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The Impact of new Borders on Trade. World War I and the Economic Disintegration of Central Europe

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The Impact of new Borders on Trade. World War I and the Economic Disintegration of Central Europe[†]

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Abstract

This paper investigates the impact of changes in national border demarcation on economic integration. It treats the national breakups in Central Europe due to WWI as a natural experiment, which allows for evaluating the particular effect of new national borders. A gravity model of trade is used to analyze goods-specific trade among Central European regions. The main results are, first, that the treatment effect of new borders is large. Second, decomposing the border effect provides evidence of a "border before border" for parts of Germany that became separated even before WWI. Third, the analysis indicates a high level of economic integration before WWI among Polish regions that became politically unified only after the war.

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1. Introduction

In 1995 McCallum presented his famous estimate that the national border between the US and Canada had a very large negative effect on bilateral trade in 1988, evaluated at the level of regions. Several years later, H. Wolf (2000) demonstrated that a “home bias” in trade can also be found evaluating shipments among US states that only cross state borders but not the US national border. The existence of both intra-national and international trade frictions coinciding with political barriers was confirmed by later studies, although the effects were found to be smaller (cf. e.g. Anderson and van Wincoop, 2003, or Hillberry and Hummels, 2003). H. Wolf’s finding indicates that there are significant region pair-specific trade frictions. This finding has a problematic implication for McCallum-type border effects: once the national border demarcation does not change over time in the sample, all bilateral fixed effects that affect international trade are attributed to the national border as border effect, e.g. various network or infrastructure effects. Thus, in order to identify the actual “treatment effect” of a border, the border indicator has to vary over time, i.e. it must not be itself a fixed effect. To my knowledge, no systematic attempt in this direction has been undertaken to date.

In the literature, border effects are usually approximated by the average deviation of trade between pairs of regions that are separated by the barrier and region pairs, in which bilateral shipments are not subject to this barrier, controlling for a number of variables. We may view the former case as a kind of “treatment” of trade flows. Measuring the average treatment effect (ATE) of national borders on bilateral trade thus requires observations of “untreated” trade, i.e. a control group. This procedure is usually based on information taken from the same cross-section by comparing cross-border and within-country trade at a certain point in time. However, when tracking the border effect, one is actually interested in the average effect on those bilateral flows that are in fact treated by a border (ATET). The ATE will be equal to the ATET if the treated flows are a random selection out of the entire sample.

Therefore, estimating the ATET requires both a sample including changes in the demarcation of countries’ national borders as well as regressions, in which one controls for potential fixed effects specific to the treatment group. However, even if the sample includes such changes, the evaluation is usually not feasible, since political disintegration induces disruptions in statistical records. When this coincides with war and territorial changes, it becomes difficult to obtain appropriate data. Thus, empirical research on border effects usually analyzes samples, in which borders remain stable over time or focuses on political integration in the basis of immediate policy interest.[1]

In this paper, the national breakups in Central Europe due to WWI serve as a natural experiment, in which one observes political dissolution and unification as well as stable national border barriers at the same time. I make use of an extensive set of data that provides for the opportunity to compare prewar and postwar trade. An Anderson and van Wincoop (2004)-type gravity model of trade is applied to evaluate railway shipments among Central European regions located in Germany and Poland. The data is reported for a large set of different commodities and commodity groups. The sample allows me to both evaluate changes in the national demarcation as well as to control for systematic deviation of the treatment group from the general population of bilateral trade flows. I accomplish the latter exploiting the additional information contained in the time-domain. I use prewar observations of the treatment group as further counterfactual observations or control group, respectively.

This paper contributes to the literature in two ways. On the one hand, it adds to the border literature by examining the specific impact of newly erected ("new") borders and of the dissolution of national border barriers on trade.[2] On the other hand, it adds to the historiography, which has viewed the political and national breakup of Central and Eastern Europe between 1914 and 1945 as a trigger of substantial economic disintegration through the erection of new borders and subsequent protectionism (e.g. Kindleberger, 1989, and Pollard, 1981). Thereby, this paper complements an early study by de Ménil and Maurel (1994) on the disintegration of Austria-Hungary as well as recent research on the political integration of Poland by N. Wolf (2005). The former found relatively high trade among successor states of Austria-Hungary after WWI, linked to relatively low trade of these countries with non-Ex-Austro-Hungarian countries. Wolf investigated the internal integration of the Second Republic of Poland. Evaluating price movements and inter-regional trade, he found that Poland economically integrated surprisingly quickly during the inter-war period.

The remainder of this paper is structured as follows. In the following two sections, I summarize the development of economic integration in Central Europe in order to identify determinants of new national demarcation, i.e. possibly suspected self-selection of the

[1] Nonetheless, given by the fact that the number of countries in the world increased from 74 in 1946 to 192 in 1995, events of political disintegration are frequent, which makes it important to understand their economic implications (figures taken from Alesina et al. 2000, p.1276).

[2] Other studies concerned with national disintegration (e.g. Fidrmuc and Fidrmuc, 2005, or de Ménil and Maurel, 1994) have neither identified the effect of new borders nor controlled for possible self-selection.

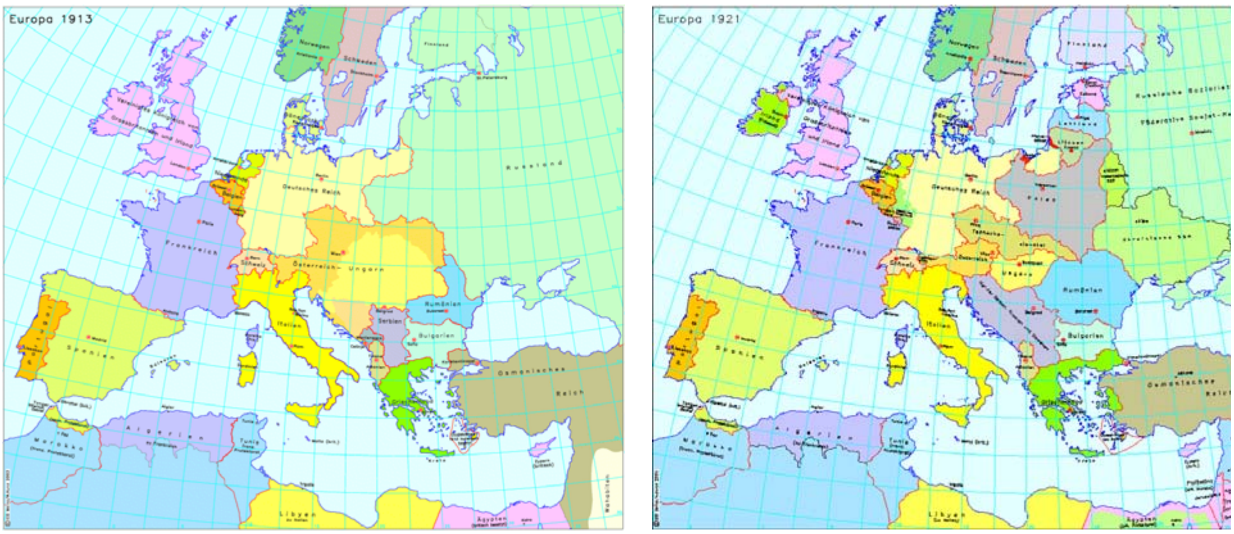
treatment group. In the fourth section, I provide a sketch of the theory-based gravity equation. In the fifth section, I present the data and discuss the requirements of the model, and present the main findings in the sixth section. The seventh section concludes.

2. Antagonistic developments in Central Europe's economic and political integration around WWI

At the end of the First World War national breakups in Central Europe had a huge impact on the political map. Already at the time the war erupted, national movements in Central and Eastern Europe recognized the opportunity to found independent nation states. Between 1917 and 1921, Central Europe's political geography was entirely reshaped. A number of small and middle-sized states that were mostly democratic and nationally homogeneous took the place of three vast, multinational monarchies (i.e. Austria-Hungary, the German Empire, and the Russian Empire). The largest of the new countries was the Second Republic of Poland. Poland had not existed as a sovereign state since 1795, when its neighboring countries had occupied and divided the Aristocratic Republic of Poland. The Eastern partition area of the so-called *Rzeczpospolita Polska* became the Russian governorate "Kingdom of Poland", the Western partition area became the Prussian province "West Prussia", and the Southern partition area became the Austrian crown land "Galicia and Bukovina". However, despite all attempts at political integration during the period of partition, the Poles maintained the idea of an independent Polish state enforced by "cultural and ideological ties that united [them]" (Tomaszewski 2002, p.127). After WWI, additional major territorial changes occurred at Germany's Western border: Alsace and Lorraine became part of France, whereas the Saar (*Saargebiet*) was governed by the League of Nations between 1920 and 1935.

The impact of national breakups on Central Europe's economic integration by contrast is less clear than the political effect. Whereas economic integration across borders is generally regarded to be very low before the war, the degree of within-country economic integration is disputed for the pre-WWI period (as we will see, this would be important even when one was focusing solely on international integration). Economic historians, most notably Polish, have suggested deep economic integration of the partition areas with their respective partitioning power before WWI (e.g. Tomaszewski 2002). Landau (1992, p.144) asserts that the authorities of each of the partitioning powers systematically conducted the economic integration of the respective Polish region. This view usually stresses that the partitioning powers installed their legal, economic, and political institutions in the respective Polish region. This process certainly contributed to furthering also their economic integration.

Map 1: National breakups in Central Europe between 1913 and 1921



Source: Kunz, Andreas (ed.) (2003), IEG-MAPS - Server for digital historical maps, Universität Mainz.

Additionally, the way, in which railway infrastructure was extended, is likely to have weakened trade linkages across borders among the partition areas. During the late 19th and early 20th century, the extension of railway infrastructure became a crucial factor for economic integration. Since railway construction in Central Europe was subject to military-strategic considerations, rail tracks often run parallel to national borders instead of crossing them. For instance, the Kingdom of Poland's foreign trade by rail in 1913 took place via only seven connections crossing the border to Germany and no more than two connections crossing the border to Austria-Hungary. Among these few lines, there were no direct connections between Polish industrial centers that were situated on different sides of the partitioning borders, e.g. between Warsaw and Posen. Instead, railway connections were directed to the respective capital city, e.g. Berlin. As a further obstacle, Russian railways use broad gauge tracks instead of the European standard track and did also so in the Russian partition area.

Despite all this evidence for integration within countries, Müller (2002, p.55) opposes the hypotheses of Tomaszewski and Landau. He states that the integration of the Eastern provinces into the German economy was relatively low. Müller argues that even right before WWI the agricultural sector of these provinces was underdeveloped and unable to exploit its exporting potential to Western Germany, which grain markets he considers to be imperfect. The problematic implication of Müller's (2002) statement is that estimated trade frictions along the new postwar borders might have been present already before the war. Without controlling for prewar trade frictions the impact of new borders would then be overestimated A self-selection bias would be present once national border demarcation after WWI depended on prewar economic integration of regions. Schultz (2002) has analyzed anecdotal evidence from the peace negotiations at Versailles in 1919. She opines that economic arguments were important factors for the determination of new borders in Central and Eastern Europe. During the negotiations, politicians from the new Central European states argued that economic self-sufficiency would be a necessary condition for the establishment of the young nation states. Yet, Schultz concludes that economic arguments only came third after nationality and history when negotiators at last decided about the final border demarcation.

Economic historians describe the post-WWI period as being characterized by extraordinary economic disintegration triggered by the war (e.g. Kindleberger, 1989, or Pollard, 1981). I find it difficult to follow such a general statement about the effect of WWI on economic integration for different reasons. First, we know little about the prewar level of integration, which is the natural point of reference when evaluating the impact of new borders on postwar trade. Second, we usually observe political unification and disintegration contemporaneously – as in the case of Poland. Unification processes may smooth the impact of political disintegration. Analyzing internal Polish trade flows, N. Wolf (2005) was able to empirically demonstrate a successful process of economic integration of the former partitioned regions between 1926 and 1934. Third, international integration after the war may have been positively influenced by two factors. One factor is that railway infrastructure in Central Europe was no longer aligned due to national borders. For instance, Poland obtained direct connections to all German industrial centers by receiving a part of Germany's former Eastern provinces and its accompanying dense railway infrastructure. The other factor is that increased economic dependency may have forced Central European countries to integrate across borders as described in the next section.

The examination of these contradicting hypotheses is eased by the fact that the war did not substantially alter potentially important sources of bilateral transaction costs, which makes it easier to control for their influence. We do not observe forced migration in contrast to the years following WWII, which means that the composition of population in each region was relatively stable over time. Moreover, the railway infrastructure destroyed during WWI was soon rebuilt, since the Polish government decided for large investments in tracks and equipment shortly after the war (Landau 1992, p.147).

3. Central Europe between free trade and protectionism, 1880-1930

In the late 19th and early 20th century, tariffs constituted an important determinant for trade as non-tariff barriers were at this point seldom applied. Yet, the rise in tariff levels was dwarfed by the drop in transport costs over the period. In the context of this study it is nevertheless important to know how tariffs developed because they increasingly became an instrument used to penalize certain cross-border trade. After the end of a phase of free trade around 1880, European governments began to institute tariff barriers. In the 1890s for instance, German Chancellor von Caprivi intended to replace imports of raw materials mainly from the U.S. with imports from Central and Eastern Europe (Bairoch 1989, pp.61-62). Thus, Germany concluded agreements with Austria-Hungary in 1891 and Russia in 1894 granting exemptions from barriers to trade in agricultural products.

The spread of protectionism in the decade before WWI resulted in the splitting of Europe into a region with high tariffs in Eastern Europe and comparably low tariffs in the rest of Europe (see table 1). Before WWI, the Kingdom of Poland's exports were almost completely oriented towards the Russian market. Tennenbaum (1916) holds the Russian external tariffs responsible for the overbearance of Russia in the Kingdom's exports, since these were very high. Some tariffs even prohibited foreign trade at all, e.g. tariffs on finished goods as well as on natural resources. Thereby, Poland was almost completely cut off from certain Western trade despite its proximity to Western Europe and had to import many goods from remote Russian deposits such as coals from the Donetzk.

Table 1: Indicators of import tariff levels before and after World War I

Region	*1913*	*1927*
Germany	15.8 %	20.4 %
Russia	72.5 %	-
Austria-Hungary	22.9 %	-
Poland	-	53.5 %
Successor states of Austria-Hungary (av.)	-	26.2 %
Eastern European countries* (av.)	37.0 %	48.9 %
Western European countries (av.)	23.6 %	25.1 %
European average*	28.0 %	33.1 %

Source: De Ménil and Maurel (1994, p.555) based on Liepmann (1938).

Notes: The table reports unweighted arithmetic means of the ad-valorem equivalent import tariff rates for 144 commodities. The asterisk * denotes exclusion of Austria-Hungary and its successor states. Averages (av.) are arithmetic means.

When the war ended, the creation of new states in Central Europe turned intra-national into inter-national trade. Instable political systems in Central and Eastern European countries evoked economic crisis, e.g. hyperinflations in Poland and Germany during the early 1920s. Despite the tense economic situation, a concerted action for implementing a new European economic order was not taken after the war. The dearth of attention given to such a goal in Woodrow Wilson's Fourteen Points provides further indication that this was apparently not foreseen.[3] The struggle for economic independence caused a rise in tariff levels throughout Europe. By 1927, Eastern Europe had experienced a strong increase in tariff levels, although tariffs in this region were already well above the European average in 1913. Polish tariffs constituted an exception, because tariffs were high but still lower than they had been under Russian rule. Similar to the economic nationalist movements, Soviet Russia aimed at economic self-sufficiency and independence from the capitalist economies. It thus restricted imports to the minimum, which brought Russian-Polish trade virtually to an end (Tomaszewski, 1970). Contrary to Eastern Europe, tariff levels in Western Europe, Germany, and the successor states of Austria-Hungary remained modest (cf. table 1).

The reason for the rise in tariffs is that opportunities for capital formation in the successor states of the Russian, German, and Austrian Empires were rare (Teichova 1989, p.893). Therefore, these countries began to levy high import and export duties in order to produce trade surpluses with one another. Germany found itself in a particularly adverse situation. Up until January 1925, the country was forced by the treaty of Versailles to unilaterally and unconditionally grant the most favored nation status to each of the victorious powers and to Poland. Of course, this obligation narrowed Germany's leeway in conducting a trade policy, which was favorable in its terms.

In spite of being dependent on good trade relations, the Polish and the German government failed to regulate the common trade relation for the time after the expiration of the Versailles treaty. Since the early 1920s, Poland had begun to settle agreements with potential trading partners and had tried to reduce her economic dependency on Germany.[4] Germany had concluded only a treaty with Russia until 1925. According to the most favored nation principle Poland would have had to open up much more than Germany, and even in sectors,

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[3] Only one, the third, of the Fourteen Points issued by U.S. President Wilson on January 8, 1918 was concerned with the economy and was not even explicitly aimed at Europe: „[The program of the world's peace ... is this:] III. The removal, so far as possible, of all economic barriers and the establishment of an equality of trade conditions among all the nations consenting to the peace and associating themselves for its maintenance."

[4] During the years 1922-1924 alone, Poland concluded 13 agreements (Puchert 1963, p.48). Yet, still in 1925 Germany accounted for about half of Poland's imports and about one quarter of its exports.

where the German industry was more advanced. Hence, for Poland an agreement with Germany based on this principle could only be unfavorable. Of course, on the Polish side one was aware of Germany's importance for Poland's economic development. The German side, aware of the Polish situation, hesitated in the negotiations in order to exploit its advantageous position and to force the Polish government to make further concessions. Finally, Germany and Poland raised tariffs in mid 1925 and ended up in escalating the conflict by repeated mutual tariff increases. This tariff war (*Zollkrieg*) - or economic war (*Wirtschaftskrieg*) - lasted until 1934.

Kowal (2002) cautions us to be aware that antagonism at the state-level is only one side of the story. He highlights the efforts of companies, interest associations, and single ministries on both sides to normalize economic relations during the tariff conflict. These efforts actually led to reductions of and exceptions from barriers to trade. Furthermore, informal contacts were a feature of German-Polish trade relations that could substitute to some extent the absence of a bilateral treaty (Kowal 2002, pp.150-153). Müller (2002, p.60-62) mentions a further aspect that is likely to have fostered Polish postwar foreign trade. Before WWI, additional costs were incurred at the border of the Russian partition area by nonofficial but state-guided protectionist measures. These were introduced by Russia at the cost of Polish foreign trade, and were therefore probably abolished after the war.

Indeed, Germany and Poland kept up tight trade relations with one another after WWI despite the new borders and the tariff conflict. There are two interrelated explanations for a high degree of economic interdependency across borders within Central Europe, e.g. between Germany and Poland. One reason could be that Germany had to service huge reparations to the allies, despite that these countries had largely closed their markets for imports. Therefore, its Eastern European neighbors gained importance as trading partners. This argument points to a more general explanation, namely that the struggle for economic independence is a sign of small home markets – of less developed countries – that depend strongly on foreign trade independent of political intentions like economic self-sufficiency.

4. Empirical Strategy

Changes in barriers to trade, like national borders, affect the integration between region pairs. The gravity model of trade has become the main tools to quantitatively investigate such processes at the inter-national and inter-regional level. The interdependence of all trade relations is one main insight from Anderson and van Wincoop's (AW) (2003, 2004) gravity model of trade. Their theory-based model yields that changes in the economic integration between two regions affects their integration with other regions as well. The model applied subsequently is almost completely based on AW (2004).

AW assume separable preferences and technology. This allows for the two-stage budgeting, where bilateral trade is determined in a conditional general equilibrium, i.e. the allocation decisions within region *i* are separable from the bilateral allocation of trade across regions *i* and *j*.[5] Second, AW (2004) assume that all goods are differentiated by place of origin. The aggregator of varieties is assumed to be identical across regions. Third, consumers in all regions are supposed to have identical, homothetic preferences, approximated by a constant elasticity of substitution (CES) utility function. After formulating the consumer maximization function, AW (2004) can derive their model, which is described by the following system of equations (for the complete derivation, see App. A)

$$(1) \qquad X_{ij}^{k} = \frac{Y_i^k E_j^k}{Y^k}\left(\frac{t_{ij}^k}{P_j^k \Pi_i^k}\right)^{1-\sigma_k}$$

$$(2) \qquad \left(\Pi_i^k\right)^{1-\sigma_k} \equiv \sum_j \left(\frac{t_{ij}^k}{P_j^k}\right)^{1-\sigma_k} \frac{E_j^k}{Y^k}$$

$$(3) \qquad \left(P_j^k\right)^{1-\sigma_k} = \sum_i \left(\frac{t_{ij}^k}{\Pi_i^k}\right)^{1-\sigma_k} \frac{Y_i^k}{Y^k}$$

where X_{ij}^k denotes region *i*'s shipments into region *j* in product class *k*.
Y_j is the nominal income of region *j*'s inhabitants.
E_j^k is the nominal expenditure of region *j*'s inhabitants on product *k*.
σ_k is the elasticity of substitution between varieties in product class *k*, with $\sigma_k \neq 1$.
β_i^k is some positive distribution parameter.
p_{ij}^k denotes the price charged by region *i* for exports of product *k* to region *j*.

This system of equations facilitates separating trade resistance into three components: (i) the bilateral trade resistance t_{ij}^k, (ii) the exporter i's resistance to trade with all regions Π_i ("outward multilateral resistance"), and (iii) the importer j's resistance to trade with all regions P_j ("inward multilateral resistance"). Even though the Π_i's and P_j's are not

[5] The term two-stage budgeting refers to the consecutiveness of allocation decisions. In a first step, consumers allocate their budget to either traded or non-traded goods. In the second step, only the decision is considered on which variety of the traded goods they spend their budget.

observable, equation (3) and (4) can be simultaneously solved for all Π_i's and P_j's in terms of product specific income shares $\{Y_i^k / Y^k\}$, bilateral trade resistance t_{ij}^k, and elasticities σ_k.

(4) $$Y^k = \sum_i Y_i^k = \sum_j E_j^k$$

is the overall output of *k*, which has to be equal to overall expenditure on *k*.

The inward and outward multilateral resistance terms represent relative barriers as they summarize the average trade resistance between one region and its trading partners. Given $\sigma_k > 1$, equations (1) – (3) demonstrate that bilateral trade depends on these relative barriers to trade. Equations (1) – (3) indicate that bilateral trade positively depends on the inward multilateral resistance P_j^k, i.e. the flow of goods from region *i* to *j* increases when trade costs of other suppliers to *j* increase. But also "high resistance to shipments from *i* to its other markets, captured in outward multilateral resistance Π_i^k, tips more trade back into *i*'s market in *j*." (AW 2004, p.21) Here, it is important to note that theory-based gravity implies that relative economic size of trading partners is crucial for trade patterns as well. A small region, in economic terms, depends more on foreign trade than a large region, which can make use of the size of its domestic market and shift foreign trade flows to its internal market. Therefore, a small region's multilateral resistance to trade is more affected by changes in overall trade barriers than a large region's multilateral resistance.

The next step is to move from the theoretical model to an operational equation and then to discuss requirements for the trade cost function. Taking the natural logarithm of (1) and adding the normally distributed error term e_{ij}^k yields the objective equation

(5) $$\ln X_{ij}^k = a^k + \ln Y_i^k + \ln E_j^k + (1-\sigma_k)\ln(t_{ij}^k) - (1-\sigma_k)\ln \Pi_i^k + (1-\sigma_k)\ln P_j^k + e_{ij}^k$$

where *a* denotes the constant. Note that the sample consists of trade by weight, whereas (12) requires trade by value as dependent variable. Following N. Wolf (2005), I use the implicit assumption that $X_{ij}^k = p_{ij}^k c_{ij}^k$ in order to replace the unobserved values X_{ij}^k by the observable quantities c_{ij}^k and obtain

(6) $$\ln c_{ij}^k = a^k + \ln Y_i^k + \ln E_j^k + (-\sigma_k)\ln t_{ij}^k - \ln p_i^k - (1-\sigma_k)\ln \Pi_i^k + (1-\sigma_k)\ln P_j^k + e_{ij}^k$$

Furthermore, the unobservable resistance terms and production variables in (6) are accounted for by a set of inward and outward region specific dummy variables, yielding (introducing a time index *t*)

(7) $$\ln\left(c_{ij,t}^{k}\right)=a_t+A_{i,t}^{k}+A_{j,t}^{k}+\left(-\sigma^{k}\right)\ln\left(t_{ij,t}^{k}\right)+e_{ij,t}^{k}$$, where

(8) $$A_{i,t}^{k}=\ln\left(Y_{i,t}^{k}\right)-\left(1-\sigma^{k}\right)\ln\left(\Pi_{i,t}^{k}\right)-\ln\left(p_{i,t}^{k}\right)$$ and

(9) $$A_{j,t}^{k}=\ln\left(E_{j,t}^{k}\right)-\left(1-\sigma^{k}\right)\ln\left(P_{j,t}^{k}\right)$$

The import and export dummies of each region take the value of 'one' whenever that region enters as an importer or exporter, respectively. Otherwise they take the value of 'zero'. Thus, the import and export dummies control for all the region-specific features, i.e. multilateral resistance terms, income and expenditure, as well as prices. The final building block is to link the unobservable trade cost factor t_{ij}^{k} to a function of m observables, including the variables of interest

(10) $$t_{ij,t}=\prod_{m=1}^{M}\left(z_{ij,t}^{m}\right)^{\gamma_t^m}$$

Let z_{ij}^{m} be normalized such that $z_{ij}^{m}=1$ represents zero trade barriers associated with the m-th variable. Thus, $(z_{ij}^{m})^{\gamma m}$ is equal to one plus the tax equivalent of trade barriers associated with the m-th variable. In this analysis, (10) is modeled as a function consisting of (i) transport costs proxied by distance ("$dist_{ij}$"), (ii) costs that are incurred when crossing an international border, and (iii) possible costs or savings through the abolition of the partition borders. Thus, its most general form is given by

(11) $$t_{ij,t}^{k}=(dist_{ij})^{\rho k}\,(border_t^{k})^{\delta_{1ij,t}}\,(pl\_integration_t^{k})^{\delta_{2ij,t}}$$

The δ's represent indicator variables. δ_1 is equal to 'one' if regions *i* and *j* do not belong to the same country, otherwise it is equal to 'zero'. A negative and significant coefficient of this variable reflects a trade diverting border effect, meaning that *ceteris paribus* regions traded less when they were located on different sides of a border. δ_2 concerns region pairs that became politically unified after WWI. If the region pair became unified it is equal to 'one', otherwise it is equal to 'zero'. The aim of using this indictors is to identify how the dissolution of borders affected trade.[6]

The aim of the analysis is to identify changes in trade frictions as specifically as possible. Therefore, the measured border effects must be decomposed in several steps and dimensions.

[6] An additional dummy was introduced to control for large trade frictions within Germany found by N. Wolf (2006), which could obscure the results. This friction is controlled for by an indicator that is "one" once a West German region the trades with a region in East Germany, otherwise it is zero.

First, they are decomposed into the average effect of prewar vs. postwar borders. Second, I decompose the measured postwar effect into the average effect of old vs. new borders as following for $(border\_old^k)^{\delta_{3ij,t}}$

(12) $$\delta_{3ij,t} = \begin{cases} 1 & \text{if } i \text{ and } j \text{ were separated by a border both before and after WWI, t >1918} \\ 0 & \text{else} \end{cases}$$

and for $(border\_new^k)^{\delta_{4ij,t}}$

(13) $$\delta_{4ij,t} = \begin{cases} 1 & \text{if } i \text{ and } j \text{ are separated by a border only since WWI, t >1918} \\ 0 & \text{else} \end{cases}$$

Third, the effect of both new and old postwar borders is differentiated as being the effect of either the German-Polish border or of any other border. For $(new\_plger^k)^{\delta_{5ij,t}}$ it is defined as

(14) $$\delta_{5ij,t} = \begin{cases} 1 & \text{if } i \text{ and } j \text{ were separated by a border only since WWI, conditional on both } i \text{ and } j \text{ being either German or Polish after the war} \\ 0 & \text{else} \end{cases}$$

and for $(new\_other^k)^{\delta_{6ij,t}}$

(15) $$\delta_{6ij,t} = \begin{cases} 1 & \text{if } i \text{ and } j \text{ were separated by a border only since WWI, conditional on either i or j being German or Polish after the war and the other being a third country} \\ 0 & \text{else} \end{cases}$$

Fourth, to the extent possible, these effects have also been decomposed with respect to time, i.e. for 1926 and 1933.

As described in the introduction, the sample used here allows controlling for systematic deviations of the treatment group from general population. Therefore, I use prewar observations on the treatment groups, being subject to new borders or to political unification, respectively. Effectively, I apply a difference-in-differences estimator (DID) for (12) - (15) and all comparable dummy variable specifications. The coefficient of the DID's time-varying component yields the ATET. The time-invariant component of the DID is subsequently called border fixed effect (BFE), since it represents the time-invariant component of what is usually estimated to be the border effect in the literature. The BFE is significantly different from zero once there are additional fixed-effects between the region pairs in the treatment group.

To begin with, I want to achieve an unambiguous understanding of what newly erected ("new") borders are as opposed to long established ("old") borders. Therefore, one set of regressions is based on a sub-sample restricted to shipments among TD that belonged to Germany before WWI. Note that in case of the restricted sample, there are naturally only estimates of the effect of new borders, but neither an estimate of a prewar border effect nor estimates of old borders after WWI.

A remaining issue is that many observations of the dependent variable are zero. This is the case for about half of the observations of each of the goods' respective trade flows. The absence of bilateral trade is not unusual, even when one examines contemporary trade flows once the data is disaggregated, e.g. at a regional or sectoral level. However, if one wants to log-linearize the gravity equation the value of the dependent variable has to be an element of number space $\mathbf{R}^{+}$. One cannot simply exclude those zero entries and apply the least squares (LS) procedure to the remaining sample, because the LS estimator will be biased and inconsistent (cf. Judge et al. 1988, pp.796-799).

Since I deal with a limited dependent variable issue here, a Tobit estimator is applied. The Tobit estimator belongs to the class of censored regression models (CRM) and is a standard approach if the researcher has a-priori knowledge of the dependent variable being limited at a certain threshold. Censored regression models apply maximum likelihood (ML) procedures. The likelihood of a sample as the present one has a component for strictly positive and one for observations equal to the threshold. According to the Tobit approach, the distribution of the former is continuous; the distribution of the latter is discrete. The probability to find an observation at the lower bound is then equal to the integral over the region underneath the distribution function above the excluded domain. If $c_{ij}^{k} > 0$ the "usual" component of the likelihood function applies.[7] However, this procedure does not yield coefficient estimates that can be interpreted as elasticities. Thus, I apply an approach by Eichengreen and Irwin (1995) in addition to Tobit. They proposed to replace observations in the dependent variable vector, which are "zero", by small positive integers, i.e. by ones. According to Eichengreen and Irwin this procedures replicates closely the results generated by Tobit if one multiplies the resulting coefficients by the inverse share of non-zero observations. These "scaled" coefficients can then be interpreted as elasticities.

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[7] As in other limited dependent variable models, the estimated coefficients do not have a direct interpretation as the marginal effect of the associated regressors contained in $\boldsymbol{h}_{ij}'$. In CRM a change in $\boldsymbol{h}_{ij}'$ has two effects: First, an effect on the probability of c_{ij}^{k} being observed. Second, given that it is observed, an effect on the mean of the dependent c_{ij}^{k}. Therefore, results from censored regressions cannot be directly compared to the results of OLS.

5. Data

The available statistical sources report annual railway shipments of different commodities and commodity groups, respectively. The German and Polish sources give this data at a regional level, namely at the level of administrative transport districts (TD). Since the Polish source has been modeled on the German example, both the definition of goods and of the TD match each other. In contrast, the Russian and Austro-Hungarian authorities did not provide any comparable statistics on railway shipments broken down by district or region. They usually report aggregate data. The German statistics can substitute such records in case of bilateral trade between these foreign regions and German districts taking German imports as those TDs exports. Nonetheless, goods-specific data on the foreign trade of the Russian and Austrian partition area is needed as well as on *internal trade* of both regions. Therefore, I approximated these figures using evidence on production shares as well as narrative evidence from various Russian, Polish, and Austro-Hungarian sources (for details, see app. C).

The German and Polish data is taken from three annual series. These are, in case of Germany, the *Statistics of the Goods' Movement on German Railways* before WWI and the *Goods' Movement on German Railways* after WWI as well as, in case of Poland, the *Statistical Yearbook of Goods' Movements on Polish State Railways*. All data is given in metric tons. The sample comprises observations of railway shipments from 29 TD into 44 regions. The former 29 TD make up Germany and Poland after WWI. The latter number of 44 importers is given by the same 29 exporting regions plus further 15 European regions (for a list of all regions in the sample see App.B). 1910 and 1913 are taken as prewar reference years that are compared to 1926 and 1933.[8]

I evaluate shipments of seven important goods and groups of goods, respectively, as representatives of both total trade as well as of trade in these sectors. These are brown coal, chemical products, iron and steel, rye, paper, hard coal, and coke. This yields a total of 5104 observations per good, i.e. 1276 per cross-section or year, respectively. Each prewar cross-section comprises 556 observations on cross border trade; each postwar cross-section comprises 799 observations on cross border trade. In 1926 and 1933, out of these 799 observations there are 254 of trade flows across a new border. There are also 10 observations

[8] The data and details of the composition of commodity groups are provided on request. It would basically be possible to choose a year right after WWI in order to compare the state of economic integration. But in contrast to years more proximate to WWI, 1926 provides for data that is quite extensive and whose interpretation is more immediate than that at earlier dates. Such data would be biased by all the direct consequences of war, e.g. guerilla fights.

in each postwar cross-section of trade across a former border dissolved after the war.[9] In all those regions railways accounted for the major share in inter-regional trade. Thus, it appears sufficient to use only data on railway shipments.[10]

(map 2)

Polish shipments after WWI are reported according to nine TD (*dyrekcji*). These are represented by four regions in the gravity model, which have been compiled according to the four regions identified by the German statistics. Altogether, this compilation is unproblematic, since the Polish transport districts and the regions based on the German statistics can be matched.

The considerable change in Germany and Poland's respective territories causes several statistical difficulties that must be taken into account. Territorial changes between Germany and Poland took place almost entirely along the boundaries of the German TDs (cf. map 2).[11] Nonetheless, minor disruptions in the statistical records due to the division of TD complicate the analysis. It is not possible to make the pre-WWI records fully comparable to the post-WWI records, since three German TDs were split up between Poland and Germany. They are accounted for in the postwar statistics as new foreign TDs. One of these new TD results from the division of the former Upper Silesia (*Oberschlesien*), into a German and a Polish part, called Upper Silesia and East Upper Silesia (*Ost-Oberschlesien*), respectively. Another new TD results from the division of the districts of Posen and of West-Prussia. A very small part of each district remained part of Germany and was merged to become the „borderland of Posen-West Prussia" (*Grenzmark Posen-Westpreußen*) after the war. The larger parts of each former TD merged to form a new district, called West Poland, that was part of postwar Poland. Since the number of regions in each cross-section of the panel must be the same, one basically has two options. One may opt either for non-ambiguous demarcation, i.e. to compile regions alongside the actual postwar barriers, or for comparable shape of regions before and

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[9] One observation per postwar cross-section is missing in this list that is dissolution of the national border between Alsace-Lorraine and France.

[10] The share of railway shipments in Polish domestic trade was about 99% in the 1930s (N. Wolf 2005). In Germany, the 1926 share of railways was smaller, namely about four fifth (Statistisches Bundesamt 1926/78). In Russia, the respective share in 1910 is about two thirds with a high variation across sectors (Žarago, 1914), in Germany the share in 1910 is about 84% for rye and coal (Statistisches Jahrbuch 1913). For Austria-Hungary the share cannot be determined that easily. However, shipments by waterways in Galicia did play no role in the trade of those goods considered except for rye trade.

[11] That is the case with the Saar as well as with Alsace and Lorraine. The reshaping of others TD can be regarded of minor economic consequence as it is the case for Northern Schleswig, Eupen, and Memel.

after the war, i.e. to construct bi-national regions. As this study focuses on border effects, it is more appropriate to use the former approach.

A second problem is that the postwar regions of "East Poland" and "Galicia" are not identical to prewar "Kingdom of Poland" and "Galicia". The postwar TD "East Poland" corresponded to both the former Kingdom of Poland and to the region east of it, i.e. the Eastern Borderlands (*kresy*). Thus, the postwar area of East Poland in 1926 is larger than the former Kingdom. The opposite is the case for the region "Galicia", which was larger before WWI than after the war because it included the Bukovina beforehand. All these represent changes in the definition of TD in terms of geography rather than in terms of population since the problematic regions – with the exception of Silesia – were not densely populated and are also not special with respect to specific industries. Independent from this, the use of region-specific fixed effects that are time-variant should be sufficient to control for a systematic bias introduced by the mentioned changes, since all these are area-specific and not bilateral pair-specific.

Distances required by the model are calculated as center-to-center Great Circle distances.[12] Intra-region distances are determined following an approach by Head and Mayer (2000)

$$dist_{ii} = 0.67\sqrt{area_i/\pi} \qquad (16)$$

This measure is based on the assumptions that (i) $region_i$ has a disk shape, (ii) its production is concentrated in a single point at its center, and (iii) consumers are uniformly distributed across space. Despite the strict assumptions the measure has worked well for similar purposes according to Head and Mayer (2000).

6. Estimation Results

I performed regressions using both Tobit and OLS. Since the results obtained are similar regardless of the approach taken, I proceed by only reporting results from the Tobit model. I mention results from LS if they contradict those obtained via Tobit estimation. An overview of all regression results is given in App. D.

First, I compare results from a typical regression, i.e. without controlling for BFE, to a set of regression, in which the actual treatment effect of the border is given. I denote the former as the "naïve" approach to estimating border effects. Second, I discuss the results from the regressions based on the sub-sample in order to establish a benchmark result of the impact of

[12] Center cities are determined according to their economic importance and position in space, see App.B.

new borders on trade. Thereafter, I add further insights from the evaluation of the complete sample and compare those to the benchmark.

Table 2 illustrates that the estimates obtained by the two approaches can lead to highly different conclusions. Take three examples: Using the naïve approach, we would have overestimated the impact of all new borders – except the new German-Polish border – on trade in chemical products, namely a coefficient of -2.5, whereas in fact it is statistically insignificant. At the same time, we would have underestimated the impact of those new borders on trade in iron and steel, namely a coefficient that is statistically insignificant although in fact it is -2.1. Finally, we would have highly overestimated the effect of political unification on Poland's internal postwar integration by overlooking that integration among these regions has been substantial already before the war.

Table 2: Effect of controlling for BFE on border coefficient estimates

(selected regressions)

	Naïve regression results			*Actual border treatment effect*		
Indicator	Chemicals	Iron & steel	Hard coals	Chemicals	Iron & steel	Hard coals
oldBORDER_postwar	-4,128 (0,696)	-5,920 (0,418)	-12,458 (1,595)	-4,267 (0,688)	-5,866 (0,414)	-12,339 (1,584)
newGER-PL_postwar	-3,638 (0,486)	-4,736 (0,355)	-9,369 (1,259)	-2,629 (0,529)	-5,003 (0,421)	-11,917 (1,374)
newGER-PL_BFE				-1,099 (0,231)	0,303 (0,239)	2,629 (0,588)
newOTHER_postwar	-2,502 (0,448)	-0,029 (0,385)	-3,126 (1,033)	-0,832 (0,499)	-2,091 (0,449)	-4,299 (1,183)
newOTHER_BFE				-1,785 (0,240)	2,087 (0,244)	1,250 (0,611)
PL_integration	1,095 (1,064)	2,301 (0,671)	4,085 (1,823)	-0,864 (1,188)	0,059 (0,876)	-2,723 (2,257)
PL_integration_BFE				1,884 (0,550)	2,249 (0,571)	6,844 (1,340)
#Obs. (censored obs.)	4861 (1349)	4960 (1322)	4901 (3116)	4861 (1349)	4960 (1322)	4901 (3116)

Notes: The table reports coefficient estimates obtained from Tobit estimation. Standard errors are reported in parenthesis. Coefficient estimates for other variables than border indicators are not reported, including the estimate of prewar border effects. For further results see App. C.

The regressions based on the sub-sample yield reasonable estimates. The impact of the new borders on formerly internal German trade is negative, large, and statistically significant. I obtain the largest negative estimate of a border effect on trade in coals, i.e. hard coal and brown coal, with coefficients of about –6 and even estimates of about -7 for coke. For all other goods, the estimated coefficients are between -3.3 and -4.7, where the lower and upper bounds are given by chemical products and paper, respectively. These are all difference-in-differences estimates. The coefficients on the BFE are all negative but relatively small. The lower bound is given by paper (–0.7). The coefficient estimates for paper, chemicals, and rye are all significantly different from zero, the estimates for coals and coke are not statistically significant. One exception is iron and steel, for which the BFE is estimated to be small, positive, and significant. These results indicate that the new borders had a large, negative effect on trade, which is robust to controlling for possible self-selection.

In order to better explain these estimates, I decompose the border effect into the effect of the new German-Polish border in the East and the effect of other new borders in the sample. As long as I evaluate the sub-sample, these other new borders are exclusively located at Germany's Western new border. The decomposition yields that the new German-Polish border had a much more diverting effect than the new border in the West on trade in coals and in coke as well as in iron and steel – it is important to note, though, that the effect of the former on trade in brown coal is large, but statistically insignificant. The German-Polish border has a slightly weaker negative effect than the new border in the West on trade in paper. The effect of the new borders in the East and West on trade in chemical products and rye are not statistically significantly different from each other. The regressions yield significantly negative BFEs for diversion of trade in chemical products, rye, and paper at the German-Polish border. Evaluating the effect of the new Western border, the BFEs are negative and significant only for trade in chemical products. In addition, I even find that the BFE is significantly positive for trade in iron and steel across the Western border. In contrast to the regions separated from Germany in the West, the Polish regions were obviously poorly integrated into the German economy, except for sectors where Silesia played a significant role as a producer and exporter, i.e. for coals, coke, and iron and steel. It seems that the impact of the new Eastern border was, therefore, particularly trade diverting in the case of these goods.

When analyzing the complete sample, it becomes feasible both to measure prewar border effects and to obtain estimates of the impact of political integration on trade as well as to evaluate border effects by country. As a general result across regressions, I find that the average border effect was larger after the war than beforehand. The estimated prewar coefficients range from –3.3 for trade in chemical products to –6.9 for trade in iron and steel products. The estimated postwar coefficients range from –3.5 for trade in chemical products to –7.9 for trade in hard coals.[13] I observe the largest increase in trade diversion for trade in rye, for which the estimated effect is small and statistically insignificant in the period before WWI. An exception is the average effect of borders on trade in iron and steel, which was less negative after the war then beforehand.

Generally, the new borders less negatively affected postwar trade than borders that were in place already before the war. The lower bounds of estimated differences in the effect of "old" and "new" borders are given by–4.7 and –1.6, respectively, for trade in chemical products. The respective upper bounds are given by coefficients of –14.1 and –7.9 for trade in hard coals. This difference supports the view that long-established economic relations among regions continued to positively affect the level of trade after the war. The positive impact of historical ties survived the war, the demarcation of new borders, and subsequent hostile trade policy in Central Europe. The result mirrors N.Wolf's (2005a) finding of path dependent trade relations within postwar Poland arising from the common history of regions. During the after-war years analyzed, Poland's internal trade was influenced by trade linkages with the former partitioning powers. Both historical trade relations and mere infrastructure could account for these persistent links. The BFE for the treatment group (with new borders) is positive and significant considering trade in hard coals as well as trade in iron and steel. The BFE is negative and significant in the case of trade in all other goods. The diverting effect of the new borders is aggravated by the fact that three out of four regions separated from Germany were well integrated in those sectors for which they were main producers and exporters.

Generally, decomposing the border effect based on the complete sample into the effect of the new German-Polish border and the average effect of all other new borders in the sample yields similar results to those obtained from the sub-sample. The regression based on the complete sample indicates more clear-cut that the new German-Polish border has had a stronger diverting effect on trade than the effect of all other new borders. We cannot directly compare the coefficient on the other borders because its definition varies with the sample size. However, there is one contradiction to the results obtained from the sub-sample in the coefficient estimate on the new German-Polish border: shipments of rye are significantly more diverted across the new borders and the estimate of the BFE has turned statistically insignificant. In the case of rye, it appears to be too restrictive to implicitly assume that multilateral trade resistance with respect to all foreign regions is equal for all TD in the sub-

[13] Note that these coefficients give the ATE instead of the ATET, since they were not obtained by applying DID.

sample. The explanation is probably that West Prussia was not well economically integrated in rye trade with German regions, but was worse so with foreign regions.

Now I consider the conceptual opposite of new border demarcation, namely the dissolution of national borders among the former partition areas as well as East Upper Silesia. Surprisingly, the coefficient of this indicator is statistically insignificant, regardless of the good under consideration. What is more, the estimate of the BFE for unification is always positive and large. This means that prewar economic integration across borders among the partition areas was comparably high, but apparently it did not increase disproportionate after political unification compared to that prewar level.

Using the intuition of the gravity model helps to interpret the finding of relatively moderate postwar economic disintegration in Central Europe despite WWI, national breakups, and subsequent hostile trade policies. The model gives that bilateral trade depends on relative barriers as well as the influence of relative economic size. Poland was a small economy, like all the other new Central European countries. Thus, it could not rely on a large domestic market and was in a way forced to trade with Germany. This development attenuated disintegration, particularly between the new nation states and their trading partners. The overbearance of Germany in Poland's trade after the war was furthered by the absence of Russian-Polish trade. Russia's introduction of almost prohibitive barriers to trade after WWI directly translated into a relative decrease in barriers to trade within Central Europe. This explains why Polish trade was so strongly oriented towards the German market despite Poland's attempt to reduce this dependency. Moreover, Germany itself faced large barriers to trade introduced by its Western trading partners. Furthermore, the finding of significant BFEs for the treatment groups justifies the suspicion of unaccounted-for fixed effects in trade of these groups. There is evidence, though weak, that demarcation of new borders and dissolution of national borders were indeed correlated to the level of trade integration among the respective region pairs.[14]

7. Conclusions

The object of this study is to evaluate the impact of political disintegration in Central Europe after WWI for its consequence on economic integration. The study does not directly link

[14] The control for the German internal barrier to trade is negative in all regression. In most cases this result is statistically significant. The extent of the internal barrier was smaller after WWI than beforehand.

economic (dis)integration to WWI, but instead makes inferences based on the creation of barriers that the war precipitated, i.e. new national border demarcation.

Taken together, there are four main results of this evaluation. First, border effects after WWI were negative and large. However, their negative impact on trade was not extraordinarily larger than the impact of Central European borders before the war. An exception in the sample is given by trade of coals, which was much more diverted across borders after the war than beforehand. This is likely a result of the German-Polish tariff conflict between 1925 and 1934. Second, trade flows across borders were less diverted by borders first established after the war than by borders established before WWI. This result indicates path dependency of bilateral trade relations across national borders, whether it be because of historical ties or simply because of existing infrastructure. Third, regions pairs that became separated by a new national border after WWI, tended to have below average levels of economic integration already before the war. In order to correctly calculate the treatment effect of new borders, it is necessary to control for the potential "border before border" effect by estimating difference-in-differences. Finally, regions pairs that were politically unified as the Republic of Poland after WWI, display relatively high economic integration across prewar borders. Estimating difference-in-differences yields that the event of actual political unification did not have a disproportionate impact on economic integration of these regions.

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10. Appendices

App. A: Derivation of the gravity equation

Anderson and van Wincoop (2004) formulate the consumer maximization function as follows

(1) $$\max_{c_{ij}^k} U_j = \sum_k \left(\sum_i \left(\beta_i^k\right)^{(1-\sigma_k)/\sigma_k} \left(c_{ij}^k\right)^{(\sigma_k-1)/\sigma_k} \right)^{\sigma_k/(\sigma_k-1)}$$ s.t. the budget constraint

(2) $$Y_j = \sum_k E_j^k = \sum_k \sum_i p_{ij}^k c_{ij}^k$$

where c_{ij}^k denotes region *j*'s consumption of region *i*'s goods in product class *k*.
σ_k is the elasticity of substitution between all goods in product class *k*.
β_i^k is some positive distribution parameter.
Y_j is the nominal income of region *j*'s inhabitants.
E_j^k is the nominal expenditure of region *j*'s inhabitants on product *k*.
p_{ij}^k denotes the price charged by region *i* for exports of product *k* to region *j*.

Nominal demand for region *i*'s goods by region *j*'s consumers has to satisfy maximization of (1) subject to the budget constraint (2). From the Lagrangian, we obtain the following first order conditions (FOC):

(3a) $$\left(\sum_i \left(\beta_i^k\right)^{(1-\sigma_k)/\sigma_k} \left(c_{ij}^k\right)^{(\sigma_k-1)/\sigma_k} \right)^{1/(\sigma_k-1)} \left(\beta_i^k\right)^{(1-\sigma_k)/\sigma_k} \left(c_{ij}^k\right)^{-1/\sigma_k} \frac{\sigma_k - 1}{\sigma_k} = \lambda p_{ij}^k \quad \forall i \neq j$$

(3b) $$\left(\sum_i \left(\beta_i^k\right)^{(1-\sigma_k)/\sigma_k} \left(c_{ij}^k\right)^{(\sigma_k-1)/\sigma_k} \right)^{1/(\sigma_k-1)} \left(\beta_j^k\right)^{(1-\sigma_k)/\sigma_k} \left(c_{jj}^k\right)^{-1/\sigma_k} \frac{\sigma_k - 1}{\sigma_k} = \lambda p_{jj}^k$$

(3c) $$\sum_k \sum_i p_{ij}^k c_{ij}^k = Y_j$$

where (3a) and (3b) hold for all sectors *k*. Setting equal the first two conditions (3 a,b) and rearranging them, yields

(4) $$p_{ij}^k c_{ij}^k = \left(\frac{\beta_i^k}{\beta_j^k} \right)^{(1-\sigma_k)} c_{jj}^k \left(p_{ij}^k\right)^{1-\sigma_k} \left(p_{jj}^k\right)^{\sigma_k} \quad \forall i, k$$

Summing up (4) over all *i* and using the definition from the budget constraint (2) gives

(5) $$\sum_i p_{ij}^k c_{ij}^k = E_j^k = \left(\beta_j^k\right)^{-(1-\sigma_k)} c_{jj}^k \left(p_{jj}^k\right)^{\sigma_k} \sum_i \left(\beta_i^k p_{ij}^k\right)^{(1-\sigma_k)} \quad \forall k$$

Now, one replaces the terms in (5) that do not depend on *i* (except for E_j^k) by the terms in (4) that do not depend on *i*. After some rearrangement that yields

(6) $$\frac{\left(p_{ij}^k \beta_i^k\right)^{(1-\sigma_k)}}{\sum_i \left(\beta_i^k p_{ij}^k\right)^{(1-\sigma_k)}} E_j^k = p_{ij}^k c_{ij}^k = X_{ij}^k \quad \forall k$$

where the latter equation stems from the definition that demand *X* in region *i* for products *k* from region *j* is given by price times quantity, i.e. $X_{ij}^k = p_{ij}^k\ c_{ij}^k$. One may simplify (6) assuming equal weights β_i^k for each region of origin. This assumption yields

(7) $$X_{ij}^k = \left(\frac{p_{ij}^k}{P_j^k}\right)^{1-\sigma_k} E_j^k$$

where P_j^k is the CES price index in *j* defined as

(8) $$P_j^k \equiv \left[\sum_i \left(p_{ij}^k\right)^{1-\sigma_k}\right]^{1/(1-\sigma_k)}$$

Prices p_{ij}^k differ between locations due to a mark-up on p_i^k, which is the supply price received by producers of *k* in region *i*.

To achieve a formulation like (7) and (8), several assumption were needed. (i) I assumed that the mark-up on prices contains only the ad-valorem tariff equivalent of trade costs t_{ij}^k. (ii) A further assumption is that trade costs are proportional to trade volumes. Taken together, (i) and (ii) imply $p_{ij}^k = p_i^k\ t_{ij}^k$. (iii) Trade costs are assumed to be borne by the exporter, i.e. formally the exporter incurs export costs equal to (t_{ij} - *1*) for each good shipped from *i* to *j*. The nominal value of exports from *i* to *j* is, thus, the sum of the value of production at the origin $p_i\ c_{ij}$ plus the trade cost that the exporter passes on to the importer, i.e. $X_{ij}^k = p_{ij}^k\ c_{ij}^k = p_i^k\ c_{ij}^k + (t_{ij}^k - 1)\ p_i^k\ c_{ij}^k$.

Imposing market clearing conditions for all regions and sectors

(9) $$Y_i^k = \sum_j X_{ij}^k \qquad \forall\ i, k$$

and inserting equations (7) into (9) as well as the assumption on the equivalence of trade costs and trade volumes (ii) into (7) gives that

$$(10) \qquad Y_i^k = \sum_j \left(\frac{p_{ij}^k}{P_j^k} \right)^{1-\sigma_k} E_j^k = \sum_j \left(\frac{p_i^k t_{ij}^k}{P_j^k} \right)^{1-\sigma_k} E_j^k$$

which has to be rearranged in order to solve for p_i^k:

$$(11) \qquad \left(p_i^k\right)^{1-\sigma_k} = \frac{Y_i^k}{\sum_j \left(t_{ij}^k / P_j^k\right)^{1-\sigma_k} E_j^k}, \quad \forall i$$

Now, equation (11) can be substituted in equations (7) and (8). The result is the theory-based gravity model, which is described by the following system of equations

$$(12) \qquad X_{ij}^k = \frac{Y_i^k E_j^k}{Y^k} \left(\frac{t_{ij}^k}{P_j^k \Pi_i^k} \right)^{1-\sigma_k}$$

$$(13) \qquad \left(\Pi_i^k\right)^{1-\sigma_k} \equiv \sum_j \left(\frac{t_{ij}^k}{P_j^k} \right)^{1-\sigma_k} \frac{E_j^k}{Y^k}$$

$$(14) \qquad \left(P_j^k\right)^{1-\sigma_k} = \sum_i \left(\frac{t_{ij}^k}{\Pi_i^k} \right)^{1-\sigma_k} \frac{Y_i^k}{Y^k}$$

where Π_i and P_j are called outward and inward multilateral resistance, respectively.

$$(15) \qquad Y^k = \sum_i Y_i^k = \sum_j E_j^k$$

is the overall output of *k*, which has to be equal to overall expenditure on *k*.

App. B: Compilation of regions; Definition of center cities

TDs acc. to German statistics, prewar		TDs acc. to German statistics, postwar		Region in the gravity model (CTD)			
Name of TD	#TD	Name of TD	#TD	#CTD	ie. prewar	ie. postwar	Center city
East Prussia	1a	East Prussia	1	1	1a	1	Königsberg
West Prussia	1b	East Prussian harbors	2	2	2a	2	Königsberg
East Prussian harbors	2a	Pomerania	3	3	3	3	Stettin
West Prussian harbors	2b	Pomeranian harbors	4	4	4	4	Kolberg
Pomerania	3	Mecklenburg	5	5	5	5	Güstrow
Pomeranian harbors	4	Harbors Rostock to Flensburg	6	6	6	6	Lübeck
Mecklenburg	5	Schleswig-Holstein, Lübeck	7	7	7	7	Kiel
Harbors situated between Rostock and Flensburg	6	Harbors situated at Elbe river	8	8	8	8	Hamburg
Schleswig-Holstein, Lübeck	7	Harbors situated at Weser river	9	9	9	9	Vegesack
Harbors situated along Elbe river	8	Harbors situated at Ems river	10	10	10	10	Leer
Harbors situated along Weser r.	9	Oldenburg, Stade	11a	11	11	11a+b	Verden
Harbors situated along Ems r.	10	Hanover, Braunschweig, Schaumburg-Lippe	11b	12	1b+12	47	Posen
Hannover, Braunschweig, Oldenburg, Schaumburg-Lippe	11	Borderland of Posen-West Prussia	12	13	13	47a	Gleiwitz
Posen	12	Upper Silesia	13	15	14+15	13-15	Katowice
Oppeln	13	Stadt Breslau	14	16	16+16a	16a+16b	Breslau
City of Breslau	14	Province of Lower Silesia	15	17	17	17+12	Berlin
Province of Lower Silesia	15	Berlin; inner	16a	18	18	18	Fürstenwalde
Berlin	16	Berlin; outer	16b	19	19	19a+b	Magdeburg
Berlin suburbs	16a	Brandenburg	17	20	20+20a	20+20a	Rudolstadt
Brandenburg	17	Anhalt and Magdeburg	18	21	21	21+21a	Dresden
Anhalt und Magdeburg	18	Merseburg, Erfurt	19a	22	22	22	Gießen
Thuringia and the administrative districts of Merseburg and Erfurt	19	Thuringia and the administrative districts of Merseburg and Erfurt	19b	23	23	23	Dortmund
Saxony and Leipzig	20	Saxony and Leipzig	20	24	24	24	Mülheim
Greater Leipzig	20a	Leipzig	20a	25	25	25	Lippstadt
Hesse-Nassau, Upper Hesse	21	Hesse-Nassau, Upper Hesse	21	26	26	26+26a	
Ruhr basin (Westphalia)	22	Frankfurt a.M.	21a	27	27	27	Cologne
Ruhr basin (Rhine province)	23	Ruhr basin (Westphalia)	22	28	28	28	Saarbrücken
Westphalia, Lippe, Waldeck	24	Ruhr basin (Rhine province)	23	30	29+30	44	Duisburg
		Westphalia, Lippe (and Waldeck)	24	31	31+34	31+34	Straßburg
Rhine province right of the river Rhine	25	Rhine province right of the river Rhine	25	32	32	32	Neustadt a.d. Weinstr.
Rhine province left of the river Rhine and Cologne	26	Rhine province left of the river Rhine and Cologne	26	33	33	33	Darmstadt
Saar	27	Cologne	26a	35	35	35	Karlsruhe
Duisburg and other harbors situated along the river Rhine	28	Duisburg	28	36	36	36	Stuttgart
Lorraine	29	Bavarian Palatine (excl. Ludwigshafen)	31	37	37	37	Munich
Alsace	30	Hesse (excl. Oberhessen)	32	46	2b	46	Nuremberg
Bavarian Palatine (excl. Ludwigshafen)	31	Baden	33	50	50	50a+50b/ d+45	Dantzig
Hesse (excl. Oberhessen)	32	Ludwigshafen, Mannheim	34	51	51	51	Moscow
Baden	33	Württemberg, Hohenzollern	35	52	52	52	Warsaw
Ludwigshafen, Mannheim	34	South Bavaria	36	52a	52a	52a	Przemysl
Württemberg, Hohenzollern	35	Munich	36a	53	53	53	Bukarest
South Bavaria	36	North Bavaria	37	53a	53a	53a	Budapest
North Bavaria	37	Saar	27	54	54	54	Beograd
Russia	50	Alsace-Lorraine	44	55	55	55	Žilina
Kingdom of Poland	51	Memel	45	56	56	56	Salzburg
Galicia, Bukovina	52	Danzig	46	57	57	57	Bern
Rumania	52a	West Poland (former German Territories, excl. East Upper Silesia)	47	58	58	58	Rome
Hungary, Slavonia, Croatia, Bosnia	53	East Upper Silesia	47a	59	59	59	Paris
Serbia, Bulgaria, Turkey, Greece	53a	Northern Schleswig	48	60	60	60	Luxemburg
Bohemia	54	Russia	50a	61	61	61	Brussels
Austria (without 52, 54)	55	Latvia, Lithuania, Estonia, Finland	50b/ d	62	62	62	Utrecht
Switzerland	56	East Poland	51	63	63	63	London
Italy	57	Galicia (Polish part)	52	64	64	64+48	Gothenburg
France	58	Rumania	52a				Kopenhagen
Luxemburg	59	Hungary	53				
Belgium	60	Yugoslavia	53a				
Netherlands	61	Tchechoslovakia	54				
Great Britain	62	Austria	55				
Sweden, Norway	63	Switzerland	56				
Denmark	64	Italy	57				
		France (without Alsace & Lorraine)	58				
		Luxembourg	59				
		Belgium	60				
		Netherlands	61				
		Great Britain	62				
		Sweden, Norway	63				
		Denmark (without Schleswig)	64				

App. C: Tables of coefficient estimates: *brown coal*

Estimation method: Tobit; Sample: sub-sample					
Variable \ Regression No.	**1**	**2**	**4**	**5**	**6**
C	36.945	37.252	36.946	40.238	40.205
	0.916	0.911	0.916	0.908	0.908
LOG(DISTANCE)	-4.985	-5.045	-4.986	-5.742	-5.736
	0.141	0.140	0.141	0.129	0.129
NEW_DEMARC					-5.948
					1.505
NEW_DEMARC_BFE					-1.043
					0.639
NEW_PLGER			-12.684	-13.031	
			32.664	38.731	
NEW_PLGER*D1926	-2.698	-3.747			
	177567	177568			
NEW_PLGER*D1933	-13.766	-14.758			
	83.199	86.291			
NEW_PLGER_BFE	-0.998		-0.998	-0.671	
	0.766		0.766	0.796	
NEW_OTHER			-3.535	-3.056	
			1.853	1.932	
NEW_OTHER*D1926	-3.480	-5.617			
	2.379	2.155			
NEW_OTHER*D1933	-3.592	-5.719			
	2.443	2.223			
NEW_OTHER_BFE	-2.205		-2.205	-1.696	
	1.038		1.038	1.084	
EASTWEST_PREWAR	-2.714	-2.675	-2.714		
	0.287	0.287	0.287		
EASTWEST_POSTWAR	-1.411	-1.365	-1.411		
	0.275	0.275	0.275		
Total observations	2904	2904	2904	2904	2904
Left censored obs	1869	1869	1869	1869	1869
adj. R^2	0.813	0.812	0.814	0.796	0.795

Notes: The results for the region-specific dummy variables are omitted for the sake of clarity.
Standard errors are given below each coefficient estimate.

App. C: Tables of coefficient estimates: *chemical products*

Estimation method: Tobit; Sample: sub-sample					
Variables \ Regression No.	**1**	**2**	**4**	**5**	**6**
C	18.868	19.033	18.904	20.384	20.422
	0.351	0.348	0.351	0.326	0.326
LOG(DISTANCE)	-1.842	-1.874	-1.848	-2.177	-2.183
	0.054	0.053	0.054	0.044	0.044
NEW_DEMARC					-3.460
					0.376
NEW_DEMARC_BFE					-0.445
					0.223
NEW_PLGER			-3.440	-3.193	
			0.456	0.467	
NEW_PLGER*D1926	6.915	6.513			
	34445	40364			
NEW_PLGER*D1933	-3.775	-4.234			
	0.484	0.413			
NEW_PLGER_BFE	-0.494		-0.490	-0.345	
	0.262		0.262	0.266	
NEW_OTHER			-4.273	-3.848	
			0.597	0.608	
NEW_OTHER*D1926	-4.261	-5.103			
	0.762	0.676			
NEW_OTHER*D1933	-4.196	-5.035			
	0.760	0.674			
NEW_OTHER_BFE	-0.894		-0.886	-0.668	
	0.370		0.370	0.376	
EASTWEST_PREWAR	-0.918	-0.904	-0.912		
	0.094	0.094	0.094		
EASTWEST_POSTWAR	-0.589	-0.561	-0.587		
	0.104	0.104	0.104		
Total observations	2904	2904	2904	2904	2904
Left censored obs	503	503	503	503	503
adj. R^2	0.794	0.793	0.794	0.786	0.786

Notes: The results for the region-specific dummy variables are omitted for the sake of clarity.
Standard errors are given below each coefficient estimate.

App. C: Tables of coefficient estimates: *iron and steel*

Estimation method: Tobit; Sample: sub-sample					
Variables \ Regression No.	**1**	**2**	**4**	**5**	**6**
C	20.346	20.213	20.346	21.681	21.533
	0.317	0.314	0.318	0.296	0.298
LOG(DISTANCE)	-2.014	-1.988	-2.014	-2.311	-2.285
	0.048	0.048	0.049	0.040	0.040
NEW_DEMARC					-3.953
					0.303
NEW_DEMARC_BFE					0.451
					0.202
NEW_PLGER			-4.585	-4.377	
			0.344	0.350	
NEW_PLGER*D1926	-3.677	-3.740			
	0.410	0.344			
NEW_PLGER*D1933	-5.739	-5.803			
	0.449	0.389			
NEW_PLGER_BFE	-0.038		-0.038	0.094	
	0.230		0.231	0.235	
NEW_OTHER			-2.842	-2.409	
			0.539	0.548	
NEW_OTHER*D1926	-3.529	-2.457			
	0.683	0.606			
NEW_OTHER*D1933	-2.141	-1.068			
	0.684	0.607			
NEW_OTHER_BFE	1.119		1.120	1.289	
	0.334		0.335	0.340	
EASTWEST_PREWAR	-0.872	-0.880	-0.872		
	0.085	0.085	0.085		
EASTWEST_POSTWAR	-0.476	-0.499	-0.478		
	0.095	0.094	0.095		
Total observations	2909	2909	2909	2909	2909
Left censored obs	411	411	411	411	411
adj. R^2	0.853	0.853	0.852	0.846	0.843

Notes: The results for the region-specific dummy variables are omitted for the sake of clarity.
Standard errors are given below each coefficient estimate.

App. C: Tables of coefficient estimates: *rye*

Estimation method: Tobit; Sample: sub-sample					
Variables \ Regression No.	**1**	**2**	**4**	**5**	**6**
C	29.742	29.960	29.736	31.165	31.134
	0.617	0.611	0.618	0.587	0.586
LOG(DISTANCE)	-4.569	-4.613	-4.568	-4.896	-4.892
	0.095	0.093	0.095	0.082	0.082
NEW_DEMARC					-3.693
					0.621
NEW_DEMARC_BFE					-0.691
					0.366
NEW_PLGER			-3.645	-3.571	
			0.732	0.742	
NEW_PLGER*D1926	-3.723	-4.800			
	0.902	0.790			
NEW_PLGER*D1933	-3.528	-4.602			
	0.969	0.868			
NEW_PLGER_BFE	-1.094		-1.095	-0.918	
	0.446		0.447	0.446	
NEW_OTHER			-4.019	-3.840	
			1.087	1.098	
NEW_OTHER*D1926	-2.516	-3.020			
	1.338	1.212			
NEW_OTHER*D1933	-6.410	-6.928			
	1.877	1.790			
NEW_OTHER_BFE	-0.553		-0.556	-0.267	
	0.597		0.597	0.599	
EASTWEST_PREWAR	-1.096	-1.070	-1.098		
	0.178	0.177	0.178		
EASTWEST_POSTWAR	-0.648	-0.616	-0.650		
	0.192	0.193	0.193		
Total observations	2910	2910	2910	2910	2910
Left censored obs	1546	1546	1546	1546	1546
adj. R^2	0.767	0.766	0.767	0.757	0.757

Notes: The results for the region-specific dummy variables are omitted for the sake of clarity.
Standard errors are given below each coefficient estimate.

App. C: Tables of coefficient estimates: *paper*

Estimation method: Tobit; Sample: sub-sample					
Variables \ Regression No.	**1**	**2**	**4**	**5**	**6**
C	21.758	21.928	21.750	22.985	22.985
	0.304	0.302	0.304	0.284	0.284
LOG(DISTANCE)	-1.961	-1.995	-1.960	-2.227	-2.227
	0.047	0.046	0.047	0.038	0.038
NEW_DEMARC					-4.687
					0.308
NEW_DEMARC_BFE					-0.731
					0.194
NEW_PLGER			-4.351	-4.245	
			0.355	0.366	
NEW_PLGER*D1926	-3.946	-4.925			
	0.425	0.366			
NEW_PLGER*D1933	-4.933	-5.920			
	0.498	0.450			
NEW_PLGER_BFE	-1.009		-1.010	-0.909	
	0.224		0.224	0.229	
NEW_OTHER			-5.932	-5.641	
			0.520	0.533	
NEW_OTHER*D1926	-5.572	-5.992			
	0.663	0.591			
NEW_OTHER*D1933	-6.292	-6.712			
	0.663	0.591			
NEW_OTHER_BFE	-0.473		-0.474	-0.358	
	0.319		0.319	0.327	
EASTWEST_PREWAR	-0.948	-0.931	-0.949		
	0.080	0.081	0.080		
EASTWEST_POSTWAR	-0.169	-0.139	-0.170		
	0.089	0.089	0.089		
Total observations	2910	2910	2910	2910	2910
Left censored obs	442	442	442	442	442
adj. R^2	0.845	0.844	0.845	0.836	0.836

Notes: The results for the region-specific dummy variables are omitted for the sake of clarity.
Standard errors are given below each coefficient estimate.

App. C: Tables of coefficient estimates: *hard coal*

Estimation method: Tobit; Sample: sub-sample					
Variables \ Regression No.	**1**	**2**	**4**	**5**	**6**
C	34.684	34.763	34.690	37.654	37.521
	0.885	0.873	0.886	0.848	0.849
LOG(DISTANCE)	-4.946	-4.961	-4.947	-5.632	-5.611
	0.135	0.132	0.135	0.117	0.117
NEW_DEMARC					-5.673
					0.896
NEW_DEMARC_BFE					0.265
					0.528
NEW_PLGER			-9.001	-8.709	
			1.143	1.176	
NEW_PLGER*D1926	-7.479	-7.279			
	1.407	1.269			
NEW_PLGER*D1933	-11.002	-10.803			
	1.637	1.518			
NEW_PLGER_BFE	0.191		0.191	0.528	
	0.622		0.623	0.629	
NEW_OTHER			-2.299	-1.466	
			1.372	1.393	
NEW_OTHER*D1926	-3.862	-4.514			
	1.757	1.559			
NEW_OTHER*D1933	-0.760	-1.410			
	1.737	1.537			
NEW_OTHER_BFE	-0.674		-0.674	-0.170	
	0.851		0.852	0.863	
EASTWEST_PREWAR	-2.067	-2.063	-2.068		
	0.252	0.251	0.252		
EASTWEST_POSTWAR	-1.451	-1.440	-1.452		
	0.284	0.283	0.284		
Total observations	2908	2908	2908	2908	2908
Left censored obs	1543	1543	1543	1543	1543
adj. R^2	0.774	0.774	0.774	0.764	0.760

Notes: The results for the region-specific dummy variables are omitted for the sake of clarity.
Standard errors are given below each coefficient estimate.

App. C: Tables of coefficient estimates: *hard coal*

Estimation method: Tobit; Sample: sub-sample					
Variables \ Regression No.	**1**	**2**	**4**	**5**	**6**
C	30.061	30.392	30.082	33.450	33.333
	0.871	0.860	0.871	0.845	0.843
LOG(DISTANCE)	-4.582	-4.648	-4.586	-5.365	-5.346
	0.134	0.131	0.134	0.119	0.119
NEW_DEMARC					-7.063
					1.161
NEW_DEMARC_BFE					-0.667
					0.518
NEW_PLGER			-10.618	-10.852	
			1.757	1.869	
NEW_PLGER*D1926	9.857	9.037			
	105781	128486			
NEW_PLGER*D1933	-11.873	-12.898			
	2.184	2.104			
NEW_PLGER_BFE	-1.009		-1.007	-0.637	
	0.630		0.630	0.639	
NEW_OTHER			-5.275	-4.641	
			1.528	1.573	
NEW_OTHER*D1926	-4.261	-5.475			
	1.749	1.574			
NEW_OTHER*D1933	-7.262	-8.471			
	2.516	2.402			
NEW_OTHER_BFE	-1.298		-1.294	-0.665	
	0.804		0.805	0.820	
EASTWEST_PREWAR	-2.438	-2.404	-2.436		
	0.255	0.255	0.255		
EASTWEST_POSTWAR	-1.533	-1.484	-1.530		
	0.271	0.271	0.272		
Total observations	2903	2903	2903	2903	2903
Left censored obs	1710	1710	1710	1710	1710
adj. R^2	0.765	0.765	0.765	0.750	0.748

Notes: The results for the region-specific dummy variables are omitted for the sake of clarity.
Standard errors are given below each coefficient estimate.

App. C: Tables of coefficient estimates: *chemical products*

Estimation method: Tobit; Sample: full sample							
Variables \ Regression No.	**2**	**3**	**4**	**5**	**6**	**7**	**8**
C	20.901	21.270	20.850	20.927	20.895	21.486	21.759
	0.381	0.383	0.381	0.381	0.381	0.357	0.359
LOG(DISTANCE)	-2.300	-2.388	-2.289	-2.304	-2.298	-2.438	-2.504
	0.059	0.059	0.059	0.059	0.059	0.050	0.050
BORDER_PREWAR	-4.031	-3.575	-4.235	-4.026	-4.040	-3.672	-3.268
	0.359	0.360	0.369	0.359	0.360	0.354	0.354
BORDER_POSTWAR							-3.532
							0.255
NEW_DEMARC					-1.714	-1.592	
					0.365	0.364	
NEW_DEMARC_BFE					-1.507	-1.454	
					0.175	0.175	
OLD_DEMARC	-4.637	-4.128	-4.267	-4.707	-4.881	-4.695	
	0.501	0.696	0.688	0.500	0.494	0.492	
NEW_PLGER	10.343	-3.638	-2.629	-2.613			
	46882	0.486	0.529	0.500			
NEW_PLGER*D1933	-13.259						
	46882						
NEW_PLGER_BFE	-1.261		-1.099	-1.258			
	0.227		0.231	0.227			
NEW_OTHER	-1.000	-2.502	-0.832	-0.822			
	0.652	0.448	0.499	0.500			
NEW_OTHER*D1933	0.471						
	0.869						
NEW_OTHER_BFE	-1.788		-1.785	-1.786			
	0.240		0.240	0.240			
PL_INTEGRATION		1.095	-0.864				
		1.064	1.188				
PL_INTEGRATION_BFE			1.884				
			0.550				
EASTWEST_PREWAR	-0.528	-0.473	-0.538	-0.524	-0.530		
	0.116	0.117	0.116	0.116	0.116		
EASTWEST_POSTWAR	-0.216	-0.138	-0.229	-0.216	-0.227		
	0.130	0.131	0.130	0.130	0.130		
Total observations	4861	4861	4861	4861	4861	4861	4861
Left censored obs	1349	1349	1349	1349	1349	1349	1349
adj. R^2	0.731	0.740	0.747	0.746	0.746	0.730	0.724

Notes: The results for the region-specific dummy variables are omitted for the sake of clarity. Standard errors are given below each coefficient estimate.

App. C: Tables of coefficient estimates: *iron and steel*

Estimation method: Tobit; Sample: full sample							
Variables \ Regression No.	**2**	**3**	**4**	**5**	**6**	**7**	**8**
C	22.989	22.879	22.914	22.978	23.049	23.509	23.488
	0.405	0.407	0.405	0.405	0.412	0.387	0.391
LOG(DISTANCE)	-2.555	-2.521	-2.541	-2.553	-2.564	-2.673	-2.656
	0.063	0.062	0.063	0.063	0.064	0.053	0.054
BORDER_PREWAR	-6.750	-7.083	-7.152	-6.755	-6.739	-6.462	-6.860
	0.514	0.520	0.546	0.514	0.521	0.521	0.533
BORDER_POSTWAR							-4.431
							0.208
NEW_DEMARC					-4.028	-3.955	
					0.313	0.309	
NEW_DEMARC_BFE					1.076	1.103	
					0.185	0.185	
OLD_DEMARC	-6.583	-5.920	-5.866	-6.600	-7.314	-7.188	
	0.359	0.418	0.414	0.358	0.358	0.353	
NEW_PLGER	-4.462	-4.736	-5.003	-5.230			
	0.476	0.355	0.421	0.404			
NEW_PLGER*D1933	-1.986						
	0.671						
NEW_PLGER_BFE	0.148		0.303	0.147			
	0.237		0.239	0.237			
NEW_OTHER	-2.735	-0.029	-2.091	-2.270			
	0.527	0.385	0.449	0.446			
NEW_OTHER*D1933	1.291						
	0.759						
NEW_OTHER_BFE	2.086		2.087	2.085			
	0.245		0.244	0.245			
PL_INTEGRATION		2.301	0.059				
		0.671	0.876				
PL_INTEGRATION_BFE			2.249				
			0.571				
EASTWEST_PREWAR	-0.499	-0.503	-0.510	-0.501	-0.491		
	0.123	0.124	0.123	0.123	0.125		
EASTWEST_POSTWAR	-0.052	-0.076	-0.052	-0.060	-0.085		
	0.139	0.140	0.139	0.139	0.142		
Total observations	4960	4960	4960	4960	4960	4960	4960
Left censored obs	1322	1322	1322	1322	1322	1322	1322
adj. R^2	0.758	0.766	0.772	0.770	0.762	0.748	0.738

Notes: The results for the region-specific dummy variables are omitted for the sake of clarity. Standard errors are given below each coefficient estimate.

App. C: Tables of coefficient estimates: *rye*

Estimation method: Tobit; Sample: full sample							
Variables \ Regression No.	**2**	**3**	**4**	**5**	**6**	**7**	**8**
C	31.458	31.767	31.291	31.476	31.445	32.245	32.423
	0.689	0.690	0.687	0.690	0.691	0.654	0.654
LOG(DISTANCE)	-4.983	-5.050	-4.949	-4.987	-4.979	-5.167	-5.209
	0.109	0.108	0.108	0.109	0.109	0.095	0.094
BORDER_PREWAR	-1.162	-0.935	-2.288	-1.161	-1.231	-0.883	-0.664
	0.690	0.687	0.768	0.691	0.701	0.699	0.689
BORDER_POSTWAR							-6.595
							0.440
NEW_DEMARC					-4.803	-4.729	
					0.607	0.608	
NEW_DEMARC_BFE					-0.713	-0.612	
					0.312	0.311	
OLD_DEMARC	-8.285	-7.763	-7.788	-8.442	-8.611	-8.414	
	0.685	0.737	0.727	0.681	0.658	0.657	
NEW_PLGER	-6.169	-5.245	-6.093	-6.019			
	0.894	0.655	0.753	0.733			
NEW_PLGER*D1933	0.381						
	1.258						
NEW_PLGER_BFE	0.261		0.837	0.263			
	0.389		0.393	0.389			
NEW_OTHER	-1.270	-4.412	-2.263	-2.719			
	1.276	0.979	1.075	1.076			
NEW_OTHER*D1933	-4.922						
	2.368						
NEW_OTHER_BFE	-2.162		-2.204	-2.162			
	0.484		0.485	0.484			
PL_INTEGRATION		3.026	-2.609				
		1.020	1.302				
PL_INTEGRATION_BFE			5.548				
			0.823				
EASTWEST_PREWAR	-0.623	-0.549	-0.654	-0.622	-0.611		
	0.206	0.206	0.205	0.207	0.206		
EASTWEST_POSTWAR	-0.484	-0.423	-0.489	-0.483	-0.494		
	0.235	0.236	0.233	0.235	0.236		
Total observations	5018	5018	5018	5018	5018	5018	5018
Left censored obs	3417	3417	3417	3417	3417	3417	3417
adj. R^2	0.704	0.720	0.726	0.719	0.720	0.700	0.697

Notes: The results for the region-specific dummy variables are omitted for the sake of clarity. Standard errors are given below each coefficient estimate.

App. C: Tables of coefficient estimates: *hard coal*

Estimation method: Tobit; Sample: full sample							
Variables \ Regression No.	**2**	**3**	**4**	**5**	**6**	**7**	**8**
C	38.907	38.591	38.687	38.882	38.745	40.573	40.342
	1.042	1.041	1.043	1.044	1.045	0.997	0.997
LOG(DISTANCE)	-5.948	-5.861	-5.902	-5.943	-5.915	-6.362	-6.294
	0.163	0.161	0.164	0.163	0.163	0.143	0.141
BORDER_PREWAR	-5.093	-5.705	-6.230	-5.108	-5.174	-4.332	-4.966
	1.221	1.221	1.286	1.223	1.226	1.233	1.242
BORDER_POSTWAR							-7.902
							0.624
NEW_DEMARC					-7.871	-7.381	
					0.878	0.875	
NEW_DEMARC_BFE					1.709	1.894	
					0.450	0.448	
OLD_DEMARC	-13.814	-12.458	-12.339	-13.993	-14.110	-13.530	
	1.390	1.595	1.584	1.405	1.356	1.358	
NEW_PLGER	-10.882	-9.369	-11.917	-12.208			
	1.688	1.259	1.374	1.329			
NEW_PLGER*D1933	-2.991						
	2.441						
NEW_PLGER_BFE	2.144		2.629	2.141			
	0.584		0.588	0.585			
NEW_OTHER	-7.267	-3.126	-4.299	-4.310			
	1.494	1.033	1.183	1.188			
NEW_OTHER*D1933	6.527						
	2.028						
NEW_OTHER_BFE	1.261		1.250	1.258			
	0.612		0.611	0.613			
PL_INTEGRATION		4.085	-2.723				
		1.823	2.257				
PL_INTEGRATION_BFE			6.844				
			1.340				
EASTWEST_PREWAR	-1.402	-1.457	-1.437	-1.412	-1.447		
	0.320	0.321	0.320	0.321	0.322		
EASTWEST_POSTWAR	-1.246	-1.333	-1.266	-1.249	-1.321		
	0.380	0.380	0.379	0.381	0.381		
Total observations	4901	4901	4901	4901	4901	4901	4901
Left censored obs	3116	3116	3116	3116	3116	3116	3116
adj. R^2	0.659	0.658	0.663	0.658	0.654	0.651	0.644

Notes: The results for the region-specific dummy variables are omitted for the sake of clarity. Standard errors are given below each coefficient estimate.

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