The Sensitivity of Housing Demand to Financing Conditions: Evidence from a Survey

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Key questions about the link between financing and housing demand (and house prices)

- To what extent was the run-up in house prices in the 2000s caused by
  - Low interest rates?
  - Easier access to credit / lower down payments?
  - "Exuberant" expectations?
- Is the increase in mortgage rates since mid-2013 responsible for the slowdown in US house price growth?
  - What will happen to housing if rates rise further?
- Are LTV caps a useful macroprudential tool to deflate housing bubbles?

Answers to these questions depend (at least partly) on sensitivity of housing demand to

- Interest rates
- Down payment requirements

Estimating the effects of financing on the housing market is very difficult

- Macro level: time-series / panel regressions
  - Interest rates: typically modest effects on HP growth (overviews: Kuttner, 2014; Dokko et al., 2011)
  - Leverage: Duca et al. (2011) argue that LTV changes in US had substantial effects during boom
  - LTV/DSTI caps ($>$ 20 countries; IMF 2013): studies typically find that introduction of caps lowers HP growth

  $\Rightarrow$ Pro: captures general equilibrium effects; con: identification
- Cross-section: typically no exogenous variation that could be used to cleanly estimate effects

Estimating the effects of financing on the housing market is very difficult (II)

- Calibration exercises, mostly based on user cost framework (Poterba, 1984)
  - e.g. Himmelberg, Mayer, and Sinai (2005); Glaeser, Gottlieb, and Gyourko (2013)
  - How much housing demand *should* react to changes in financing conditions
- But does not give very sharp predictions. E.g., effect on HP of increasing down payment requirement from 5% to 20% predicted to be:
  - 0 if effective discount rate (shadow cost of funds) $= r_{mortgage}$
  - about -25% if effective discount rate $= 20\%$/year

Our approach: let's just ask people

- *Suppose you're moving today and plan to buy a home similar to the one you're in. How much would you be willing and able to pay for this home today? How much would you put down?*
  1. Mortgage rate $= r_0$; down payment fixed at 20%
  2. Mortgage rate $= r_0$; down payment *at least* 5%
  3. Mortgage rate $= r_1$; down payment *at least* 5%
  4. Mortgage rate $= r_1$; down payment *at least* 5%; inherited 100k
- Randomization: either $r_0 = 4.5\%$ and $r_1 = 6.5\%$
  or $r_0 = 6.5\%$ and $r_1 = 4.5\%$
  $\Rightarrow$ between- and within-respondents estimation of effect of r
- 2 vs. 1: effect of down payment restriction
- 4 vs. 3: effect of non-housing wealth shock

Advantages and limitations of survey approach

Advantages:

- Clean identification of effects
- Can look not only at average effects but also at heterogeneity as function of respondent characteristics

Limitations:

- Respondents would think harder about this in reality
  - Not clear it would bias results; might just add noise
  - That said, they do seem to take task quite seriously
- Ignores general equilibrium effects
  - E.g. in reality, r may affect discount rates, bank risk taking
  - Nevertheless can inform/discipline models of the housing market

Overview of findings

- Changes in interest rates have relatively small effect on respondents' willingness-to-pay (WTP): on average, 2 ppt change in r leads to about 5% change in WTP
  - Consistent between and within respondents
  - Smaller than what workhorse user cost model would predict
- Lower down payment requirements and the cash windfall have sizeable average effects on WTP
  - Lowering required down payment from 20% to 5% increases average WTP by about 15%
  - \$100k cash windfall increases average WTP by about 10%
- Substantial heterogeneity in effects

Theoretical predictions: user cost model (Poterba, 1984)

- "Arbitrage": NPV(rent) = NPV(buy)
- Follow assumptions of Glaeser et al. (2013); in particular allow for discount rate (shadow cost of funds) ρ to exceed r
- Objects of interest: $-\frac{\partial \log P}{\partial x}$ where $x = r$ (mortgage rate) or θ (down payment fraction)

	$\rho = r_{\text{after-tax}}$	$\rho = 0.1$	$\rho = 0.2$
$-\frac{\partial \log(P)}{\partial r}$	8.53	6.80	5.32
$-\frac{\partial \log(P)}{\partial \theta}$	0	0.82	1.65

- Based on this, a 2 ppt decrease in r should raise WTP by 10-17%
  - Caveat: with stochastic r and ability to refi, get lower sensitivity
  - Also, at macro level ρ likely co-moves with $r \Rightarrow$ larger effect
- Effect of a decrease in θ from 0.2 to 0.05 very sensitive to ρ: no effect if ρ low, but could raise WTP by 25% if ρ is around 0.2

Details on survey

- NY Fed Survey of Consumer Expectations
  1. Monthly module: inflation expectations, labor market expectations, etc.
  2. Quarterly (special) modules: in this case on housing and mortgages
- Roughly 1,200 respondents ("household heads"), staying in sample for up to 12 months (rotating panel). Geographically representative of US.
- Housing module fielded in Feb 2014; 85% of invited households participated
- Various drops (e.g. if $<$21 or $>$70 years old; or if take $<$3 min or $>$30 min for this set of questions). Leaves $N = 962$.
- Sample: 73% owners; median age: 48; median income: 67.5k
- Average time spent on these questions: 8.5 min

Screenshot of Q1

Suppose that you were to sell your current primary residence today and pay off your outstanding mortgage. Further, suppose you were to move to a town/city similar to your current one. You want to buy a home, as you intend to stay for the indefinite future.

You have found a home that you like, and are planning to put in an offer on the house. Homes similar to the one that you are interested in have been selling for **$230,000** lately.

You need to think about the maximum amount you would be willing to pay for the home, taking into account how much of a down payment you would be able to make.

Assume that you are required to make a down payment of 20% of the purchase price, and finance the rest with a 30-year fixed-rate mortgage with an interest rate of 6.5%.

The table below shows two examples of what different purchase prices would mean for your effective total monthly payment (including maintenance costs, property taxes and insurance, and taking into account the tax deductibility of interest payments).

Purchase Price	Down Payment (20%)	Mortgage	Effective Monthly Payment
$290,000	$58,000	$232,000	$1,703
$170,000	$34,000	$136,000	$1,264

For instance, if you were to pay $290,000 for the house, with a required down payment of $58,000, your monthly payment would be $1,703. On the other hand, if you paid $170,000, with the required down payment of $34,000, your monthly payment would be $1,264.

CALCULATOR

Below is a tool you can use to determine what your down payment and monthly payment would be based on different purchase prices. You can put in any purchase price, and see what it means for your required down payment and your effective monthly payment. You can use this calculator as many times as you would like to help you arrive at the maximum amount you would pay for this home. You will enter your final answers at the bottom of the page.

Purchase Price: $ 250000

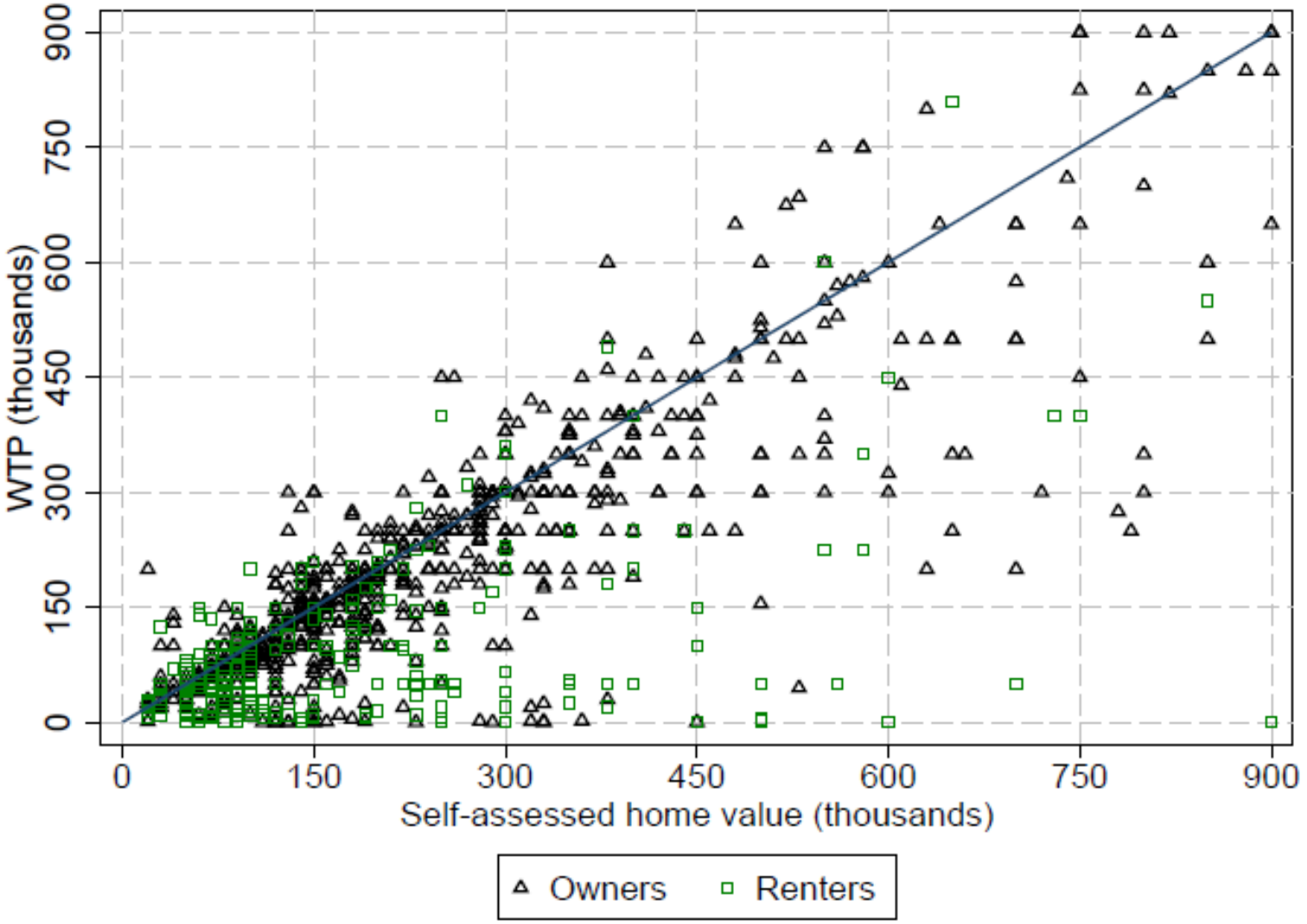
Purchase Price	Down Payment	Mortgage	Effective Monthly Payment
$250,000	$50,000	$200,000	$1,556

FINAL ANSWER

What would be the maximum amount you would be willing and able to pay for this home today?

Note that you need to be able to make a down payment of 20% of the purchase price that you enter, so pick a purchase price taking into account your financial situation if you were to sell your current home (and pay off your outstanding mortgage) today.

Q1: WTP with 20% down payment vs. appraisal



- corr(WTP,appraisal) = 0.84 for owners, 0.56 for renters
- Only 11% put WTP = appraisal

Q1: Explaining variation in WTP

	Log(WTP)	Log(WTP)
Interest Rate Low	0.066	0.059
	(0.047)	(0.040)
Log(Appraisal)		0.719***
Owner	0.367**	0.375***
Equity in (0, 50K]	-0.012	0.059
Equity in (50, 125K]	0.339**	0.245**
Equity in (125K, 200K]	0.436***	0.218*
Equity of more than 200K	0.798***	0.265**
Liquid Savings of [5K, 30K)	0.159*	0.031
Liquid Savings of [30K, 100K)	0.351***	0.196***
Liquid Savings of [100K, 500K)	0.320***	0.206***
Liquid Savings of 500K or more	0.394***	0.278***
Non-Housing Debt of [1000, 5000)	0.073	0.094
Non-Housing Debt of [5K, 30K)	0.104	0.052
Non-Housing Debt of 30K or more	-0.051	-0.008
Credit Score 680-719	0.222**	0.058
Credit Score 720-760	0.220**	0.156*
Credit Score Above 760	0.115	0.085
Income in (40K, 75K]	0.199**	0.042
Income in (75K, 150K]	0.418***	0.111
Income greater than 150K	0.697***	0.230***
Demographics	✓	✓
Adj. R2	0.53	0.65

Q1 takeaways

- Renters and owners look very different
  - Note: in US, first-time homebuyers account for 30-50% of transactions
- Explanatory variables appear to capture much of the relevant variation between respondents
- Low interest rates move WTP in expected direction: about +5-6% for 2 ppt change (though not statistically significant)
  - *Within*-respondent effect (Q2 vs. Q3) very similar
  - Paper: effect smaller than predicted by workhorse user cost model ($\sim$10-17%)

Comparing to estimates of $-\frac{\partial \log P}{\partial r}$ in the literature

- Earlier calibrations: semi-elasticity between 5 and 8
- Adelino et al. (2012) use changes in CLL (DiD) together with jumbo-conforming rate spread (10-25 bps)
  - Get local semi-elasticity estimates between 1 and 9
- Studies cited in Kuttner (2014): HP increase about 0.3-0.9% for 10 bps decrease in long-run rates (usually over 8-12 quarters)
  - Corresponds to semi-elasticity of 3-9
  - ...even though at macro level, ρ likely changes with r (we hold it fixed) so would expect larger effect (e.g. Himmelberg et al., assuming $\rho = (1 - \varphi)\, r$, propose semi-elasticities around 20).
  - Kuttner: "Puzzle [as to] why house prices are less sensitive to interest rates than theory says they should be"

Q2: Lowering the down payment requirement

"Consider the same situation as before (...)

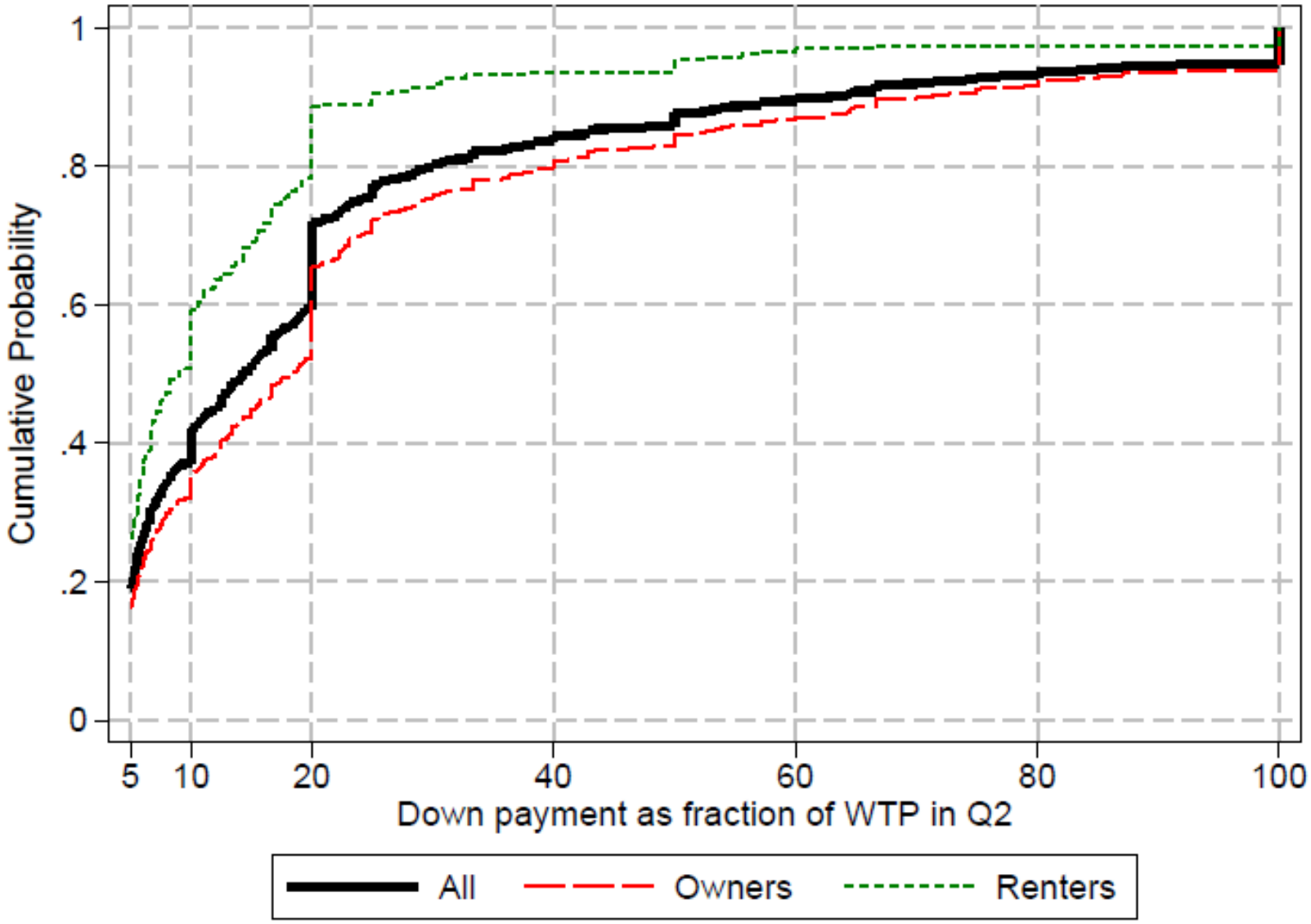
Now, the **minimum down payment is only 5%** *instead of a required 20% of the purchase price.*

However, you also have a choice of putting down more than 5% of the purchase price, if you wish (and have the financial resources to do so – after selling your current home).

As before, the mortgage interest rate is [4.5% / 6.5%]."

- Give examples of monthly payment for different purchase prices and down payments
- Provide calculator where respondent can study effects of changing purchase price and down payment

Down payment fractions chosen

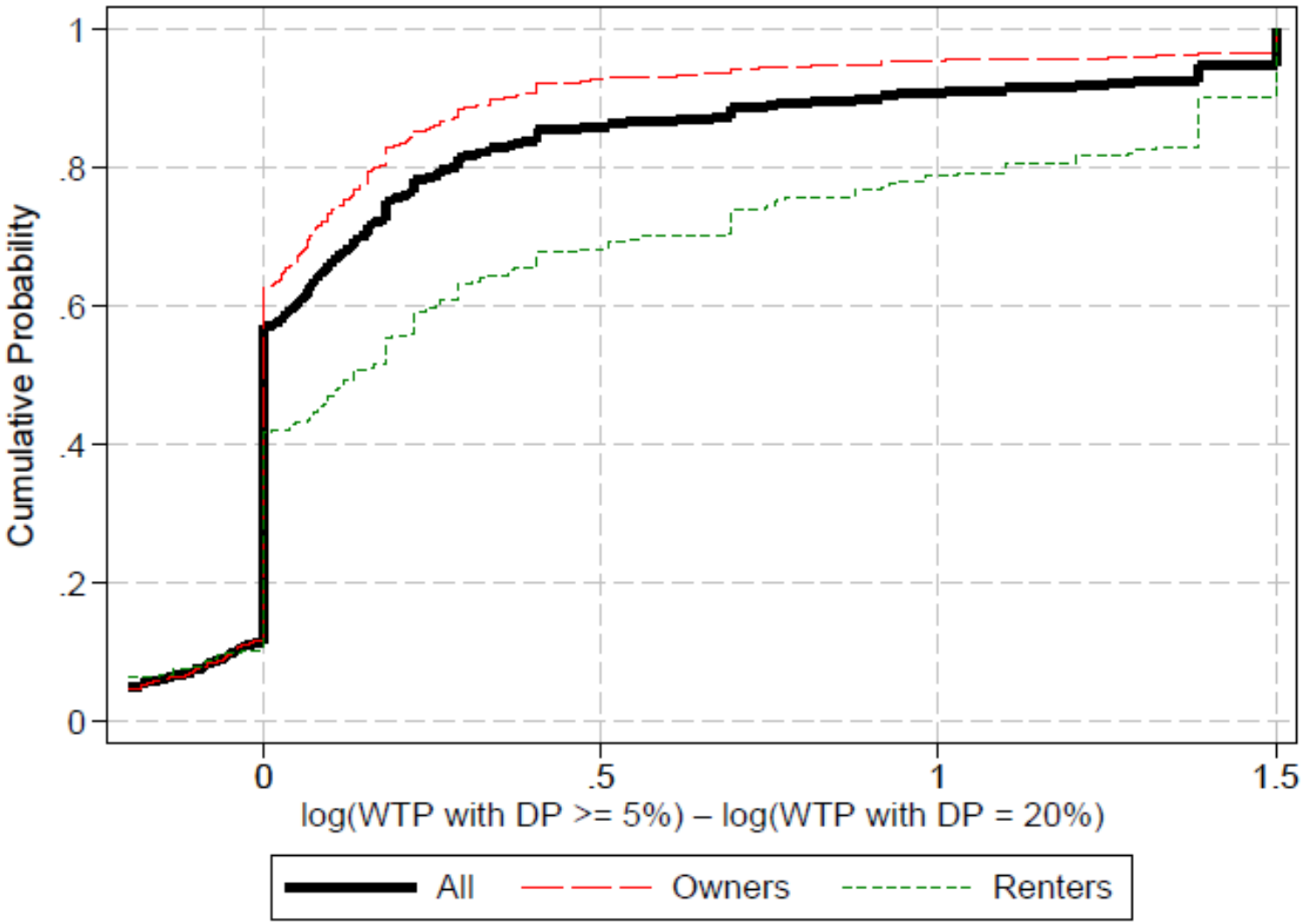


Down payment fractions chosen – averages

Sample	N	Average	Median
Full	957	22.9	14.3
Owners	695	26.0	18.4
Renters	262	14.8	9.1
4.5% rate	461	21.5	13.2
6.5% rate	496	24.2	15.6

- On average, current owners would put down about 10% more (as fraction of WTP) than renters
- Lower rates = higher leverage (as one would expect)
- Regressions: higher down payments associated with more equity, savings, less debt, higher credit scores, older respondents

Effects of lower down payment requirement on WTP



- 46% leave WTP unchanged, 43% increase it

Average effects of lower DP requirement on WTP

- Trimmed means of $\log(WTP|DP \geq 5\%) - \log(WTP|DP = 20\%)$, without top/bottom 5%:

Sample	N	Trimmed mean
Full	962	0.152
Owners	698	0.064
Renters	264	0.395

- Average WTP increases by around 15%
- Large differences between renters and owners; points toward substantial heterogeneity in effective discount rates
  - Regressions: larger effects if less equity, savings; low credit score, low income – even if only looking at owners
- Discount rates such that user cost model can "explain" these sensitivities:
  - Owners: $\approx 5\%$/year
  - Renters: $\geq 30\%$/year

Q2 takeaways

- Substantial heterogeneity in chosen down payments
  - Renters vs. owners
  - Regressions: higher down payments associated with more equity, savings, less debt, higher credit scores, older respondents
  - Also, down payment fractions about 2.5 ppt lower in low interest rate condition
- Effect of lower down payment requirement on WTP
  - Average increase about 10-15%
  - Much larger for renters
  - Regressions: larger effects if less equity, less savings, low credit score, low income.

Screenshot of Q4

We return to scenario that you just answered, with a minimum down payment of 5% and a mortgage interest rate of 4.5%. You said that you would be willing to pay $265,000 for the home, and put a down payment of $20,000, leading to an effective monthly payment of $1,587.

Suppose now that you just inherited $100,000 in cash. You could use all or part of this towards the down payment if you want but you don't have to. How would this affect your maximum price and down payment for the **same home** that you considered in the previous three scenarios?

CALCULATOR

Below is a tool you can use to determine what your monthly payment would be based on different purchase prices and down payments. You can put in any purchase price and any down payment (which has to be at least 5% of the purchase price but can be any amount above that), and see what it means for your effective monthly payment. You can use this calculator as many times as you would like to help you arrive at the maximum amount you would pay for this home. You will enter your final answers at the bottom of the page.

Purchase Price: $ 275000

Down Payment: $ 40000

Purchase Price	Down Payment	Mortgage	Effective Monthly Payment
$275,000	$40,000	$235,000	$1,548

FINAL ANSWER

What would be the maximum purchase price you would be willing and able to pay for this home today?

Note that you need to be able to make a down payment of at least 5% of the purchase price that you enter. So pick a purchase price taking into account your financial situation if you were to sell your current home today, and the fact that you now have an additional $100,000.

$ 280000

And how high would your down payment be? Your down payment can be $14,000 or more.

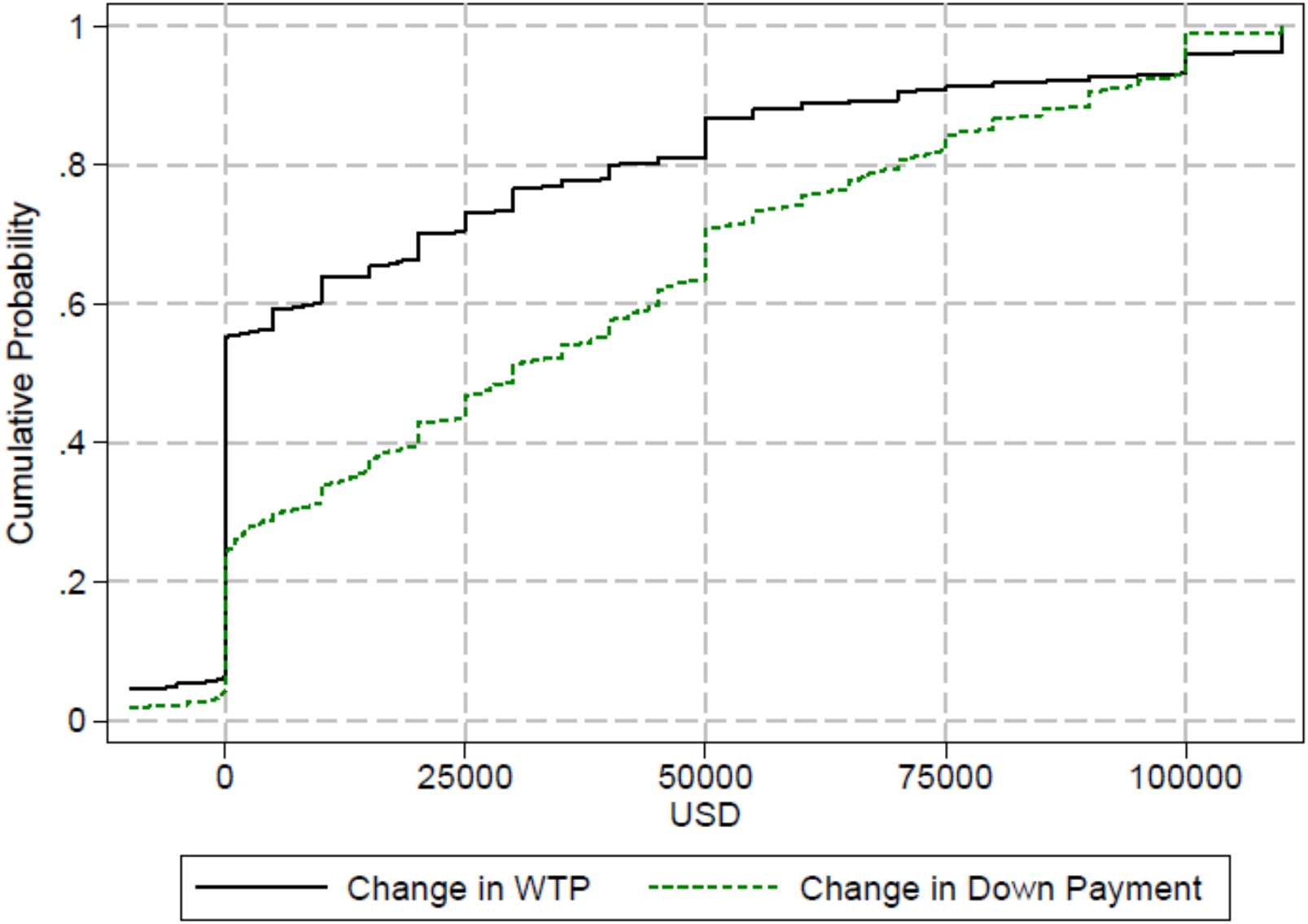
$ 60000

You stated that you would be willing to pay $280,000 for this home, and put a down payment of $60,000. This would mean that your monthly payment would be $1,490 per month. If you are not satisfied with this, please change your answer, otherwise click next.

BACK NEXT

0% 25% 50% 75% 100%

Effects of 100k cash windfall



Q4: Effects of 100k cash windfall

"Suppose now that you just inherited $100,000 in cash. You could use all or part of this towards the down payment if you want but you don't have to." (Everything else as in Q3.)

- 76% of respondents increase their down payment; 45% increase WTP
- On average, respondents would spend about 1/3 of cash windfall on down payment
  - Similar for owners and renters
- WTP increases on average by about $17k, or 10% on average
  - Larger for renters: 25% vs. 7%
  - Regressions: larger effects if less savings, more debt, low credit score, low income
- Substantial decrease in leverage: average down payment fraction increases by about 20 percentage points
  - Suggests high leverage chosen in earlier questions due to constraints, not "preference"

Discussion

- Both between- and within-respondent estimates suggest only modest effect of mortgage rates on WTP
  - $\sim 5\%$ for 2ppt change in mortgage rate
  - Toward low end (but in ballpark) of estimates in the literature
  - Lower than predicted by user cost model
  - No strong hints as to why – maybe behavioral?
  - Increases and decreases found to have asymmetric effects
- Down payment requirements and cash windfalls have larger effects, but with substantial heterogeneity
- Baseline user cost model appears insufficient to get realistic estimates of sensitivity of house prices to financing conditions
- Models that allow for effects of financing to vary across different market segments appear promising – e.g. Landvoigt, Piazzesi, and Schneider (2013)

Discussion

- Policy: suggests that interest rates may not be as important a driver of house prices as often thought
  - Consistent with results from existing empirical literature
- But many caveats when extrapolating from our quantitative results:
  - General equilibrium (effects on discount rates)
  - Low rates may themselves affect credit conditions ("reach for yield")
- LTV restrictions likely have very different effect for different segments of housing market
  - E.g. first-time homebuyers vs. retirees
- Effects may also be weaker when overall economic conditions stronger
- Methodological point: respondents "well-behaved" even with rather complicated survey questions $\Rightarrow$ valuable empirical tool