Motivation

• What determines the spatial distribution of economic activity?
• There are several competing explanations:
  – Institutions
  – Natural Advantage
  – Culture
  – Market Access
• Very difficult to empirically disentangle the effects of these factors.
This Paper

• We exploit German division and reunification as a natural experiment to provide evidence for the importance of market access.

• Key Idea: Division and Reunification exogenously changed the relative market access of West German cities.
Plan of the Presentation

1. Sketch of the theoretical model
2. Empirical strategy
3. Basic results
4. Further evidence
5. Conclusion

Theoretical Model I

• We consider a standard new economic geography model based on Helpman (1998).

• There are N locations (here cities) which are endowed with an immobile resource (housing).

• Consumers:
  – Spend a share $\mu$ of their income on manufacturing varieties and the remaining income on the immobile resource.
  – Have CES preferences with an elasticity of substitution $\sigma$ over manufacturing varieties.
  – Inelastically supply one unit of labor.
The Costs of Remoteness

Stephen Redding, Daniel Sturm

Theoretical Model II

- Manufacturing firms have IRS, use labor as the only input and are monopolistically competitive.
- Manufacturing varieties are subject to iceberg transport costs \( T \), which are in turn a function of distance \( (T_{ij} = \text{dist}_{ij}^0) \).
- In the long-run population is perfectly mobile across locations and migration equalizes real wages.

Calibration

- We use central values from the existing literature for the three key parameters of the model \((\sigma = 4, \mu = 2/3 \text{ and } \phi = 1/3)\)
- We calibrate the stock of the immobile resource in each city so that the 1939 distribution of population across cities in pre-war Germany is the (unique) equilibrium of the model.
- We simulate the division of Germany and allow the population of the West German cities to adjust to this exogenous shock.
Figure 1: Simulated Change in West German City Population
By distance in km from the East–West Border

Figure 2: Differences in Simulated Population Changes
within and beyond 75km of E–W border for small and large West German cities
Data

- We focus on a sample of West German cities which had at least 20000 inhabitants in 1919.
- We aggregate cities that merge during the sample period.
- Observations:
  - Pre-war: 1919, 1925, 1933, 1939
  - Reunification: 1992, 2002

Basic Empirical Strategy

- Difference-in-Differences Estimation:
  - Compare population growth in West German cities close to the East-West border with other West German cities both before and after division.

- Baseline Specification

\[ Popgrowth_{ct} = \beta \text{Border}_c + \gamma (\text{Border}_c \times \text{Division}_t) + d_t + \epsilon_{ct} \]
Our key coefficient of interest on the border division interaction is negative and highly statistically significant, consistent with the predictions of the theoretical model. Division leads to a reduction in the annualized rate of growth of the cities along the East-West German border relative to other West German cities of about 0.75 percentage points. This estimate implies a decline in the population of treatment cities relative to control cities over the 38-year period from 1950 to 1988 of around one-third.

In column 2 we augment our baseline specification and examine heterogeneity over time in the treatment effect of division. Instead of considering a single interaction term between the border dummy and a dummy for the period of division, we introduce separate interaction terms between the border dummy and individual years when Germany was divided. These interaction terms between division years and the border dummy are jointly highly statistically significant.

Figure 3: Indices of Treatment and Control City Population

Figure 4: Difference in Population Indices, Treatment – Control
Table 2 - Basic Results on the Impact of Division

<table>
<thead>
<tr>
<th>Border 0-25km × Division</th>
<th>Border 25-50km × Division</th>
<th>Border 50-75km × Division</th>
<th>Border 75-100km × Division</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.129</td>
<td>0.129</td>
<td>0.233</td>
<td>-0.009</td>
</tr>
<tr>
<td>(0.139)</td>
<td>(0.139)</td>
<td>(0.215)</td>
<td>(0.148)</td>
</tr>
</tbody>
</table>

Notes: Standard errors are homoscedastic and adjusted for clustering on city. * denotes significance at the 10% level; ** denotes significance at the 5% level; *** denotes significance at the 1% level.
Is it Really Loss of Market Access?

- The decline of the cities along the East-West border is consistent with our model.
- There is no simple explanation for the decline in terms of institutions, endowments or culture.

However, there are other possible explanations for the decline:

- Differences in industrial structure
- Differences in war-related disruption
- Western Economic Integration
- Fear of further armed conflict
Quantitative Analysis of the Model

• Can the model not only qualitatively, but also quantitatively account for the decline of the cites along the East-West border?

• To compare moments in the simulation and the data, we undertake a grid search over 21 values of each parameter:
  – Elasticity of substitution ($\sigma$) from 2.5 to 6.5
  – Share of tradeables in expenditure ($\mu$) from 0.65 to 0.85
  – Distance elasticity of transport costs ($\phi$) from 0.10 to 1.10
Identification

• We first show that the relative decline of the East-West border cities is a well-behaved function of two relationships:
  – The strength of agglomeration and dispersion forces: $\sigma(1 - \mu)$
  – The coefficient on distance: $(1 - \sigma)\phi$

• We pin down values for $\sigma(1 - \mu)$ and $(1 - \sigma)\phi$ by comparing the predictions of the model with our two key empirical findings:
  – The relative decline of the East-West border cities.
  – The more pronounced relative decline of smaller cities.
Figure 6: Contours of the Simulated Division Treatment

![Graph showing contours of the simulated division treatment.](image)

**Figure 7: Simulated and Estimated Division Treatments**

![Graph comparing simulated and estimated division treatments.](image)
City Structure

- Maybe the cities along the East-West border declined because they were specialized in industries that declined after the war.

- To control for this possibility we match each treatment city to a control city that is as similar as possible in terms of observed characteristics.

### Table 3 – Matching

<table>
<thead>
<tr>
<th></th>
<th>Population Growth (1)</th>
<th>Population Growth (2)</th>
<th>Population Growth (3)</th>
<th>Population Growth (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Border × Division</td>
<td>-0.921***</td>
<td>-1.000***</td>
<td>-0.888***</td>
<td>-0.782***</td>
</tr>
<tr>
<td></td>
<td>(0.218)</td>
<td>(0.253)</td>
<td>(0.247)</td>
<td>(0.261)</td>
</tr>
<tr>
<td>Border</td>
<td>0.309*</td>
<td>0.338**</td>
<td>0.082</td>
<td>0.061</td>
</tr>
<tr>
<td></td>
<td>(0.153)</td>
<td>(0.156)</td>
<td>(0.167)</td>
<td>(0.194)</td>
</tr>
<tr>
<td>Year Effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Matching on</td>
<td>Population</td>
<td>Total Employment</td>
<td>Employment in 28 sectors</td>
<td>Employment in 28 sectors and geography</td>
</tr>
<tr>
<td>Observations</td>
<td>280</td>
<td>280</td>
<td>280</td>
<td>280</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.29</td>
<td>0.26</td>
<td>0.38</td>
<td>0.29</td>
</tr>
</tbody>
</table>

**Notes:** Standard errors are heteroscedasticity robust and adjusted for clustering on city. * denotes significance at the 10% level; ** denotes significance at the 5% level; *** denotes significance at the 1% level.
Could differences in destruction or refugee flows have affected cities post-war growth performance?

To control for this possibility, we include measures of the degree of war-related disruption in the regression and allow their effect to vary over time.

### Table 4: Controlling for War Disruption

<table>
<thead>
<tr>
<th></th>
<th>Population Growth</th>
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</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Border × Division</td>
<td>0.007***</td>
<td>0.002***</td>
<td>0.009***</td>
</tr>
<tr>
<td>(3)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Notes
- Standard errors are heteroscedasticity robust and adjusted for clustering on city.
- * denotes significance at the 10% level; ** denotes significance at the 5% level; *** denotes significance at the 1% level.

### Variable Definitions
- War Disruption Measure: Rubble
- Observations: 777, 756, 833
- R-squared: 0.24, 0.24, 0.24

<table>
<thead>
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<th>Population Growth</th>
<th>Population Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year Effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Border × Division</td>
<td>0.007***</td>
<td>0.002***</td>
<td>0.009***</td>
</tr>
</tbody>
</table>

### Results

<table>
<thead>
<tr>
<th></th>
<th>Population Growth</th>
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<th>Population Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Border × Division</td>
<td>0.007***</td>
<td>0.002***</td>
<td>0.009***</td>
</tr>
<tr>
<td>(3)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Western Integration

- West Germany experienced considerable economic integration with Western Europe in the post-war period.
- Can Western integration (at least partly) explain the relative decline of the cities along the East-West border?

<table>
<thead>
<tr>
<th>Border Distance Grid Cells</th>
<th>Western Border 0-25 km × Division</th>
<th>Western Border 25-50 km × Division</th>
<th>Western Border 50-75 km × Division</th>
<th>Western Border 75-100 km × Division</th>
<th>Year Effects</th>
<th>Western Border Distance Grid Cells</th>
<th>Year Effects</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>0.032 (0.226)</td>
<td>-0.162 (0.152)</td>
<td>-0.675** (0.297)</td>
<td>-0.756*** (0.240)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>0.045 (0.151)</td>
<td>0.032 (0.226)</td>
<td>-0.162 (0.152)</td>
<td>-0.675** (0.297)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>(1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5 - Controlling for Western Economic Integration
Fear of Further Armed Conflict

• Several pieces of evidence suggest that fear of a further armed conflict cannot explain the decline of the East-West border cities:
  – Difficult to square with the larger decline of small cities and our quantitative analysis.
  – There is no evidence of a negative effect of proximity to the East-West border in centrally planned East Germany.
  – There is no evidence of stronger treatment effects close to strategic points along the border (“Fulda Gap”).
  – Nuclear deterrence made a small scale war very unlikely.
  – No evidence that another war was an everyday concern.

Reunification

• Do we observe a reversal of fortune in the cities along the East-West border after reunification?
• There are good reasons to be sceptical:
  – The size and income of the area added is much smaller compared to division.
  – Heavy subsidies for the border cities are rapidly discontinued.
  – While division abruptly severed all links between East and West Germany, the re-creation of such links after reunification is likely to take time.
Table 6 - The Impact of Reunification

<table>
<thead>
<tr>
<th></th>
<th>Population Growth (1)</th>
<th>Population Growth (2)</th>
<th>Population Growth (3)</th>
<th>Population Growth (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Border × Division</td>
<td>-0.477***</td>
<td>-0.127</td>
<td>-0.223</td>
<td>-0.007</td>
</tr>
<tr>
<td></td>
<td>(0.156)</td>
<td>(0.128)</td>
<td>(0.202)</td>
<td>(0.136)</td>
</tr>
<tr>
<td>Border</td>
<td>-0.141</td>
<td>-0.141</td>
<td>-0.236</td>
<td>-0.064</td>
</tr>
<tr>
<td></td>
<td>(0.106)</td>
<td>(0.106)</td>
<td>(0.168)</td>
<td>(0.108)</td>
</tr>
<tr>
<td>Year Effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>City Sample</td>
<td>All</td>
<td>All</td>
<td>Small Cities</td>
<td>Large Cities</td>
</tr>
<tr>
<td>Observations</td>
<td>595</td>
<td>238</td>
<td>120</td>
<td>118</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.30</td>
<td>0.15</td>
<td>0.21</td>
<td>0.14</td>
</tr>
</tbody>
</table>

Notes: Standard errors are heteroscedasticity robust and adjusted for clustering on city. * denotes significance at the 10% level; ** denotes significance at the 5% level; *** denotes significance at the 1% level.

Summary

- West German cities close to the East-West border substantially decline after division relative to other West German cities.
- The evidence suggests that this decline can be largely explained by the change in market access of these cities.
- While institutions and natural advantage are certainly also important, market access plays a substantial role in determining economic prosperity.