Technical Appendix for The Costs of Remoteness: Evidence from German Division and Reunification

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Structure of the Technical Appendix

Section A of this technical appendix contains a more detailed exposition of the multi-region version of the Helpman (1998) model discussed in Section 3 of the paper. Section B discusses in greater detail the calibration of the model to data on cities in pre-war Germany and the simulation of the impact of German division based on central values of parameters from the existing literature (Section 3.3 of the paper). Section C discusses in further detail the quantitative analysis of the model, in which we undertake a grid search over alternative possible values for parameters and compare moments in the simulation and data (Section 6.1 of the paper). Section D reports details of the robustness tests for our baseline estimation which we briefly discuss in Section 5.2 of the paper. Section E contains the detail on the aggregations undertaken to deal with city mergers and make the administrative city data as comparable as possible over time.

A Theoretical Model

A1. Consumption

The economy as a whole is populated by a mass of representative consumers, L, who are mobile across cities and are endowed with a single unit of labour which is supplied inelastically with zero disutility. Utility is defined over a consumption index of traded manufacturing goods, C_c^M, and consumption of non-traded housing, C_c^H. The upper level utility function is assumed to be Cobb-Douglas:[1]

$$U_c = \left(C_c^M\right)^{\mu} \left(C_c^H\right)^{1-\mu}, \qquad 0 < \mu < 1. \tag{1}$$

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[1] To clarify the exposition below, we use c to indicate a city when it is consuming and i to indicate a city when it is producing.

The manufacturing consumption index takes the standard CES (Dixit-Stiglitz) form and we assume that manufacturing varieties are subject to iceberg trade costs. In order for one unit of a variety produced in city i to arrive in city c, a quantity $T_{ic} > 1$ must be shipped, so that $T_{ic} - 1$ measures proportional trade costs. The dual manufacturing price index is as follows:

$$P_c^M = \left[\sum_i n_i (p_i T_{ic})^{1-\sigma} \right]^{1/(1-\sigma)}, \tag{2}$$

where we have used the fact that all n_i manufacturing varieties produced in city i face the same elasticity of demand and charge the same equilibrium price $p_{ic} = T_{ic} p_i$ to consumers in city c.

The price index in equation (2) depends on consumers' access to manufacturing goods, as captured by the number of varieties and their free on board prices in each city i, together with the trade costs of shipping the varieties from cities i to c. We summarize consumers' access to manufacturing goods using the concept of *consumer market access*, CMA_c:

$$P_c^M = [CMA_c]^{1/(1-\sigma)}, \qquad CMA_c \equiv \sum_i n_i (p_i T_{ic})^{1-\sigma}. \tag{3}$$

Applying Shephard's lemma to the manufacturing price index, equilibrium city c demand for a manufacturing variety produced in i is:

$$x_{ic} = p_i^{-\sigma} (T_{ic})^{1-\sigma} (\mu E_c) \left(P_c^M\right)^{\sigma-1}, \tag{4}$$

where E_c denotes total expenditure which equals total income and, with Cobb-Douglas utility, consumers spend a constant share of their income, μ, on manufacturing goods.

With constant expenditure shares and housing in inelastic supply, the equilibrium price of housing depends solely on the expenditure share, $(1-\mu)$, total expenditure, E_c, and the supply of housing, H_c:

$$P_c^H = \frac{(1-\mu)E_c}{H_c}. \tag{5}$$

Total expenditure is the sum of labor income and expenditure on housing which is assumed to be redistributed to the city population:

$$E_c = w_c L_c + (1-\mu)E_c = \frac{w_c L_c}{\mu}. \tag{6}$$

A2. Production

There is a fixed cost in terms of labour of producing manufacturing varieties, $F > 0$, and a constant variable cost. The total amount of labor, l, required to produce x units of a variety is:

$$l = F + x, \tag{7}$$

where we have normalized the variable labour requirement to one.

Profit maximization subject to a downward sloping demand curve for each manufacturing variety yields the standard result that the equilibrium free on board price of manufacturing varieties is a constant mark-up over marginal cost:

$$p_i = \left(\frac{\sigma}{\sigma - 1}\right) w_i. \tag{8}$$

Combining profit maximization with free entry in manufacturing, equilibrium output of each manufacturing variety equals the following constant:

$$\overline{x} = \overline{x}_i = \sum_c x_{ic} = F(\sigma - 1). \tag{9}$$

A3. Manufacturing Wage Equation

Given demand in all markets, the free on board price charged by a manufacturing firm in each city must be low enough in order to sell a quantity $\overline{x}$ and cover the firm's fixed production costs. We saw above that free on board prices are a constant mark-up over marginal cost. Therefore, given demand in all markets, the equilibrium wage in city i, w_i, must be sufficiently low in order for a manufacturing firm to sell $\overline{x}$ and cover its fixed production costs. Together, equations (4), (8) and (9) define the following *manufacturing wage equation*:

$$\left(\frac{\sigma w_i}{\sigma - 1}\right)^{\sigma} = \frac{1}{\overline{x}} \sum_c \left(w_c L_c\right) \left(P_c^M\right)^{\sigma-1} \left(T_{ic}\right)^{1-\sigma}. \tag{10}$$

This relationship pins down the maximum wage that a manufacturing firm in city i can afford to pay given demand in all markets and the production technology.

On the right-hand side of the equation, market c demand for varieties produced in i depends on total expenditure on manufacturing varieties, $\mu E_c = w_c L_c$, the manufacturing price index, P_c^M, that summarizes the price of competing varieties, and on trade costs, T_{ic}. Total demand for varieties produced in i is the weighted sum of demand in all markets, where the weights are bilateral trade costs, T_{ic}.

Defining the weighted sum of market demands faced by firms as *firm market access*, FMA_i, the manufacturing wage equation may be written more compactly as:

$$w_i = \xi \left[FMA_i\right]^{1/\sigma}, \qquad FMA_i \equiv \sum_c \left(w_c L_c\right) \left(P_c^M\right)^{\sigma-1} \left(T_{ic}\right)^{1-\sigma}, \tag{11}$$

where $\xi \equiv \left(F\left(\sigma - 1\right)\right)^{-1/\sigma} \left(\sigma - 1\right)/\sigma$ collects together earlier constants. It is clear from the manufacturing wage equation that cities close to large markets (lower trade costs T_{ic} to high values of $\left(w_c L_c\right)\left(P_c^M\right)^{\sigma-1}$) will pay higher equilibrium nominal wages.

A4. Factor Market Equilibrium

With integrated factor markets, individuals will move across cities to arbitrage away real wage differences. The real wage depends on the price of traded manufacturing varieties and non-traded housing, and we thus obtain the following labor mobility condition:

$$\omega_c \equiv \frac{w_c}{\left(P_c^M\right)^{\mu}\left(P_c^H\right)^{1-\mu}} = \omega, \qquad \text{for all } c \tag{12}$$

where ω_c denotes the real wage and we implicitly assume that all cities are populated in equilibrium.

Labor market clearing implies that labor demand in manufacturing sums to the city population. Using the constant equilibrium output of each variety in equation (9) and the manufacturing production technology in equation (7), the labor market clearing condition may be written as follows:

$$L_i = n_i \bar{l}_i = n_i F \sigma, \tag{13}$$

where $\bar{l}_i$ denotes the constant equilibrium labor demand for each variety. This relationship pins down the number of manufacturing varieties produced in each city as a function of city population and parameters of the model.

Substituting for w_c, P_c^M and P_c^H, the labor mobility condition (12) can be re-written to yield an expression linking the equilibrium population of a city (L_c) to the two endogenous measures of market access introduced above, one for firms (FMA_c) and one for consumers (CMA_c), and the exogenous stock of the non-traded amenity (H_c):

$$L_c = \chi (FMA_c)^{\frac{\mu}{\sigma(1-\mu)}} (CMA_c)^{\frac{\mu}{(1-\mu)(\sigma-1)}} H_c, \tag{14}$$

which is equation (2) in the paper, where $\chi \equiv \omega^{-1/(1-\mu)} \xi^{\mu/(1-\mu)} \mu / (1-\mu)$ is a function of the common real wage ω.

A5. General Equilibrium

General equilibrium is fully characterized by a vector of seven variables $\{w_c, p_c, L_c, n_c, P_c^M, P_c^H, E_c\}$. The equilibrium vector is determined by the system of seven equations defined by (11), (8), (12), (13), (3), (5) and (6). All other endogenous variables can be written as functions of this vector. As usual in the new economic geography literature, the inherent non-linearity of the model makes it impossible to find closed form solutions for the equilibrium values. We therefore calibrate the model to observed city populations in pre-war Germany and simulate the implications of the imposition of the East-West border.

B Calibration and Simulation

In Section 3.3 of the paper we calibrate the model and simulate the impact of Germany's division using central values of the model's parameters from the existing literature. In this section of the technical appendix, we discuss in further detail the calibration and simulation of the model.

The choice of values for the model's main parameters – the elasticity of substitution (σ), the share of manufacturing in expenditure (μ) and the elasticity of transport costs with respect to distance (ϕ) – is discussed in Section 3.3 of the paper. The only other parameter of the model is the fixed cost for manufacturing varieties (F). As this parameter rescales the number of manufacturing varieties, we set it equal to one without loss of generality.

To determine the stock of the non-traded amenity in each city, we calibrate the model by using the system of equations that characterize general equilibrium to solve for the values that the non-traded amenities must take in order for the 1939 distribution of population across cities in pre-war Germany to be an equilibrium of the model with real wage equalization. More specifically, the calibration takes the distribution of population in pre-war Germany (L_c) as given, and solves for the equilibrium values of the other elements of the equilibrium vector $\{n_c,\, p_c,\, P_c^M,\, w_c,\, E_c,\, P_c^H\}$ and the stock of the non-traded amenity $\{H_c\}$ in all cities. These seven variables are determined by solving the seven simultaneous equations that determine general equilibrium, which were discussed above and for ease of reference are collected together below:

$$n_c = \frac{L_c}{F\sigma} \tag{15}$$

$$p_c = \left(\frac{\sigma}{\sigma-1}\right) w_c \tag{16}$$

$$P_c^M = \left[\sum_i n_i (p_i T_{ic})^{1-\sigma}\right]^{\frac{1}{1-\sigma}} \tag{17}$$

$$w_c = \xi \left[\sum_i (w_i L_i) \left(P_i^M\right)^{\sigma-1} (T_{ic})^{1-\sigma}\right]^{\frac{1}{\sigma}} \tag{18}$$

$$E_c = \frac{w_c L_c}{\mu} \tag{19}$$

$$P_c^H = \frac{(1-\mu) E_c}{H_c} \tag{20}$$

$$\omega_c \equiv \frac{w_c}{(P_c^M)^{\mu} \left(P_c^H\right)^{1-\mu}} = \omega \tag{21}$$

where $\xi \equiv (F(\sigma-1))^{-1/\sigma} (\sigma-1)/\sigma$.

Changing units in which the non-traded amenity stock is measured (i.e. increasing or decreasing the stock of the non-traded amenity in each city by the same proportion) changes the value of the common real wage across all pre-war German cities. We choose units for the non-traded amenity stock such that the common real wage ω across all pre-war German cities is equal to one.

As discussed in the paper, we simulate the impact of division on West German city populations by assuming that transport costs to cities East of the new border between East and West Germany become prohibitive. The simulation solves for the new general equilibrium of the model, allowing the population of the West German cities to endogenously reallocate until a new long-run equilibrium is reached where real wages are equalized across West German cities. In particular, the simulation takes the stock of the non-traded amenity in each West German city (H_c) as given by the values from the calibration. We solve for the new equilibrium vector $\{n_c,\, p_c,\, P_c^M,\, w_c,\, E_c,\, P_c^H,\, L_c\}$ for West Germany from the system of seven equations that determine general equilibrium. In the new long-run equilibrium, the common real wage across West German cities will be less than one, due to the lost gains from trade with cities in the former Eastern parts of Germany.

C Quantitative Analysis of the Model

In Section 6.1 of the paper we undertake a quantitative analysis of the model and show that it can explain not only the qualitative pattern but also the quantitative magnitude of the decline of West German cities along the East-West German border. In this section of the technical appendix, we discuss in further detail this quantitative analysis of the model, in which we search for the parameter values that minimize the distance between moments in the simulation and the data.

As discussed in the paper, the quantitative predictions of the model depend upon two key relationships, the strength of agglomeration and dispersion forces $\sigma(1-\mu)$ and the coefficient on distance $(1-\sigma)\phi$. These two relationships depend in turn on three parameters: the elasticity of substitution σ, the share of expenditure on manufacturing μ, and the elasticity of transport costs with respect to distance ϕ. We undertake a grid search over the following 21 values of each of these three parameters:

$$\sigma = \left\{ \begin{array}{c} 2.5,\ 2.7,\ 2.9,\ 3.1,\ 3.3,\ 3.5,\ 3.7,\ 3.9,\ 4.1,\ 4.3,\ 4.5,\ 4.7,\ 4.9,\ 5.1,\ 5.3, \\ 5.5,\ 5.7,\ 5.9,\ 6.1,\ 6.3,\ 6.5 \end{array} \right\}$$

$$\mu = \left\{ \begin{array}{c} 0.65,\ 0.66,\ 0.67,\ 0.68,\ 0.69,\ 0.70,\ 0.71,\ 0.72,\ 0.73,\ 0.74,\ 0.75,\ 0.76, \\ 0.77,\ 0.78,\ 0.79,\ 0.80,\ 0.81,\ 0.82,\ 0.83,\ 0.84,\ 0.85 \end{array} \right\}$$

$$\phi = \left\{ \begin{array}{c} 0.10,\ 0.15,\ 0.20,\ 0.25,\ 0.30,\ 0.35,\ 0.40,\ 0.45,\ 0.50,\ 0.55,\ 0.60,\ 0.65, \\ 0.70,\ 0.75,\ 0.80,\ 0.85,\ 0.90,\ 0.95,\ 1.00,\ 1.05,\ 1.10 \end{array} \right\}$$

There are therefore a total of 9,261 possible parameter configurations. As shown in Figures A1 and A2 which are discussed further below, the model is able to explain the quantitative decline of the East-West border cities without having to invoke multiple equilibria, and so we focus on the 5,145 parameter configurations for which $\sigma(1-\mu) > 1$ and the model has a unique stable equilibrium.

As discussed in the paper, for each parameter configuration, we first calibrate the model to the 1939 distribution of population across cities in pre-war Germany, and then simulate the impact of division on the population of West German cities. The simulation solves for the new steady-state equilibrium population of each West German city following division. To compare the predicted changes in steady-state populations in the simulation to our econometric estimates of division's impact on population growth, we annualize the change in steady-state populations in the simulation over the 38-year period from 1950 to 1988.

To show how the magnitude of the simulated division treatment varies across alternative parameter configurations, Figures A1 and A2 of this technical appendix present three-dimensional graphs of the simulated division treatments for small and large cities respectively. The simulated division treatment for each group of cities is the difference between the mean population growth of cities within 75 kilometers of the East-West border and the mean population growth of cities beyond 75 kilometers of the East-West border. As in the paper, small and large cities are defined as those with a 1919 population below and above the median for the future West Germany. The figures display the simulated division treatments as a function of the strength of agglomeration and dispersion forces, $\sigma(1-\mu)$, and the coefficient on distance, $(1-\sigma)\phi$. The figures show three-dimensional surfaces, which are constructed through the 5,145 discrete points of our parameter grid using triangle-based linear interpolation.

From the figures, the model is well-behaved in $\sigma(1-\mu)$ and $(1-\sigma)\phi$ space. The magnitudes of the simulated division treatments for small and large cities vary intuitively with parameter values. The simulated division treatments are decreasing in the value of $\sigma(1-\mu)$, because a higher value of $\sigma(1-\mu)$ implies weaker agglomeration and stronger dispersion forces. As the elasticity of substitution σ increases, the varieties of different cities become closer substitutes, diminishing the benefits of proximity to large markets. Similarly, as the share of the non-traded amenity in expenditure $(1-\mu)$ increases, the higher price of the non-traded amenity in larger markets acts as a stronger dispersion force.

As also shown in the figures, the simulated division treatments are greatest for intermediate values of the distance coefficient $(1-\sigma)\,\phi$. On the one hand, when the distance coefficient is equal to zero, markets in the former Eastern parts of Germany are of equal importance to all West German cities. Therefore the loss of Eastern market access caused by German division has no differential effect on the relative population of West German cities close to and far from the new border. On the other hand, as the coefficient on distance converges to minus infinity, trade between cities approaches zero. Therefore markets in the former Eastern parts of Germany become of negligible importance to all West German cities, and so again German division has no differential effect on the relative population of West German cities close to and far from the new border.

Comparing the magnitudes of the simulated declines in the figures to the estimated declines of -1.097 and -0.384 percentage points per annum for small and larger cities respectively, the simulated declines become substantially larger than the estimated declines as one approaches the threshold for multiple equilibrium at which $\sigma\,(1-\mu)=1$. The figures also show that, for given parameter values, the simulated division treatment is greater for small than for large cities. The reason, as discussed in the paper, is that the own market is less important relative to markets in other cities for small cities than for large cities. Therefore, the loss of access to markets in the former Eastern parts of Germany has a larger proportionate impact on overall market access for small cities than for large cities.

D Robustness of Empirical Results

In this section of the technical appendix, we discuss in more detail the robustness of our baseline parametric results in Section 5.2 and Table 2 of the paper to alternative samples and specifications.

First, we have augmented our baseline empirical specification in equation (3) of the paper with either state ("Länder") fixed effects or city fixed effects. In our baseline empirical specification, the inclusion of the East-West German border dummy controls for time-invariant heterogeneity between the treatment and control groups of cities. Therefore, with a balanced panel, the inclusion of state or city fixed effects merely allows for additional time-invariant heterogeneity within the treatment and control groups of cities. As a result, the point estimate of the treatment effect of division γ remains unchanged, but the standard error differs. While the standard error is marginally higher after the inclusion of state or city fixed effects, the treatment effect of division remains highly statistically significant.

Second, to explore the sensitivity of the results to specific subsets of observations, we have re-estimated the baseline specification excluding individual states from the regression. Additionally, we have also excluded cities that are close to the coast, which may depend less on market access within Germany. In each case, we find that division leads to a quantitatively similar and highly statistically significant decline in the population growth of cities along the East-West German border relative to other West German cities.

Third, while a key advantage of our baseline sample is that it selects cities based on pre-treatment characteristics, a disadvantage of this strategy is that we examine a fixed number of cities and therefore abstract from the emergence of new cities. To address this concern we have also re-estimated our baseline specification for an alternative sample of all West German cities with a population greater than 50,000 in 2002. We track the population of each of these cities back in time as far as data are available, which yields an unbalanced panel in which the number of cities increases over time. Re-estimating our baseline specification (equation (3) in the paper) using this alternative sample, the estimated coefficient (standard error) on the division treatment is -0.611 (0.244). Therefore the estimated treatment effect of division is not driven by the consideration of a fixed number of cities.

Fourth, our sample is based on all West German cities which had more than 20,000 inhabitants in 1919. However, if a settlement with a population between 10,000 and 20,000 inhabitants in 1919 merges with a city in our sample, we aggregate the settlement with the city in all years of our sample. While these aggregations make the administrative city data more comparable over time, one concern is that we may be supplementing our sample with particularly successful population centres. To address this concern, we first re-estimated our baseline specification dropping the eight cities for which such an aggregation occurs. As shown in Column (1) of Table A1, the estimated treatment effect of division is virtually unchanged from Column (1) of Table 2 of the paper. Additionally, we have also regressed a city-year dummy variable that is equal to one when these aggregations occur on the same right hand side variables as in our baseline specification in equation (3) of the paper. In this regression, as shown in Column (1) of Table A2, we find no evidence of a statistically significant correlation between these aggregations and the division treatment. Therefore, our estimate of the treatment effect of division does not appear to be sensitive to the aggregation of cities with smaller settlements with a population between 10,000 and 20,000 inhabitants in 1919.

As discussed in the data section of the paper, we also aggregate cities with more than 20,000 inhabitants in 1919 that merge during our time period for all years in the sample. Overall 20 cities in our sample are the result of aggregations, either because of a merger with a smaller settlement as discussed above and/or because of a merger between cities with more than 20,000 inhabitants in

1919. As a further robustness test, we have also re-estimated our baseline specification excluding any city in our sample which is the result of an aggregation. As shown in Column (2) of Table A1, we again find an almost identical pattern of results to that in our baseline specification from Column (1) of Table 2. Additionally, we regressed a city-year dummy variable that is equal to one when any aggregation occurs on the same right hand side variables as in our baseline specification in equation (3) of the paper. Again, as shown in Column (2) of Table A2, there is no evidence of a statistically significant correlation between aggregations and the division treatment. These results provide further evidence that our estimate of the treatment effect of division is not sensitive to the aggregations of the administrative city data.

Finally, there also smaller changes in city boundaries that we cannot control for through our aggregations. To explore whether our estimate of the treatment effect of division is influenced by these smaller changes in city boundaries, we have excluded all city-year observations in which such a boundary change occurs. The estimated division treatment is again virtually unchanged, as shown in Column (3) of Table A1. In addition, we have regressed a city-year dummy variable that is equal to one if one of these smaller boundary changes occurs on the same right hand side variables as in our baseline specification in equation (3) in the paper. As shown in Column (3) of Table A2, we find no evidence of a statistically significant correlation between such boundary changes and the division treatment. Therefore, our estimate of the treatment effect does not appear to be sensitive to smaller changes in city boundaries not captured in our aggregations. This pattern of results is consistent with the idea that city boundary changes are primarily driven by idiosyncratic factors, such as the historical location of settlements relative to administrative boundaries.

E Data

As discussed in Section 4.1 of the paper, we aggregate cities which merge between 1919 and 2002 for all years in our sample, and we also aggregate any settlement with a population greater than 10,000 in 1919 that merges with one of our cities for all years in the sample. The following list reports for each city in our dataset the cities or settlements that it has absorbed and the years in which the merger occurred.

Bergisch Gladbach	1975 absorbed Bensberg
Beuthen	1927 absorbed Rossberg
Bochum	1929 absorbed Langendreer and Linden-Dahlhausen 1975 absorbed Wattenscheid
Bonn	1969 absorbed Bad Godesberg
Bremerhaven	1939 absorbed Wesermünde (Wesermünde is itself the result of a merger between Geestemünde and Lehe in 1924)
Dortmund	1928 absorbed Hörde
Düsseldorf	1929 absorbed Benrath
Duisburg	1929 absorbed Hamborn 1975 absorbed Homberg, Rheinhausen and Walsum
Essen	1929 absorbed Katernberg, Kray and Steele
Frankfurt am Main	1928 absorbed Höchst
Gelsenkirchen	1924 absorbed Rotthausen 1928 absorbed Buer and Horst (Emscher)
Hagen	1929 absorbed Haspe
Hamburg	1938 absorbed Altona, Wandsbek and Harburg-Wilhelmsburg (Harburg-Wilhelmsburg were themselves separate cities until 1927)
Hannover	1920 absorbed Linden
Herne	1975 absorbed Wanne-Eickel (Wanne and Eickel were themselves separate cities until 1926)
Hindenburg	1927 absorbed Zaborze
Köln	1975 absorbed Rodenkirchen and Porz
Mönchengladbach	1975 absorbed Rheydt (Rheydt itself merged in 1929 with Odenkirchen)
Oberhausen	1929 absorbed Sterkrade and Osterfeld
Potsdam	1939 absorbed Nowawes
Solingen	1929 absorbed Ohligs and Wald
Wiesbaden	1926 absorbed Biebrich
Wilhelmshaven	1937 absorbed Rüstringen
Zwickau	1944 absorbed Planitz

We also record all city-year observations in which a city reports a smaller change in boundaries as a result of a merger with another settlement whose population we are unable to track. This information was taken from each city's official webpage and http://de.wikipedia.org/.

Figure A1: Simulated Treatment Effect of Division for Small Cities

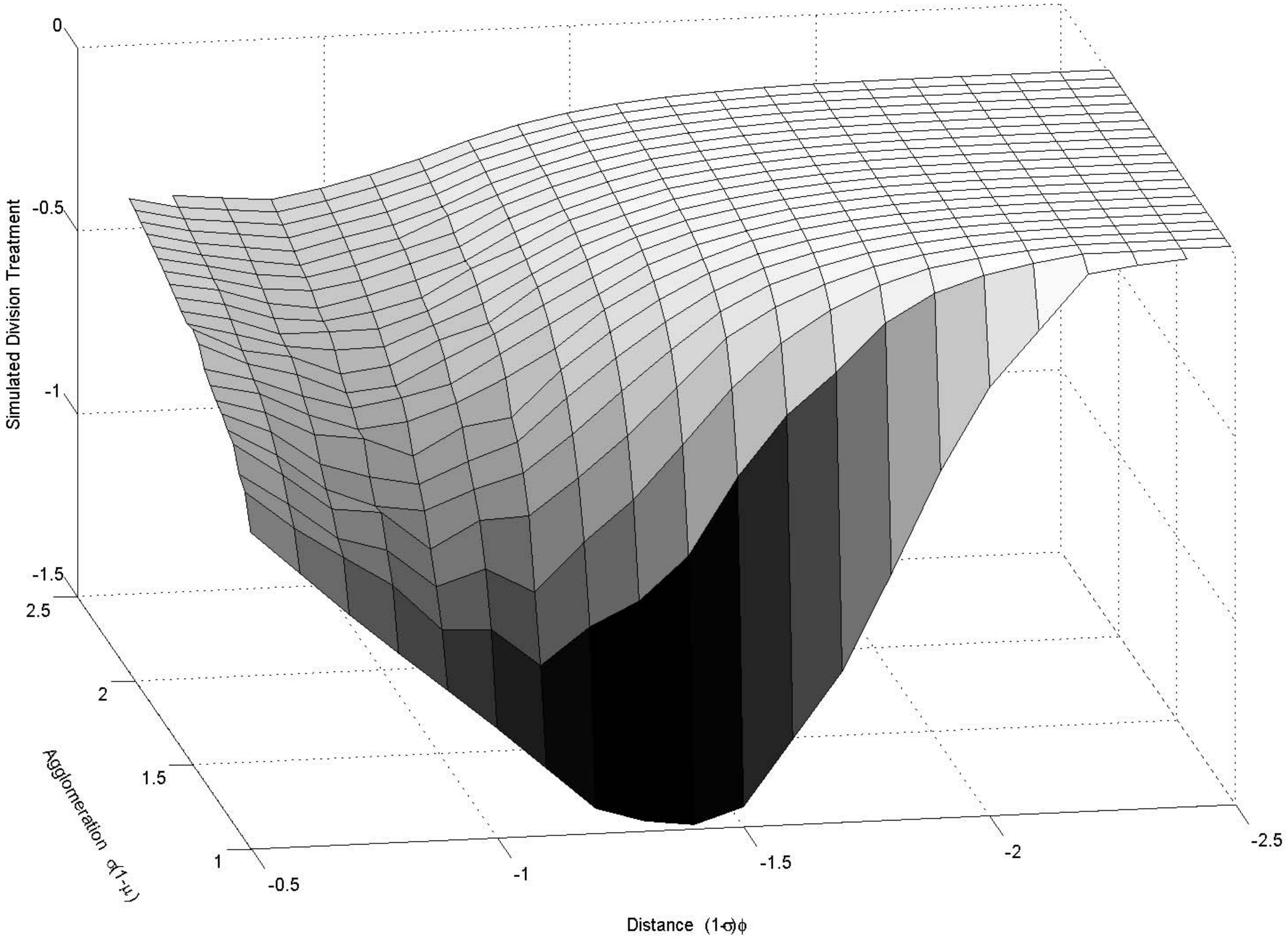

Figure A2: Simulated Treatment Effect of Division for Large Cities

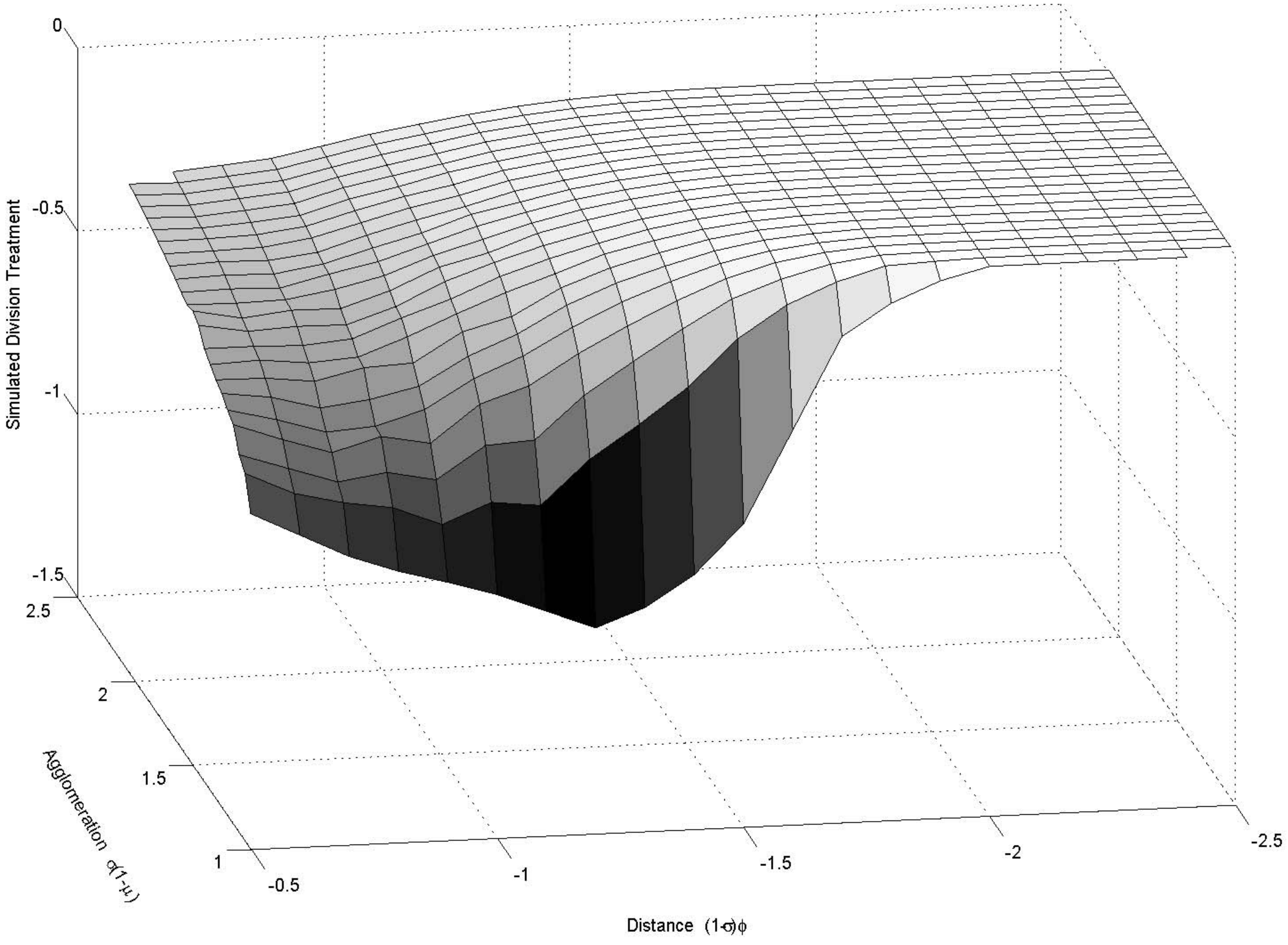

Table A1 - Robustness to Excluding Aggregations

	Population Growth (1)	Population Growth (2)	Population Growth (3)
Border × Division	-0.775***	-0.871***	-0.759***
	(0.185)	(0.201)	(0.187)
Border	0.128	0.148	0.183
	(0.141)	(0.151)	(0.153)
Year Effects	Yes	Yes	Yes
Sample Exclusion	Small Aggregations	All Aggregations	Other city-year Boundary Changes
Observations	777	693	718
R-squared	0.21	0.21	0.35

Notes: The dependent variable and explanatory variables are the same as in Table 2 of the paper. Column (1) excludes from the sample in Table 2 cities that merge with a settlement with a population in between 10,000 and 20,000 inhabitants in 1919 in all years of the sample. Column (2) excludes from the sample in Table 2 these cities as well as cities that merge with another city in all years of the sample. Column (3) excludes from the sample in Table 2 any city-year observation in which a city reports a smaller change in its boundaries. 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.

Table A2 - Aggregations and the Division Treatment

	Small Aggregations Dummy (1)	All Aggregations Dummy (2)	City-year Boundary Change Dummy (3)
Border × Division	0.003	-0.004	-0.024
	(0.008)	(0.026)	(0.054)
Border	-0.013**	-0.014	0.002
	(0.007)	(0.026)	(0.038)
Year Effects	Yes	Yes	Yes
Observations	833	833	833
R-squared	0.02	0.04	0.24

Notes: The sample and right-hand side variables are the same as in Table 2 of the paper. The left-hand side variable in Column (1) is a city-year dummy variable which equals one when an aggregation occurs between a city and a smaller settlement with a population in between 10,000 and 20,000 inhabitants in 1919. The left-hand side variable in Column (2) is a city-year dummy variable which equals one when any city aggregation occurs. The left-hand side variable in Column (3) is a city-year dummy variable which equals one when a city reports a smaller change in its boundaries that is not included in our aggregations. In all three columns we estimate linear probability models. 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.