When Birth or Death Hits Home:
House Prices, Rents and Demography in Paris and Amsterdam, 1400-present

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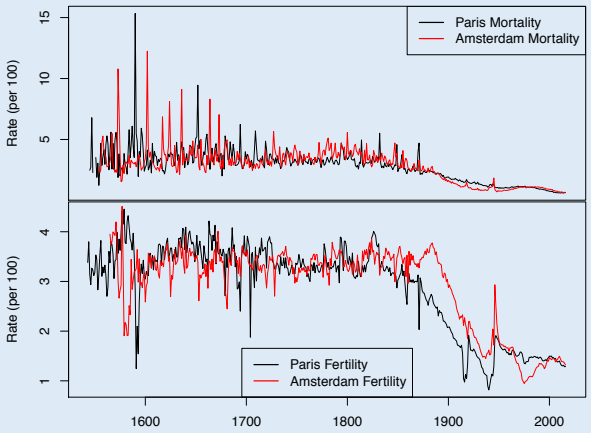
Research objective & contribution

Urbanization and population aging are two of the most important factors affecting future urban housing demand. The objective of this paper is to measure the causal impact of such demographic changes on house and rent prices. To do so, we exploit long-run data on prices and demographics in Paris and Amsterdam since 1400.

There are three reasons for this long-term approach:

- Population is endogenous and moves slowly. Historically this was different: shocks such as the outbreak of the plague provide large variation in demography exogenous to economic conditions.
- 500 years of data is sufficient to test whether demographic structure affects prices. The number of births 20-30 years ago is plausibly exogenous to current economic conditions, but might predict prices due to the age-dependency of housing demand. Since Mankiw & Weil (*RSUE*, 1989) such effects have been subject to significant debate.
- Supply constraints and rent controls were limited before World War I: we observe prices in a free market for many centuries. Existing measures (e.g. Combes et al., *RES*, 2018) are always conditional on the regulatory environment.

Fertility and mortality over the long-run



Based on a large amount of archival- and non-archival sources, we reconstituted marriage, birth and death rates for both Paris and Amsterdam. For Amsterdam, we also estimated net migration. Mortality has been substantially more volatile than fertility in both cities. The largest mortality shocks in Amsterdam are the result of the plague (last outbreak occurred in 1667). The two biggest shocks in Paris are due to the Siege of Paris (1590) and La Fronde (1648). Before the late 19th century, both cities were only growing due to migration.

Prices and population growth or decline

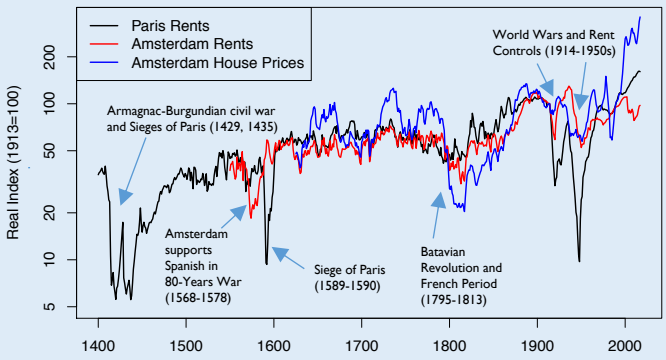
OLS results, 5-year changes:

	Dependent variable:		
	Paris	Amsterdam	
	$\Delta_5 r_t$	$\Delta_5 r_t$	$\Delta_5 h_t$
$\Delta_5 pop_t^+$	0.981***	0.592***	0.343
	(0.347)	(0.176)	(0.497)
$\Delta_5 pop_t^-$	2.016***	0.985***	4.977***
	(0.212)	(0.322)	(1.385)
Constant	0.030**	0.012	0.029
	(0.014)	(0.009)	(0.026)
Obs.	409	359	284
R^2	0.485	0.220	0.154
Note:		Newey-West Errors	

Glaeser & Gyourko (*JPE*, 2005) argue that house prices change less in growing cities compared to declining cities, because supply cannot adjust if population declines.

We regress 5-year changes in rent prices on separated positive and negative population changes to show that this disparity also holds for growth and decline episodes within the same city, and for rent prices. Its effect does seem more pronounced for house prices.

Long-term: real rent and house prices since 1400



Most large shocks in prices coincide with major events that significantly affected the economy and urban population. Real prices have increased over the long-run, but much less than (unreported) population levels. All three series are cointegrated with population levels. For real rent prices in Amsterdam and Paris, the cointegrating vector implies a long-term elasticity of prices w.r.t. population of about 0.4

Estimation method: Local level model based on repeat-sales methodology from Francke (2010).
Data sources: Rents from d'Avenel (1894) and Eichholtz et al. (2018). House prices from Verwey (1944), Eichholtz (1997), Korevaar (2018), NVM database and the Amsterdam City Archives. Prices deflated with CPI

Medium-term: baby booms predict housing booms

Consistent with models of age-dependent housing demand, we examine whether current 5-year fertility predicts 5-year nominal log changes in rent or house prices 20-30 years later:

$$\Delta_5 r_t \text{ or } \Delta_5 h_t = \text{Fertility}_{t-x} + \Delta_5 \ln(\text{Wages}_t) + \Delta_5 \ln(\text{CPI}_t) + \text{Fertility}_t + \text{Nuptiality}_t + \text{Mortality}_t + \text{Migration}_t$$

Results imply that a one percent decrease in the share of population in their 20s reduces rent prices by about 2 percent and house prices by about 5 percent. The results are robust to using real terms and using average t-stats of non-overlapping 5-year samples.

OLS results, 5-year rates:

	Dependent variable:			
	Paris		Amsterdam	
	$\Delta_5 r_t$	$\Delta_5 r_t$	$\Delta_5 r_t$	$\Delta_5 h_t$
$\text{Fertility}_{t-21/25}$			1.578**	
			(0.719)	
$\text{Fertility}_{t-22/26}$		2.311*		4.980***
		(1.311)		(1.421)
$\text{Fertility}_{t-26/30}$	2.642**			
	(1.120)			
Controls	Yes	Yes	Yes	Yes
Observations	358	359	324	284
R^2	0.306	0.293	0.371	0.275

Notes: Newey-West Errors, *p<0.1; **p<0.05; ***p<0.01

For Amsterdam, the fertility lag was selected based on actual correlations of demographic structure with rent / house prices (available for 1680-1915 only). These groups were most significant. Results for both Paris and Amsterdam are robust to using different lags, as long as they measure some the share of population in their 20s.

Short-term: negative population shocks reduce prices

IV results, Amsterdam rents, 1554-1687:

	Δr_t		
Mortality: M_t	−1.250**	−1.244**	−0.985*
	(0.618)	(0.627)	(0.566)
Wages: Δw_t		0.516	0.374
		(0.472)	(0.486)
CPI: Δp_t			0.082
			(0.075)
Fertility: F_t			−0.963
			(1.056)
Nuptiality: N_t			−1.875
			(2.899)
Migration: Mi_t		0.728***	0.709***
		(0.273)	(0.253)
Constant	0.058**	0.038	0.081
	(0.023)	(0.024)	(0.056)
Observations	133	133	122
Resid. S.E.	0.054	0.051	0.049
Note:		*p<0.1; **p<0.05; ***p<0.01	

Population is endogenous to rent prices because both variables are related to local economic conditions for which we cannot control. We therefore exploit the frequent arrival of the plague in Amsterdam, with 31 episodes between 1554-1667, as an instrument for mortality, and corresponding population levels. A dummy for plague arrival strongly predicts mortality, while plausibly exogenous to the local economy.

The IV-regression implies that a one percent increase in annual mortality (a one percent decline in population) reduces rent prices by about 1.25 percent. This estimate is in line with (unreported) VAR results for both Paris and Amsterdam for the full period between the 1500s and 1913.

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