## Mortgage Amortization and Wealth Accumulation

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$$

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## Summary

"One nice thing about investing in a house is that you're committed to a mortgage payment. So if you don't take out a home equity line of credit or do something like that, you will accumulate wealth."
Nobel Laureate Robert Shiller (CNN Dec 4 ${ }^{\text {th }}$, 2014)

1) Standard mortgages $=$ loan + repayment plan (amortization $)$
2) These amortization "illiquid savings" plans are immense (In U.S. $\$ 100$ s of bil/yr $\rightarrow$ comparable w/ pension programs)
3) First causal evidence of effect on wealth $\rightarrow$ substantial ( $\$ 1$ amortization $\rightarrow \sim \$ 1$ wealth)
4) Implications for homeownership and wealth building/inequality, debt-savings fungibility, and macroprudential policies

## The Basics

## What is a mortgage?

Standard Mortgage $=$ Loan + Repayment Plan $($ Amortization $)$

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Interest

Lender
$\uparrow$

Parker et al. 13', Di Maggio et al. '17,.


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## What is a mortgage?

Standard Mortgage $=$ Loan + Repayment Plan (Amortization)

# expenses <br> savings 

Interest + Debt Repayment

Lender
$\uparrow!$
Parker et al. 13', Di Maggio et al. '17,



## Research question

## What is the effect of mortgage amortization on wealth accumulation?

Wealth Accumulation $=$ Mtg Amortization (Repayment) + Net (non-mtg) Savings

$$
\text { Fungibility }(F):=-\frac{\partial S}{\partial A}
$$

Wealth Elasticity $\left(\epsilon_{W}\right):=\frac{\partial W}{\partial A}:=1$ - Fungibility
$H_{0}$ : No effect - perfect fungibility between savings and debt repayment
$H_{a}$ : Some effect - imperfect fungibility
$>$ If $H_{a}$ : what is the level of fungibility $F$ and therefore elasticity $\epsilon_{W}$ ?

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\$0 \$0 "leakage"
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-\$1 "crowdout"
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## What is the effect of mortgage amortization $+\$ 1$ on wealth accumulation? <br> +\$1 +\$1 \$0

Wealth Accumulation $=$ Mtg Amortization (Repayment) + Net (non-mtg) Savings II
Income

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Expenses

$$
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\$0 Income

$$
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-\$1 Expenses
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## Research question

## What is the effect of mortgage amortization on wealth accumulation?

Do they reduce other savings

$$
\epsilon_{W}=0
$$

or cut expenses/leisure

$$
\epsilon_{W}=1
$$

or both?

$$
\epsilon_{W} \in[0,1]
$$

## Empirical Challenges

1) Debt repayments \& savings co-determined (obviously)
2) Detailed administrative household-level wealth information

## Our approach

## 1) Natural Experiment from Dutch Macroprudential Policy

Jan-2013 remove tax benefits/conformability of incremental IO mtgs

## 2) Administrative data

Tax records of assets, income, and liabilities for entire population for 2007-2016

## 3) Design

Wealth accumulation for homebuyers before vs. after Jan-2013

## Our macroprudential shock

\% New Mortgage Offers Fully Amortizing


## Preview of Findings

1) $\Delta € 1$ amortization increases wealth $€ 1_{\left(\epsilon_{W} \sim 1\right)}$
$>$ Little debt-savings substitutability $(F \sim 0)$
$>$ Not selection: Holds for only life-event driven purchases (ex. timing of birth of child)
$>$ Not "non-savers": Holds for HHs who save substantially

## 2) "Paid" for with income and expenditures

$>$ Higher wealth paid for with higher income $\left(\sim 1 / 4^{\text {th }}\right)$ and lower expenditures $\left(\sim 3 / 4^{\text {th }}\right)$

## Dutch Mortgage Environment in 2012

> Harsh recourse laws (think harsher than U.S. student loans)
> Little role for strategic default - orders of magnitude lower default rates than U.S. in crisis peak
$>$ Origination LTVs $>100 \%$
$>$ Regulatory DTI limits
$>$ DTI max computed as if 30 yr amortizing loan (not affected by the regulation)
$>$ New mortgages typically $50 \%$ interest-only
> External validity: IO mtg isn't weird subsample \& most have some amortization

## The Regulation

## "Financial Stability" program

$>$ Announced in '12 (passage uncertain til Oct) starting January 1st, 2013
$>$ Based on date purchase contract, not close date (typically $>2$ months later)
$>$ For close dates, "treatment" will start after March 1", 2013
$>$ Afterwards only 30-year fully amortizing mortgages eligible for MID
$>$ Applies to incremental loans, so fully to first-time homebuyers and partially to other buyers

## Data and Definitions

$$
\begin{aligned}
& \Delta \boldsymbol{W e a l t h} \\
& \\
& \text { Assets } \equiv \Delta \text { Assets }-\Delta \text { Liabilities } \\
&+ \text { Stocks (tax records confirmed by banks) } \\
&+ \text { Bonds (tax records confirmed by banks) } \\
&+ \text { Voluntary Pension (implied from tax records) } \\
& \text { Liabilities } \equiv \text { Mortgages (tax records confirmed by banks + registry) } \\
&+ \text { Other liabilities } \text { (credit registry) }
\end{aligned}
$$

${ }^{1}$ Wealth does NOT include value of human capital (which we explore separately)
${ }^{2}$ Accurate annual house values limited, but can/do look at assessed values

## Summary Stats - Our Sample

Universe of all 111,523 first-time time homebuyers in Netherlands in 2012/2013

## Relatively High Income

$>$ Pre-tax household income as of ' 11 (mean $€ 58 \mathrm{k}$; median $€ 54 \mathrm{k}$ )

## Relatively Young

> Oldest person in household as of '14 (mean 38; median 36; 90th-tile 52)

## Highly Levered

$>$ Balance ' 14 (mean $€ 203 \mathrm{k}$; median $€ 187 \mathrm{k}$ )
$>$ LTV '14 (median $105 \% ; 25^{\text {th }}$ percentile $101 \%$ )

## Most have liquid financial savings

$>$ Level as of ' 14 (mean $€ 18 \mathrm{k}$; median $€ 8 \mathrm{k} ; 25^{\text {th }} € 2.6 \mathrm{k}$ )
> Substantial variability within household over time (esp. in years of job loss)

## Effect on MTG Repayment（1st stage）

$$
\Delta \text { MtgBalance }_{i, J a n-\text { Dec } 15}=\sum_{j} \delta_{j} \times 1_{\text {Closing Date }^{j}}+\epsilon_{i}
$$

## HH Outcomes in 2015：1st Time Home Buyers＇12－＇13

$>$ X：Close date
$>$ Y：－ M MTG ‘15
$>$ Base：Feb＇13
$>$ No controls
$>1^{\text {st }}$ stage $\sim € 2 \mathrm{k}$
Not shown（in paper） $\Delta$ Amort $\sim \Delta$ Repaid


Cohort Apr May Jun Jul Aug Sep Oct Nov Dec Jan Mar Apr May Jun Jul Aug Sep Oct Nov Dec （home purchase date） 2012
$\begin{array}{lllllllllllllllllll}\text { Age } & 32 & 31 & 30 & 29 & 28 & 27 & 26 & 25 & 24 & 23 & 21 & 20 & 19 & 18 & 17 & 16 & 15 & 14\end{array} 13 \quad 12$
（months since purchase）

## Hypothetical under perfect fungibility

Assume $F=1$
$\rightarrow \epsilon_{w}=0$
HH Outcomes in 2015: 1st Time Home Buyers '12-'13


## Effect on Financial Assets

HH Outcomes in 2015: 1st Time Home Buyers '12-'13
Fail reject: $F=0$


Cohort Apr May Jun Jul Aug Sep Oct Nov Dec Jan Mar Apr May Jun Jul Aug Sep Oct Nov Dec (home purchase date)

| Age | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 21 | 20 | 19 | 18 | 17 | 16 | 15 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| An | 14 | 13 | 12 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

(months since purchase)

## Effect on Non-MTG Liabilities

HH Outcomes in 2015: 1st Time Home Buyers '12-'13
Non-mtg liabilities
Fail reject: $F=0$


## Net Effect on Non-Housing Wealth

HH Outcomes in 2015: 1st Time Home Buyers '12-'13
Non-housing wealth

Fail reject: $F=0$


Cohort Apr May Jun Jul Aug Sep Oct Nov Dec Jan Mar Apr May Jun Jul Aug Sep Oct Nov Dec (home purchase date) 20122013
$\begin{array}{lllllllllllllllllll}\text { Age } & 32 & 31 & 30 & 29 & 28 & 27 & 26 & 25 & 24 & 23 & 21 & 20 & 19 & 18 & 17 & 16 & 15 & 14\end{array} 13 \quad 12$ (months since purchase)

## Net Effect on Wealth

HH Outcomes in 2015: 1st Time Home Buyers '12-'13
$>$ MTG Repaid $\sim € 2 \mathrm{k}$
$>\Delta$ Wealth $\sim € 2 \mathrm{k}$
$>$ Fail reject:

$$
\begin{gathered}
F=0 \\
\epsilon_{w}=1
\end{gathered}
$$



## No bunching or evidence of selection

HH Outcomes in 2015: 1st Time Home Buyers '12-'13
Not shown (but in paper): "Smooth" across the reg
$>$ Pre-reg Income
> Level \& growth
$>$ Pre-reg wealth
> Level \& growth
$>$ House value
> At purchase \& growth
$>$ Orig LTV
$>$ MTG Rates
Also, same $\epsilon_{w}$ using non-FTHBs directly (or as a control)...


Cohort Apr May Jun Jul Aug Sep Oct Nov Dec Jan Mar Apr May Jun Jul Aug Sep Oct Nov Dec (home purchase date) 2012
$\begin{array}{llllllllllllllllll}\text { Age } & 32 & 31 & 30 & 29 & 28 & 27 & 26 & 25 & 24 & 23 & 21 & 20 & 19 & 18 & 17 & 16 & 15\end{array} 14$ (months since purchase)

## Robust to Life-Event Date

$>$ Sub-sample of buyers with "lifeevent"

Life-event $=$ $\Delta \# H H$ members
$>$ Cohort $=$ Month of life event (not closing date)
$>$ Later life-event $\rightarrow$ later buyers
$>$ Addressing selection concerns

HH Outcomes in 2015: 1st Time Home Buyers '12-'13 w/ Life-Event


## MTG Amort \& $\Delta$ Wealth

|  | $1^{\text {st }}$ Stage | RF | IV | IV | IV | IV |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
|  | (1) | $(2)$ | $(3)$ | $(4)$ | $(5)$ | $(6)$ |
|  | MTG | $\Delta$ Wealth | $\Delta$ Wealth | $\Delta$ Non-Home | $\Delta$ Wealth | $\Delta$ Wealth |
|  | Repaid '15 | $\prime 15$ | '15 | Wealth '15 | '15 | '15 |
| Post | $2045.0^{* * *}$ | $2030.8^{* * *}$ |  |  |  |  |
|  | $(19.22)$ | $(14.34)$ |  |  |  |  |
| MTG Repaid '15 |  |  | $0.993^{* * *}$ | -0.007 | $0.864^{* * *}$ | $0.997^{* * *}$ |
|  |  |  | $[0.88,1.10]$ | $[-0.12,0.11]$ | $[0.54,1.19]$ | $[0.84,1.15]$ |
|  |  |  | $(17.62)$ | $(-0.09)$ | $(5.26)$ | $(12.80)$ |
| Life-Event Buyers | - | - | - | - | Y | - |
| Fin Asset '15\| $\Delta$ | - | - | - | - | - | $>10 \mathrm{k} \mid>3 \mathrm{k}$ |
| IV | - | - | Post | Post | Post(life) | Post |
| F-Stat | - | - | 369.3 | 369.3 | 42.3 | 223.0 |
| Obs | 42,468 | 42,468 | 42,468 | 42,468 | 16,581 | 22,005 |
| Adj. R-sq | 0.020 | 0.011 | 0.331 | 0.002 | 0.355 | 0.252 |

1-3: MTG repaid \& wealth rise $\sim € 2 \mathrm{k} \rightarrow \epsilon_{w} \sim 1$
4: $F \sim 0$
5: Holds using timing of "life-event" (ex. birth of child)
6: Holds for those with who save substantial amounts of financial assets
Not shown (in paper): Robust to concerns about MID or other potential concurrent events, sample used, wealth measures (ex. levels, including real estate or not), and standard errors

## How do they "pay" for $\Delta$ wealth?

|  | (1) <br> $\Delta$ Income '15-'12 | (2) <br> $\Delta$ \#Earners <br> '15-'12 | (3) <br> $\Delta$ Income '15-'12 | (4) <br> $\Delta$ Income '15-'12 | (5) <br> $\Delta$ Income '15-'12 | (6) Income '15 | (7) Income <br> '12 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Post | $\begin{gathered} 1270.1^{* * *} \\ (7.71) \end{gathered}$ | $\begin{gathered} 0.0239^{* * *} \\ (3.36) \end{gathered}$ | $\begin{aligned} & 364.2 \\ & (1.59) \end{aligned}$ |  |  |  |  |
| $\Delta$ Hrs Worked '15-'12 |  |  | $\begin{aligned} & 10.52^{* * *} \\ & (40.62) \end{aligned}$ |  |  |  |  |
| MTG Repaid '15 |  |  |  | $\begin{gathered} 0.621^{* * *} \\ {[0.38,0.87]} \\ (4.97) \\ \hline \end{gathered}$ | $\begin{gathered} 0.576^{* * *} \\ {[0.29,0.90]} \\ (3.83) \\ \hline \end{gathered}$ | $\begin{gathered} 0.457^{* *} \\ {[0.05,0.79]} \\ (2.20) \\ \hline \end{gathered}$ | $\begin{gathered} -0.119 \\ {[-0.39,0.04]} \\ (-1.60) \\ \hline \end{gathered}$ |
| Muni FE | N | N | N | N | Y | Y | Y |
| Add. Cntrls | N | N | N | N | Y | Y | Y |
| IV | - | - | - | Post | Post | Post | Post |
| F-Stat | - | - | - | 369.3 | 141.6 | 141.6 | 141.6 |
| Obs | 42,468 | 42,468 | 42,468 | 42,468 | 40,352 | 40,352 | 40,352 |
| Adj. R-sq | 0.001 | 0.001 | 0.175 | 0.001 | -0.046 | -0.005 | -0.015 |

1-3: HHs increase income via more earners \& hrs worked (labor supply, rest expenditures)
4: $36 \%$ "paid for" w/ higher income (gross HH incomes, so Net $\sim$ Gross $\times$ [1-42\%])
5: Holds with controls for pre-reg income/assets
6 -7: Driven by income in ' 15 not' $12 \rightarrow 26 \%$ paid for w/ income

## Possible mechanisms

## (1) Liquidity wedge ${ }_{\text {Defisco } \& \text { Mondragon } 19, \ldots}$

$>$ Illiquid savings $\neq$ liquid savings for short-term consumption smoothing
$>$ Constrained by positive equity (risky) and own income (state of the world where you need it!)
> Inconsistent: $F \sim 0$ and no variation by amount of liquidity, "weird" EIS - alter consumption/labor today and ongoing to avoid any risk (at all) in the future...

## (2) Behavioral

(a) Default setting Madrian and Shea ' 01 , Chetty et al. ' ' 14 , Beshears et al. ' $19, \ldots$
(b) Commitment device Kovacs and Moran ' 19 , Vihriala ' ${ }^{19}$,...
(c) Mental accounting Thaler ' 80 , Kahneman \& Tverskey ' 84 , Camanho \& Fernandes ${ }^{1} 18, \ldots$

## (3) Combination?

$>$ Heuristic ("rule of thumb") liquidity targets ("rain day fund")
$>$ "Perceived precautionary savings motive" Olafsson \& Pagel ' 17 , Aydin ‘'19, D'Acunto et al' 2020,...

## Consistent w/ Existing Work

## (1) Debt forgiveness \& consumption (U.S.) Ganong \& Noel 19

$>$ Increased liquidity (maturity extensions) for distressed $\rightarrow$ large change in consumption
(2) Mortgage run-offs (U.S. \& others) Coulibaly \& Li ‘06; d'Astous '17; Andersen et al. '19
$>$ After loans fully paid go from regular (mostly) principal payments to nothing
$>$ Muted changes in savings, bigger changes in consumption \& income
(3) Borrowers selecting IO (U.S. \& others) Larsen et al. '18, Amoromin et al. ‘18,...
$>$ Higher consumption and default more
(4) Elderly household balance sheets (U.S. \& others) Kaplan et al. '14
$>$ Substantial home equity (little/no mortgage debt), but few liquid assets
> "Wealthy hand-to-mouth"
$>$ Even more than pensions, intertemporal substitution in amortization may be costly...

## Potential for Persistence

\% of Hand-to-Mouth Homeowners w/ a Mortgage


1) Fully amortizing borrowers (U.S.) don't completely "undo" amortization
2) Partially amortizing borrowers (Dutch) don't amortize on their own
> Median non-housing financial assets for all 60-65 year-olds w/ a mortgage is only $€ 26 \mathrm{k}$
$>\epsilon_{W} \sim 1$ for $50+$ yr-olds and 4 yrs after reg (when treatment $>$ median non-housing wealth)

## Conclusion/why do we care?

## $\uparrow$ mortgage amortization $\rightarrow$ wealth accumulation $\uparrow$

1) Micro

Beshears et al. ' 19,
$>1 / 3^{\text {rd }}$ of U.S. households have an amortizing mortgage
$>$ Fungibility of debt repayment vs savings (some macro models might need adjustments)

## 2) Public Economics/Aging Li and Yang ${ }^{4} 10$, Sodini e tal. ${ }^{117, \ldots}$

## In U.S. $\$ 100$ s of billions/year $\rightarrow$ comparable w/ pension programs

$>$ MTG Design and retirement policies (If you care about pensions you should care about amortization!)
$>$ Homeownership \& wealth building/inequality (ex. racial differences)

## 3) Macroprudential Policy Campbell et al. ' 19 ; Guren et al. ' $19, \ldots$

In U.S. 2 years of amortization ~ first 4 yrs of TARP payments post Great Recession
$>$ Ex-post: Reduced repayment plans (interest-only/maturity extensions)
$>$ Ex-ante: Do HHs undo regulation intent (by altering savings)?
> The " 30 yr" mortgage is arbitrary. What about 20? 40?

## THANK YOU

