Main goal of the paper : address the identification challenge of distinguishing agglomeration and dispersion forces from variation in locational fundamentals.

**Model**: model of internal city structure incorporating agglomeration and dispersion forces & number of heterogeneous locations within the city.

Locations differ in terms of

* Productivity 🡪 production externality & fundamentals
* Amenities 🡪 residential externality & fundamentals
* Density of development
* Transport infrastructure 🡪 congestion 🡪 travel time

**Reduced-form**:

* Division leads to a reorientation of the gradient in land prices and employment in WB away from the main pre-war concentration of economic activity in EB, while reunification leads to a reemergence of this gradient.

Flooding = exogenous variation used to structurally estimate both the commuting and agglomeration parameters.

Goal = to decompose overall productivity and amenities for each tract into production and residential externalities & fundamentals. **Identification assumption: changes in structural residuals are uncorrelated with the exo change in the surrounding concentration of economic activity induced by Berlin’s division and reunification. This identifying assumption requires that the systematic change in the pattern of economic activity in WB following division and reunification is explained by the mechanisms of the model (the changes in commuting access and production and residential externalities) rather than by systematic changes in the pattern of structural residuals (production and residential fundamentals)**

Estimate the model using GMM on structural residuals 🡪 should be = 0 because of the identifying assumption that changes in the pattern of economic activity (delta in the data) should be orthogonal to changes in fundamentals.

The structural residuals are closed-form functions of the observed data and parameters, so this estimation holds constant the observed endogenous variables of the model at their values in the data.

**THE MODEL**:

Model with risk-neutral workers that get utility from “consumption” of residence-workplace specific goods that are made of amenities in the residence tract *I*, the good, floor space, travel costs to *j,* and an idiosyncratic shock.

Commuting market clearing condition that equates the measure of workers employed in block j (H\_mj) with the measure of workers choosing to commute to block j

Diagram, schematic

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Production: perfect competition and CRS (Cobb Douglas). Profit maximization in block *j* gives optimal employment in j H\_mj, as well as equilibrium commercial floor prices q\_j

Land Market Clearing: no arbitrage between commercial and residential use of floor space after the tax equivalent of land use regulations.

Lead to the residential land market clearing condition + the commercial land market clearing condition 🡪 total demand for floor space = total supply of floor space

A picture containing diagram

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**General with exo location characteristics**:

Given

* Model characteristics {\alpha, \beta, \nu, \epsilon, \kappa}, U\_bar
* Vector of exogenous location characteristics : {T, E, A, B, \Phi, K, \xi, \tau}

Equilibrium : {\pi\_M, \pi\_R, Q, q, w, \theta}, H total city population

Characterising equations

* (9) population mobility
* (5) residential choice probability + workplace choice probability
* (18) commercial land market clearing
* (17) residential land market clearing
* (12) profit maximization and zero profits
* (13) no arbitrage between alternative uses of land

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**General with Agglomeration Forces**

Allow final goods productivity to depend on production fundamentals (\alpha\_j) and production externalities 🡪 impose a structure.

**A picture containing diagram

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Similarly for residential externalities

Graphical user interface, application

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🡪 *generates the potential for multiple equilibria in the model if these agglomeration forces are sufficiently strong relative to the exogenous differences in characteristics across locations.*

**Recovering Location Characteristics**

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*This identification result hinges on the data available. In the absence of any one of the five observed variables (floor prices, workplace, employment, residence employment, land area and travel times), these unobserved adjusted fundamentals would be under-identified, and could not be determined without making further structural assumptions.*

**Berlin’s division and reunification**

Capture the division through infinite commuting costs, infinite rates of decay of production externalities, infinite rates of decay of residential externalities. 4 channels

* Loss of employment opportunities in EB
* Loss of commuters from EB
* Loss of production externalities from EB
* Loss of residential externalities from EB

🡪 all of these should “reduce the expected utility from living in WB and hence reduce the overall population, as workers out migrate to WG.

*The mechanisms that restore equilibrium in the model are changes in wages and floor prices. W and R employment reallocate across locations within WB to to WB, until wages and floor prices have adjusted such that firms make 0 profits in all locations with positive production, workers are indifferent across all population locations, and there are no-arbitrage opportunities in reallocating flood space between commercial and residential use.*

**REDUCED FORM RESULTS**

1. Evolution of the land price gradient over time

Diagram

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CBD : where prices are the highest before flood

1. DiD estimates

Potential flaw:

* Assumes that “non-flooded” tracts (flood < 2feet according to our characterization) are actually not flooded at all, or such that it doesn’t affect “time-invariant factors that have constant effects over time, which are differenced out before and after division”

Adopt a grid-cell specification, which we can’t really do given our data

Autocorrelation

**GRAVITY**

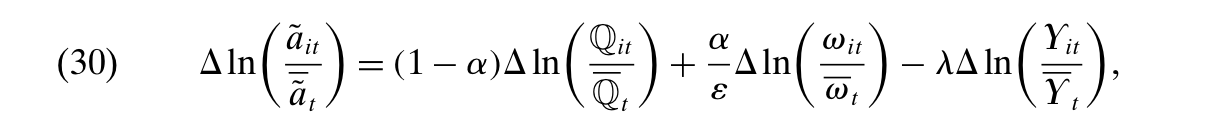
*From the commuting proba (4) one of the model’s key predictions is a semi-log gravity equation for commuting flows from residence i to workplace j.*

*\nu = \epsilon\*\kappa is the semi-elasticity of commuting flows with respect to travel times and is a combination of the commuting cost parameter \kappa and the commuting heterogeneity parameter \epsilon.*

**STRUCTURAL ESTIMATION**

From proposition 2 🡪 closed-form solutions for adjusted production and residential fundamentals in terms of the observed data & parameters.

Production externalities



Residential externalities

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The two moment conditions above impose that the changes in adjusted production and residential fundamentals are uncorrelated with the exo change in the surrounding concentration of economic activity induced by the flood 🡪 **no way this holds**

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Split in distance grid cell k from pre-war CBD 🡪 by grid cell.

*The identifying assumption requires that the systematic change in the gradient of economic activity in WB relative to the pre-war CBD following division is explained by the mechanisms of the model rather than by systematic changes in the pattern of structural residuals (adjusts production and residential fundamentals).****Since Berlin’s division stemmed from military considerations during WWII and its reunification originated in the wider collapse of Communism, the resulting changes in the surrounding concentration of economic activity are plausibly exogenous to changes in adjusted production and residential fundamentals in West Berlin blocks.***

The commuting market clearing condition (26) 🡪

Diagram

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Plug in the commuting flows from i to j 🡪 to replace psi H\_mj

Wage variance: requires that the variance of log adjusted wages in the model is equal to the variance of log wages in the data for WB during division

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**GMM Estimation**