or more) member	Dummy	0.022
Education	Dummy	-0.005
Effective tax rate (until ’97)	1	0.046
Calendar time	year	-0.005
NRPMT	Dummy	0.047

Results

LTV regression (for $LTV_{it} > 0$)

- Repayment schedule is compulsory (discretionary) for repayment (non-repayment) mortgages
- Marginal effect of income values with mortgage type:
  - RPMT: 18 cent more debt per extra 10k euro of income
  - NRPMT: 12 cent less debt per extra 10k euro of income
  - RPMT: constant marginal effect over time
  - NRPMT: decreasing marg. effect (-0.056 at T=0; -0.339 at T=30)
  - RPMT: income only determines initial debt level
  - NRPMT: extra income accelerates repayment (which is discretionary)

Results

LTV regression (for $LTV_{it} > 0$)

- LTV is a convex decreasing function of mortgage elapsed time:
  - Effect of house price appreciation
  - RPMT: 1.09% decline per year
  - NRPMT: 0.81% decline per year
- LTV significantly higher for non-repayment mortgages:
  - Results also hold for individual mortgage types
  - Difference increases with time elapsed since mortgage commencement

Results

LTV regression (for $LTV_{it} > 0$)

- Indication that their relatively high LTV may be associated with a selection of non-compulsory principal repayment types
- Non-repayment mortgages are riskier
- What caused proliferation of non-repayment mortgages?

Results

Probit model for mortgage type (*Prob*(*NRPMT* = 1))

- Dependent variable: Mortgage type (*NRPMT* = 1)

Variable	Unit	Δ Prob
Income	0.1	-0.009
Net worth	EUR 10000	-0.0003
2nd household member	dummy	0.109
3rd (or more) member	dummy	0.112
Age	year	-0.017
Effective tax rate (until ’97)	0.01	0.004
Calendar time	year	0.028
Affordability	0.1	-0.018

Results

Probit model for mortgage type (*Prob*(*NRPMT* = 1))

- NRPMT mortgages chosen by households that are more likely to be financially constrained (low net worth, large family)
- Proliferation of non-repayment mortgages driven by:
  - Declining affordability
  - Tax advantages
  - Increased banking competition

Conclusions

- Mortgage financing being practically the only source of external financing
- Loan-to-value ration decreasing much faster for contracts with compulsory principal repayment
- Potential implications of the prevalence of non-compulsory repayment mortgages for future homeownership rates
- Endogeneity of sample selection taken into account