The Costs of Remoteness: Evidence from German Division and Reunification*

Stephen J. Redding†
London School of Economics, Princeton and CEPR

Daniel M. Sturm‡
University of Munich and CEPR

March 2006

Abstract

This paper exploits the division of Germany after the Second World War and the re-unification of East and West Germany in 1990 as a natural experiment to provide evidence of the importance of market access for economic development. In line with a standard new economic geography model, we find that following division cities in West Germany that were close to the new border between East and West Germany experienced a substantial decline in population growth relative to other West German cities. We provide several pieces of evidence that the decline of the border cities can be entirely accounted for by their loss in market access and is neither driven by differences in industrial structure nor differences in the degree of war-related disruption. Finally, we also find some first evidence of a recovery of the border cities after the re-unification of East and West Germany.

Keywords: Market Access, Economic Geography, German Division, German Reunification

JEL classification: F15, N94, O18

*We are especially grateful to James Harrigan and Peter Neary for discussions and suggestions. We would also like to thank conference and seminar participants at the NBER, CEPR, Harvard, Princeton, Berkeley, Brown, LSE, Dartmouth, Berlin, Mannheim and Munich, and Tim Besley, Gilles Duranton, Theo Eicher, Keith Head, Henry Overman, Steve Pischke, Albrecht Ritschl, Tony Venables and Niko Wolf for their comments. We are also very grateful to Alexander Knapp, Mirabelle Muuls, Ralph Ossa and Marco Schonborn for excellent research assistance. This paper was produced as part of the Globalisation Programme of the ESRC-funded Centre for Economic Performance, LSE. Redding also acknowledges financial support from the Leverhulme Trust and Princeton. Sturm also acknowledges financial support from the German Science Foundation through SFB/TR 15 and the European Union TMR Network on the Economic Geography of Europe. The usual disclaimer applies.

†Department of Economics, Princeton Universtiy, Fisher Hall, Princeton, NJ 08544-1021, Tel: (609) 258 7440 E-mail: reddings@princeton.edu

‡Department of Economics, University of Munich, Ludwigstr. 28 (Vgb), 80539 Munich, Germany. Tel: +49-89-2180 1363. E-mail: daniel.sturm@lmu.de

1. Introduction

One of the most striking empirical regularities is the huge divergence in economic activity both within and across countries. A number of – not mutually exclusive – explanations for this fact have been proposed. An influential view is that differences in institutions, such as the protection of private property, can explain a large part of the differences in economic performance.[1] An alternative explanation is that differences in natural endowments, such as climatic conditions and the disease environment, can account for these income differences.[2] A third view that has featured less prominently in the debate is the role of market access in explaining spatial variation in economic activity, as emphasized in the literature on new economic geography following Krugman (1991), Hanson (1996) and Davis and Weinstein (2002).[3]

In this paper we exploit the division of Germany after the Second World War and the reunification of East and West Germany in 1990 as a source of exogenous variation to provide evidence for the causal importance of market access for economic development. Map 1 illustrates how the new border between East and West Germany that emerged in the wake of World War II separated areas that had been part of the same state since 1871 and had been highly integrated for several centuries. The drawing of the border was motivated by military considerations and was based on allocating occupation zones of roughly equal population to the American, British and Russian armies. With the collapse of the wartime alliance between the Western Powers and Russia, the new border between East and West Germany became one of the best guarded and most sealed in the world, and all economic interactions across the border ceased. As a result, West German cities close to the new border experienced a disproportionate loss of market access, because these border cities lost nearby trading partners with whom they could previously interact at low transport costs. In contrast, the effect on West German cities further from the border was more muted, because they were more remote from the trading partners lost, and therefore already faced higher transport costs prior to division.

Our approach has a number of attractive features. First, in contrast to cross-country studies there is no obvious variation in institutional quality that could explain the differential performance of the cities in our sample, as both our treatment and control cities are part of the same country throughout our sample period. Second, as we follow cities within West Germany over time, it is also

[1] See for example Acemoglu *et al.* (2001), La Porta *et al.* (1998) and Rodrik *et al.* (2004).

[2] See for example Bloom and Sachs (1998), Diamond (1997) and Gallup *et al.* (1998).

[3] See Fujita *et al.* (1999) and Baldwin *et al.* (2003) for syntheses of theoretical research, and Overman *et al.* (2003) and Head and Mayer (2004a) for surveys of empirical work.

hard to explain our findings in terms of changes in natural advantage, such as access to navigable rivers or coasts, climatic conditions or the disease environment. While the nature of our experiment enables us to control for natural advantage and institutions to reveal the role played by market access, our analysis certainly does not imply that these other factors do not also have a role to play. Third, the change in market access following German division is much larger than typically observed in other contexts and we are able to observe the effects over a long period of time. Finally, the military and political considerations that determined the border are unlikely to be correlated with pre-war characteristics of cities. Taken together these features of our approach enable us to empirically disentangle the effects of market access from other determinants of comparative economic development.

Our paper proceeds as follows. We begin by discussing the historical background to German division and reunification in Section 2. To guide our empirical investigation, Section 3 develops a multi-region version of the Helpman (1998) model of economic geography. The model formalizes the role of market access in shaping the distribution of population across space. We calibrate the model to city-level data for Germany in 1939 and simulate the impact of post-war division on the equilibrium distribution of population across West German cities.[4] We focus on West Germany which remained a market-based economy after division. The central prediction of the model is that the relatively larger loss of market access for cities close to the new border will lead to a reallocation of population away from those cities to other West German cities.

We test this prediction using a rich panel of data on West German cities over the period 1919 to 2002. Our basic empirical strategy, which is developed in Section 4, is a 'difference in differences' specification that compares population growth in West German cities close to and far from the new East-West border both prior to and after division. Our basic empirical finding, reported in Section 5, is that after division West German cities close to the new border between East and West Germany experience a marked decline in population growth relative to other West German cities. Over the 40 year period of division, we estimate a decline in the annualized rate of population growth of 0.75 percentage points relative to other West German cities, implying a cumulative reduction in the relative size of border cities of around one third. The difference in population growth rates for the two groups of cities is not apparent prior to division but emerges in its immediate aftermath. The estimated effect is strongest in the 1950s and 1960s and declines over time, consistent with gradual adjustment towards a new long-run equilibrium distribution of population.

[4] Throughout the paper, the phrases "pre-war" or "post-war" relate to the Second World War.

While suggestive of the importance of market access, the observed decline in the border cities is also potentially consistent with other explanations. First, cities close to the new border could have specialized in industries that experienced a secular decline in the post-war period. Second, the border cities could have suffered different levels of war-related disprution, both in terms of war destruction and/or refugees from the former Eastern parts of Germany. Any such variation in the level of war-related disruption could have influenced the relative post-war development of West German border and non-border cities. Finally, a belief that the border cities would be particularly vulnerable in case of a new armed conflict in Western Europe could have contributed towards their relative decline.

To further strengthen the case that our results are explained by the loss of market access due to German division, and to exclude these alternative explanations, Section 6 provides several additional pieces of evidence. First, we use a measure of market potential, which is a widely employed empirical proxy for market access, to estimate the loss of market access due to the new border for each West German city in our dataset. We find that the drop in market potential caused by the new border can completely explain the differential growth performance of the border cities. Second, as suggested by the economic geography model, we find that the decline of the border cities is not uniform. Smaller cities are disproportionately affected by the loss of hinterland. Third, we show that parts of the population which are no longer economically active react less to the imposition of the border than the economically active population. Finally, we establish that neither the degree of war-related disruption nor patterns of specialization can explain the relative decline of the border cities.

The division of Germany appeared to be a permanent feature of the geopolitical landscape and the reunification of East and West Germany caught most contemporary observers by surprise. Reunification therefore provides an additional source of exogenous variation in market access. However, compared to division, the reunification of East and West Germany is a much smaller experiment, as discussed in Section 7. In line with this, we find a similar pattern of results but on a much smaller scale. We expect that the recovery of the former border cities will become more substantial as convergence between East and West Germany progresses over the next decades.

A substantial empirical literature has previously examined the link between access to markets and economic development. One strand in this literature uses measures of market access to explain differences in factor prices or the location of production across regions or countries (see, for example, Davis and Weinstein 2002, 2003, Hanson 2005, Head and Mayer 2004b, 2005, and Redding and

Venables 2004).[5] Another strand in this literature follows Hanson's (1996a, 1996b, 2001) analysis of the effects of the trade integration between Mexico and the United States, and considers trade literalizations as a source of variation in market access. Recent contributions to this literature include Overman and Winters (2004) for the United Kingdom and its integration into the European Union, Paluzie et al. (2002) for early-twentieth century Spain, and Wolf (2006) for early-twentieth century Poland.[6]

The central challenge facing this literature is to disentangle the influence of market access from other factors affecting the spatial distribution of economic activity. While there is a clear association between levels of economic activity and market access, skepticism regarding the causal interpretation of this association arises in part from the fact that theoretical models of economic geography themselves suggest that market access is endogenous. Localized shocks to income in a region will also change the region's market access both directly – as the size of the region's own market is part of its market access – and indirectly by changing neighboring regions' market access and hence income, which in turn influences the region's own market access. One strategy to overcome this problem has been to use instruments for market access, which have included lagged population levels or growth rates, lagged transportation infrastructure, the distance of U.S. counties from the eastern seaboard, or the distance of countries from the United States, Europe and Japan. However, these instruments are only valid under demanding identification assumptions, which are unlikely to be satisfied in practice.

Similarly, the use of trade liberalizations as a source of exogenous variation in market access is also problematic. One reason is that a large political economy literature models trade protection as an endogenous outcome that is determined by industry characteristics, such as supply and demand elasticities and the ratio of imports to industry output.[7] Therefore, changes in trade policy may not only alter market access and so result in changes in income or production, but changes in income or production may also lead to endogenous changes in trade policy and hence market access. The key innovation of our paper is to exploit the large and exogenous variation in market access due to German division and reunification to provide evidence on the causal relationship between market access and economic development.

[5] Related work examines the connection between countries' openness to trade and income levels or growth, as in Frankel and Romer (1999) and Alcalá and Ciccone (2002).

[6] Another related literature examines the effects of borders, and distance more generally, on trade flows. See in particular McCallum (1995) and Anderson and van Wincoop (2003).

[7] See for example the large literature following Grossman and Helpman (1994). The theoretical predictions of this literature receive empirical support in Goldberg and Maggi (1999) and subsequent contributions.

2. Historical Background

In the wake of World War II Germany's boundaries changed dramatically. Map 1 illustrates how pre-war Germany was divided into four different parts: West and East Germany, areas that became part of Poland and finally an area that became part of Russia. West Germany, which was the largest of these parts, accounted for approximately 53 percent of the area and just over 58 percent of Germany's 1939 population of 69.3 million.[8] East Germany comprised approximately 23 percent of the area and 22 percent of the 1939 population of Germany. The areas that became part of Poland and Russia contained 24 percent of the area of pre-war Germany and accounted for nearly 14 percent of the 1939 population. East and West Berlin comprised the remaining 6 percent of the 1939 population. The new border between East and West Germany cut through some of the most central regions of pre-war Germany that had been integrated for several centuries.[9]

The political process leading to the eventual division of pre-war Germany took several unexpected turns (see for example Franklin 1963, Kettenacker 1989 and Loth 1988). While a number of proposals to divide Germany after its eventual defeat were discussed during the early phase of World War II, the United States and Russia backed off such plans towards the end of the war. Instead the main planning effort was to organize the eventual military occupation of Germany. Early on it was decided to allocate separate zones of occupation to the American, British and Russian armies. The planning process for the zones began in spring 1943, negotiations continued during 1944, and the protocol formalizing the zones was signed in London in September 1944. The protocol divided pre-war Germany into three zones of roughly equal population, after excluding the areas that were expected to become part of Poland and Russia. Additionally it was agreed that Berlin would be jointly occupied.[10] The protocol was modified in 1945 to create a small French zone by reducing the size of the British and American zones.

As tensions between the Western allies and Russia increased with the onset of the cold war, the

[8] All figures in this paragraph are taken from the 1952 edition of the "Statistisches Jahrbuch für die Bundesrepublik Deutschland." The data on area and 1939 population are based on the 1937 boundaries of Germany prior to territorial expansion immediately prior to and during the Second World War.

[9] As a point of comparison the territory of Germany was reduced by just 13 percent, which contained approximately 10 percent of its population, as part of the peace treaty at the end of World War I ("Statistisches Jahrbuch für das Deutsche Reich" 1921/1922). Furthermore, these areas were small border regions along the eastern, western and northern edges of Germany.

[10] In early 1944, when the protocol on the occupation zones was negotiated British and American planners believed that the Russian army was likely to capture most of Germany (see for example Sharp 1975). These expectations turned out to be severely mistaken as the American and British armies captured substantially more of pre-war Germany than their future zones of occupation. Shortly after the end of hostilities, American and British troops retreated from substantial parts of East Germany back to the line which had been agreed in the protocol on the zones of occupation in September 1944.

zones of occupation became the nucleus for the foundation of an East German and a West German state in 1949. The territory of West Germany was the combined area of the British, French and American zones, and was extended to include the Saarland from 1957 onwards. East Germany was founded on the Russian zone of occupation. While the two countries maintained some politically motivated and largely symbolic economic cooperation, local economic links between areas on either side the border were suppressed from 1949 when East Germany introduced central planning into its economy. From 1952 onwards extensive border fortifications emerged and the new border between East and West Germany became one of the most sealed and best guarded in the world.

In the closing stages of World War II and its immediate aftermath, there was a wave of migration from the former Eastern parts of Germany and other German settlements in Eastern Europe to the future West Germany. Even though the main border between East and West Germany was closed in 1952, there remained until 1961 the possibility for limited transit between East and West Berlin. After the construction of the Berlin Wall in August 1961, migration between East and West Germany virtually ceased.[11]

The division of Germany was formalized in international treaties and was generally believed to be permanent.[12] Increasing dissatisfaction among East Germans about heavy restrictions on mobility, lack of personal freedom and the declining performance of the East German economy led to large scale demonstrations in 1989 and culminated in the fall of the Berlin Wall on 9 November 1989. In the aftermath of these events, the East German system rapidly began to disintegrate. Only eleven months later East and West Germany were formally reunified on 3 October 1990.

3. Theoretical Framework

In this section, we outline a multi-region version of the Helpman (1998) model of economic geography, calibrate the model to data for pre-war Germany, and use the calibrated model to simulate the effects of German division.[13] The model determines the distribution of population across cities as the outcome of a tension between agglomeration and dispersion forces. The two

[11] Between the census in 1939 and 1950 the population of what would later become West Germany increased from 39.3 million to 47.7 million. Between 1950 and 1961, an estimated 3.6 million refugees migrated from East to West Germany. In the three years leading up to 1961, the average flow of refugees was around 210,000 per year. In the three years after 1961, the average flow dropped to around 36,000 per year. These flows accounted for around one third and 5 percent of the population growth rate for West Germany over the respective periods (see Bethlehem 1982).

[12] The so called Basic Treaty ("Grundlagenvertrag") of December 1972 between East and West Germany recognized "two German states in one German nation." Following this treaty East and West Germany were accepted as full members of the United Nations.

[13] A more detailed exposition of the model is contained in a technical appendix available from the authors. For related theories of city development, see Henderson (1974) and Black and Henderson (1999).

agglomeration forces are a "home market effect," where increasing returns to scale and transport costs imply that firms want to concentrate production near to large markets, and a "cost of living effect," where consumer love of variety and transport costs imply a lower cost of living near to large markets. The two dispersion forces are a "competition effect," where transport costs imply that firms close to large markets face more intense product market competition, and a "congestion effect," where an increase in population raises the price of a non-traded amenity, and so implies a higher cost of living near to large markets.

3.1. Endowments, Preferences and Technology

The economy consists of a fixed number of cities $c \in \{1, \ldots, C\}$, each of which is endowed with an exogenous stock of a non-traded amenity, H_c, in perfectly inelastic supply.[14] There is a mass of representative consumers, L, who are mobile across cities and are endowed with a single unit of labor which is supplied inelastically with zero disutility. Each consumer allocates a constant share of expenditure μ to horizontally differentiated varieties of traded manufacturing goods, and devotes the remaining share $(1-\mu)$ to consumption of the non-traded amenity, where $0 < \mu < 1$. The differentiation of manufacturing varieties takes the Dixit-Stiglitz form, so that there is a constant elasticity of substitution $\sigma > 1$ between individual varieties.

Manufacturing varieties are produced using labor which is the sole factor of production. The production of each manufacturing variety involves a fixed cost and a constant marginal cost. Manufacturing varieties are produced under conditions of monopolistic competition, and can be traded between cities subject to an iceberg transport cost, whereby $T_{ic} > 1$ units must be shipped from city i to city c in order for one unit to arrive.

3.2. Equilibrium City Size

The population of cities is determined endogenously by a labor mobility condition which requires workers to receive the same real wage in all cities that are populated in equilibrium. The real wage in a city depends on the consumer price index for traded manufacturing varieties and the price of the non-traded amenity. Therefore, labor mobility implies:

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

[14] In Helpman (1998), the stock of the non-traded amenity is interpreted as housing, but it captures any immobile resource which generates congestion costs, and therefore acts as a force for the dispersion of economic activity.

where ω_c is the real wage; w_c is the nominal wage; P_c^M is the Dixit-Stiglitz price index for manufacturing varieties; and P_c^H is the price of the non-traded amenity.

Substituting for w_c, P_c^M and P_c^H the labor mobility condition can be re-written to yield an expression linking the equilibrium population of a city (L_c) to two endogenous variables, market access (MA_c) and supplier access (SA_c), and the exogenous stock of the non-traded amenity (H_c):

$$L_c = \chi (MA_c)^{\frac{\mu}{\sigma(1-\mu)}} (SA_c)^{\frac{\mu}{(1-\mu)(\sigma-1)}} H_c \tag{2}$$

where χ is a constant and $\sigma > 1$.

'Market access' (MA_c) summarizes a city's proximity to demand in all markets and determines the highest nominal wage that firms in a city can afford to pay in a zero-profit equilibrium. It is defined as: $MA_c \equiv \sum_i (w_i L_i) \left(P_i^M\right)^{\sigma-1} (T_{ci})^{1-\sigma}$, where demand in market i for city c's varieties depends on total labor income ($w_i L_i$), the manufacturing price index (P_i^M), and transport costs (T_{ci}). Market access includes both the "home market effect" (through income and hence expenditure) and the "competition effect" (through the manufacturing price index). Supplier access (SA_c) summarizes a city's proximity to sources of supply, including the number of varieties produced in each location (n_c), the 'free on board' prices of those varieties (p_i) and the costs of transportation (T_{ic}): $SA_c \equiv \sum_i n_i (p_i T_{ic})^{1-\sigma}$. Supplier access captures the "cost of living effect," since cities with higher supplier access have lower manufacturing price indices.[15] Finally, the stock of the non-traded amenity is the source of the "congestion effect."

The intuition behind the equilibrium relationship in equation (2) is straightforward. An increase in market access enables local firms to pay higher nominal wages, which will lead to an inflow of population until the price of the non-traded amenity has increased sufficiently in the city (and fallen elsewhere) that real wages are again equalized across cities. Similarly, an increase in supplier access reduces the cost of consuming manufacturing varieties in the city and will also result in a population inflow until the price of the non-traded amenity has adjusted sufficiently to re-establish real wage equalization. Finally, an increase in the stock of the non-traded amenity reduces its price, which again has to be offset by an increase in population in the city.

The labor mobility condition (1) is clearly a long-run relationship. After an exogenous shock to market and supplier access, adjustment costs imply that it will take some time for city populations to adjust towards their new steady-state values. The simplest way to model such an adjustment

[15] Clearly both market and supplier access are concerned with access to markets, whether for firms or consumers. Therefore, in the empirical analysis below, we will use the term market access to refer to both concepts except when the distinction between them is important.

process is to assume, as in Krugman (1991) and Fujita *et al.* (1999), that migration is proportional to the real wage gap between cities.[16]

The full general equilibrium of the model is characterized by a system of seven equations that determine the equilibrium nominal wage, price of manufacturing varieties, manufacturing price index, price of the non-traded amenity, aggregate expenditure and city population. All other endogenous variables of the model can be written as functions of this equilibrium vector $\{n_c,\ p_c,\ P_c^M,\ w_c,\ E_c,\ P_c^H,\ L_c\}$. As usual in the economic geography literature, the non-linearity of the model makes it impossible to find closed form solutions for the equilibrium values. We will therefore calibrate the model to observed city populations in pre-war Germany and simulate the general equilibrium impact of division.

3.3. Calibration and Simulation

The dataset used for the calibration is described in detail in the next section and is the same as employed in the econometric estimation. To calibrate the model, we use central values from the literature for the three key parameters of the model, which are the elasticity of substitution, the level of transport costs, the share of manufacturing goods in total expenditure and the stock of the non-traded amenity in each city, as discussed further in the calibration appendix. For these parameter values, it is the case that $\sigma(1-\mu) > 1$, and the model has a unique stable equilibrium.[17] We use the system of equations that determine general equilibrium to calibrate the stocks of the non-traded amenity in each city which make the 1939 distribution of population across cities in pre-war Germany an equilibrium of the model with real wage equalization.

We simulate the division of Germany after the Second World War by assuming that transport costs between all West German cities in our dataset and cities East of the border between East and West Germany become infinite. We then solve 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.[18] We focus on West Germany, since it remained a market-based economy after division, and therefore we would expect the mechanisms emphasized in the model to apply.

[16] Baldwin (2001) replaces this myopic migration decision with forward-looking rational expectations and finds that the qualitative implications of the economic geography model remain unchanged.

[17] If instead parameter values were such that $\sigma(1-\mu) < 1$, the model has multiple equilibria. In either case market access is central in determining the equilibrium distribution of population across cities, but when there are multiple equilibria, German division could shift the economy between alternative equilibrium population distributions. We return to consider this possibility below when we analyze reunification.

[18] The qualitative results of the simulation do not depend on holding the total West German population constant at its 1939 level.

Figures 1 and 2 display the results of the simulation. Two striking regularities emerge from the simulation. Figure 1 graphs average simulated percentage changes in population against distance from the new East-West border. For ease of interpretation, the percentage changes have been normalized so that their mean across West Germany is equal to zero.[19] The figure shows a sharp decline in the population of cities close to the border, which diminishes rapidly with distance from the border. The size of the mean decline in city populations does not necessarily fall monotonically with distance from the East-West border for several reasons. In particular, distance to the border is only an imperfect proxy for the amount of economic hinterland that a city has lost due to the border, and the impact of division depends on city size. Figure 2 illustrates a marked difference in the simulated impact on the population of small and large cities, defined as cities with a population less than or greater than the 1939 median. For both small and large cities, the figure displays the difference in the average percentage change in population between cities within and beyond 75 kilometers of the East-West border. The simulations show a much larger relative decline in the population of small border cities than large border cities.

The intuition for the decline of cities close to the border is as follows. The drawing of the new border between East and West Germany has three immediate effects. First, all West German cities suffer a fall in supplier access due to the loss of sources of supply in the former Eastern parts of Germany. This reduction in supplier access raises the consumers' cost of living and hence reduces real wages (the "cost of living effect"). Second, the loss of Eastern markets reduces expenditure on West German manufacturing varieties (the "home market effect"). This reduction in expenditure reduces market access, which implies lower nominal and real wages. Third, there is a decrease in product market competition in West German cities due to the loss of competitors from the former Eastern parts of Germany (the "competition effect"), which allows West German firms to pay higher nominal wages, thereby increasing real wages. Because there are gains from trade in the model, the "cost of living effect" and "home market effect" are stronger than the "competition effect." Therefore, the immediate impact of the loss of potential trading partners in the former Eastern parts of Germany is to reduce the real wage in all West German cities.[20]

However, West German cities close to the border are more adversely affected by division than

[19] By construction, the mean of the absolute changes in city populations equals zero, since the total population across all West German cities is held constant in the simulation. However, since cities are of different size, the mean percentage change in city population need not equal zero.

[20] A direct implication of the "cost of living effect" and the "home market effect" being stronger than the "competition effect", is that the model predicts a higher price of the non-traded amemity in larger cities, which is consistent with empirical evidence from land rents.

those further from the border. They had lower transport costs to cities in the former Eastern parts of Germany prior to division, and so experience a greater reduction in the gains from trade. Therefore, the immediate impact of division is to reduce real wages in border cities relative to other West German cities. This reduction in real wages triggers a population outflow from cities close to the border, which further reduces their market and supplier access relative to other cities. The mechanism that restores real wage equalization within West Germany is that the population movements between cities trigger a fall in the price of the non-traded amenity in the border cities relative to other West German cities.[21] In the transition to the new steady-state equilibrium, cities will exhibit different rates of population growth, as the economy gradually adjusts to the exogenous shock of division. In the new long-run equilibrium of the model, the common real wage in West Germany is lower than the equilibrium real wage prior to division, as a result of the lost gains from trade with trading partners in the former Eastern parts of Germany.

The finding that division has a greater impact on the population of small border cities than on those that are larger is also very intuitive. In small cities, the *own* market is less important relative to markets in other cities. Therefore, the loss of access to markets in other cities has a larger proportionate impact on overall market access.

The results of the simulation vary intuitively with parameter values. Increasing the sensitivity of transport costs to distance steepens the rate at which the simulated impact diminishes with distance from the border. Increasing the share of expenditure on the non-traded amenity reduces the magnitude of the effects, as adjustment in the price of the non-traded amenity becomes more important in preserving the attractiveness of border locations. The two main predictions of the model - a large negative effect close to the border that diminishes rapidly with distance from the border and a disproportionately large impact on the populations of small cities - are robust across parameter values. They are basic implications of increasing returns to scale, transport costs and love of variety preferences which mean that the proximity and size of surrounding markets become important in determining a location's attractiveness. In Section 6, we return to consider the parameter values where the simulated decline in the West German border cities in the model is closest to the estimated decline in our econometric results.

[21] If the supply of housing was itself allowed to adjust, depreciating in cities whose population has fallen and expanding in cities whose population has risen, this would magnify the relative decline of cities proximate to the closed border.

4. Empirical Strategy and Data

4.1. Data Description

Our basic dataset is a panel of West German cities covering the period from 1919 until 2002, which includes the populations of all West German cities which had more than 20,000 inhabitants in 1919.[22] For the pre-war period city populations are only available for the census years, which were 1919, 1925, 1933 and 1939. For the division period we have assembled data at 10 year intervals from 1950 (which is the first post-war year for which reliable population data are available) to 1980, and also for 1988 immediately prior to reunification. For the reunification period, we have collected data for 1992 immediately after reunification and 2002. A detailed description of the sources of all our data is contained in the data appendix.

Our data refer to administrative cities as data on metropolitan areas is unavailable over such a long time period for Germany. To ensure that the data on administrative cities are as comparable as possible over time, we aggregate cities which merge between 1919 and 2002 for all years in our sample. In addition we are able to track all settlements with a population greater than 10,000 in 1919 which merge with a city in our sample, in which case we aggregate the settlement with the city for all years in the sample.[23] This results in smooth population series for most cities. Finally, to deal with other smaller changes in city boundaries, we record all city-year observations in which a city reports a merger and the population series for the city is visibly affected. As a robustness test, we drop these city-year observations from the estimation sample.

After aggregating cities that merge we are left with a sample of 119 West German cities, not including West Berlin, which we exclude from all our estimates to avoid that any of our results are driven by the isolated location of West Berlin as an island within East Germany.[24] Table 1 lists the subset of 20 cities out of these 119 cities that were located within 75 kilometers of the East-West border. Distance to the border is measured as the shortest Great Circle Distance from a city to any point on the border between East and West Germany.

The data on population are combined with information on a variety of other city characteristics. First, we have collected data on total employment and employment in industry in each city. For

[22] This choice of sample ensures that the composition of cities is not itself affected by the division of Germany after World War II.

[23] An appendix available from the authors reports details of all aggregations.

[24] We have also excluded the cities Saarbrücken, Saarlouis and Völklingen, which are located in the Saarland on the Western fringes of West Germany. The Saarland was under French administration after World War I until 1935 and also after World War II until 1957, which substantially reduces the amount of data available for these cities and also makes it questionable whether they are a valid control group. Including the available information for these cities in the sample does not change any of our results.

1939 we also obtained a detailed breakdown of total employment into 28 sectors. Second, we have collected information on the share of population over 65 in each city. Finally, we have obtained three measures of the degree of war-related disruption by city. These are the amount of rubble in cubic metres per capita, the number of destroyed dwellings as a percentage of the 1939 stock of dwellings, and the percentage of the city's 1961 population that were refugees from the former Eastern parts of Germany.

Even though our main focus in this paper is West German cities, we have also collected the populations of all other cities that were part of Germany prior to World War II and had more than 20,000 inhabitants in 1919. These data are used in the calibration of the model and in Section 6 to construct market potentials for the West German cities. For this purpose we have also collected the latitude and longitude of each city in our sample and computed the great circle distance between cities. The distribution of all cities in our dataset within pre-war Germany is shown in Map 1.

4.2. Empirical Strategy

The main prediction of our theoretical model is that the imposition of the East-West border will result in a relocation of population from West German cities close to the new border to other West German cities. In the transition to the new long-run equilibrium, cities close to the border will experience a reduction in population growth rates relative to cities further from the border. Similarly, the removal of this border due to the reunification of East and West Germany in 1990 should increase the relative population growth rate of cities close to the East-West border.

To investigate this hypothesis we adopt a simple 'difference in differences' methodology. We compare the growth performance of West German cities which were located close to the border between East and West Germany (our treatment group) with the growth performance of other West German cities (our control group). We examine the effects of division by undertaking this comparison before and after the division of Germany. Similarly, we examine the effects of the reunification of East and West Germany by undertaking the comparison for the periods of division and reunification. For our basic results we are going to classify cities as close to the border if they were within 75 kilometers of the East-West border. We will show below that this choice of cutoff is empirically plausible and is corroborated in non-parametric estimates which do not impose a particular distance metric on the data.

Our baseline econometric equation for division is a long-differences specification where we pool annualized rates of growth of West German city populations over the periods 1919-25, 1925-33,

1933-39, 1950-60, 1960-70, 1970-80 and 1980-88. We exclude the 1939-50 difference to abstract from the Second World War period.[25] We regress annualized city population growth ($Popgrowth_{ct}$) on a dummy ($Border_c$) which is equal to one when a city is a member of the treatment group within 75 kilometers of the border, on an interaction term between $Border_c$ and a dummy ($Division_t$) which is equal to one when Germany is divided, and on a full set of time dummies (d_t):

$$Popgrowth_{ct} = \beta Border_c + \gamma \left(Border_c \times Division_t \right) + d_t + \varepsilon_{ct} \tag{3}$$

where ε_{ct} is a stochastic error. In Section 7 below, we consider a similar specification for reunification.

The specification (3) allows for unobserved fixed effects in city population levels, which are differenced out when we take long differences. The time dummies control for common macroeconomic shocks which affect the population growth of all West German cities and secular trends in rates of population growth over time. They will also capture any effect of division on the average population growth rate of all West German cities.

The coefficient β on the border dummy captures any systematic difference in rates of population growth between treatment and control groups prior to division. Our key coefficient of interest is the coefficient γ on the interaction term between the border dummy and the division dummy, which captures the treatment effect of division on the relative growth performance of the treatment and control groups of cities. A negative and statistically significant value of γ implies a decline in the rate of growth of border cities compared to non-border cities following German division, as predicted by the theoretical model.

To address concerns about serial correlation using difference in differences estimators (Duflo *et al.* 2004), we cluster the standard errors on city. We also consider augmented versions of this baseline specification where we allow for more general error components, including state ("Länder") dummies or city fixed effects in population growth rates. When city fixed effects in population growth rates are included, the border dummy ($Bord_c$) is dropped since it is colinear with the fixed effects.

[25] In Section 6 we introduce explicit controls for disruption caused by the Second World War. Our results are robust to including the 1939-50 difference during which border and non-border cities experience relatively similar rates of population growth.

5. Baseline Empirical Results

5.1. Basic Difference in Differences Analysis

Before we estimate our basic specification (3), Figures 3 and 4 summarize the impact of the East-West border on West German cities. Figure 3 graphs total city population in the treatment group of border cities and the control group of non-border cities over time. For each group, total population is expressed as an index relative to its 1919 value, so that the index takes the value one in 1919. The two vertical lines indicate the year 1949 when the Federal Republic of Germany (West Germany) and the German Democratic Republic (East Germany) were established and the year 1990 when East and West Germany were reunified. Figure 4 graphs the difference between the two population indices and corresponds to a simple graphical difference in differences estimate of the impact of division on the population of border relative to non-border cities.

In the period prior to World War II, population growth of border and non-border cities is very similar, with border cities experiencing a slight relative decline during the Great Depression of the early 1930s, but recovering to the trend rate of growth of the non-border cities by 1939. During the Second World War and its immediate aftermath, border cities experience marginally higher population growth than non-border cities, probably due to migration from the Eastern parts of pre-war Germany.

This pattern changes sharply after 1949, when East and West Germany emerge as separate states with different economic systems and local economic links are severed. From this point onwards, West German cities close to the new East-West border experience substantially lower rates of population growth than non-border cities. Population in the border cities actually falls between 1960 and 1980, whereas population in non-border cities continues to grow. By the early 1980s, the discrepancy in rates of population growth begins to close, consistent with the idea that the negative treatment effect of division on border cities has gradually worked itself out and the distribution of population in West Germany is approaching a new steady state.

Following reunification in 1990, there is a step-increase in city population in West Germany, reflecting migration from the former East Germany. This migration raised population in non-border cities by somewhat more than in border cities. From 1992 onwards, population in the border cities grows somewhat faster compared to non-border cities, which is consistent with the beginning of a recovery in the border cities due to improved market access after reunification.

5.2. Parametric Estimates

Table 2 contains our basic parametric results. In Column (1) we estimate our baseline specification in equation (3). The coefficient β on the border dummy, which captures any systematic difference in rates of population growth between treatment and control groups prior to division, is positive but not statistically significant. This is consistent with the drawing of the new border between East and West Germany having been driven by factors which are uncorrelated with fixed city characteristics. Our key coefficient of interest γ 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 border cities relative to non-border cities of about 0.75 percentage points. This estimate implies a decline in the population of border cities relative to non-border cities over the 38 year period from 1950 to 1988 of around one third.[26]

In Column (2) we examine heterogeneity over time in the treatment effect of division on border cities. 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 and their magnitude declines monotonically over time. After some thirty years, the size of the treatment effect falls by approximately 2/3 from 1.25 percentage points during 1950-60 to 0.40 percentage points during 1980-88, consistent with relative city size gradually adjusting towards a new long-run equilibrium.

In Column (3) we investigate heterogeneity in the treatment effect depending on distance from the East-West border. Instead of considering a single border measure based on a distance threshold of 75 kilometers, we introduce a series of dummies for cities lying within cells 25 kilometers wide at varying distances from the border ranging from 0-25 kilometers to 75-100 kilometers. We include both the distance cell dummies and their interactions with division, where the interaction terms capture the treatment effect of division on cities within a distance cell. The estimated coefficients on the division interactions for 0-25 kilometers, 25-50 kilometers and 50-75 kilometers are negative and statistically significant, while the estimated coefficient on the interaction for 75-100 kilometers is positive but not statistically significant.

Therefore, consistent with the predictions of the theoretical model, the negative treatment effect of division on border cities is highly localized, with little evidence of any effect beyond 75 kilometers from the border. One somewhat surprising feature of the estimates is that the coefficient for the

[26] Since $(1.0075)^{38} = 1.33$.

0-25 kilometers grid cell is actually smaller than that for the 25-50 kilometers grid cell, though the difference is not statistically significant. From the simulation of the model, one would have expected a larger negative treatment effect for cities in the immediate vicinity of the border. This pattern of results could be related to the operation of federal subsidy programmes for the East-West border region, which were disproportionately concentrated on areas in the immediate vicinity of the border. To the extent that these subsidy programmes were successful in promoting the development of the East-West border region, our estimates provide a lower bound to the negative treatment effect of division on border cities.[27]

In Columns (4) and (5), we augment the baseline specification from Column (1) with state dummies and city fixed effects respectively. Our basic long differences specification already controls for city fixed effects in population *levels* and allows for time-invariant differences in mean population growth rates between border and non-border cities (via the coefficient β). Therefore, introducing state dummies or city fixed effects in population growth rates merely allows for time-invariant heterogeneity within the treatment group of border cities and within the control group of non-border cities. As a result, the point estimate of the treatment effect of division γ is unchanged. Although the standard errors are marginally higher, the treatment effect of division remains highly statistically significant. Though not reported in the interests of brevity, all of the results presented below remain statistically significant if population growth rate fixed effects are included.

We also considered a number of further robustness tests not reported here. We re-estimated the model excluding individual states, excluding cities which are close to the coast (since coastal cities may be differentially affected by division), excluding city-year observations where a city reports a merger that is not captured by our aggregations and the merger visibly affects the city's population series, and using an alternative estimation sample based on all West German cities with a population of greater than 50,000 in 2002. In each case, we find that division leads to a quantitatively similar and highly statistically significant decline in the population growth of border cities relative to other West German cities.

5.3. Non-parametric Estimates

In this section, we present the results of an alternative estimation strategy that enables us to estimate a separate division treatment for each city. We regress annualized population growth in

[27] Ziegler (1992) estimates that roughly half of all regional policy spending in West Germany during the 1970s and 1980s was allocated to the East-West border region. Evaluating the impact of these regional policy programmes is difficult, since regional policy spending is likely to be highly endogenous, with areas that are particularly hard-hit receiving more support.

West German cities on a full set of city fixed effects (η_i) and interactions between the city fixed effects and the division dummy ($\eta_i \times Division_t$):

$$Popgrowth_{ct} = \sum_{i=1}^{N} \mu_i \eta_i + \sum_{i=1}^{N} \theta_i \left(\eta_i \times Division_t\right) + \omega_{ct} \tag{4}$$

where c and i index cities; N is the number of cities in our sample; η_i is a dummy which is equal to zero except for city i when it takes the value one; $Division_t$ is defined as above; μ_i and θ_i are coefficients to be estimated; and ω_{ct} is a stochastic error.

The coefficients μ_i on the city fixed effects capture mean population growth for individual cities during the pre-war period. The coefficients θ_i on the interaction terms between the city fixed effects and division capture the change in individual cities' mean rates of population growth between the pre-war and division periods, and correspond to a separate treatment effect of division for each West German city. The interaction terms between the city fixed effects and division are jointly highly statistically significant (p-value<0.000) and Figure 5 graphs the estimated values of the division treatments against distance from the East-West German border. For ease of interpretation, we have normalized the division treatments in the figure so that their mean value across cities is equal to zero.

The non-parametric specification estimates separate treatment effects for each individual West German city and imposes no prior structure on how these are related to distance from the East-West border. Nonetheless, we find a clear relationship between the estimated treatment effects and distance from the East-West border. The estimated coefficients for cities close to the border are clustered below zero, implying that these cities experience a below average change in their population growth rates between the pre-war and division periods. Furthermore, the negative impact of division is highly localized as predicted by the theoretical simulation, with the decline in relative growth performance most evident for cities within 75 kilometers of the East-West border, confirming the findings of the parametric estimation above.[28]

6. The Role of Market Access

The empirical results so far have presented clear evidence that population growth in West German cities close to the East-West border declined relative to population growth in other West

[28] The average estimated division treatment within 75 kilometers of the East-West border is statistically significantly different from the average treatment across all cities, the average treatment between 75 kilometers and 150 kilometers from the border, the average treatment between 150 and 225 kilometers from the border, and the average treatment more than 225 kilometers from the border at conventional levels of statistical significance.

German cities during the period when Germany was divided. This finding is consistent with the predictions of the theoretical model, which emphasizes the negative impact from the loss of access to markets on the other side of the border.

It would be difficult to explain the observed pattern of estimates with the other two leading explanations for differences in economic performance, namely differences in institutions or natural endowments. As both border and non-border cities are part of the same country during all years of our sample, there are no obvious differences in institutions between our treatment and control cities that could be responsible for the decline of the border cities. Similarly, there is no simple explanation for our findings in terms of changes in natural advantage, such as access to navigable rivers or coasts, climatic conditions or the disease environment.[29]

Nonetheless, there are other possible explanations for our findings. First, industrial structure could differ systematically between the treatment and control groups, and the industries in which border cities are specialized could be precisely those industries which declined during the period of division relative to the period prior to the Second World War. Second, cities in the treatment and control groups could differ systematically in terms of the extent of destruction they suffered during the war or the extent of migration they received in the immediate aftermath of the war prior to the closing of the border. Differences in war-related disruption could in turn have contributed towards the change in the relative growth performance of border and non-border cities between the pre-war and division periods. Third, the decline of the border cities could have been influenced by the threat of further armed conflict in Western Europe, although it seems unlikely that any future conflict would have been limited to a narrow strip along the East-West border. Fourth, closer economic integration between West Germany and its EU trade partners could have elevated the population growth of Western cities within West Germany and contributed to the relative decline of the cities close to the East-West border.

In the remainder of this section, we present several pieces of additional evidence that the decline of the border cities is driven by their loss of market access, rather than by these alternative explanations.

[29] Our empirical findings also cannot be easily explained by models of stochastic city growth (see for example Simon 1955 and Gabaix 1999). If city development follows an independent stochastic process, the imposition of the East-West border has no clear effect on the relative growth prospects of West German cities close to and far from the border.

6.1. Adding Market Potential

We begin by providing evidence that the negative treatment effect of division can be completely accounted for by a measure of market access taken from the empirical economic geography literature. Following a long tradition dating back to Harris (1954), we calculate a measure of West German cities' market potential equal to the distance-weighted sum of population in all German cities from which they are not separated by the East-West border:

$$MPOT_{ct} = \sum_{i} \left(\frac{I_{cit}}{dist_{ci}} \right) L_{it} \tag{5}$$

where I_{cit} is a dummy variable that takes a value of one, except when a pair of cities is divided by the East-West border during division, in which case it takes a value of zero; $dist_{ci}$ is the Great Circle Distance between cities c and i; L_{it} denotes population in city i at time t.

Market potential provides an empirical measure of market access that captures a city's proximity to population centres.[30] The equilibrium relationship in equation (2) of the model implies that changes in market access lead to changes in city population. Therefore, for each city, we construct an index equal to market potential divided by its 1919 value. The evolution of this index over time captures changes in city market potential due to German division. In particular, the drop in market potential in a city in response to division will be greater for West German cities close to the new East-West border, since these have smaller distances to population centres further East.

Table 3 presents estimation results incorporating this empirical measure of market potential. In Column (1) we reproduce our baseline estimates from Column (1) of Table 2. In Column (2) we estimate the same specification augmented with the market potential index. The estimated coefficient on market potential is positive and highly statistically significant, consistent with the idea that an increase in market potential spurs population growth. More importantly, the coefficient on the border×division interaction falls by an order of magnitude so that it is now close to zero and statistically insignificant.

While this result is suggestive that the decline in the border cities can be explained by changes in market access, one potential problem with the specification is that this measure of market potential is likely to be endogenous. Changes in a West German city's market potential are not only driven

[30] The theoretical measure of market access featured in equation (2) depends on trade costs, population, nominal wages and price indices in each city. The empirical measure of market potential in equation (5) captures trade costs with distance and whether cities are separated by a closed border, and exploits information on population, but does not control for variation in nominal wages and price indices on which information is not available at the city-level. Empirical evidence from other contexts where a theory-based measure of market access can be constructed (see for example Redding and Venables 2004 and Head and Mayer 2004) suggests that market potential is highly correlated with theory-based measures of market access.

by the exogenous loss of eastern markets as a result of German division, but also by changes in the population of other surrounding West German cities and changes in own city population. These changes could be driven by unobserved shocks which not only impact on market potential but also have direct effects on population growth.

To address this problem we construct a direct measure of the loss of eastern markets due to division for each West German city. We use the 1939 distribution of population across cities to calculate the market potential derived by each West German city from markets in East Germany and the regions of Germany that became part of Poland and Russia after the Second World War. Our measure of lost eastern markets is equal to zero before 1949 and then equal to a city's lost eastern market potential, as measured in 1939, for all years when Germany is divided.

Column (3) includes this measure in our baseline specification from Column (1). The estimated coefficient on the border×division interaction falls by around one half and is no longer statistically significant. The measure of eastern market potential is negatively signed, suggesting that cities with a larger loss of eastern market potential experienced a decline in population growth relative to other West German cities following division, although the coefficient is not statistically significant at conventional values (p-value=0.13). Column (4) restricts the post-war sample to the period 1950 to 1970, where we found above that the treatment effect of division was strongest. In line with division being a more powerful determinant of city growth in the immediate post-war years, we now find that the coefficient on the border×division interaction is close to zero and statistically insignificant, while our measure of eastern market potential is negatively signed and highly statistically significant. In Column (5) we further restrict the sample to cities within 150 kilometers of the East-West German border. Again we can completely explain the slowdown in the population growth of border cities relative to other West German cities with our measure of eastern market potential loss.

To further explore the ability of market access to account for the relative decline of the border cities, we undertake a grid search over possible values for the model's parameters for those values where the relative decline of the border cities in the simulation is closest to the estimated decline in our econometric results.[31] Clearly, the model abstracts from a whole host of idiosyncratic factors that affect the trajectory of individual cities, and whose importance relative to the impact of German division is likely to be greatest for cities further from the East-West border, as evident in the non-parametric estimates in Figure 5. Therefore, we focus on the ability of the model to explain the overall quantitative decline of the cities along the East-West border. The parameter

[31] The technical appendix which discusses the theoretical model in more detail also contains further discussion of the grid search over possible parameter values.

vector where the mean percentage decline in the population of the border cities in the simulation is closest to the mean estimated decline in the non-parametric results is an elasticity of substitution of 3.9; a share of the non-traded amenity stock of 0.35; and an elasticity of transport costs with respect to distance of 0.30 (implying a coefficient on distance of -0.87). This parameter vector corresponds closely to the central values for these parameters in the existing empirical literature. Therefore, despite the model being highly stylized, there are plausible parameter values where it is able to explain not only the qualitative, but also the quantitative decline of the border cities.

Finally, the market access mechanism emphasized in the model operates in market-based economies, such as West Germany. In centrally-planned East Germany, the allocation of resources was determined by the priorities of the planning process, which are unlikely to mimic market forces. To investigate this, we also estimated our baseline specification (3) on our data for East Germany. We find that, if anything, East German cities within 75 kilometers of the East-West border experience more rapid growth relative to other East German cities after the division of Germany. This provides further evidence that the decline of the West German border cities is driven by market forces, rather than by other factors associated with being close to the border.[32]

All of these results suggest that the relative decline of the West German border cities can be entirely accounted for by the loss of market access triggered by the division of Germany, and provides evidence against alternative explanations, such as fear of further armed conflict, differences in industrial structure or war-related disruption.

6.2. Size Heterogeneity

An additional implication of our model is that the imposition of the new East-West border should have a disproportionately large effect on smaller border cities. The intuition for this pattern is that, in small cities, the own market is less important relative to markets in other cities. As a result, the loss of access to population centres on the other side of the East-West border has a larger impact on overall market access for smaller cities than for larger cities.

Columns (6) and (7) of Table 3 test this additional prediction of the model. In Column (6) we re-estimate the specification from Column (1) for the sub-sample of cities with a population

[32] There is a more general remaining difficulty in the economic geography literature of distinguishing the pecuniary externalities, captured by market access, from techological externalities in the form of knowledge spillovers. In the absence of separate data and independent spatial variation for the two forms of externalities, it is difficult to conclusively distinguish between these two complementary mechanisms. However, the ability of an empirical measure measure of market access to completely account for the division treatment, the model's ability to quantitatively explain the decline of the border cities for plausible parameter values, and our finding below that small border cities are disproportionately affected by division, all seem to suggest that the pecunary externalities emphasised by the model largely account for our findings.

in 1919 below the median value for that year. Column (7) repeats the exercise for cities with a 1919 population greater than or equal to the median.[33] The estimated treatment effect is negative for both sub-samples of cities. However, in line with the predictions of the theoretical model, the negative treatment effect is substantially larger and more precisely estimated for the sub-sample of smaller cities. Smaller cities do indeed suffer disproportionately from the loss of access to markets across the new East-West border.

This particular impact of the border is not only consistent with our economic geography model, but it is unclear why we should see this precise pattern of results under the alternative possible explanations for our findings. For example, this pattern of results is puzzling under the alternative view that the decline of the border cities was driven by fear of further armed conflict, since larger population centres have been historically more attractive military targets.

6.3. Employment and Demography

The mechanisms underlying the negative treatment effect in the model work through both access to markets and access to sources of supply. Reduced market access lowers the maximum nominal wage that a manufacturing firm can afford to pay in a location. Reduced supplier access raises the price index for tradeable manufacturing goods. This suggests that the economically inactive, in particular the retired, should be less affected by the border as they receive an income which is independent of their location and only suffer from the increased price index due to reduced supplier access.

Table 4 investigates this hypothesis using a variety of alternative measures of whether the burden of division falls disproportionately on the economically active. These comprise the share of the population over 65, the ratio of employment to population and the ratio of employment in industry to population. The data on demographic structure and employment are unavailable for some years resulting in a smaller sample. Column (1) estimates our baseline specification from Column (1) of Table 2 for the subset of years over which demographic data are available and shows that a very similar pattern of results is found despite the smaller sample. In Column (2) we regress the percentage of the city population over 65 years old on the same set of explanatory variables. The estimated coefficient on the border×division interaction is positive and statistically significant, implying that division was followed by an increase in the share of the population above working age in border cities relative to other West German cities.

[33] We split the sample based on the 1919 population distribution to ensure that the split is not driven by population growth during the sample period.

In Columns (3) and (4) we consider the same specification taking the ratio of employment to population or the ratio of employment in industry to population as our left-hand side variable. In each case, employment like population is measured by place of residence. In both columns, we find a negative and statistically significant coefficient on the border×division interaction, implying that division led to a decline in the ratio of employment to population in border cities relative to other West German cities. All of these specifications support the idea that the economically inactive are less affected by division, because they do not suffer the fall in nominal wages driven by reduced market access and only experience a higher consumer price index due to reduced supplier access.

6.4. City Structure

In this section, we examine whether differences in city structure could have contributed to the relative decline of the border cities. As a first step Table 5 reports descriptive statistics for border and non-border cities in 1939 immediately prior to the Second World War. Treatment cities were on average somewhat larger and less industrial than control cities, though these differences are not statistically significant at the 5 percent level.

To provide further evidence that differences in city structure are not driving our results, we combine our difference in differences methodology with matching. We match each treatment city within 75 kilometers of the East-West border to a non-border control city as similar as possible to the treatment city in terms of its observed characteristics. Matching leads to a dramatic reduction in the sample size as we exclude all non-border cities which are not matched with a border city. The counterbalancing advantage is that we compare the border cities to a group of non-border cities that are closer in terms of their observed characteristics.

In Column (1) of Table 6 we match on population by minimizing the squared difference in 1939 population between treatment and control cities. This addresses the concern that small cities may have systematically different economic structures to large cities. In Column (2) we match on 1939 employment levels which controls for heterogeneity in the size of the workforce across cities. Column (3) addresses concerns about industrial structure. We compare treatment and control cities that are as similar as possible in terms of their employment levels across disaggregated industries by minimizing the sum of squared differences in 1939 employment across 28 sectors.[34]

In Column (4) we match on industrial structure and geography, by requiring the control group of cities to lie within a band 100-175 kilometers from the East-West border, and minimizing the sum

[34] The sectors are comparable to two-digit ISIC industries. See the data appendix for a list of the sectors. Matching on employment in disaggregated manufacturing industries alone yields a similar pattern of results.

of squared differences in 1939 employment levels in the 28 disaggregated sectors. The distance grid cell estimates in Table 2 and the non-parametric results above suggest that a control group more than 100 kilometers from the East-West border should not be strongly influenced by the division treatment. Eliminating cities that are more than 175 kilometers from the border ensures that the control group is geographically close to the treatment group, as this control group excludes the industrial Ruhr area and other cities in the far West of West Germany from the control group.

Across all four columns of Table 6, we find a negative and highly statistically significant coefficient on the border×division interaction, which is of the same magnitude as in our baseline specification. This provides powerful evidence of a strong negative treatment effect of division on border cities after controlling for variation in city structure and geographical location. The similarity of the estimation results with and without matching is further evidence that the drawing of the border between East and West Germany was driven by military and political considerations unrelated to pre-existing city characteristics.

6.5. War Devastation and Refugees

To address the concern that differences in war-related disruption could explain the decline of the border cities, we exploit city-level data on war destruction and on German refugees from the former Eastern parts of Germany. Our war-related destruction variables are cubic metres of rubble per capita and the number of destroyed dwellings relative to the 1939 stock of dwellings. Our refugees variable is the percentage of a city's population that originated in the former eastern parts of Germany, as measured in the population census for 1961 when the Berlin Wall was built.

We begin by estimating a cross-section regression of the degree of war-related destruction on our border dummy, which is equal to one if the city is within 75 kilometers of the East-West German border. We find that border cities experienced marginally less destruction, but the difference is not statistically significant at conventional levels.[35] To further explore a possible link between war-related destruction and the decline of the border cities, columns (1) and (2) of Table 7 estimate our baseline specification from Column (1) of Table 2, but include a full set of interactions between our two measures of war-related destruction and year dummies. This specification allows devastation associated with the Second World War to have different effects on city growth rates in different years and places no prior structure on the time period over which these effects operate.

[35] The regressions using rubble and destroyed dwellings have 111 and 108 observations respectively since the data are missing for a few cities. The estimated coefficients (*standard errors*) are -0.876 (*2.213*) and -8.940 (*5.961*) respectively.

The inclusion of the interactions between war destruction and year dummies has little impact on the estimated treatment effect of division on border cities. The treatment remains of the same magnitude and highly statistically significant, providing strong evidence that our results are not driven by differing levels of war damage experienced by border and non-border cities. In addition we find that cities which experienced heavier destruction during the Second World War, grew more rapidly during the 1950s as rebuilding took place, but war-related destruction seems to have little effect on city growth thereafter. This finding is in line with the results of Davis and Weinstein (2002) and Brakman *et al.* (2004) that Japanese and West German cities recovered surprisingly fast from the damage done by Allied bombing attacks and returned to their pre-war growth trajectories.

We also run a cross-section regression of refugees from the former Eastern parts of Germany on the border dummy. We find that border cities have a statistically significantly higher share of their 1961 population that originated in the former Eastern parts of Germany.[36] Including the full set of interactions between refugees and year dummies in our baseline specification, the treatment effect of division remains negative, statistically significant and of a similar magnitude. Therefore, the relative decline of the border cities is not driven by different levels of migration from the former Eastern parts of Germany prior to the construction of the Berlin Wall. The refugees interaction for 1939 is positive and statistically significant, implying that refugees migrated to West German cities with higher pre-war population growth rates. The refugees interaction for 1960 is negative and statistically significant, consistent with most of the refugee movements occurring prior to 1950, and high refugee inflows into a city slowing its population growth rate in the following decade.[37]

6.6. Western Integration

One remaining concern is that our estimates of the relative decline of the cities along the East-West border could in part be explained by an improvement in market access along the Western border of West Germany due to closer Western European integration. Western economic integration plausibly involves a smaller change in market access, and is hard to reconcile with the treatment effect's timing (stronger in the 1950s and 1960s than later) and highly localized nature (within 75 kilometers of the East-West German border). Nevertheless, it could have contributed to the relative improvement in the population growth of more Western cities in West Germany during the

[36] The estimated coefficient (*standard error*) are 5.168 (*2.017*).

[37] As a further robustness check, we have included both interactions between war-related destruction and year dummies and also interactions between refugees and year dummies. Again the treatment effect of division is negative, statistically significant and of similar magnitude. Using rubble as the measure of war-related destruction, the estimated coefficient (*standard error*) for the division treatment are -0.739 (*0.196*).

division period.

To explore this possibility we augment our baseline specification from column (1) in Table 2 with a dummy, which is equal to one if a city lies within 75 kilometers of the Western border of West Germany, and with the interaction between this dummy and division. Our estimate of the relative decline of the cities along the East-West German border retains a similar magnitude and statistical significance. The interaction between proximity to the Western border of West Germany and division is positive, but much smaller than the division treatment estimated for the cities along the East-West German border and statistically insignificant.

As a further robustness test, we augmented the distance grid cells specification in column (3) in Table 2 with similar distance grid cells based on proximity to the Western border of West Germany. In this specification we find that distance cells closer to the Western border of West Germany exhibit a more positive treatment effect, which is marginally significant for the 25 to 50 kilometers grid cell. This finding of only a small increase in the relative population growth of cities in the far West of West Germany is consistent with Western economic integration involving a smaller change in market access compared to German division. Nonetheless, it is difficult to separate the effects of Western economic integration from those of division. The simulation of the model shown in Figure 1 suggests that the population relocation following division could have particularly enhanced population growth in cities in the far West of West Germany.

More importantly, as in the other specification considered in this section, the estimated division treatment for cities along the East-West German border remains of a similar magnitude to before and highly statistically significant.[38] Therefore, the change in market access induced by Western economic integration cannot explain the relative decline of the cities along the East-West German border.

7. Reunification

We have so far presented a variety of evidence supporting division's negative impact on cities close to the East-West German border through market access. We now explore whether reunification reversed the effects of division. In many ways, reunification is a much smaller experiment. First, the economic mass added to West Germany by reunification is much smaller than what was taken

[38] These results are also in line with our earlier findings in column (4) of Table 7, where exclude cities more than 175 kilometers from the East-West border from the control group, and with the pattern of estimates apparent in the non-parametric results.

away due to division, in terms of area, population and per capita income.[39] Second, the subsidies to the former border region were rapidly reduced in the immediate aftermath of reunification and were entirely phased out by the end of 1994. Third, even if reunification involved changes in market access of the same magnitude as division, history may not be reversed if there are multiple equilibria ($\sigma(1-\mu) < 1$ in the model). In this case, the temporary shock of division may have a permanent impact on the spatial distribution of population by shifting the economy between multiple equilibria.

To investigate the impact of reunification column (1) of Table 8 estimates our baseline specification from equation (3) for the division and reunification periods using annualized rates of population growth for the periods 1950-60, 1960-70, 1970-80, 1980-88 and 1992-2002. The estimated coefficient γ on the border×division interaction is negative and highly statistically significant, implying that population growth was slower in border cities relative to non-border cities during the period of division than after reunification. While this finding is consistent with an improvement in the relative growth prospects of border cities following reunification, it is not very revealing. This specification implicitly assumes that the border cities are in a steady state during the division period and are then hit by the exogenous reunification shock, which is clearly invalid during much of the early division period.

To mitigate this problem column (2) to (4) of Table 8 restricts the sample prior to reunification to the period 1980 to 1988. With this more plausible, but much shorter, comparison period we again find a negative coefficient γ on the border×division interaction, and columns (3) and (4) show that this effect is again larger for small cities. However, the estimated coefficients are substantially smaller in magnitude relative to our results for division and are no longer statistically significant at conventional levels. Therefore, although the reunification shock is smaller in magnitude and it is hard to separate its effects from those of division, there is some evidence that the change in market access following reunification is again beginning to change the relative fortunes of border and non-border cities.

8. Conclusion

This paper exploits the division of Germany after the Second World War and the reunification of East and West Germany in 1990 as a natural experiment to provide evidence for the importance

[39] While East and West Germany had broadly similar level of income per capita prior to the Second World War (see for example Ritschl 1996), in 1990 GDP per capita in West Germany stood at $23,915 compared to $8,679 in East Germany (Lipschitz and McDonald 1990). See Sinn (2002) for a survey of progress towards convergence between East and West Germany since re-unification.

of market access for economic development. As we focus on a sample of cities which are part of the same country and which had very similar natural endowments over time, our analysis controls for these other leading explanations for spatial variation in economic activity, in order to empirically disentangle the role played by market access.

Following division West German cities close to what became the East-West border went from being at the heart of an integrated Germany to being on the periphery of West Germany. In line with a standard new economic geography model, we show that the border led to a sharp decline in population growth in West German cities close to the border relative to other West German cities. Over the forty year period of division, we estimate a decline in the annualized rate of population growth of 0.75 percentage points, implying a cumulative reduction in the relative size of border cities of around one third.

We provide a variety of further evidence that our results are capturing loss of access to markets rather than alternative possible explanations such as systematic differences in city structure, disruption associated with the Second World War, or the fear of further armed conflict. We show that the negative treatment effect of division on border cities can be completely explained by an empirical measure of market access and is stronger for smaller cities, as predicted by the theoretical model. Furthermore, we provide evidence that the burden of division falls disproportionately on the economically active, who are affected by both the fall in nominal wages and the rise in the consumer price index. We demonstrate that our results remain if we combine matching and differences in differences techniques to control for variation in city structure. Finally, our estimates are also robust to controlling for levels of war-related destruction and refugees from the former Eastern parts of Germany. Taken together, we find strong evidence supporting a causal relationship between market access and the spatial distribution of economic activity.

A Data Appendix

The data on city populations were collected from the statistical yearbooks of pre-war Germany ("Statistisches Jahrbuch des Deutschen Reiches") and West Germany ("Statistisches Jahrbuch für die Bundesrepublik Deutschland"). Information on the latitude and longitude of West and East German cities was obtained from the German Federal Agency for Cartography and Geodesy ("Bundesamt für Kartographie und Geodäsie") and the webpage http://www.jewishgen.org/ShtetlSeeker/ for cities which are now part of Poland and Russia.

Data on employment in each city is available for the pre-war period in the 1925, 1933 and 1939 population census ("Volks-, Berufs- und Betriebszählung"). We use the "Beschäftigte in der Industrie" as our measure of employment in industry. Intertemporally comparable employment data at our level of regional disaggregation for the post-war period was only available in the 1961, 1970 and 1987 West German population census. The city level results of these censuses were published in the Statistical Yearbook of German Cities ("Statistisches Jahrbuch Deutscher Gemeinden"). We use the "Beschäftigte im Produzierenden Gewerbe" as our measure of employment in industry for the post-war period. In the 1939 population census, total employment is also broken down into 28 disaggregated sectors. The industry classification is comparable to modern two-digit classifications: Agriculture, Mining, Minerals, Steel, Chemicals, Textiles, Paper, Print, Leather, Wood, Food, Apparel, Shoes, Construction, Utilities, Business Services, Transport, Restaurants, Public Administration, Education, Clerical, Consulting, Medical, Veterinary, Cosmetics, Entertainment, Domestic Help, and Other Support Worker.

Information on the share of the population over 65 for all our cites was only available in the 1933 and 1939 census for the pre-war period. For the post-war this information was taken from the 1961, 1970 and 1987 West German population census, as reported in the Statistical Yearbook of German Cities. Our two measures of war devastation are taken from Kästner (1949), who reports the results of a survey undertaken by the German Association of Cities ("Deutscher Städtetag"), which was also published in the Statistical Yearbook of German Cities. Our two measures of destruction are available for almost all of our cities. Our refugees measure is the share of each West German city's population that identified themselves as originating from the former Eastern parts of Germany in the 1961 census, as reported in the Statistical Yearbook of German Cities.

B Calibration Appendix

The parameter values that we use for the calibration and simulation of the model shown in Figure 1 and 2 are taken from central values in the existing empirical literature. In line with the estimates in Feenstra (1994), we assume that the elasticity of substitution between manufacturing varieties (σ) is four. We set the share of the non-traded amenity in consumer expenditure ($1-\mu$) equal to one third, which is consistent with consumer expenditure survey estimates of housing's share of consumer expenditure (Bureau of Labor Statistics 2002). The fixed cost (F) rescales the number of manufacturing varieties and, without loss of generality, we set it equal to one. We set the elasticity of transport costs with respect to distance as equal to one third, which is consistent with the estimates in Hummels (2001) and Limao and Venables (2001). The assumed values of the elasticity of substitution and the elasticity of transport costs with respect to distance imply a coefficient on distance in the CES demand for manufacturing varieties of minus one ($T_{ci}^{1-\sigma} = dist_{ci}^{\phi(1-\sigma)}$). This value for the coefficient on distance is directly in line with estimates from the gravity equation literature, as in Anderson and van Wincoop (2003) and Redding and Venables (2004).

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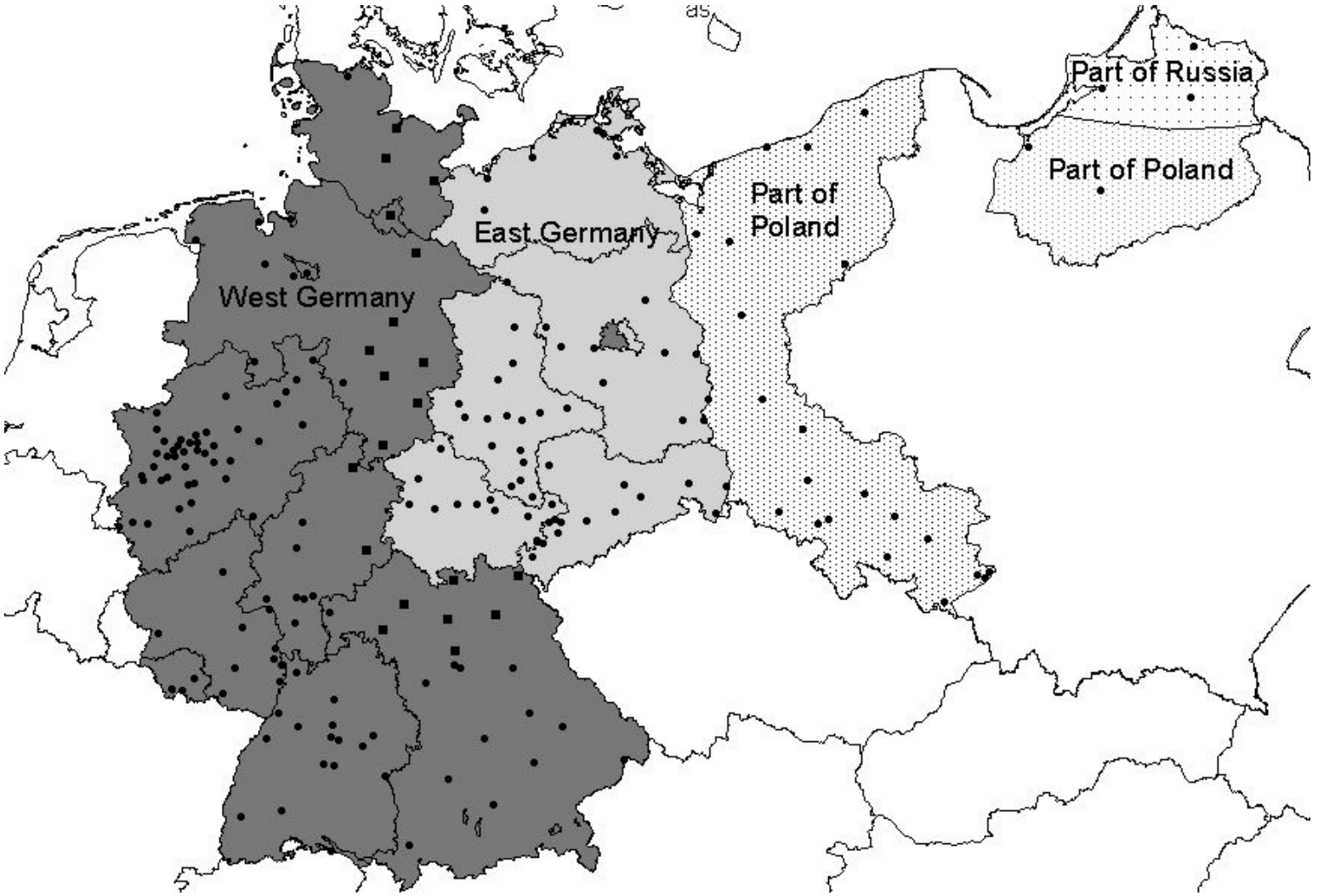
Map 1 – Germany in its pre - World War II borders



Notes: The map shows Germany in its pre - World War II borders (usually referred to as the 1937 borders) and the division of Germany into an area that became part of Russia, an area that became part of Poland, East Germany and West Germany. The West German cities in our sample which are within 75 kilometers of the German-German border are denoted by squares, all other cities by circles.

Figure 1: Simulated Change in West German City Population

By distance in km from the East-West Border

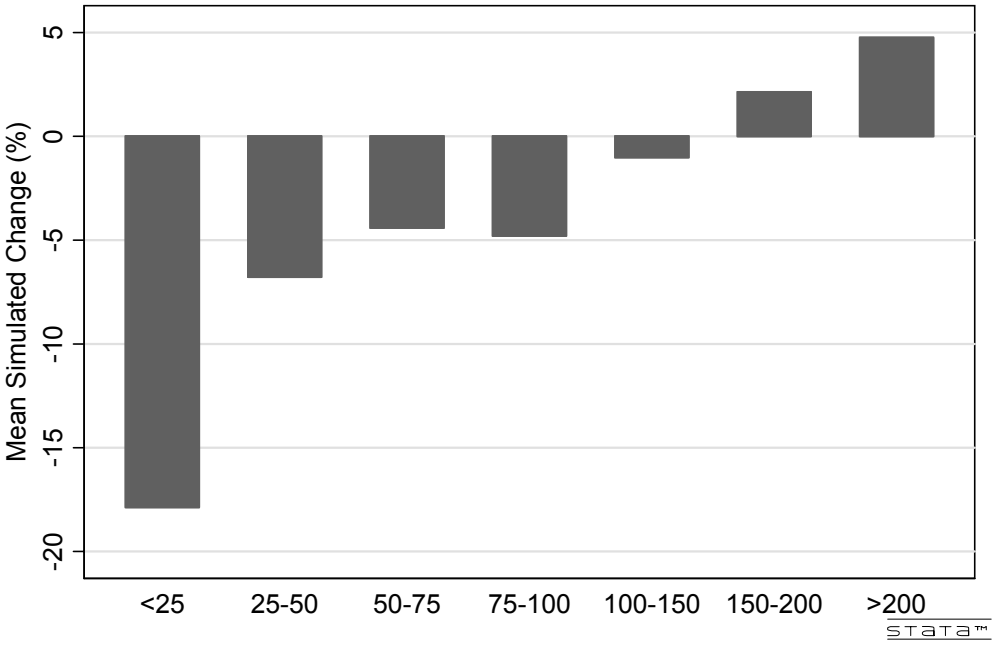


Figure 2: Differences in Simulated Population Changes

within and beyond 75km of E-W border for small and large West German cities

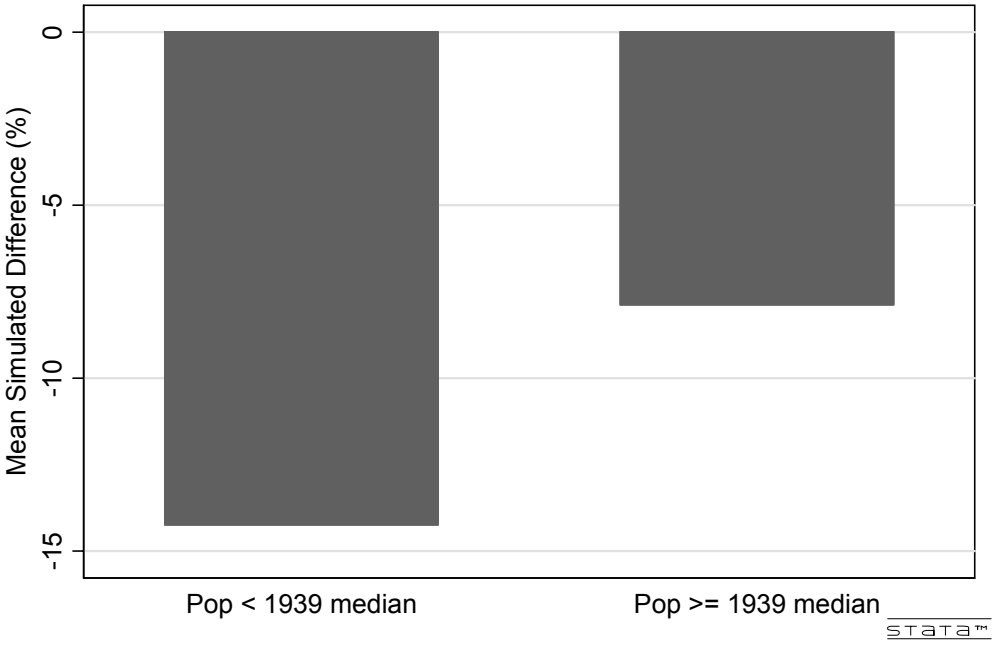


Figure 3: Indices of Border & Non-Border City Population

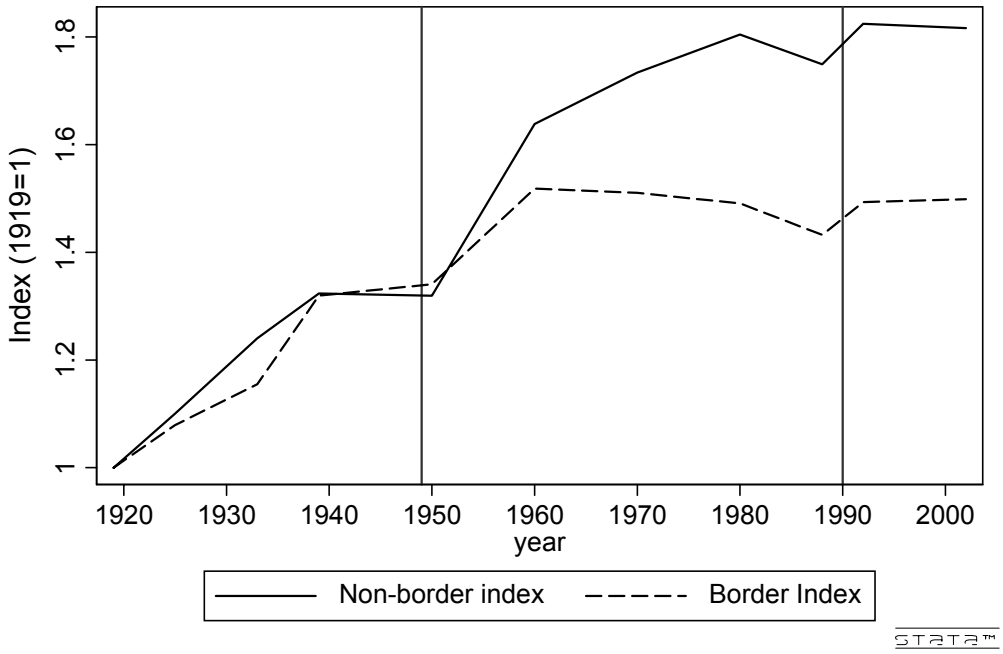


Figure 4: Difference in Population Indices, Border - Non-border

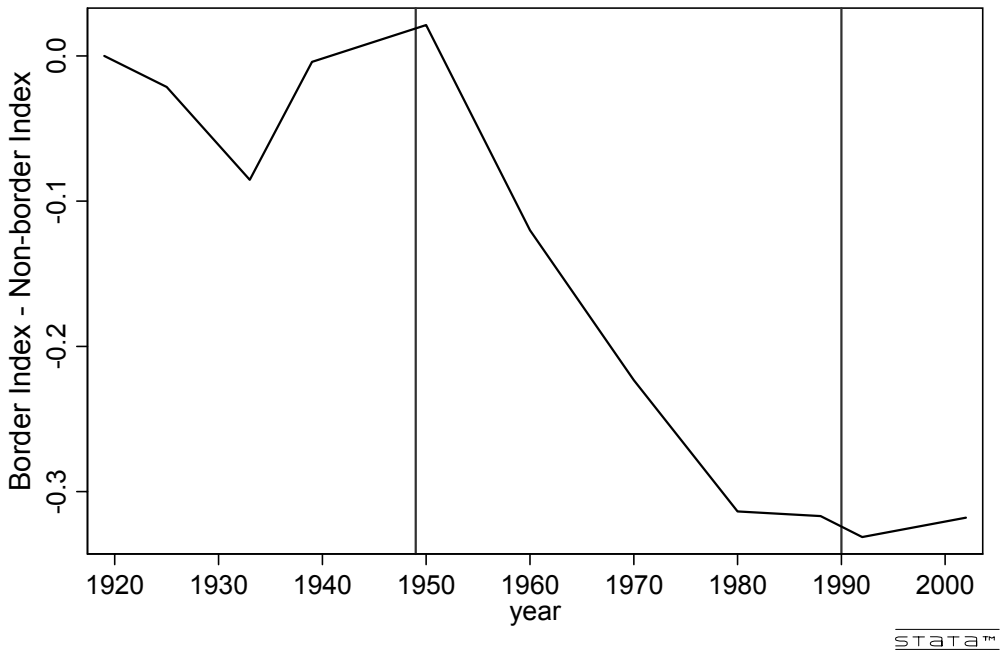


Figure 5: Non-parametric Division Treatment Estimates

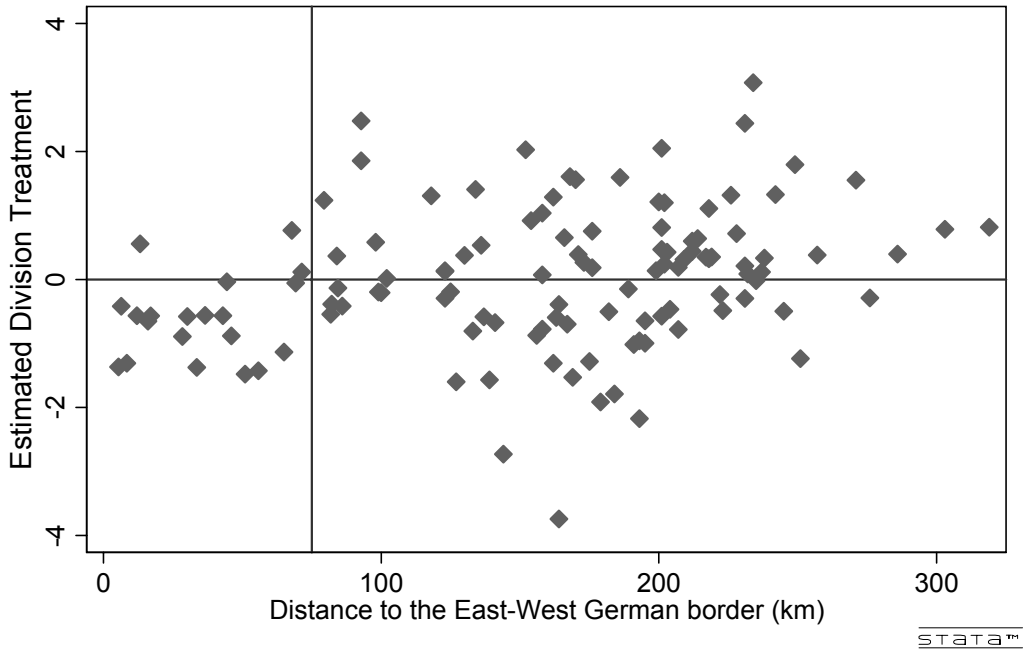


Table 1 - Treatment Group of Border Cities

Bamberg	Hannover
Bayreuth	Hildesheim
Braunschweig	Hof
Celle	Kassel
Coburg	Kiel
Erlangen	Lübeck
Fulda	Lüneburg
Göttingen	Neumünster
Goslar	Schweinfurt
Hamburg	Würzburg

Notes: The treatment group of twenty West German cities that lie within 75 kilometer of the former border between East and West Germany.

Table 2 - Baseline Empirical Results

	(1) Population Growth	(2) Population Growth	(3) Population Growth	(4) Population Growth	(5) Population Growth
Border × Division	-0.746***			-0.746***	-0.746***
	(0.182)			(0.183)	(0.196)
Border × Year 1950-60		-1.249***			
		(0.348)			
Border × Year 1960-70		-0.699**			
		(0.283)			
Border × Year 1970-80		-0.640*			
		(0.355)			
Border × Year 1980-88		-0.397***			
		(0.147)			
Border 0-25km × Division			-0.702***		
			(0.257)		
Border 25-50km × Division			-0.783***		
			(0.189)		
Border 50-75km × Division			-0.620*		
			(0.374)		
Border 75-100km × Division			0.399		
			(0.341)		
Border	0.129	0.129		0.325*	
	(0.139)	(0.139)		(0.187)	
Border 0-25km			-0.110		
			(0.185)		
Border 25-50km			0.144		
			(0.170)		
Border 50-75km			0.289		
			(0.272)		
Border 75-100km			-0.299*		
			(0.160)		
Year Effects	Yes	Yes	Yes	Yes	Yes
State ("Länder") Effects				Yes	
City Effects					Yes
Observations	833	833	833	833	833
R-squared	0.21	0.21	0.21	0.22	0.32

Notes: Data are a panel of 119 West German cities. The left-hand side variable is the annualized rate of growth of city population, expressed as a percentage. Population growth rates are for 1919-25, 1925-33, 1933-39, 1950-60, 1960-70, 1970-80 and 1980-88. Border is a dummy which is 0 unless a city lies within 75 kilometers of the former border between East and West Germany in which case it takes the value 1. Division is a dummy which is 0 except for the years 1950-88 when German was divided in which case it takes the value 1. Border 0-25km is a dummy which is 0 unless a city lies within 25 kilometers of the East-West border in which case it takes the value 1. 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 3 - Market Potential and Size Effects

	(1) Population Growth	(2) Population Growth	(3) Population Growth	(4) Population Growth	(5) Population Growth	(6) Population Growth	(7) Population Growth
Border × Division	-0.746***	-0.060	-0.437	0.090	0.072	-1.097***	-0.384
	(0.182)	(0.207)	(0.306)	(0.366)	(0.399)	(0.260)	(0.252)
Market Potential Index		4.775***					
		(0.492)					
Eastern Market Potential Loss			-0.341	-1.171***	-1.195***		
			(0.226)	(0.277)	(0.366)		
Border	0.129	0.242**	0.129	0.129	0.043	0.233	-0.009
	(0.139)	(0.122)	(0.139)	(0.139)	(0.184)	(0.215)	(0.148)
Year Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Sample	1919-1939 & 1950-1988	1919-1939 & 1950-1988	1919-1939 & 1950-1988	1919-1939 & 1950-1970	1919-1939 & 1950-1970	1919-1939 & 1950-1988	1919-1939 & 1950-1988
City Sample	All Cities	All Cities	All Cities	All Cities	Cities within 150km of the E-W border	Small Cities	Large Cities
Observations	833	833	833	595	230	420	413
R-squared	0.21	0.30	0.21	0.11	0.24	0.23	0.30

Notes: Sample is the same as in Table 2 except: in Columns (4) and (5) the division sample is restricted to 1950-1970, in Column (5) the city sample is restricted to cities within 150 kilometers of East-West German border, Column (6) reports results for small cities defined as those with a 1919 population below the median, and Column (7) reports results for large cities defined as those with a 1919 population greater than or equal to the median. Left-hand side and right-hand side variables are defined as in Table 2, except for market potential which is the distance weighted sum of population in all cities not separated by a border. The market potential index equals market potential divided by its value in 1919 and captures cities' changing market access over time. Eastern market potential loss is equal to 0 before 1949 and otherwise equal to the market potential that a West German city derived in 1939 from markets in East Germany and the former areas of pre-war Germany that became parts of Poland and Russia. 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 4 - Demographic Structure and Employment

	(1) Population Growth	(2) Population Aged Over 65 (Percent)	(3) Share of Total Employment in Population (Pecent)	(4) Share of Ind. Employment in Population (Percent)
Border × Division	-1.014***	0.785**	-1.101**	-1.170**
	(0.232)	(0.327)	(0.439)	(0.507)
Border	0.327**	1.204***	0.519	-1.737
	(0.164)	(0.242)	(0.646)	(1.124)
Year Effects	Yes	Yes	Yes	Yes
Observations	595	595	714	714
R-squared	0.15	0.89	0.49	0.28

Notes: Right-hand side variables are defined as in Table 2. Column (1) repeats the basic specification from Table 2 for the sample for which demographic structure data are available, which are the years 1933, 1939, 1961, 1970 and 1987. Employment data are available for these years and for 1925, which accounts for the larger number of observations in Columns (3) and (4). 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 5 - Characteristics of the Treatment and Control Cities

	Number of cities	Mean City Population in 1939	Share of industry employment in total employment in 1939
Treatment Cities (<75km to the East - West border)	20	185,490 (376,092)	45.60% (8.26)
Control cities (≥75km to the East - West border)	99	131,235 (168,701)	50.92% (13.23)

Notes: Standard deviations in parentheses.

Table 6 - Matching

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

Notes: Left-hand side and right-hand side variables are defined as in Table 2. The years included are the same as in Table 2. In Column (1) matching is based on minimizing squared 1939 population differences between treatment and control cities. In Column (2) matching is based on minimizing squared 1939 employment differences between treatment and control cities. In Column (3) matching is based on minimizing the sum of squared 1939 employment differences in 28 sectors. In Column (4) matching is based on minimizing the sum of squared 1939 employment differences in 28 sectors and requiring the control city to lie within 100-175 kilometers from the East-West German border. 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 7 - War Devastation

	(1) Population Growth	(2) Population Growth	(3) Population Growth
Border × Division	-0.737***	-0.656***	-0.678***
	(0.182)	(0.191)	(0.211)
Border	0.136	0.129	0.029
	(0.139)	(0.146)	(0.167)
War Disruption × Year 1919-25	-0.014	-0.004	0.004
	(0.011)	(0.006)	(0.020)
War Disruption × Year 1925-33	0.019	0.006	-0.018
	(0.017)	(0.007)	(0.019)
War Disruption × Year 1933-39	-0.001	0.004	0.064**
	(0.023)	(0.009)	(0.028)
War Disruption × Year 1950-60	0.073***	0.033***	-0.056**
	(0.015)	(0.008)	(0.026)
War Disruption × Year 1960-70	0.012	0.009	-0.006
	(0.017)	(0.007)	(0.026)
War Disruption × Year 1970-80	-0.014	0.004	0.062*
	(0.025)	(0.012)	(0.034)
War Disruption × Year 1980-88	0.007	0.002	0.009
	(0.013)	(0.006)	(0.020)
Year Effects	Yes	Yes	Yes
Disruption Measure	Rubble	Dwellings	Refugees
Observations	777	756	833
R-squared	0.24	0.24	0.24

Notes: Left-hand side and right-hand variables are defined as in Table 2 except for War Devastation. The years included are the same as in Table 2. In Column (1) War Devastation is measured as rubble per capita, expressed as cubic metres per capita. In Column (2) War Devastation is the number of destroyed dwellings as a percentage of the 1939 stock of dwellings. The war devastation variables are missing for a few cities which accounts for the smaller number of observations than in Table 2. 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 8 - Reunification

	(1) Population Growth	(2) Population Growth	(3) Population Growth	(4) Population Growth
Border × Division	-0.477***	-0.127	-0.223	-0.007
	(0.156)	(0.128)	(0.202)	(0.136)
Border	-0.141	-0.141	-0.236	-0.064
	(0.106)	(0.106)	(0.168)	(0.108)
Year Effects	Yes	Yes	Yes	Yes
City Sample	All	All	Small Cities	Large Cities
Year Sample	1950-1988 & 1992-2002	1980-1988 & 1992-2002	1980-1988 & 1992-2002	1980-1988 & 1992-2002
Observations	595	238	120	118
R-squared	0.30	0.15	0.21	0.14

Notes: Left and right-hand side variables are defined as in Table 2. In Column (1) population growth rates are for 1950-60, 1960-70, 1970-80, 1980-88, and 1992-2002. In Columns (2) to (4) population growth rates are for 1980-88 and 1992-2002. Column (3) reports results for small cities defined as those with a 1919 population below the median. Column (4) reports results for large cities defined as those with a 1919 population greater than or equal to the median. 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.