Interest accumulation in reverse mortgage loans with termination moral hazard

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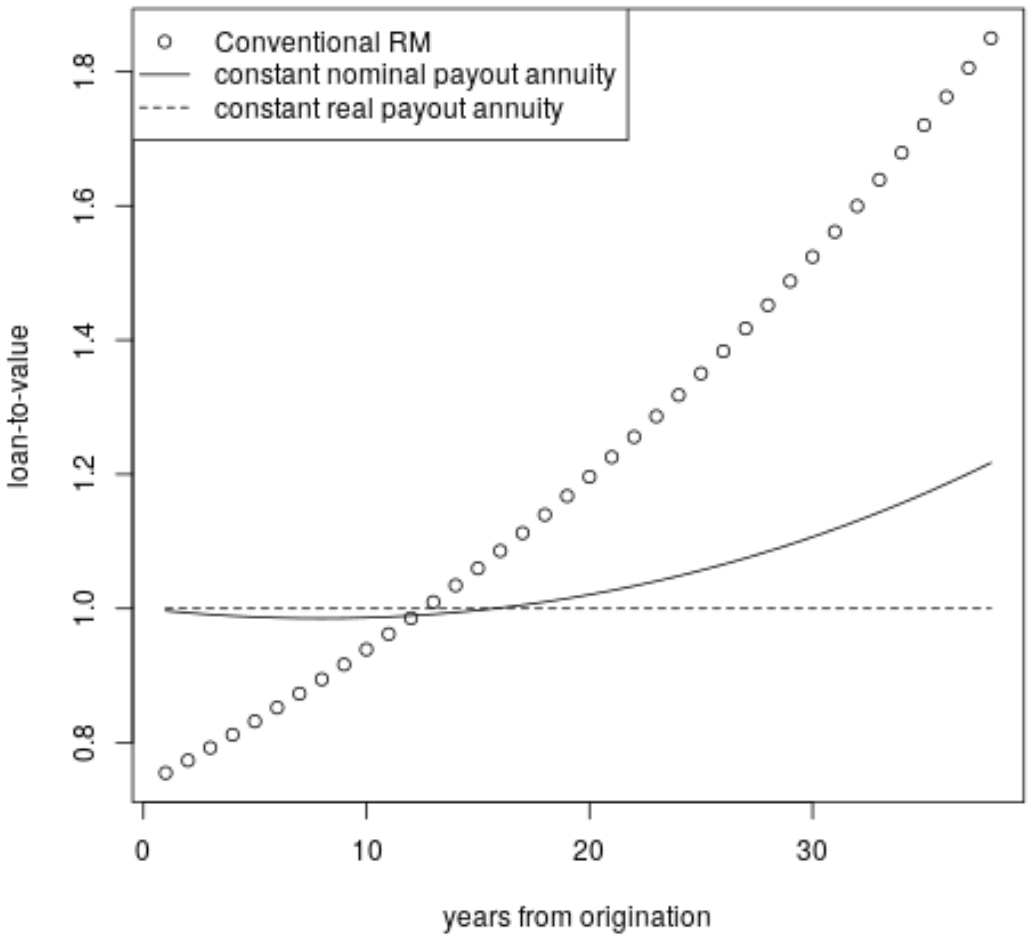
Reverse mortgage mechanics

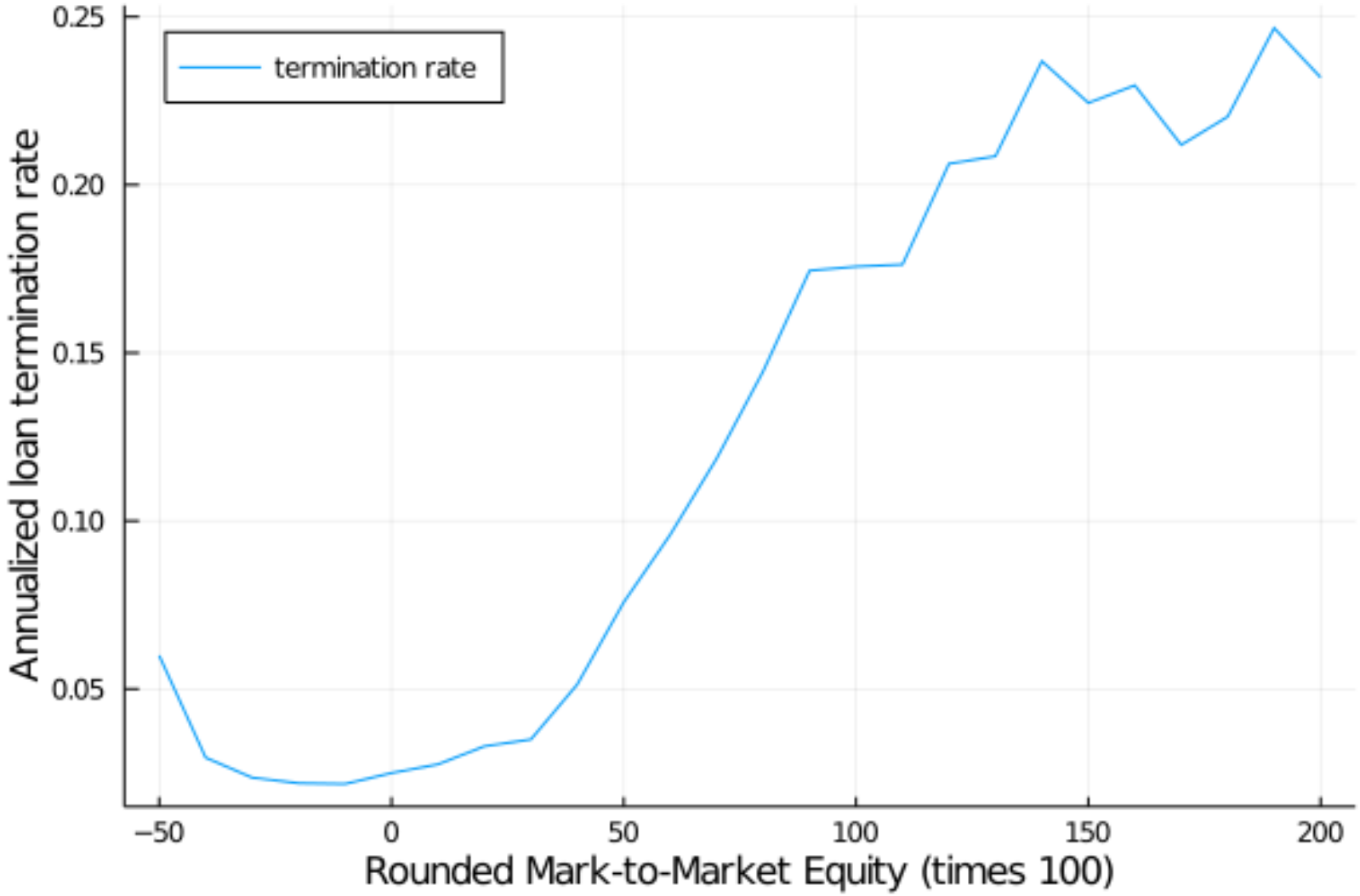
- Lump sum or credit line at origination
  - Lump sum could be annuitized or (usually) not
- No payments (beyond covenanted operations) required until
  - min([move, die])
- Non-recourse, lender likely gets min(collateral, balance)

Research Question: Is this flattening rotation a good idea?

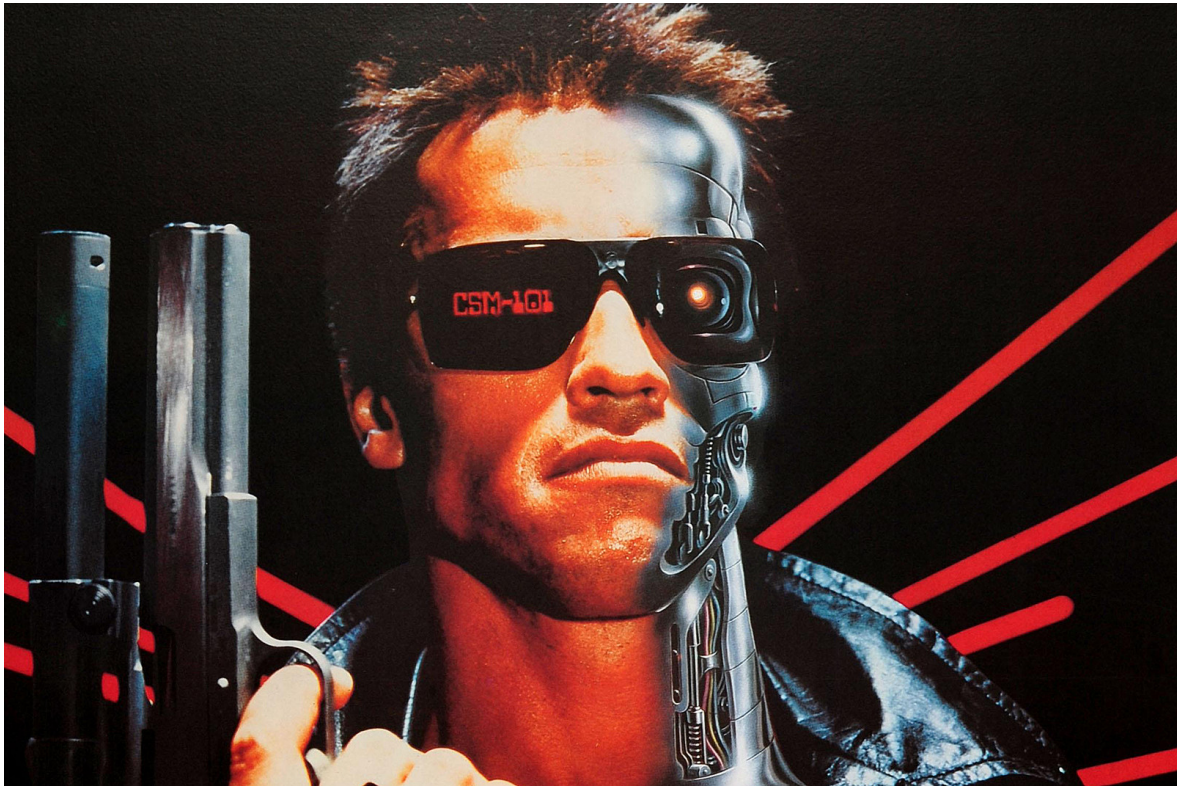


Moral hazard on duration

Theory: little cost to remain when at or under water
Empirics: strong refi/sale temptation otherwise



Model of borrower behavior



Getting to efficient loan terms

- Value of home can be decomposed
  1. Net rents during occupancy ($r - g \times v$ if all nice)
  2. Expected sale price after exit from home
- Side-note: Ratio $\frac{\text{Source 2}}{\text{Source 1}}$ very high w/ low $r - g$.
- If no payments, maximal cash proceeds = Source 2.
  - Forward sale
  - Reverse mortgage with infinite interest rate
- But expected sale price on exit is endogenous
  - Why move voluntarily with either structure?
- Need owner to pay user cost every period to get efficiency
  - E.g. sale-leaseback
  - But whence the cashflow to pay rent?
    - RM evidently low in pecking order

Annuitized Reverse mortgage

- Precedent: fixed-debt RAM
- Two parts of the loan:
  1. The usual
  2. Life annuity that pays
     - interest until move
     - borrower after a move while alive
- With constant r, g:
  - Annuitized component is user cost
  - Can preserve 100% LTV per diagram
- Issues to analyze
  - Annuities are unfair
  - Prices are stochastic
  - Calibrate borrower *behavior* (not utility?)

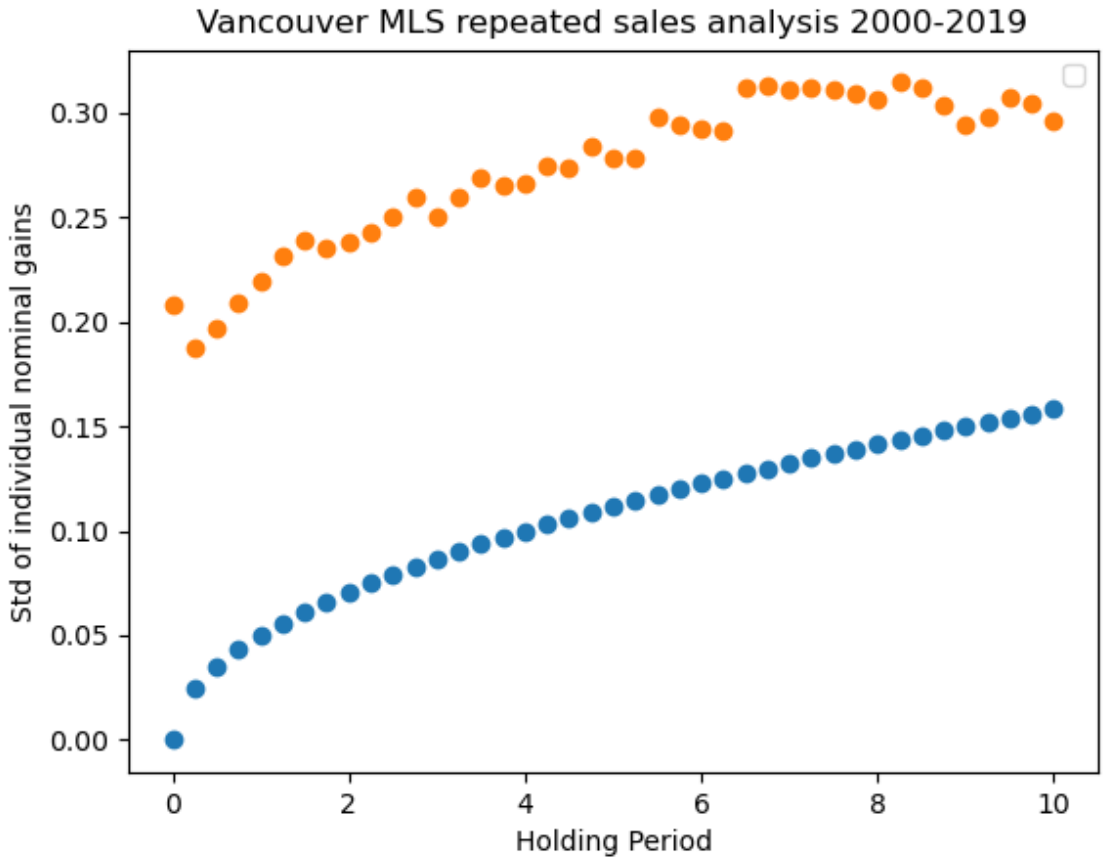
Model basics

- Question: cost to insure RM put option
  - Assume always exercised at termination
  - Termination per HECM picture logit
  - riskless rate discounting
- Initial LTV 50%, 1.5% spread (per HECM)
  - No other lender behavior
  - Assume insurance fees as points
- Annuity with 7.5% load (per Canadian quotes for 70 year old woman
- Annuitize 0 . . . 50% of remaing 50% (0. . . 25% of property value)
- Borrower moves as a HECM borrower logit through 1997-2011
  - Zillow Zindex
  - HECM loan to value and terminations

Volatility trajectory

Standard likely better for proposed enhancement
Role of flippers vs reverse mortgagors?

Standard deviation of individual home price transactions by length of holding period in Greater Vancouver (orange dots) versus 5% times root of years since origination (blue dots). Repeated sale transactions pooled within holding periods in quarters across homes and time periods.



Balance evolution

$$L_t = L_{t-1}\left[1 + r + s\right] - a, \tag{1}$$
$$X_t = X_t\left[1 + r + \alpha s\right], \tag{2}$$
$$b_t = L_t + X_t. \tag{3}$$

"Empirical" question

Recognizing credit market imperfections and price volatility, still a good idea?

Table: Parameter notation and assumptions

Symbol	Meaning	Parameterization
r	Nominal riskless rate	1% or 5%
s	Spread to an insured lender	2% (per recent HECM vintages)
α	Fraction of s applied to annuitized component of loan	0, .5, 1
b_t	Reverse mortgage balance at date t	See equations (1) through (3).
ω	A realization of collateral values	
$v_{t\omega}$	Value of home at date t on path ω	Mean 2%, Std. Dev 10% + $.065\sqrt{t}$.
L_0	Initial loan to value for standard lump sum reverse mortgage	50%
load	Loading on annuity (e.g. administrative fees)	7.5%
A	Fair cost to provide an annuity	
a	Annual cash flow from the annuity	
x	Fraction of $1 - L_0$ annuitized and paying debt until move Reverts to borrower after move	0,.1,. . . .5
$\lambda_{t,\omega}$	Probability loan terminates (move or die)	per text
$S_{t,\omega}$	Probability loan not yet terminated	
m_t	Mortality at age t	For Canadian woman age 70 at origination

Why isn't this just a sale-leaseback?

- Very similar
- Annuity likely pays less than market rent
- Control and ownership remain linked

Numerical analysis.

				Length	
r	annuity wedge α	annuitized %	Insurance cost	Mean	sd
0.01	0	0	0.0039	10.88	3.33
0.01	0	0.25	0.0019	10.94	3.22
0.01	0	0.5	0.0013	11.05	3.10
0.05	0	0	0.1205	14.38	3.74
0.05	0	0.25	0.0953	14.37	3.64
0.05	0	0.5	0.0718	14.23	3.47
0.01	0.5	0	0.0040	10.85	3.31
0.01	0.5	0.25	0.0032	11.09	3.31
0.01	0.5	0.5	0.0025	11.30	3.21
0.05	0.5	0	0.1198	14.38	3.75
0.05	0.5	0.25	0.1077	14.49	3.60
0.05	0.5	0.5	0.0974	14.55	3.38
0.01	1	0	0.0040	10.84	3.33
0.01	1	0.25	0.0043	11.28	3.35
0.01	1	0.5	0.0051	11.68	3.32
0.05	1	0	0.1205	14.39	3.73
0.05	1	0.25	0.1249	14.64	3.55
0.05	1	0.5	0.1334	14.93	3.25

Conclusion

- Consider "first best" product
  - Lump sum equal to expected value on death
  - Annuity to pay "rent" and moderate balance growth
- Realistic volatility of home prices
- Consider spread α
  - Pre-mortality annuity return
  - Annuity lender return
- Consider termination moral hazard
  - Nonstandard agent terminators
- Insurance costs reduced considerably if α moderate
- If such a great idea why not done?
  - LESA
  - Fixed-debt RAM: conjecture
    - No one wants lump sum part as annuity
    - So threw out other annuity component