The Economics of Density: Evidence from the Berlin Wall

Ahlfeldt, Redding, Sturm and Wolf, Econometrica 2015

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Introduction

- Last time we looked at the monocentric model to think about the city.
- There is another approach: Trade.
  - What determines the flow of goods across countries
  - Role of consumer preferences, tariffs, shipping costs
  - what are the gains from trade?
- Instead of goods we can think of shipping "people", from one location to another.
- In the city, need to "ship" workers to firms, which is costly.
- There are similar agglomeration forces within and between cities.
- [Ahlfeldt et al.(2015)Ahlfeldt, Redding, Sturm, and Wolf] use a trade model to enrich the standard urban model.

Challenges

- Main Challenge: distinguish agglomeration forces from variation in location fundamentals
  - High land prices or productivity could be due to agglomeration forces
  - but could also be due to highly value amenities.
- [Hanson(1997)]:

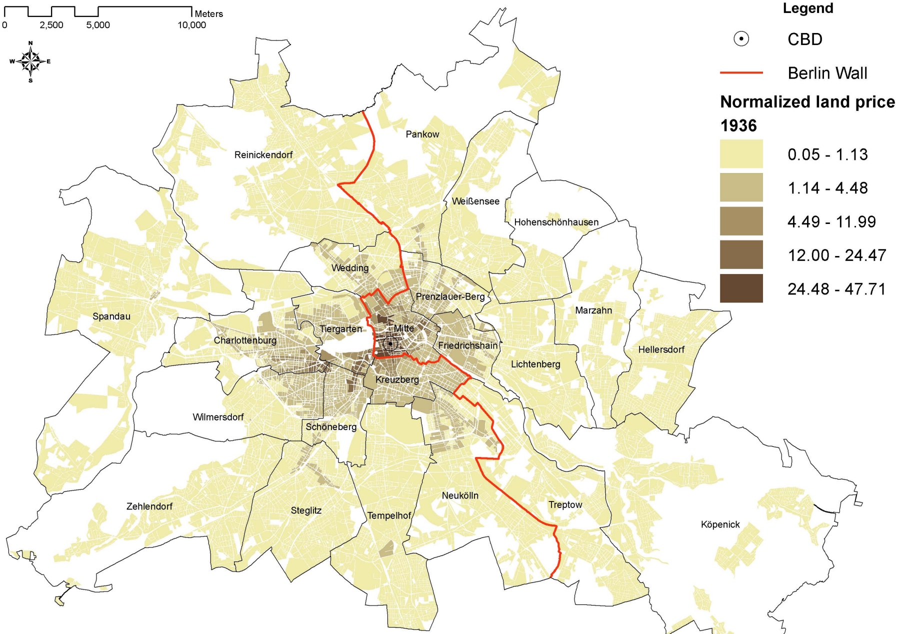
  Agglomeration due to static increasing returns is observationally equivalent to agglomeration due to exogenous site-specific characteristics.

Challenges

- Theoretical challenge: literature makes strong assumptions on geography:
  - Monocentric.
  - Symmetric.
- Empirical challenge: Find exogenous variation in surrounding economic activity
  - separate agglomeration (should be affected)
  - from amenity (should not)
  - hard to come by in general!

The Berlin Wall

- July 1945: Berlin is separated into sectors along existing district boundaries
- June 1948: Tensions between East and West start to emerge. Berlin Blockade.
- 1961: To stem flow of refugees into Western Germany, East Germany constructs the Berlin Wall.
- This ends all local interaction between East and West of the city.
- Cuts through transport and communication networks.
- Wall falls in 1989, and Germany formally reunified on 3 October 1990.



Meters
0
2,500
5,000
10,000
N
W
E
S
Legend
CBD
Berlin Wall
Normalized land price
1936
0.05 - 1.13
1.14 - 4.48
4.49 - 11.99
12.00 - 24.47
24.48 - 47.71
Pankow
Reinickendorf
Weißensee
Hohenschönhausen
Wedding
Prenzlauer-Berg
Marzahn
Spandau
Tiergarten
Mitte
Charlottenburg
Friedrichshain
Hellersdorf
Lichtenberg
Kreuzberg
Wilmersdorf
Schöneberg
Zehlendorf
Neukölln
Treptow
Steglitz
Tempelhof
Köpenick

Model Outline

- picture.
- Describe tensions between agglomeration and dispersion
  - production and residential externalities
  - commuting costs and inelastic housing supply.

Model

- There are $i = 1, \ldots, S$ discrete *blocks*
  - each block is of size L_i (think m^2)
  - an endogenous fraction θ_i is used for residential, rest commercial
- H workers live in the city, perfectly mobile within city and economy.
  - Reservation level of utility $\bar{U}$.
- Workers deciding to move to Berlin draw idiosyncratic utility shocks for each residence/workplace combination and choose most preferred bundle.

Workers

- risk neutral: $U_{ijo} = C_{ijo}$ is a consumption index.
- Worker o resides in block i and works in block j at wage w_j.
- Residential amenity B_i, residential floor space l_{ijo}, numeraire consumption c_{ijo}

$$C_{ijo} = \frac{B_i z_{ijo}}{d_{ij}} \left(\frac{c_{ijo}}{\beta}\right)^{\beta} \left(\frac{l_{ijo}}{1-\beta}\right)^{1-\beta}, 0 < \beta < 1$$

- iceberg commuting cost $d_{ij} = e^{\kappa \tau_{ij}} \in [1, \infty)$ from i to j
- McFadden and [Eaton and Kortum(2002)] utility shock z

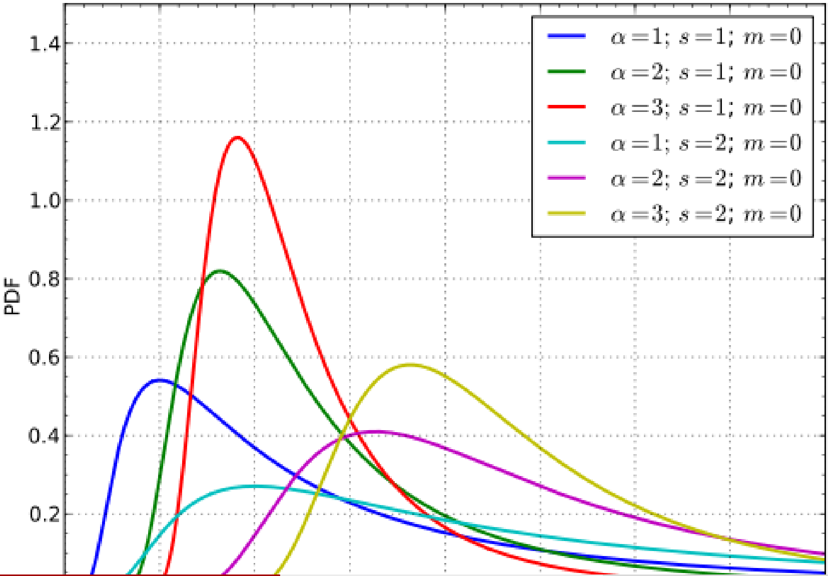
Frechet Distribution

- $z$is drawn from a Frechet Distribution

$$F(z_{ijo}) = e^{-T_i E_j z_{ijo}^{-\varepsilon}}, T_i, E_j > 0, \varepsilon > 1$$

  - T_i: mean idiosyncratic utility from living in i
  - E_j: mean idiosyncratic utility from working in j
  - ε: dispersion of utilities

Frechet Distribution



Worker Sorting

- Take residential amenities, goods and factor prices and location of firms and other workers as given.
- Choose location with highest utility.
- Optimal consumption and housing choices are independent of z_{ijo}.
- Given prices Q_i for residential housing l_{ijo}, $p_i = 1$ for c_{ijo}, and wage w_j,

$$\max_{c_{ij}, l_{ij}} U_{ij}$$

$$s.t. w_j = p_i c_{ij} + Q_i l_{ij}$$

Worker optimal choice

- We obtain

$$
\begin{aligned}
l_{ijo} &= \frac{w_j}{Q_i}(1-\beta) \\
c_{ijo} &= \beta w_j
\end{aligned}
$$

- plugged into utility gives indirect utility

$$
u_{ijo} = \frac{z_{ijo} B_i w_j Q_i^{\beta-1}}{d_{ij}} \tag{1}
$$

- So, workers compare u_{ijo} across all (i, j) given their shock z_{ijo}.

Probability of Location Choice

- Indirect u (1) is a function of a Frechet RV.
- The maximum of a set of Frechet RVs is Frechet as well.
- Can derive probability of worker choosing to live in i and work in j as

$$\pi_{ij} = \frac{T_i E_j \left(d_{ij} Q_i^{1-\beta}\right) (B_i w_j)^{\varepsilon}}{\sum_{r=1}^{S} \sum_{s=1}^{S} T_r E_s \left(d_{rs} Q_r^{1-\beta}\right) (B_r w_s)^{\varepsilon}} \equiv \frac{\Phi_{ij}}{\Phi} \qquad (2)$$

- Think of a transition matrix: rows where to live, columns where to work
- Summing over rows or columns give the marginal probabilities.

Locational Probabilities: Interpretation

$$\pi_{ij} = \frac{T_i E_j \left(d_{ij} Q_i^{1-\beta}\right)^{-\varepsilon} (B_i w_j)^{\varepsilon}}{\sum_{r=1}^{S} \sum_{s=1}^{S} T_r E_s \left(d_{ij} Q_i^{1-\beta}\right)^{-\varepsilon} (B_r w_s)^{\varepsilon}} \equiv \frac{\Phi_{ij}}{\Phi}$$

- Workers facing identical prices $\{Q_i, w_j\}$, commuting costs d_{ij}, and location characteristics $\{B_i, T_i, E_j\}$ will choose *differently* between (i, j)
- Comparative statics are intuitive from this expression:
  - higher amenity B_i increases probability of choosing i
  - higher commuting costs decrease it
  - higher average idiosyncratic utilities (in z via T_i, E_j) increase it.

Commuting Market Clearing

- Requires that the measure of workers employed in block j, H_{Mj}, is equal to the measure of workers who choose to commute there.
- Conditional probability of commuting to j, given living in i is $\pi_{ij|i}$
- Then, if H_{Ri} is the measure of workers who reside in i, commuting equlibrium is

$$H_{Mj} = \sum_{i=1}^{S} \pi_{ij|i} H_{Ri}$$

- The expression for $\pi_{ij|i}$ is interesting:

$$\pi_{ij|i} = \frac{E_j \left(\frac{w_j}{d_{ij}} \right)^{\varepsilon}}{\sum_{s=1}^{S} E_s \left(\frac{w_s}{d_{is}} \right)^{\varepsilon}}$$

- Supply of workers to j is an increasing function of relative wages w_j.

Production

- Perfect Competition final good producers, CRS.

$$y_j = A_j H_{Mj}^{\alpha} L_{Mj}^{1-\alpha}$$

A_j is productivity in j, L_{Mj} is commercial land used in j.

- Firms take distribution of z as well as prices given. standard:

$$\max_{H_{Mj}, L_{Mj}} A_j H_{Mj}^{\alpha} L_{Mj}^{1-\alpha} - w_j H_{Mj} - q_j L_{Mj}$$

where q_j is the price of commercial floor space.

- FOCS:

$$H_{Mj} = \left(\frac{\alpha A_j}{w_j}\right)^{\frac{1}{1-\alpha}} L_{Mj} \quad (3)$$

$$L_{Mj} = \left(\frac{(1-\alpha) A_j}{q_j}\right)^{\frac{1}{\alpha}} H_{Mj}$$

Equilibrium commercial floor space price

- We impose zero profits:

$$A_j H_{Mj}^{\alpha} L_{Mj}^{1-\alpha} - w_j H_{Mj} - q_j L_{Mj} = 0$$

- Together with (3) this implies that equilibrium price

$$q_j = (1-\alpha)\left(\frac{\alpha}{w_j}\right)^{\frac{\alpha}{1-\alpha}} A_j^{\frac{1}{1-\alpha}}$$

- higher productivity (or lower wages) allow firms to pay higher rent, while still making zero profits.

Housing Supply

- Given that blocks can be mixed use (θ_i), we need a no-arbitrage condition
- Let $\xi_i \geq 1$ denote one plus the tax equivalent of land use regulation for commercial land relative to residential land.

$$\begin{aligned} \theta_i = 1 \quad & \text{if} \quad q_i > \xi_i Q_i \\ \theta_i \in [0,1] \quad & \text{if} \quad q_i = \xi_i Q_i \\ \theta_i = 0 \quad & \text{if} \quad q_i < \xi_i Q_i \end{aligned}$$

- Remember landlords allocating land to the highest bidder (bid rent approach)?

$$\mathbb{Q}_i = \max\{q_i, Q_i\}$$

and $\mathbb{Q}$ is the observed floor price.

- There is a competitive construction sector that uses capital M and land K to supply floorspace.

Land Market Clearing

1. Demand for residential floor space equals supply, $(1-\theta_i)L_i$

$$\mathbb{E}[l_i]\, H_{Ri} = (1-\beta)\frac{\mathbb{E}[w_s|i]\, H_{Ri}}{Q_i} = (1-\theta_i)L_i$$

2. Demand for commerical space equals supply

$$\left(\frac{(1-\alpha)A_j}{q_j}\right)^{1/\alpha} H_{Mj} = \theta_j L_j$$

3. If 1. and 2. are satisfied, total demand must equal total supply

$$(1-\theta_i)L_i + \theta_i L_i = L_i = \varphi_i K_i^{1-\mu}$$

General Equilibrium and Agglomeration

- Multiple Equilibria: Standard problem in urban models.
- Endogenous agglomeration forces: the density of people/firms/agents affects productivity (+?) and amenities (–?)
- Each workers' location decision depends on amenities and productivity
- But given that productivity is affected by agglomeration forces, we are in a circle.

GE without Agglomeration

- Start by having no agglomeration. Model as is.
- This means fixing $T_i, E_j, \varphi_i, K_i, \xi_i, A_i, B_i$ at admissible values.
- then, there exists a unique general equilibrium vector

$$\{\pi_{\mathbf{M}}, \pi_{\mathbf{R}}, \mathbf{H}, \mathbf{Q}, \mathbf{q}, \mathbf{w}, \theta\}$$

- In other words, if there are *no* agglomeration forces, the equilibrium is unique.

Adding Agglomeration

- Standard approach: use employment density in surroundings

$$A_j = a_j \mathcal{Y}_j^{\lambda}$$

  where $\mathcal{Y}_j$ is the travel-time weighted sum of employment density in surrounding blocks.
    - clearly, $\mathcal{Y}_j$ is an endogenous object of the model. it's worker's location choices.
- Similarly for Residential externalities:

$$B_i = b_i \Omega_i^{\eta}$$

  where Ω_i is the weighted sum of residential density in surroundings.
- Potential for multiple equilibria: if agglomeration is strong relative to exogenous differences across blocks.

Identification of the Model

1. Given observed location decisions and travel times, get commuting probabilities π
2. Get unique wages via commuting market clearing
3. Given wages and observed floor prices, use firm cost function to get productivity
4. Given wages, observed floor prices, residence choices, worker utility gives amenities

Division and Reunification

- The model has 4 channels which are affected by the Wall:

1. Loss of employment opportunity in East Berlin
2. Loss of commuters from East
3. Loss of production externalities from East
4. Loss of residential externalities from East

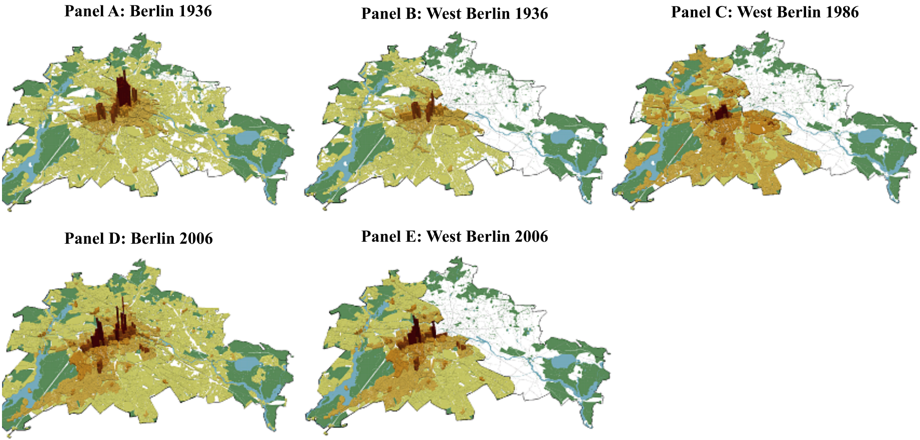
- Operationalized by imposing inifinte commuting costs for affected commutes, and the shutdown of externality parameters for affected areas.
- Note all endogenous variables adjust in the model after this. New Equilibrium
- In particular, removing the Wall need not restore the previous equilbrium.

Data Requirements

This paper needs a lot of good data.

1. workplace employment (job density per cell)
2. resident employment (density of employed people residing per cell)
3. price of floor space (via Land prices and model assumption)
4. commuting times between cells.
    1. they have 15,937 blocks. i.e. they have travel times in minutes for each of 254 million connections (15,937 x 15,937), for car and public transport.

Evolution of Land Price Gradient



Effects of Division

- investigate this closer with

$$\Delta \ln \text{outcome}_i = \alpha + \sum_{k=1}^{K} \mathbb{I}_{ik}\beta_k + \ln M_i\gamma + u_i$$

- outcome: floor prices, workplace employment, resident employment
- $\mathbb{I}_{ik}$: indicator for whether bock i is in distance grid k (500m intervals)
- M_i: time-invariante observable characteristics (close to park...)

Effects of Division

BASELINE DIVISION DIFFERENCE-IN-DIFFERENCE RESULTS (1936–1986)[a]

	(1) $\Delta \ln Q$	(2) $\Delta \ln Q$	(3) $\Delta \ln Q$	(4) $\Delta \ln Q$	(5) $\Delta \ln Q$	(6) $\Delta \ln$ EmpR	(7) $\Delta \ln$ EmpR	(8) $\Delta \ln$ EmpW	(9) $\Delta \ln$ EmpW
CBD 1	−0.800***	−0.567***	−0.524***	−0.503***	−0.565***	−1.332***	−0.975***	−0.691*	−0.639*
	(0.071)	(0.071)	(0.071)	(0.071)	(0.077)	(0.383)	(0.311)	(0.408)	(0.338)
CBD 2	−0.655***	−0.422***	−0.392***	−0.360***	−0.400***	−0.715**	−0.361	−1.253***	−1.367***
	(0.042)	(0.047)	(0.046)	(0.043)	(0.050)	(0.299)	(0.280)	(0.293)	(0.243)
CBD 3	−0.543***	−0.306***	−0.294***	−0.258***	−0.247***	−0.911***	−0.460**	−0.341	−0.471**
	(0.034)	(0.039)	(0.037)	(0.032)	(0.034)	(0.239)	(0.206)	(0.241)	(0.190)
CBD 4	−0.436***	−0.207***	−0.193***	−0.166***	−0.176***	−0.356**	−0.259	−0.512***	−0.521***
	(0.022)	(0.033)	(0.033)	(0.030)	(0.026)	(0.145)	(0.159)	(0.199)	(0.169)
CBD 5	−0.353***	−0.139***	−0.123***	−0.098***	−0.100***	−0.301***	−0.143	−0.436***	−0.340***
	(0.016)	(0.024)	(0.024)	(0.023)	(0.020)	(0.110)	(0.113)	(0.151)	(0.124)
CBD 6	−0.291***	−0.125***	−0.094***	−0.077***	−0.090***	−0.360***	−0.135	−0.280**	−0.142
	(0.018)	(0.019)	(0.017)	(0.016)	(0.016)	(0.100)	(0.089)	(0.130)	(0.116)
Inner Boundary 1–6			Yes	Yes	Yes		Yes		Yes
Outer Boundary 1–6			Yes	Yes	Yes		Yes		Yes
Kudamm 1–6				Yes	Yes		Yes		Yes
Block Characteristics					Yes		Yes		Yes
District Fixed Effects		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,260	6,260	6,260	6,260	6,260	5,978	5,978	2,844	2,844
R^2	0.26	0.51	0.63	0.65	0.71	0.19	0.43	0.12	0.33

[a] Q denotes the price of floor space. EmpR denotes employment by residence. EmpW denotes employment by workplace. CBD1–CBD6 are six 500 m distance grid cells for distance from the pre-war CBD. Inner Boundary 1–6 are six 500 m grid cells for distance to the Inner Boundary between East and West Berlin. Outer Boundary 1–6 are six 500 m grid cells for distance to the outer boundary between West Berlin and East Germany. Kudamm 1–6 are six 500 m grid cells for distance to Breitscheid Platz on the Kurfürstendamm. The coefficients on the other distance grid cells are reported in Table A.2 of the Technical Data Appendix. Block characteristics include the log distance to schools, parks and water, the land area of the block, the share of the block's built-up area destroyed during the Second World War, indicators for residential, commercial and industrial land use, and indicators for whether a block includes a government building and urban regeneration policies post-reunification. Heteroscedasticity and Autocorrelation Consistent (HAC) standard errors in parentheses (Conley (1999)). * significant at 10%; ** significant at 5%; *** significant at 1%.

Effects of Reunification

BASELINE REUNIFICATION DIFFERENCE-IN-DIFFERENCE RESULTS (1986–2006)[a]

	(1) $\Delta \ln Q$	(2) $\Delta \ln Q$	(3) $\Delta \ln Q$	(4) $\Delta \ln Q$	(5) $\Delta \ln Q$	(6) $\Delta \ln$ EmpR	(7) $\Delta \ln$ EmpR	(8) $\Delta \ln$ EmpW	(9) $\Delta \ln$ EmpW
CBD 1	0.398***	0.408***	0.368***	0.369***	0.281***	1.079***	1.025***	1.574***	1.249**
	(0.105)	(0.090)	(0.083)	(0.081)	(0.088)	(0.307)	(0.297)	(0.479)	(0.517)
CBD 2	0.290***	0.289***	0.257***	0.258***	0.191**	0.589*	0.538*	0.684**	0.457
	(0.111)	(0.096)	(0.090)	(0.088)	(0.087)	(0.315)	(0.299)	(0.326)	(0.334)
CBD 3	0.122***	0.120***	0.110***	0.115***	0.063**	0.340*	0.305*	0.326	0.158
	(0.037)	(0.033)	(0.032)	(0.032)	(0.028)	(0.180)	(0.158)	(0.216)	(0.239)
CBD 4	0.033***	0.031	0.030	0.034	0.017	0.110	0.034	0.336**	0.261
	(0.013)	(0.023)	(0.022)	(0.021)	(0.020)	(0.068)	(0.066)	(0.161)	(0.185)
CBD 5	0.025***	0.018	0.020	0.020	0.015	−0.012	−0.056	0.114	0.066
	(0.010)	(0.015)	(0.014)	(0.014)	(0.013)	(0.056)	(0.057)	(0.118)	(0.131)
CBD 6	0.019**	−0.000	−0.000	−0.003	0.005	0.060	0.053	0.049	0.110
	(0.009)	(0.012)	(0.012)	(0.012)	(0.011)	(0.039)	(0.041)	(0.095)	(0.098)
Inner Boundary 1–6			Yes	Yes	Yes		Yes		Yes
Outer Boundary 1–6			Yes	Yes	Yes		Yes		Yes
Kudamm 1–6				Yes	Yes		Yes		Yes
Block Characteristics					Yes		Yes		Yes
District Fixed Effects		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,050	7,050	7,050	7,050	7,050	6,718	6,718	5,602	5,602
R^2	0.08	0.32	0.34	0.35	0.43	0.04	0.07	0.03	0.06

[a] Q denotes the price of floor space. EmpR denotes employment by residence. EmpW denotes employment by workplace. CBD1–CBD6 are six 500 m distance grid cells for distance from the pre-war CBD. Inner Boundary 1–6 are six 500 m grid cells for distance to the Inner Boundary between East and West Berlin. Outer Boundary 1–6 are six 500 m grid cells for distance to the outer boundary between West Berlin and East Germany. Kudamm 1–6 are six 500 m grid cells for distance to Breitscheid Platz on the Kurfürstendamm. The coefficients on the other distance grid cells are reported in Table A.4 of the Technical Data Appendix. Block characteristics include the log distance to schools, parks and water, the land area of the block, the share of the block's built-up area destroyed during the Second World War, indicators for residential, commercial and industrial land use, and indicators for whether a block includes a government building and urban regeneration policies post-reunification. Heteroscedasticity and Autocorrelation Consistent (HAC) standard errors in parentheses (Conley (1999)). * significant at 10%; ** significant at 5%; *** significant at 1%.

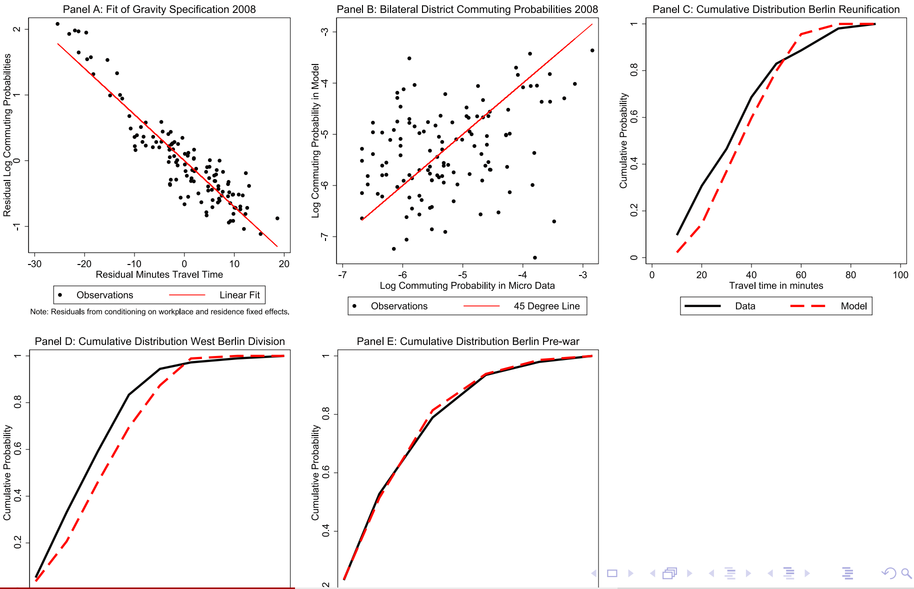
Gravity equation

- Taking the log of commuting probabilities (2) allows to write

$$\ln \pi_{ij} = -\nu\tau_{ij} + \vartheta_i + \varsigma_j$$

- Residence fixed effect ϑ_i: B_i, T_i, Q_i
- workplce fixed effect ς_j: w_j, E_j
- denominator goes into FEs
- commuting costs are $d_{ij} = e^{\kappa\tau_{ij}}$. So $\nu = \varepsilon\kappa$ is semi-elasticity of commuting flow wrt travel times.
- In commuting micro data, find $\nu = \varepsilon\kappa \approx 0.07$.
- Additional minute of travel time reduces flow of commuters by 7%.
- Later use that estimate to set Frechet parameter ε

Model Checks: First set of overidentication



Counterfactuals without Agglomeration

- Calibrate the model with Gravity equation results.
- Demonstrate that a model with exogenous amenities and productivity is unable to explain the data of before/after division.
- There is of course *some* effect, since workers can't commute anymore. It's just too small.
- They predict 1986 floor prices with the model, and compare to the 1936 baseline
- Data showed a change at the CBD of -0.8 log points. Column 1 of "Effects of divisoin" slide.
- This model shows -0.4 log points. About half the effect is missing.

Structural Estimation

- Proportional change in amenities and productivity can be written as functions of parameters and data.
- Given those, it is possible to write moment conditions.
- Identifying assumption:
  - changes in gradient of economic activity in West berlin after Wall relative to pre-war CDB are explained by mechanisms of themodel
  - ie. changes in commuting access, production and residential externalities
  - not changes in production/residential fundamentals.
- Additional moments conditions:
  1. number of workers commuting for less than 30 min in model is equal to number in data.
  2. variance of log wages in model is equal to variance in data.

GMM Results

TABLE V

GENERALIZED METHOD OF MOMENTS (GMM) ESTIMATION RESULTS[a]

	(1) Division Efficient GMM	(2) Reunification Efficient GMM	(3) Division and Reunification Efficient GMM
Commuting Travel Time Elasticity ($\kappa\varepsilon$)	0.0951***	0.1011***	0.0987***
	(0.0016)	(0.0016)	(0.0016)
Commuting Heterogeneity (ε)	6.6190***	6.7620***	6.6941***
	(0.0939)	(0.1005)	(0.0934)
Productivity Elasticity (λ)	0.0793***	0.0496***	0.0710***
	(0.0064)	(0.0079)	(0.0054)
Productivity Decay (δ)	0.3585***	0.9246***	0.3617***
	(0.1030)	(0.3525)	(0.0782)
Residential Elasticity (η)	0.1548***	0.0757**	0.1553***
	(0.0092)	(0.0313)	(0.0083)
Residential Decay (ρ)	0.9094***	0.5531	0.7595***
	(0.2968)	(0.3979)	(0.1741)

Externalities and Commuting Costs

TABLE VI

EXTERNALITIES AND COMMUTING COSTS[a]

	(1) Production Externalities ($1 \times e^{-\delta\tau}$)	(2) Residential Externalities ($1 \times e^{-\rho\tau}$)	(3) Utility After Commuting ($1 \times e^{-\kappa\tau}$)
0 minutes	1.000	1.000	1.000
1 minute	0.696	0.468	0.985
2 minutes	0.485	0.219	0.971
3 minutes	0.338	0.102	0.957
5 minutes	0.164	0.022	0.929
7 minutes	0.079	0.005	0.902
10 minutes	0.027	0.001	0.863
15 minutes	0.004	0.000	0.802
20 minutes	0.001	0.000	0.745
30 minutes	0.000	0.000	0.642

[a]Proportional reduction in production and residential externalities with travel time and proportional reduction in utility from commuting with travel time. Travel time is measured in minutes. Results are based on the pooled efficient

Counterfactuals WITH Agglomeration: much better!

TABLE VII

COUNTERFACTUALS[a]

	(1) Δ ln QC 1936–1986	(2) Δ ln QC 1936–1986	(3) Δ ln QC 1936–1986	(4) Δ ln QC 1936–1986	(5) Δ ln QC 1986–2006	(6) Δ ln QC 1986–2006	(7) Δ ln QC 1986–2006
CBD 1	−0.836***	−0.613***	−0.467***	−0.821***	0.363***	1.160***	0.392***
	(0.052)	(0.032)	(0.060)	(0.051)	(0.041)	(0.052)	(0.043)
CBD 2	−0.560***	−0.397***	−0.364***	−0.624***	0.239***	0.779***	0.244***
	(0.034)	(0.025)	(0.019)	(0.029)	(0.028)	(0.044)	(0.027)
CBD 3	−0.455***	−0.312***	−0.336***	−0.530***	0.163***	0.594***	0.179***
	(0.036)	(0.030)	(0.030)	(0.036)	(0.031)	(0.045)	(0.031)
CBD 4	−0.423***	−0.284***	−0.340***	−0.517***	0.140***	0.445***	0.143***
	(0.026)	(0.019)	(0.022)	(0.031)	(0.021)	(0.042)	(0.021)
CBD 5	−0.418***	−0.265***	−0.351***	−0.512***	0.177***	0.403***	0.180***
	(0.032)	(0.022)	(0.027)	(0.039)	(0.032)	(0.038)	(0.032)
CBD 6	−0.349***	−0.222***	−0.304***	−0.430***	0.100***	0.334***	0.103***
	(0.025)	(0.016)	(0.022)	(0.029)	(0.024)	(0.034)	(0.023)
Counterfactuals	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Agglomeration Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,260	6,260	6,260	6,260	7,050	6,260	7,050
R^2	0.11	0.13	0.07	0.13	0.12	0.24	0.13

[a]Columns (1)–(6) are based on the parameter estimates pooling division and reunification from Table V. Column (7) is based on the parameter estimates for division from Table V. QC denotes counterfactual floor prices. Column (1) simulates division using our estimates of production and residential externalities and 1936 fundamentals. Column (2) simulates division using our estimates of production externalities and 1936 fundamentals but setting residential externalities to zero. Column (3) simulates division using our estimates of residential externalities and 1936 fundamentals but setting production externalities to zero. Column (4) simulates division using our estimates of production and residential externalities and 1936 fundamentals but halving their rates of spatial decay with travel time. Column (5) simulates reunification using our estimates of production and residential externalities, 1986 fundamentals for West Berlin, and 2006 fundamentals for East Berlin. Column (6) simulates reunification using our estimates of production and residential externalities, 1986 fundamentals for West Berlin and 1936 fundamentals for East Berlin. Column (7) simulates reunification using division rather than pooled parameter estimates, 1986 fundamentals for West Berlin, and 2006 fundamentals for East Berlin. CBD 1–CBD6 are six 500 m distance grid cells for distance from the pre-war CBD. Heteroscedasticity and Autocorrelation Consistent (HAC) standard errors in parentheses (Conley (1999)). * significant at 10%; ** significant at 5%; *** significant at 1%.

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