A Household Housing Portfolio Channel of QE Transmission

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Motivation

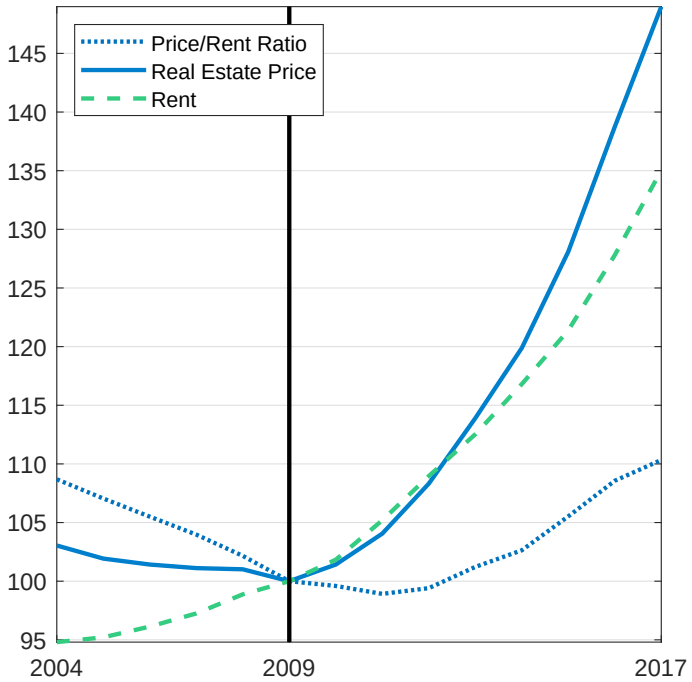
- Following the global financial crisis, advanced economy central banks have adopted new tools, the so-called unconventional monetary policies
  - Chiefly balance sheet expansion through long-term asset purchase programs (Quantitative Easing-QE)
  - In the case of the ECB, also negative deposit facility interest rate (Negative Interest Rate Policy, NIRP)
- Time-honored questions on the transmission mechanism of monetary policy:
  - What are the effects on the final objectives of monetary policy? What are the mechanisms?
  - Existing literature focused on impact on the financial markets, asset prices, bank behavior, and credit supply, and firm and household expenditure decisions (Tristani, 2021)

This paper

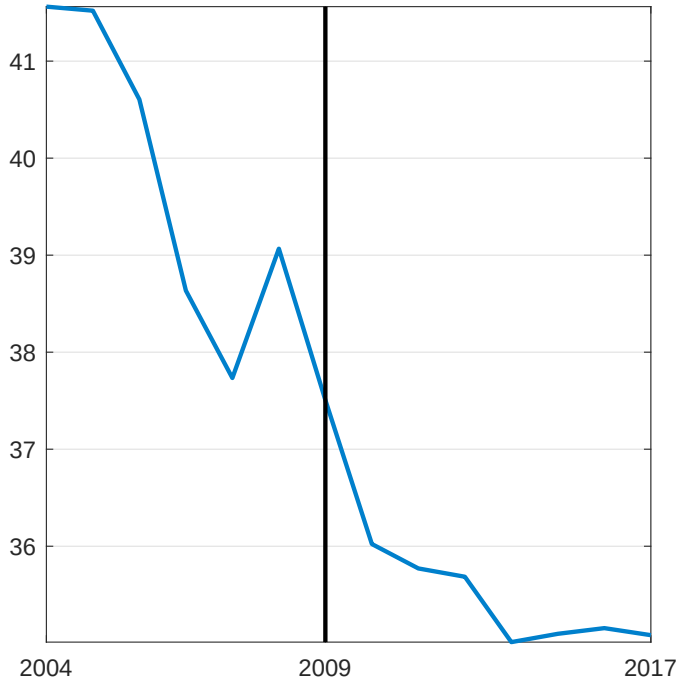
- Proposes a new housing portfolio channel of QE transmission that differs from traditional credit and collateral channels
  - QE lowers the net supply of bonds, depressing their returns
  - Households rebalance portfolios, with some buying housing without necessarily borrowing (i.e., cash purchases), which bids up prices and lowers expected future housing returns, and others selling and switching tenure
  - Wealthy buyers' total expected future portfolio return decline, potentially stimulating their current consumption and output;
  - Poor sellers may consume out of liquidated wealth
- Identifies this new channel in German region-level and household-level data
  - Regional analysis relies rich matched data set and uses variation in land scarcity as an instrument for expected future housing returns and prices, controlling for amenities as in Davidoff (2015)
  - Household-level analysis relies on Bundesbank's Panel on Household Finances and documents portfolio rebalancing toward *second homes* and consumption increase by *wealthiest and poorest* households

Germany: a housing boom without credit boom

Panel A: Residential house price and rent indexes (2009=100)



B: Domestic housing credit to households (% GDP)



German households, in the aggregate, have a high share of housing wealth and:

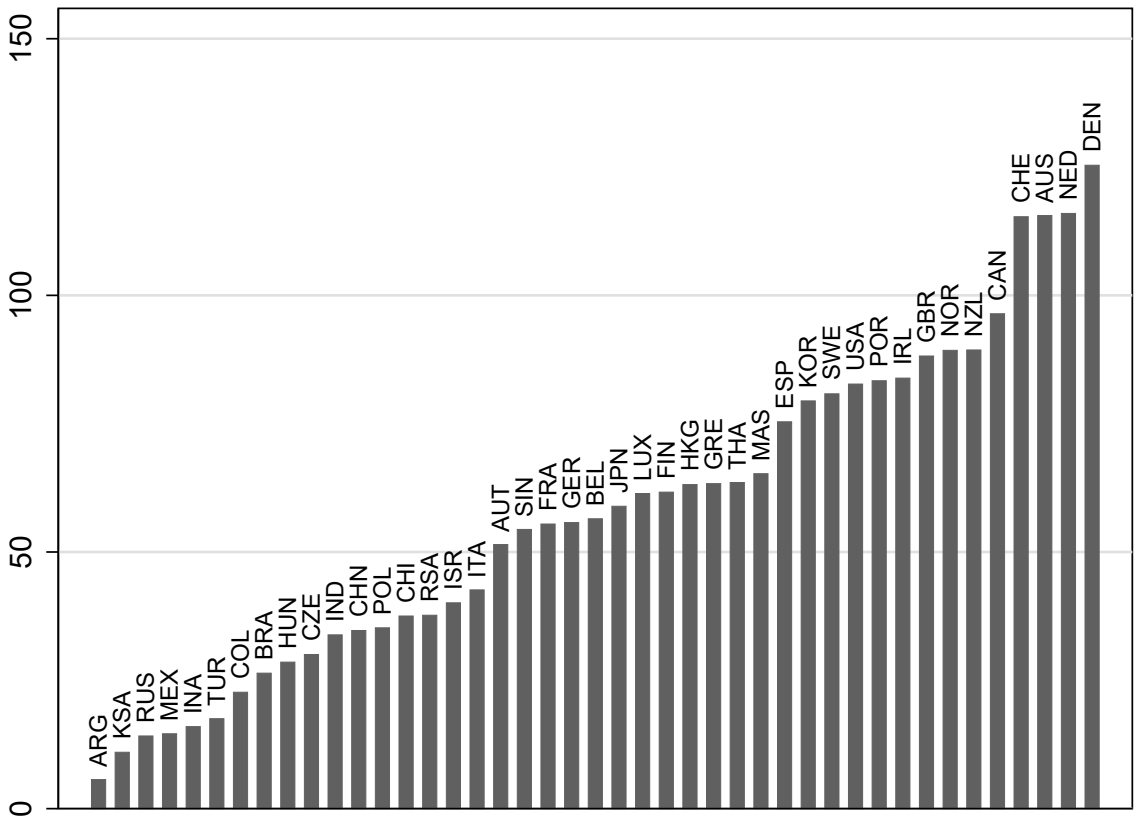
- Low stock market participation
- Low and declining leverage
- Increasing ratio of real estate to bonds
- Low and falling home ownership (buy-to-let for income?)

	2010	2014	2018
Real Estate/Total Assets	0.55	0.55	0.57
Bonds/Total Assets	0.065	0.064	0.059
Equity/Total Assets	0.083	0.085	0.085
Loans/Total Assets	0.15	0.13	0.12
Homeownership (in %)	53.2	52.5	51.5
Homeownership (with loans, in %)	27.8	26.6	25.6
Real Estate/Bonds	8.51	8.63	10.12

- NB: in Germany, mortgage interest on own-use properties is not tax-deductible. However, property *help-to-let* can deduct interest, maintenance, and depreciation
- A non-trivial fraction of wealthy households hold second-homes but rent first residence

The German case is not unique

- Few countries have household credit markets as large as in the US (IMF WEO, 2008; Cesa-Bianchi, Ferrero, and Rebucci, 2018; Badarinza, Balasubramaniam, and Ramadorai, 2021)
- Housing booms without credit booms are not uncommon (Cerutti, Dell'Ariccia, and Dagher, 2017)



Preview of results

1. Theoretically, a simple housing portfolio model with segmented asset markets guides the empirical analysis and especially identification

2. Empirically, we find that QE has a stronger impact on output growth in regions with tighter housing supply, controlling for amenities as in Davidoff (2015), other channels and confounding factors
   - The estimated regional growth differential is sizable: **1-1.5 pp** between high vs. low exposed regions during 2010-2017, **cumulatively**
   - Mechanism: QE works also through expected future housing returns and wealth effects, not through the credit market or collateral channels in Germany

3. Wealthier households rebalance toward second homes and increase consumption;
4. Poorer households give up home ownership and increase consumption

Related literature

- **Unconventional monetary policy, bank and firm behavior, and macroeconomic outcomes**
  - Kurtzman, Luck and Zimmermann (2017); Rodnyansky and Darmouni (2017); Chakaraborty, Goldstein, MacKinlay (2019); Acharya, Eisert, Eufinger and Hirsch (2019); Todorov (2020)
  - Eberly, Stock and Wright (2019); Luck and Zimmermann (2020); Fabo Jancoková, Kempf and Pástor (2021)
- **Portfolio rebalancing**
  - Peydro, Polo and Sette (forthcoming)
  - Koijen, Koulischer, Nguyen and Yogo (2021)
- **Literature on house prices, credit and household consumption**
  - Chaney, Sraer and Thesmar (2012); Aladangady (2017); Chodorow-Reich, Novand and Simsek (2021)
- **Literature that views housing as a risky asset in household portfolios**
  - Flavin and Yamashita (2002); Yao and Zhang (2005); Cocco (2005)
- **Post-2009 German housing boom**
  - Le Blanc, Kindermann, Piazzesi, Schneider (2020), Bednarek, te Kaat, Ma and Rebucci (2021);

Outline

- The model and its implications
- Regional analysis
- Household-level analysis
- Conclusions

Model

A simple housing portfolio model

- A representative (rich) regional/city household maximises end of period wealth
  - Mean-variance preferences
  - Chooses among houses, bonds and cash
- Two preferred habitat investors as in Vayanos and Vila (2021)
  - A regional specialized housing trader (interpreted as representative (poor) household who can only buy or sell houses assumed to be a hand-to-mouth consumer
  - A national specialized bond trader
- QE reduces bond supply and induces portfolio rebalancing
- Housing and total portfolio return declines can lead to anticipating consumption, thus boosting output

Portfolio problem

- Two risky assets and cash (x): houses and long-term bonds
  - Houses with price P and pays off $\mu_1 + \epsilon_1$
  - Bonds with price Q and pays off $\mu_2 + \epsilon_2$
  - Assumption: $E[\epsilon_1] = E[\epsilon_2] = 0$, $Var(\epsilon_1) = \sigma_1^2$, $Var(\epsilon_2) = \sigma_2^2$ and $Cov(\epsilon_1, \epsilon_2) = \sigma_{12}$

- Three agents: two preferred-habitat investors and one regional household that can arbitrage all markets
  - *Local* preferred-habitat investor in city housing market with demand:

$$\tilde{h} = -\alpha_1(P - \beta_1)$$

  - *National* preferred habitat investors in the bond market with demand:

$$\tilde{b} = -\alpha_2(Q - \beta_2)$$

Portfolio problem (Cont.)

The regional household trades the two risky assets, houses (h) and bonds (b), and has access to a storage technology (x), solving the following mean-variance portfolio problem:

$$\max_{h,b,x} \quad h\mu_1 + b\mu_2 + x - \frac{\gamma}{2}(h^2\sigma_1^2 + b^2\sigma_2^2 + 2hb\sigma_{12}) \tag{1}$$

$$\text{s.t.} \qquad W = hP + bQ + x, \quad \text{with multiplier } \lambda \tag{2}$$

Optimality requires

$$\lambda P = \mu_1 - \gamma h\sigma_1^2 - \gamma b\sigma_{12} \tag{3}$$

$$\lambda Q = \mu_2 - \gamma b\sigma_2^2 - \gamma h\sigma_{12} \tag{4}$$

$$\lambda = 1 \tag{5}$$

And market clearing is

$$b + \tilde{b} = \bar{b} \tag{6}$$

$$h + \tilde{h} = \bar{h} \tag{7}$$

Housing market and portfolio return impact of QE

- The key variable of interest is the portfolio return, defined as

$$\begin{aligned} E[R] &= \frac{E[W']}{W} = \frac{h\mu_1 + b\mu_2 + x}{W} \\ &= 1 + \frac{h(\mu_1 - P) + b(\mu_2 - Q)}{W} \end{aligned}$$

- **Result 1:** A reduction in the net supply of bonds, $\bar{b}$ (a QE intervention), increases demand for houses and house prices (i.e., $\frac{dh}{d\bar{b}} \leq 0$ and $\frac{dP}{d\bar{b}} \leq 0$) if and only if housing and bond returns are positively correlated ($\sigma_{12} \geq 0$)
  - **Corollary** Housing portfolio shares increase with QE
- **Result 2:** As long as σ_{12} is positive, QE also lowers the regional agent's total expected portfolio returns, i.e.,

$$\frac{dE[R]}{d\bar{b}} > 0$$

Implications for Empirical Identification

- QE can affect real economy through its impact on the portfolio return, $E[R]$
- We use regional land supply ($\bar{h}$) to achieve identification
- **Result 3:** The regional return is positively correlated with the regional housing supply, i.e.,

$$\frac{dE[R]}{d\bar{h}} > 0, \text{ given } \sigma_{12} > 0$$

With a moderate covariance term (σ_{12}), the regional return's sensitivity to QE is negatively correlated with the regional housing supply, i.e.,

$$\frac{d}{d\bar{h}}\left(\frac{dE[R]}{d\bar{b}}\right) < 0, \text{given } \sigma_{12} < \sqrt{\sigma_1^2\sigma_2^2 - \frac{1}{\gamma^2\alpha_1\alpha_2}}$$

Model predictions about a QE intervention ($\bar{b}$ declines)

Following QE, bond supply to private sector ($\bar{b}$) drops

- Bond holdings go down, bond prices increase, bond returns fall
- Wealthy households re-balance towards real estate, so housing portfolio share increases, prices increase and expected returns fall
- Poor households accommodates demand of wealthy ones, and consume out of her liquidated wealth
- City consumption and hence output can increase
- **The tighter the housing supply, i.e., the lower $\bar{h}$, the stronger the regional return decline and the possible consumption and output response**

Empirical Analysis

Regional Data

- Matched data on output, residential property prices and rents, land cover and land use based on a common region identifier (Gemeindekennziffer); Annual frequency, from 2010 to 2017 covering all 401 urban and rural regions
- Policy variables are the EONIA rate and alternative measures of the ECB balance sheet over nominal GDP for QE
- Land cover and land use from German Monitor of Settlement and Open Space Development (IOER Monitor)
- Residential price and rent indexes from Bulwiengesa: average of new and existing apartments, based on transaction and valuation data
  - We use rental yields as predictor of housing returns (e.g., Cochrane, 2011)
  - Aggregate data on total housing returns, inclusive of capital gain component, are from the Macro-history Database of Jorda et al. (2017, 2019)

Present value identity for housing (e.g., Cochrane, 2011)

- Accounting identity implies that

$$dp_t \approx \sum_{j=1}^{k} \rho^{j-1} r_{t+j} - \sum_{j=1}^{k} \rho^{j-1} \Delta d_{t+j} + \rho^k dp_{t+k} \tag{8}$$

  - where the current rental yield $dp_t \equiv d_t - p_t = \log(D_t/P_t)$, $r_t \equiv \log R_t$ is the log housing return, Δd_t is the log rent growth and ρ is a constant of approximation
  - We decompose the components by running the following regressions

$$\sum_{j=1}^{k} \rho^{j-1} r_{t+j} = a_r + b_r^k \times dp_t + \varepsilon_{t+k}^r \tag{9}$$

$$\sum_{j=1}^{k} \rho^{j-1} \Delta d_{t+j} = a_d + b_{\Delta d}^k \times dp_t + \varepsilon_{t+k}^{\Delta d} \tag{10}$$

$$dp_{t+k} = a_{dp} + b_{dp}^k \times dp_t + \varepsilon_{t+k}^{dp}. \tag{11}$$

Current rental yields predict housing returns in Germany during 1963-2009

	Future Housing Returns				Future Div. Growth				Future Rent/Price Ratio			
	Obs.	b_r^k	SE	R^2	Obs.	$b_{\Delta d}^k$	SE	R^2	Obs.	$\rho^k\ b_{dp}^k$	SE	R^2
k=1	47	0.04	0.04	0.03	47	-0.09	0.02	0.36	47	1.00	0.03	0.95
k=5	43	0.32	0.16	0.09	43	-0.31	0.09	0.23	43	0.78	0.13	0.58
k=10	38	0.84	0.25	**0.23**	38	-0.29	0.17	**0.07**	38	0.56	0.23	**0.28**
k=15	33	1.82	0.28	0.57	33	0.13	0.21	0.01	33	0.00	0.35	0.00

- A large fraction of variation in expected returns comes from rental yield variance at long horizons (e.g., k=10)
- A significantly smaller fraction corresponds to variation in expected rent growth or future price-to-rent ratios
- **We use the current rental yield as a proxy for future expected housing returns** (as long-run estimate close to 1 and multiplying a variable by a constant does not affect its effect in the estimating regression)

Empirical strategy: regional analysis

- Identification by geographic variation: consistent with our model's predictions, the impact of QE on output growth should be higher in regions in which real estate supply is tighter (as captured by land scarcity)

- Regional real estate supply proxied by land scarcity: land covered by water bodies and urban open space

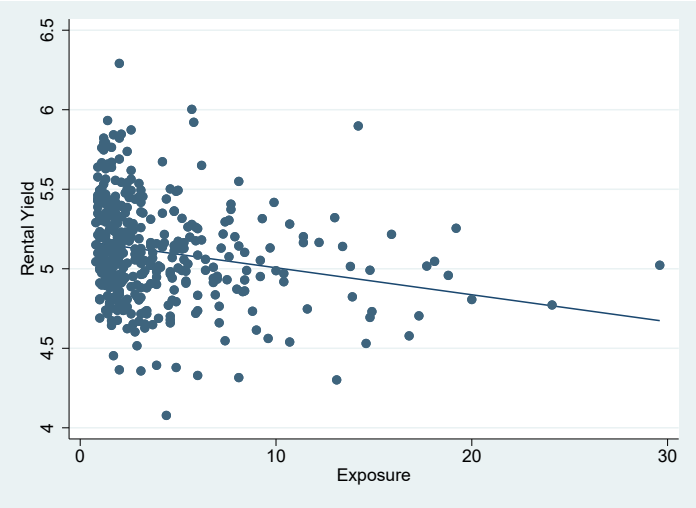
  - Consistent with traditional indicators of supply-side elasticity in the spirit of Saiz (2010) and Hilber and Vermeulen (2016)
  - To control for a possible endogenous response of land use regulation, we evaluate land scarcity at the pre-sample value in 2008
  - Results robust to using only water bodies or controlling for amenities as in Davidoff (2015)

Alternative land supply scarcity indicators and regional rental yields

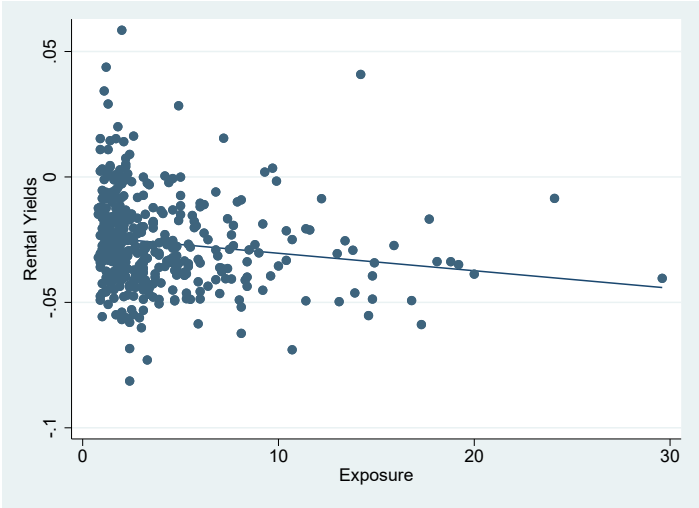
	Regional Rental Yields		
	All regions	West	East
Open Space	0.17 (0.00)	0.14 (0.01)	0.15 (0.19)
of which:			
Water	-0.18 (0.00)	-0.22 (0.00)	-0.19 (0.10)
Agriculture	0.01 (0.91)	-0.03 (0.64)	0.02 (0.84)
Forest	0.19 (0.00)	0.20 (0.00)	0.17 (0.14)
Other Open Space	-0.04 (0.48)	-0.04 (0.53)	-0.14 (0.23)
Urban Open Space	-0.15 (0.00)	-0.14 (0.01)	-0.15 (0.19)
Land scarcity, Exposure	-0.21 (0.00)	-0.22 (0.00)	-0.22 (0.05)

Exposure and rental yields

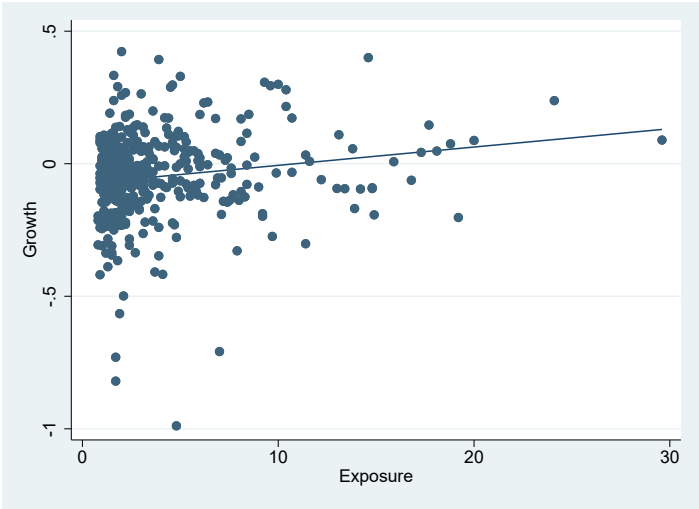
Panel A: Rental Yields



Panel B: Rental Yield Sensitivity



Panel C: Growth Sensitivity



Reduced form results

	(1) ΔGDP	(2) ΔGDP	(3) ΔGDP	(4) ΔGDP	(5) ΔGDP	(6) ΔGDP	(7) ΔGDP	(8) ΔGDP
$\text{Exposure}_{r,2008} \times \text{EONIA}_t$	-0.068**		-0.015	-0.406	-0.050	-0.010	-0.026	-0.016
	(0.030)		(0.039)	(0.301)	(0.054)	(0.039)	(0.045)	(0.039)
$\text{Exposure}_{r,2008} \times \text{QE}_t$		0.007***	0.006***	0.008***	0.006*	0.006***	0.008***	0.007***
		(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)
$\text{Exposure}_{r,2008} \times \text{QE}_t \times \text{EONIA}_t$				0.013				
				(0.010)				
$\text{Pop. Dens}_{r,2008} \times \text{EONIA}_t$					0.000			
					(0.000)			
$\text{Pop. Dens}_{r,2008} \times \text{QE}_t$					0.000			
					(0.000)			
$\text{Age above 65}_{r,2008} \times \text{EONIA}_t$						-0.112		
						(0.069)		
$\text{Age above 65}_{r,2008} \times \text{QE}_t$						0.001		
						(0.005)		
$\text{Agriculture}_{r,2008} \times \text{EONIA}_t$							-0.006	
							(0.013)	
$\text{Agriculture}_{r,2008} \times \text{QE}_t$							0.001	
							(0.001)	
$\text{Permits}_{r,2008} \times \text{EONIA}_t$								-0.033
								(0.109)
$\text{Permits}_{r,2008} \times \text{QE}_t$								-0.003
								(0.002)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	3208	3208	3208	3136	3208	3208	3208	3208
R^2	0.264	0.265	0.265	0.266	0.266	0.266	0.266	0.266

- **Econometric specification**

$$\Delta GDP_{r,t} = \alpha_r + \alpha_t + \gamma \cdot (\text{EONIA}_t \times \text{Exposure}_r) + \beta \cdot (\text{QE}_t \times \text{Exposure}_r) + \varepsilon_{r,t}$$

Economic significance and additional robustness checks

- **Economic significance:** more exposed regions (at the 75th percentile of the distribution) grew 10-20 bps more per year than less exposed ones (25th percentile) given a 6.5 pp (one-sd) increase in QE (1-1.5 percentage points cumulative growth differential during the sample period)

- Results robust to controlling for other macroeconomic variables (fiscal policy, financial uncertainty etc.) ▸ robustness

- Results robust to using only water bodies; controlling for amenities as in Davidoff (2015); using alternative instrument (Green party share)

- Results are robust to using alternative QE proxies, i.e., total debt securities, private debt securities, government debt securities and financial debt securities as a share of nominal GDP

- Other checks: spatial regressions, interaction with NIRP, drop highest-growth regions

Mechanism: controlling for rental yield or term spread turns QE insignificant; other mediating variables do not absorb the reduced form QE impact to the same extent

	(1) ΔGDP	(2) ΔGDP	(3) ΔGDP	(4) ΔGDP	(5) ΔGDP	(6) ΔGDP	(7) ΔGDP	(8) ΔGDP	(9) ΔGDP
$Exposure_{r,2008} \times EONIA_t$	0.181**	0.109*	0.003	0.006	0.106	0.185**	0.153	0.183**	0.173*
	(0.088)	(0.064)	(0.038)	(0.042)	(0.082)	(0.088)	(0.100)	(0.088)	(0.089)
$Exposure_{r,2008} \times QE_t$	0.003	0.004	0.008***	0.003	0.002	0.003	0.004*	0.001	0.004
	(0.002)	(0.002)	(0.002)	(0.005)	(0.002)	(0.002)	(0.002)	(0.004)	(0.003)
$Exposure_{r,2008} \times$ Rental $Yield_t$	-0.307***					-0.221	-0.249*	-0.292***	-0.441*
	(0.109)					(0.144)	(0.134)	(0.111)	(0.255)
$Exposure_{r,2008} \times$ Term $Spread_t$		-0.097**				-0.046			
		(0.039)				(0.051)			
$Exposure_{r,2008} \times \Delta Credit$			0.004**				0.002		
			(0.002)				(0.002)		
$Exposure_{r,2008} \times$ Mortgage $Rate_t$				-0.052				-0.029	
				(0.057)				(0.057)	
$Exposure_{r,2008} \times$ National HP $Index_t$					0.005*				-0.004
					(0.003)				(0.007)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	3208	3208	3208	3208	3208	3208	3208	3208	3208
R^2	0.267	0.267	0.266	0.266	0.266	0.267	0.267	0.267	0.267

- NB: national rental yields as proxy for expected housing returns

Mechanism: the relative importance of housing portfolio relative to other housing channels

	(1) Rental Yield	(2) Term Spread	(3) ΔCredit	(4) Mortgage Rate	(5) National HP Index
QE_t	-0.044***	-0.069***	-0.334*	-0.076***	1.076***
	(0.004)	(0.010)	(0.192)	(0.010)	(0.087)
Obs	96	96	96	96	96
R^2	0.546	0.287	0.024	0.306	0.554

- QE predicts all aggregate mediating variables, except for credit growth
- Combining results from previous two tables, we see that about 60% of reduced-form effects can be explained by decrease in housing returns and about 20% through therm spread

Instrumental Variables: 2SLS

- Previous regressions employ rental yields for Germany as a whole
- We next use our **region-level** rental yield data set to show that QE affects output growth via changes in regional rental yields

Econometric specification: (e.g. Chaney, Sraer and Thesmar 2012; Bednarek, te Kaat, Ma and Rebucci, 2021)

$$\begin{aligned} \Delta GDP_{r,t} &= \alpha_r + \alpha_t + \beta \cdot \text{Rental Yield}_{r,t} + \varepsilon_{r,t} \\ \text{Rental Yield}_{r,t} &= \alpha_r + \alpha_t + \gamma \cdot (\text{QE}_t \times \text{Exposure}_r) + \eta_{r,t} \end{aligned}$$

where r and t stand for region r and year t.

IV: QE affects output growth by reducing region-level rental yields

	1st stage	2nd stage
	(1)	(2)
	Rental Yield	ΔGDP
$\text{Exposure}_{r,2008} \times \text{QE}_t$	-0.001***	
	(0.000)	
$\text{Rental Yield}_{r,t}$		-7.407**
		(3.479)
Time FE	Yes	Yes
Region FE	Yes	Yes
Obs	3208	3208
F-Stat (1st stage)	13.3	-

Household Data

- Household panel based on Bundesbank's PHF survey with about 1700 units; 3 waves (2011, 2014, 2017) covering 4,000-5,000 households each
- Detailed data on income, saving, wealth and it composition, including particularly holdings of investment properties or second-homes
- Household characteristics like risk aversion, literacy and demographics
- Consumption calculated as income minus saving

Empirical strategy: Household analysis

- Diff-in-diff specification:

$$\Delta Y_{h,2017-2011} = \beta \cdot Y_{h,2011} + \varsigma \cdot X_{h,2011} + \epsilon_h$$

$$\Delta Y_{h,2017-2011} = \alpha \cdot \text{Bonds}_{h,2011} + \gamma \cdot X_{h,2011} + \sigma \cdot (\text{X}_{h,2011} \times \text{Bonds}_{h,2011}) + \epsilon_h$$

$$\Delta Y_{h,2017-2011} = \alpha \cdot \text{Exposure}_{h,2008} + \gamma \cdot X_{h,2011} + \sigma \cdot (\text{X}_{h,2011} \times \text{Exposure}_{h,2008}) +$$

- In the latter specification, ex-ante bond shares measure households' exposure to QE

Portfolio rebalancing results

	(1) ΔHOUSING	(2) ΔHOUSING	(3) ΔSEC.HOUSING	(4) ΔSEC.HOUSING	(5) ΔSEC.HOUSING
WEALTH (2nd quartile)	11.412***	10.136***	5.065***	5.553***	-2.552
	(2.609)	(2.709)	(1.648)	(2.020)	(3.837)
WEALTH (3rd quartile)	14.207***	12.440***	6.826***	7.783***	-9.840**
	(2.722)	(2.951)	(1.629)	(2.585)	(4.219)
WEALTH (4th quartile)	15.154***	13.555***	13.315***	14.227***	-12.068***
	(2.675)	(3.128)	(1.962)	(2.979)	(3.839)
WEALTH (2nd quartile) × BONDSHARE					0.129**
					(0.062)
WEALTH (3rd quartile) × BONDSHARE					0.276***
					(0.061)
WEALTH (4th quartile) × BONDSHARE					0.290***
					(0.056)
BONDSHARE					0.019
					(0.031)
Household Controls	No	Yes	No	Yes	Yes
$INITIAL(Y)$	Yes	Yes	Yes	Yes	No
Obs	1835	1834	1835	1834	1834
R^2	0.174	0.229	0.180	0.199	0.074

- Wealthy households rebalance towards housing
- Effect stronger for second homes and households with larger ex-ante bond shares

Consumption results

	(1) ΔCONSUMPTION	(2) ΔCONSUMPTION	(3) ΔCONSUMPTION
WEALTH (2nd quartile)	10.541***	7.235*	0.572
	(3.795)	(4.070)	(6.291)
WEALTH (3rd quartile)	19.674***	17.787***	12.199*
	(3.874)	(5.242)	(6.909)
WEALTH (4th quartile)	34.847***	29.981***	20.439***
	(4.261)	(5.846)	(7.199)
WEALTH (2nd quartile) × BONDSHARE			0.102
			(0.130)
WEALTH (3rd quartile) × BONDSHARE			0.004
			(0.178)
WEALTH (4th quartile) × BONDSHARE			0.408**
			(0.197)
BONDSHARE			-0.163**
			(0.067)
Household Controls	No	Yes	Yes
Initial Y	Yes	Yes	Yes
Obs	1777	1776	1776
R^2	0.231	0.300	0.303

- Wealthy households consume more, especially when ex-ante higher bond portfolio shares

Conclusions

- We propose a housing portfolio channel of quantitative easing
  - We show its plausibility in a simple model with housing portfolio and asset segmentation
  - We provide supporting empirical evidence using German region-level and household-level data

- Empirically, regions with less elastic housing supply respond more to QE
  - We estimate that German regions at the 75th percentile of the exposure distribution grow about 1 percentage point more than regions at the 25th percentile cumulatively during 2010-2017.
  - We show that this effect is driven by wealthier households' rebalancing towards housing, which depresses housing and thus total portfolio returns, with a similarly sized impact on consumption.

THANK YOU!

Additional Material

Reduced form results: robustness

	(1) ΔGDP	(2) ΔGDP	(3) ΔGDP	(4) ΔGDP	(5) ΔGDP
$\text{Exposure}_{r,2008} \times \text{EONIA}_t$	0.005	0.035	0.042	0.028	
	(0.064)	(0.080)	(0.048)	(0.044)	
$\text{Exposure}_{r,2008} \times \text{QE}_t$	0.007**	0.007***	0.004*	0.005*	
	(0.003)	(0.002)	(0.002)	(0.002)	
$\text{Exposure}_{r,2008} \times \text{GIPS Spread}_t$	-0.004				
	(0.009)				
$\text{Exposure}_{r,2008} \times \text{VIX}_t$		-0.007			
		(0.005)			
$\text{Exposure}_{r,2008} \times \text{Gov. Lending}_t$			0.025**		
			(0.012)		
$\text{Exposure}_{r,2008} \times \text{Gov. Cons.}_t$				-0.032**	
				(0.015)	
$\text{Exposure}_{r,2008} \times \text{EONIA Shock}_t$					0.008*
					(0.004)
$\text{Exposure}_{r,2008} \times \text{QE Shock}_t$					0.003*
					(0.002)
Time FE	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes
Obs	3208	3208	3208	3208	3208
R^2	0.265	0.266	0.267	0.267	0.264

Reduced form results: robustness (2)

	(1) ΔGDP	(2) ΔGDP	(3) ΔGDP	(4) ΔGDP	(5) ΔGDP
$\text{Exposure}_{r,2008} \times \text{EONIA}_t$	-0.015	0.035	0.037	0.021	0.023
	(0.039)	(0.059)	(0.059)	(0.057)	(0.055)
$\text{Exposure}_{r,2008} \times \text{QE}_t$	0.039***				
	(0.015)				
$\text{Exposure}_{r,2008} \times \text{QE(TOTAL DEBT)}_t$		0.051**			
		(0.023)			
$\text{Exposure}_{r,2008} \times \text{QE(GOV. DEBT)}_t$			0.052**		
			(0.023)		
$\text{Exposure}_{r,2008} \times \text{QE(FIN. DEBT)}_t$				0.044**	
				(0.022)	
$\text{Exposure}_{r,2008} \times \text{QE(PRIVATE DEBT)}_t$					0.047**
					(0.022)
Time FE	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes
Obs	3208	3208	3208	3208	3208
R^2	0.265	0.265	0.265	0.265	0.265

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Reduced form results: robustness (3)

	(1) ΔGDP	(2) ΔGDP	(3) ΔGDP	(4) ΔGDP	(5) ΔGDP	(6) ΔGDP	(7) ΔGDP	(8) ΔGDP
$\text{Exposure}_{r,2008} \times \text{EONIA}_t$	-0.006***		-0.002	-0.052**	-0.008	-0.003	-0.003	-0.002
	(0.002)		(0.003)	(0.023)	(0.005)	(0.003)	(0.004)	(0.003)
$\text{Exposure}_{r,2008} \times \text{QE}_t$		0.0006***	0.0005**	0.0007***	0.0006*	0.0005***	0.0007***	0.0005**
		(0.0002)	(0.0002)	(0.0002)	(0.0003)	(0.0002)	(0.0002)	(0.0002)
$\text{Exposure}_{r,2008} \times \text{QE}_t \times \text{EONIA}_t$				0.002**				
				(0.000)				
$\text{Pop. Dens}_{r,2008} \times \text{EONIA}_t$					0.000			
					(0.000)			
$\text{Pop. Dens}_{r,2008} \times \text{QE}_t$					-0.000			
					(0.000)			
$\text{Age above 65}_{r,2008} \times \text{EONIA}_t$						-0.119*		
						(0.069)		
$\text{Age above 65}_{r,2008} \times \text{QE}_t$						0.003		
						(0.005)		
$\text{Agriculture}_{r,2008} \times \text{EONIA}_t$							-0.009	
							(0.013)	
$\text{Agriculture}_{r,2008} \times \text{QE}_t$							0.001	
							(0.001)	
$\text{Permits}_{r,2008} \times \text{EONIA}_t$								-0.020
								(0.109)
$\text{Permits}_{r,2008} \times \text{QE}_t$								-0.003
								(0.002)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	3208	3208	3208	3208	3208	3208	3208	3208
R^2	0.264	0.265	0.266	0.267	0.266	0.267	0.267	0.266

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