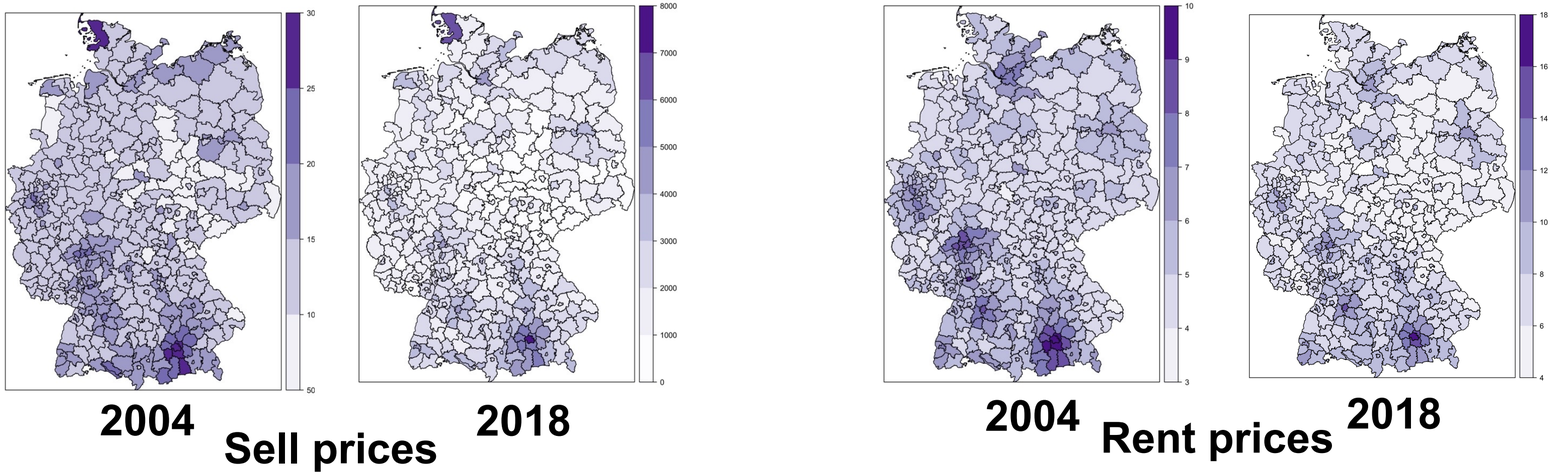
Semerikova Elena, HSE Moscow
Blokhina Anastasia, HSE Moscow
Nastansky Andreas, HWR Berlin

Convergence in German Regional Housing Markets

Warsaw, 2022

MOTIVATION & AIMS

The main aim of current work is to find out: does β-convergence across German regions exist?



Housing selling price per squared meter (years 2004 and 2018) and housing rental prices per squared meter (years 2004 and 2018)

- Housing prices show macroeconomic changes (Algieri, 2013)
- Regional markets are rarely researched
- Spatial correlation is usually not included
- Housing markets are complicated spatial system (Turgeu & Pridvigkin, 2006)
- Spatial correlation is integral for housing market analysis (Pace & Barry & Sirmans, 1998, Pace, 2000)
- Estimates are more effective and unbiased in case of spatial analysis

- In our spatial models we include P_{it-1} with a coefficient β. In case of convergence, it should be $\beta < 0$ (Vakulenko, 2013)
- This conclusion is based on absolute convergence model by Barro, Sala-I-Martin, 1992

$$\frac{1}{T} log \frac{y_{it}}{y_{i,t-T}} = \alpha + \left[\log\left(y_{i,t-T}\right)\right]\left[{}^{\left(1-e^{-\beta T}\right)}/_{T}\right] + u_{it},$$

where β < 0 in case of convergence.

DATA & METHODOLOGY

- Panel data for 397 regions of Germany in 2007-2016 (BulwienGesa AG (RIWIS), Regional Statistik Genesis).
- Depended variables: selling and rental price growth rate, €/m^2

Independent variables X_{it}

- unemployment level (unemployment level, in %)
- pendulum migration rate by working or living place (by the number of people in the place)
- employment rate (rate of working population of the region)
- wages (current prices, in €)
- number of employees (in 1000)
- gross regional income (per capita, in €)
- migration flow for regions
- emigration and immigration for federal lands

DATA & METHODOLOGY

Non-spatial model (FE)

$$ln(\frac{P_{it}}{P_{it-1}}) = \alpha_0 + lnX_{it}\alpha_1 + \boldsymbol{\beta lnP_{it-1}} + \eta_t + \mu_i + u_{it}$$

Spatial Autoregressive Model (SAR)

$$\ln(\frac{P_{it}}{P_{it-1}}) = \alpha_0 + lnX_{it}\alpha_1 + \alpha_2 W\ln(\frac{P_{it}}{P_{it-1}}) + \boldsymbol{\beta lnP_{it-1}} + \eta_t + \mu_i + \varepsilon_{it}$$

Spatial Durbin Model (SDM)

$$\ln(\frac{P_{it}}{P_{it-1}}) = \alpha_0 + lnX_{it}\alpha_1 + \alpha_2 W\ln(\frac{P_{it}}{P_{it-1}}) + WlnX_{it}\alpha_3 + \boldsymbol{\beta lnP_{it-1}} + \eta_t + \mu_i + \varepsilon_{it}$$

- Maximal likelihood estimation
- W – contiguity matrix (only regions with common border get nonzero weights)

RESULTS FOR SELLING PRICE GROWTH RATE

	FE	SAR	SDM	SDM
VARIABLES	sell	Main	Main	Wx
Lag P_{it-1}	-0.0628***	-0.0942***	-0.0999***	0.0507**
	(0.00936)	(0.0109)	(0.0111)	(0.0211)
Unemployment	0.0448***	-0.00275	-0.00458	0.00821
	(0.00710)	(0.00941)	(0.0108)	(0.0167)
Pendulum migration rate by working place	0.0164	0.0105	0.00724	-0.0457
	(0.0179)	(0.0176)	(0.0169)	(0.0372)
Pendulum migration rate by living place	-0.0348	-0.0343	-0.0261	0.0464
	(0.0313)	(0.0318)	(0.0302)	(0.0672)
Employment rate	0.244***	0.143**	0.107*	0.170*
	(0.0430)	(0.0563)	(0.0564)	(0.0957)
Wages	0.176***	-0.0278	-0.0131	0.0207
	(0.0311)	(0.0380)	(0.0392)	(0.0781)
Number of employees	0.0388	0.215***	0.171***	0.0321
	(0.0515)	(0.0536)	(0.0580)	(0.0973)
Gross Regional Income	0.0616***	-0.0464**	-0.0545***	0.0604
	(0.0215)	(0.0208)	(0.0207)	(0.0448)
Immigration regions	-0.0375	0.357	0.515	-0.596
	(0.431)	(0.410)	(0.421)	(0.908)
Immigration lands	0.911*	-0.512	-0.673	1.517
	(0.472)	(0.470)	(0.478)	(1.004)
Emigration land	-0.834***	0.311	0.317	-0.853*
	(0.235)	(0.243)	(0.241)	(0.437)
Emigration regions	0.237**	-0.0304	-0.0268	0.0135
	(0.110)	(0.110)	(0.108)	(0.172)
Time effects	Yes	Yes	Yes	Yes
ρ		0.0786***		0.0803***
		(0.0199)		(0.0200)
σ^2		0.00180***		0.00178***
		(6.37e-05)		(6.31e-05)
Constant	-1.526***			
	(0.287)			
Observations	4,764	4,764	4,764	4,764
R^2	0.356	0.410	0.415	0.415
Number of names	397	397	397	397
AIC		-16546	-16560	-16560
BIC		-16384	-16320	-16320

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

RESULTS FOR RENTAL PRICE GROWTH RATE

	FE	SAR	SDM	SDM
VARIABLES	rent	Main	Main	Wx
Lag P_{it-1}	-0.110***	-0.151***	-0.159***	0.0635***
	(0.0118)	(0.0121)	(0.0125)	(0.0231)
Unemployment	0.0111***	-0.00413	-0.00701	0.00861
	(0.00337)	(0.00466)	(0.00568)	(0.00881)
Pendulum migration rate by working place	0.0230**	0.0189*	0.0155*	-0.0189
	(0.0103)	(0.00967)	(0.00896)	(0.0214)
Pendulum migration rate by living place	-0.0352**	-0.0292*	-0.0242	0.0201
	(0.0160)	(0.0162)	(0.0154)	(0.0315)
Employment rate	0.105***	0.0685**	0.0625**	-0.0319
	(0.0216)	(0.0314)	(0.0317)	(0.0491)
Wages	0.0768***	-0.0261	0.000189	-0.0841**
	(0.0170)	(0.0220)	(0.0240)	(0.0365)
Number of employees	0.0514**	0.127***	0.0796***	0.126**
	(0.0243)	(0.0273)	(0.0292)	(0.0491)
Gross Regional Income	0.0323***	0.000949	-0.00394	0.0438*
	(0.0104)	(0.0104)	(0.0105)	(0.0226)
Immigration regions	0.352	0.608***	0.648***	-0.460
	(0.234)	(0.175)	(0.166)	(0.410)
Immigration lands	-0.0377	-0.590***	-0.638***	0.532
	(0.243)	(0.200)	(0.193)	(0.498)
Emigration land	-0.337***	-0.00627	0.00890	-0.141
	(0.102)	(0.124)	(0.122)	(0.260)
Emigration regions	0.227***	0.0756	0.0763	-0.190**
	(0.0653)	(0.0506)	(0.0478)	(0.0919)
Time effects	Yes	Yes	Yes	Yes
ρ		0.0574***		0.0660***
		(0.0188)		(0.0191)
σ^2		0.000494***		0.000488***
		(1.99e-05)		(1.97e-05)
Constant	-0.851***			
	(0.150)			
Observations	4,764	4,764	4,764	4,764
R^2	0.252	0.280	0.288	0.288
Number of names	397	397	397	397
AIC		-22700	-22725	-22725
BIC		-22538	-22486	-22486

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

CONCLUSION

- Convergence across regions exists as the coefficient of lag P(t-1) < 1 ($\approx 0{,}09$ for sell and $\approx 0{,}15$ for rent)
- Results for rent are highly realistic, but for selling price growth rate are controversial
- Unemployment positively correlate with price growth rate in non-spatial FE, that is illogical and is caused by absence of spatial effect and biased estimations
- Immigration to the region higher the price growth rate because of rising demand, emigration from the region lowers demand and price growth rate. Moreover, migration is closely connected with regional economic development level, so mostly migration-attractive places are usually rich and expensive
- Income rising factors like employment rate have highly positive effect to housing price growth rate
- Number of employees in neighbouring region makes price growth rate higher, especially for agglomerations (maybe because of commuters)
- Spatial location of the regions is important for housing price formation, because neighbouring regions affect each other by population move and clusters with common live level standards formation

NATIONAL RESEARCH
UNIVERSITY

Thank you for your attention!
We would be glad to answer your questions

APPENDIX: SPATIAL QUANTILE ESTIMATION

DO EFFECTS CHANGE OVER QUANTILES? SPATIAL QUANTILE PANEL DATA MODEL WITH FE

$$P_{it} = \alpha_{i\tau} + X_{it}\theta_{\tau} + \varepsilon_{it}$$

Method: quantile regressions with fixed effects (Machado and Santos Silva, 2019)
Adding spatial effects:

,

$$P_{it} = \alpha_{i\tau} + X_{it}\theta_{\tau} + WX_{it}\gamma_{\tau} + \varepsilon_{it}$$

Results of Panel Data Estimation with Spatial Effects (2004 – 2019)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Wxtqreg1	Wxtqreg2	Wxtqreg3	Wxtqreg4	Wxtqreg5	Wxtqreg6	Wxtqreg7	Wxtqreg8	Wxtqreg9
VARIABLES	kp_eurqm	kp_eurqm	kp_eurqm	kp_eurqm	kp_eurqm	kp_eurqm	kp_eurqm	kp_eurqm	kp_eurqm
Construction permits	0.0782	0.0814	0.0840	0.0871	0.0907	0.0956	0.101	0.107	0.115
	(0.115)	(0.0981)	(0.0874)	(0.0798)	(0.0799)	(0.0949)	(0.125)	(0.162)	(0.217)
Housing stock	-0.0116*	-0.0159***	-0.0194***	-0.0236***	-0.0285***	-0.0352***	-0.0428***	-0.0504***	-0.0608***
	(0.00644)	(0.00550)	(0.00491)	(0.00450)	(0.00453)	(0.00539)	(0.00705)	(0.00910)	(0.0122)
Number of employees	0.00904***	0.00980***	0.0104***	0.0111***	0.0120***	0.0132***	0.0145***	0.0159***	0.0177***
	(0.00293)	(0.00250)	(0.00223)	(0.00204)	(0.00204)	(0.00243)	(0.00319)	(0.00413)	(0.00553)
Commuters balance	-10.39***	-9.601***	-8.956***	-8.192***	-7.285***	-6.059**	-4.662	-3.259	-1.335
	(3.603)	(3.078)	(2.744)	(2.507)	(2.511)	(2.983)	(3.929)	(5.085)	(6.816)
WX Construction permits	1.031***	1.115***	1.184***	1.265***	1.361***	1.492***	1.640***	1.789***	1.993***
	(0.181)	(0.155)	(0.138)	(0.126)	(0.126)	(0.150)	(0.197)	(0.255)	(0.342)
WX employees	0.0343***	0.0366***	0.0385***	0.0408***	0.0434***	0.0470***	0.0512***	0.0553***	0.0610***
	(0.00256)	(0.00218)	(0.00195)	(0.00178)	(0.00179)	(0.00214)	(0.00279)	(0.00360)	(0.00483)
WX Unemployment	11.39**	12.39***	13.21***	14.18***	15.34***	16.89***	18.67***	20.45***	22.90**
	(4.835)	(4.130)	(3.681)	(3.362)	(3.365)	(3.998)	(5.268)	(6.821)	(9.144)
Observations	5,614	5,614	5,614	5,614	5,614	5,614	5,614	5,614	5,614