

**ON THE ORIGINS OF BORDER EFFECTS:
INSIGHTS FROM THE HABSBURG CUSTOMS
UNION**

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On the Origins of Border Effects: Insights from the Habsburg Customs Union¹

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Abstract:

This paper examines the emergence and dynamics of border effects over time. We exploit the unique historical setting of the multi-national Habsburg Empire prior to the Great War to explore the hypothesis that border effects emerged as a result of persistent trade effects of ethno-linguistic networks within an overall integrating economy. While markets tended to integrate, the process was strongly asymmetric and shaped by a simultaneous rise in national consciousness and organisation among Austria-Hungary's different 'nationalities'. We find that the political borders which separated the empire's successor states after the First World War became visible in the price dynamics of grain markets already 25-30 years *before* the First World War. This effect of a 'border before a border' cannot be explained by factors such as physical geography, changes in infrastructure or patterns of asymmetric integration with neighbouring regions outside of the Habsburg customs and monetary union. However, controlling for the changing ethno-linguistic composition of the population across the regional capital cities of the empire does explain most of the estimated border effects.

Keywords: Border Effects, Market Integration, Networks, Habsburg Empire, Pre-1914 Europe

JEL classification: N13, F15, Z13

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I. Where do border effects come from?

The relevance of political borders for trade has become a stylized fact in international economics. Border effects are visible both in large deviations from the law of one price (LOP) (Engel and Rogers 1996) as well as in gravity estimates of border-related trade costs (McCallum 1996) and their extent still presents a puzzle to economists. Especially their dynamics over time are not well understood. Why do borders continue to matter in periods of increasing economic integration? It is notable that even in the careful specification of Anderson and van Wincoop (2003) the US-Canadian border is estimated to have reduced trade by roughly 40 per cent in 1993, four years after the introduction of a free-trade agreement.

Apart from specification-issues (Head and Mayer 2002, Anderson and van Wincoop 2003), the literature suggests several explanations for the existence of border effects, which in principle apply to both, the LOP and the gravity approaches. Combes, Lafourcade and Mayer (2005) examine the effects of business and social networks on trade and the extent to which they explain border effects, drawing on an older literature that emphasizes the trade-creating effects of networks (especially Greif 1993, Rauch 2001, Rauch and Trinitade 2002). A key feature of such networks is that they can be trade-creating within the geographical reach of the network but trade-diverting beyond the network's boundaries. Combes et al. (2005) find for a cross-section of French districts (1993) that administrative borders are strongly trade-diverting and, further, that business and social networks explain about one third of this effect. Nevertheless, even after controlling for such networks, they still find that trade *within* an administrative district exceeds trade *across* administrative borders by 170 per cent. Evans (2003) and Chaney (2005) focus on fixed costs of exporting and firm heterogeneity. Together these forces give rise to higher trade elasticity with respect to trade barriers than implied by the elasticity of substitution alone. However, the assumption of fixed exporting costs shifts the question of the origins of border effects to one of the origins of such fixed costs. Rossi-Hansberg (2005) and, in a similar vein, Hillberry and Hummels (2005) present a model with intermediate and final goods, an agglomeration externality, and endogenous firm location. This drives endogenous changes in productivities, which also help to magnify the effects of barriers along national borders. But again, the existence of trade frictions related to the border (tariffs and NTB's) is assumed in the first place, while the model explains (in a very elegant way) a magnification of this effect.

Hence, there remains a fundamental trade-diverting effect along borders with unclear origins. This paper has a focus on the time-dynamics of borders effects and explores the hypothesis that border effects can *emerge* as a result of persistent or rising trade effects of nationality-based or ethno-linguistic networks within an overall integrating economy. We analyse the development of grain markets in the Habsburg economy at the level of 20 large cities from the late 1870s up to the First World War. The comparatively simple nature of these product markets allows us to put aside explanations of border effects based on firm heterogeneity or input-output linkages that may give rise to magnification effects. Instead, we focus on the role of network effects - more precisely, the effects of ethno-linguistic networks.

The specific features of the pre-1914 Habsburg economy of interest here are, first, the unusually large degree of ethnic and linguistic diversity not only across the multi-national empire as a whole, or between its major constituent parts Austria and Hungary, but also *within* its major sub-state regions and cities. Yet, second, all these cities were part of an empire-wide customs and monetary union. Thus we can examine the possible emergence of ‘border effects’ in the absence of distorting inter-national barriers such as tariffs and exchange rate variations or major intra-state administrative obstacles. Third, the Habsburg case offers an almost unique opportunity to explore the possible formation of an economic ‘border-before-the-border’. After the First World War, the Habsburg domains were split up among a number of successor states and along political borders that, obviously, were not in place before – the analysis is thus largely unaffected by the potential effects of unaccounted for political or administrative trade barriers that probably blur the results of other studies. However, whilst the dissolution of the empire made for new ‘nation’ states, the post-1918 political borders were not drawn along strictly ethnic lines and hence all successor states contained significant minorities.

We employ an approach similar to Engel and Rogers (1996), Trenkler and Wolf (2005) or Shiue (2005) where we take non-random deviations from the law of one price as indicators for trade costs. We make two identifying assumptions in our work. First we assume that systematic deviations from the law of one price reflect trade costs. Second, we assume that trade costs can be split into three components: trade costs that depend on distance, trade costs that depend on networks (or related trade creating factors) along the lines of existing or prospective borders, and city-specific trade costs (similar to multilateral resistance terms in Anderson and van Wincoop 2003). If both distance-related and city-specific trade costs decrease over time, while the strength of network stays high, the relative impact of the latter on trade will increase, which might result in the estimation of ‘border effects’.

There are three key results. First, we confirm the findings of Good’s (1984) earlier research pointing towards increasing overall integration in Habsburg grain markets, but, significantly, we show that this integration was systematically biased: while there is no evidence of the post-war borders showing up in Austria-Hungary’s grain markets for the years 1878-1884, they become visible from the mid-1880s onwards. Second, the emergence and persistence of this ‘border-before-a-border’ cannot be explained by changes in infrastructure, simple geographical features, asymmetric integration with neighbouring regions, or just random effects. However, what does account for the estimated border effect are differences in the ethno-linguistic composition of the population across regions and cities. A rich historical literature describes the formation of social and economic organisations such as trade co-operatives along ethno-linguistic lines, especially from the 1880s onwards (Lorenz, 2006). These organisations fostered the formation of ethno-linguistic networks, helped reduce intra-network information costs and diffuse common preferences (see Combes et al. 2005). We show empirically that the presence and strength of ethno-linguistic networks between cities can explain the emerging ‘border effect’ and most of their dynamics over time.

The rest of the paper is organized as follows. Section II briefly sketches out the historical background and the relevant historical literature on the issue. Section III sets out the empirical strategy to assess the effects of borders on price dynamics, and outlines our dataset, including some descriptive statistics on the twenty cities under consideration. Section IV describes the emergence of a

'border before a border' within the Habsburg Empire prior to 1914 while section V explores the impact of changing infrastructure and other candidate economic explanations on this finding. In Section VI we test whether the effect of post-World War One borders prior to 1914 can be explained in terms of ethno-linguistic heterogeneity. Finally, Section VII summarizes the findings and points to some broader implications.

II. Historical background: Economic integration and ethno-linguistic networks

At the turn of the 20th century, the Habsburg Empire was among the leading powers of Europe, with a share of roughly 13 per cent in total European population, producing about 10 per cent of Europe's GDP. By the end of the First World War, the empire had militarily, politically and economically collapsed. The Treaties of St. Germain (1919) and Trianon (1920) merely confirmed what had become reality from late October 1918: the Monarchy was dismembered and its territories were either incorporated into new nation states or ceded to neighbouring countries. Austria and Hungary were reduced to small landlocked countries, while Czechoslovakia, Yugoslavia and Poland emerged as independent nation states. The lands once tied together in a customs and monetary union were now separated by no less than eleven national borders, quantitative and non-quantitative barriers to trade and different national currencies.

The causes of this collapse are still heavily disputed. Yet *intra*-empire nationalism features as a key variable in most approaches, irrespective of whether they adopt a structuralist perspective on imperial decline (Wank, 1997a, b), point to the failure of political elites at the centre to engineer reform and maintain legitimacy (Jaszi, 1929; Taylor, 1948) or focus on the uncompromising pursuit of, effectively, mutually exclusive political aims by the different national communities in the crown-lands (Kornish, 1949; Lieven, 2000). In short, historians have since long argued that the rise of national self-consciousness and growing conflict among the empire's various 'nationalities', and the failure of the 1867 Constitutional Settlement between Austria and Hungary to offer an institutional arrangement capable of diffusing this conflict, were major factors in the empire's decline. However, there is also a dissenting historiography that rejects the notion of the empire's fall as inevitable or the Habsburg state as having become unviable. It was losing a war that was on a scale too large to sustain on the basis of the resources available that finished off the empire, but not any insurmountable structural, political or economic problems in the preceding decades (Good, 1984; Schulze, 2005; Sked, 2001). Such interpretation is in tune with the findings of the last thirty or so years of research into the economic development of the Habsburg Monarchy. These make for a less damning assessment of Habsburg economic performance than earlier writing in the field such as, for example, Gerschenkron (1962). Even though economic growth in the empire was not nearly rapid enough to catch-up with the European leaders before the war (Schulze 2000, 2007), the work, in particular, of David Good (1984) and John Komlos (1983, 1989) has shown that the origins of Kuznetsian Modern Economic Growth in the western regions of the empire reach back into the 18th century, that growth impulses began to diffuse from the more developed to the less advanced regions and that broad intra-empire market integration made significant progress over the course of the 19th century.

Bruckmüller and Sandgruber (2003) observe a seeming contradiction between, on the one hand, increasing inter-regional economic integration within the empire over the 19th century and, on the other, the simultaneous rise of nationalist movements ‘based mainly on common language or national consciousness (...) [that] strongly ran counter to the collective consciousness of belonging to a common state’. While the core political and economic interests of the Germans and the Magyars as the dominant groups in the Austrian and Hungarian halves of the empire (without either of them having an absolute population majority in Cis- and Transleithania) were recognized and broadly accommodated in the constitutional compromise of 1867 that established the *Dual* Monarchy, those of the Slavic people in both parts of the empire were not. There is evidence going beyond the mere observation of increasingly pervasive nationalism within the empire that suggests deepening social and economic separation between progressively self-integrating national communities in the four pre-war decades (Bruckmüller and Sandgruber, 2003). Jaworski’s (2004) research on boycott movements between different ethnic groups within the multi-national setting of East Central Europe points to ethnic mobilization as a key element of intra-state economic nationalism at work. Nationalist élites sought to mobilize popular political support for the national cause and to advance the economic interests of their clientele. In a similar vein, the contributions in Lorenz’ (2006)⁴ edited volume map the growing inter-relatedness of national movements and the co-operative movement in East Central Europe. Whilst, initially, recruitment was based largely on professional criteria, over the course of the late nineteenth century co-operatives became increasingly organized along ethnic lines. ‘Through national segregation on the regional, and, increasingly, on the local level, cooperatives evolved from socially organized and a-national, into inter-societal, nationally organized institutions’ (Lorenz, 2006: 22) during a phase of ‘ethnic segregation’ (broadly, in the 1860s and ‘70s). This was followed by a phase of ‘ethnic mobilization’, much in line with intensifying national conflicts, when co-operation became an economic mass movement.

III. Empirical Strategy and Data

We want to test the hypothesis that the intensification of networks among members of the same ethno-linguistic group gave rise to the emergence of internal borders within an overall integrating Habsburg economy. To this end we look at the dynamics of grain prices: *ceteris paribus* two cities with little or no ethno-linguistic differences will tend to trade more with each other than cities with larger differences, given that trade networks tend to evolve along social and ethnic contacts (Greif 1993, Rauch and Trinitade 2002).

The relationship between price dynamics and trade costs is examined within a simple analytical framework. For any city i let p_{it}^k be the log of its price for grain k at time t , and let $(p_{it}^k - p_{jt}^k) = \text{gap}_{ijt}^k$ denote the percentage gap for the two prices at time t (see Shiue 2005). Assume further that the trade costs are proportional to the prices in the importing market place. In line with the recent economic geography literature let $(1 - e^{-\tau})P_{i,t}$ be the trade costs, where $\tau > 0$ is a cost parameter. Then, $e^{-\tau}P_{i,t}$ is the per-unit revenue when the good is sold in location i . Intuitively, τ depends positively

⁴ See, in particular, the chapters by Hunyadi on Transylvania, Struve on Galicia and Lazarvić on Slovenia.

on the geographical distance between the locations i and j . Moreover, τ might also differ depending on the extent of networks that connect the cities, or due to location-specific factors. In principle, trade from j to i is only profitable if $P_{i,t} e^{-\tau} > P_{j,t}$. This results in the condition: $\log(P_{i,t}/P_{j,t}) = \text{gap}_{ij,t} > \tau$. Hence, arbitrage from j to i takes place when the percentage price gap is larger than the cost parameter τ . Equivalently, one trades from location i to j only if $\text{gap}_{ij,t} < -\tau$. Thus, we obtain $[-\tau ; \tau] > \text{abs}(\text{gap}_{ij,t})$ as a band of no-arbitrage. Within this band, no trade occurs that could reduce price differences between the two markets because trade costs exceed possible arbitrage profits. Obviously, the size of this band increases with τ , which in turn will depend on several factors such as transport costs. In the literature, the trade cost view of the LOP is often referred to as a weak form of the LOP. It is equivalent to the so-called spatial arbitrage condition if it is only required that prices of the same good at two locations differ at most by the trade costs (see, for example, Fackler and Goodwin 2001).

Our empirical strategy involves three steps. First, we ask whether there is any evidence for the emergence of internal borders within the empire over the course of the late 19th century. Next, we explore possible economic reasons for this finding other than those related to ethno-linguistic differences. And finally, we test whether and to what extent the pattern of ethno-linguistic differences across the Habsburg monarchy can explain the estimated border effects. To this end we use three sets of data: grain prices, measures of distance and infrastructure, and language statistics.

Prices. We use annual wholesale price data for five types of grain (wheat, rye, barley, oats, corn) in twenty major cities of the empire to examine the integration of the Habsburg economy over the period 1878-1910. The main source for the price data are *SJB* and *ÖSH*, augmented by Pribram (1938, on Vienna), Hoszowoski (1934, on Lemberg), Gorkiewicz (1950, on Cracow), *Preisstatistik* (1913) and *MSE* on Budapest and the other cities in Transleithania. All prices are given in Austrian Heller per 100 kilogrammes and are thus fully comparable both in the cross-section and over time.

The sample of cities include

- (a) Vienna, Linz, Graz and Innsbruck which became part of the post-World War I state of Austria;
- (b) Prague in Bohemia, later becoming the capital of Czechoslovakia ;
- (c) Cracow and Lemberg in Galicia , both cities became part of the post-war Polish state;
- (d) Czernowitz in the Bukowina which was ceded to Romania after the First World War;
- (e) Trieste, in the Littoral, became part of Italy;
- (f) Budapest, the centre of Hungary in both its pre- and post-war borders;
- (g) Bratislava (Pozsony) in the Danube Left Bank district, later becoming part of Czechoslovakia;
- (h) Pecs and Sopron in the Danube Right Bank district, part of both pre- and post-war Hungary, as was
- (i) Szeged in the central Danube-Theiss Basin;
- (j) Kassa on the right bank of the Theiss river, the area was ceded to Czechoslovakia after the First World War;
- (k) Debreczen and Nagy Varad in the expansive Theiss Left Bank district; the predominantly Romanian parts of the region, where Nagy Varad was located, were later ceded to Romania along with
- (l) Arad and Temesvar in the Theiss-Maros Basin, and
- (m) Kolozsvar in Transylvania.

As shown on Map 1, the regional spread of the sample cities entails broad geographical coverage of the empire as a whole. The breakdown of the population by main language groups (Table 1) shows the extent of ethno-linguistic heterogeneity both within and across the sample cities.⁵

[Map 1 about here]

Distance and Infrastructure measures. The analysis in Section IV uses simple great circle distances between cities based on longitude and latitude data. The analysis in Section V in turn builds on a new dataset that reconstructs the shortest railway connections between all 190 city-pairs, starting in 1878. By that time, all cities in the sample were connected to the railway network. However, over time and up to the First World War, the network became denser and many bilateral distances shorter. This is fully accounted for in the time-varying railway distance measures derived here (see references under *Railway Distances, 1878-1913*).

Languages. Table 1 reports the composition of the population by language for all cities in the sample. The data, extracted from the official censuses (Austria – Census, 1880-1910; Hungary – Census, 1880-1910), refer to the population within the city boundaries and that of the immediately adjacent or surrounding administrative district. Given the widening over time of the geographical and administrative boundaries of some of the cities (especially, Budapest, Prague and Vienna), this makes for more stable and meaningful ‘catchment areas’. The most striking feature here is the pronounced linguistic heterogeneity across the cities and, in some cases, the shifts in population shares held by the different national groups.

[Table 1 about here]

Let us start with some summary statistics of the data. A plot of the average prices of the five grains over time (Figure 1) shows that prices tended to decline until the mid-1880s, then fluctuated without a visible trend for about 20 years, before they started an upward tendency in the decade prior to the Great War. Wheat prices are visibly above other grain prices, typically followed by rye and barley.

[Figure 1 about here]

Figure 2 plots the (‘global’) coefficient of variation over the whole cross-section of the twenty cities averaged over wheat, rye, barley, oats, and corn, 1878-1910 (solid line). The variation of grain prices across cities declined substantially over time, in line with previous findings of Good (1984). Yet it is possible that integration proceeded asymmetrically, that is some city pairs integrated relatively more than others. Besides the ‘global’ coefficient of variation, the figure also plots the ‘internal’ coefficient of

⁵ For 1880-1910, the censuses report the languages spoken rather than nationality or ethnicity. We use ‘main language spoken’ (Austria) and ‘mother tongue’ (Hungary) as proxies for the urban populations’ composition by ethnicity. A comparison of the Austrian 1880 language data with the 1857 census data on nationality indicates a very close match even if allowance is made for inter-temporal shifts in the composition. Cf. Horch (1992) on the relationship between language and national identity in the Habsburg context.

variation, calculated again as an average over the five grains but only for city pairs that after 1918 belonged to the same state (line with squares). Finally we add the percentage difference between the ‘global’ and ‘internal’ price dispersion over time (dotted line).

[Figure 2 about here]

First, city-pairs with a common post-war border were apparently already in 1878 somewhat better integrated than other pairs, which can be partly explained in terms of their different average distances. Second, the percentage gap between ‘global’ and ‘internal’ price dispersion was increasing 1878-1910, from about 30 per cent to more than 50 per cent: integration became increasingly asymmetric since the mid 1880s.

To explore such asymmetric integration and its origins systematically, we examine the complete set of price ratios between all 190 possible city-pairs in our sample, drawing on more than 20,000 observations. On average, higher trade costs should limit the scope for arbitrage and hence increase the absolute gap between any two cities. We distinguish between transportation costs and other cost components that increase in geographical distance, cost components related to ‘borders’, and trade costs that are city-specific. We estimate the following simple specification:

$$(1) \quad \left| \text{gap}_{ij,t}^k \right| = c_0 + c_1 * \log(\text{distance}_{ij}) + c_2 * \text{border}_{ij} + \sum_1^J c_k \text{location}_k + \varepsilon_{ij,t}^k,$$

where *distance* is the geographical distance between the two cities, *location* is a full set of dummies to capture unobservable location-specific factors, while $\varepsilon_{ij,t}^k$ is an i.i.d. error component. The variable *border* is defined along the post-war borders that separated the monarchy’s successor states after 1918:

$$(2) \quad \text{border}_{ij} = \begin{cases} 1 & \text{if cities } i, j \text{ after WWI separated by a border} \\ 0 & \text{else.} \end{cases}$$

IV. Main results: the emerging border

We estimate (1) by OLS, where we start by pooling over all grains and over the complete period 1878-1910, always – here and in the following estimations – allowing for cross-sectional heteroskedasticity. Table 2 gives the results.

[Table 2 about here]

As expected, we find that price dispersion increases significantly in distance between the cities, controlling for unobservable location-specific effects. The border dummy is positive and highly significant, which is evidence of trade costs related to the post-war borders, visible for the period 1878–1910. As shown in columns 2-4 of table 2 this result is robust to other specifications, especially also to a balanced panel estimation and specifications with two-way (period and cross-section) random effects and with period fixed and random cross-section effects. It is equally robust to the introduction of cross-section or period weights (not shown). Note that the border effect is estimated to be highly significant after controlling for distance. The variation in our sample is sufficiently high to distinguish between bilateral price differences related to distance and bilateral price differences related to border effects. While very distant cities also tended to be separated by a border after the First World War, our sample has a lot of variation in this respect. 10 per cent of the city pairs were less than 200 km apart and still divided by a border after the Great War, and roughly 40 per cent of all city pairs were less than the median distance (369 km) apart, but nevertheless separated by a border after the Great War.

How can we interpret this result? The estimated border effect is obviously not explained by any systematic administrative barrier related to it, since these barriers were not in place before 1918.⁶ It is equally not explained by the fact that typically cities that after 1918 belonged to the same state were geographically close to each other, or by city-specific effects that possibly happened to differ along the future border. A key to the nature of this border effect may lie in changing patterns over time: if the border effect was present in 1878 as well as in 1910 it probably reflects differences in time-invariant characteristics of city-pairs across Habsburg, such as effects from natural geography. If, however, the border effect is changing over time, the timing of these changes might point to the forces behind. In a next step we re-estimate the model (1) where we allow both the distance and border coefficients to vary over three-year intervals, both for an unbalanced and for a balanced panel estimation (Table 3, columns 1 and 2).

[Table 3 about here]

The border effect begins to emerge only during the 1880s, increases up to the early 1890s, and stabilises between the mid-1890s and 1910. A Wald-coefficient test indicates that the increase 1878–1890 is significant at the 5 per cent level. The story is similar for the unbalanced and the balanced panel estimation, except that for the latter the increase during the early 1890s is stronger. After a peak in the 1890s, there is some decline, but the effect stays above the level reached in the early-1880s. This pattern over time corresponds to a political historiography which stresses the rise in intra-empire national conflict from the late 1880s and, for instance, the political deadlock between Czechs and Germans from the early 1890s (Berend, 2003; Kornish, 1949; Sked, 2001) as much as recent research on intra-state economic nationalism emphasizes the growing significance of ethnic mobilization and antagonism during the 1890s (Bruckmüller and Sandgruber, 2003; Jaworski, 2004; Lorenz, 2006). The effect of geographical distance decreases over time - as do the city-specific effects (not reported).

⁶ We also tested for the impact of the pre-war border between Austria and Hungary and found that this does not alter our results on the post-war border effects discussed here.

This reflects the general trend towards better integration of grain markets across the Habsburg domains, as noted in Figure 2. We also tested for differences between grains (Table 3, column 3) and find that the border-effect is significantly smaller for wheat than for other grains, which is in line with economic reasoning. The higher the unit value of a good, the higher is usually the trade-margin of that good and hence, the smaller the expected trade-diverting effect of any kind of trade barrier. This holds also for the persistently smaller distance coefficient for wheat compared to other grains.

V. Explaining the border-effect: infrastructure bias, cross-border integration, and some robustness checks

In principle, several factors may account for the estimated border effect. Increasing inter-regional differences in the density of communications networks may have followed the fault-lines of the post-1918 political dismemberment of the empire already *before* the Great War. If this had been the case systematically, it would not be captured in the time-varying distance coefficient but instead show up in the estimated coefficient on the border dummy. To explore this, we use the new dataset on the shortest railway distances between all 190 city-pairings and for each year over 1878-1910. Let us re-estimate model (1) replacing constant geographical distances by time-varying railway distances.

[Table 4 about here]

The estimated coefficients on railway distances differ only slightly from the coefficients on geographic distances, and show the same pattern over time: they decline, reflecting the general trend towards better integration. Given this, it is no surprise that the estimated border effects are not changed very much. In fact, the coefficients are slightly lower after controlling for changing distances due to improved railway infrastructures, which indicates that to some very limited degree infrastructure was better and improved more along the lines of the future political borders than across them. But this effect is tiny. Moreover, the pattern of insignificant border effects for the first years, followed by the emergence of a significant effect, remains unchanged.

Next, features of natural geography such as mountains, rivers, or access to seaports cannot possibly account for the observed changes over time due to their time-invariant nature, so we can reject this interpretation.⁷ However, what might have affected the pattern of relative integration across Habsburg is changing integration or disintegration with neighbouring regions. Especially the various large changes in German and Russian tariffs 1878-1910 might have affected different regions of the Habsburg economy in a different way. In our econometric model, we can take this into account by adding to model (1) a set of time-varying location effects, to capture location-specific integration or disintegration shocks:

⁷ For example, the potential significance of waterborne transport along the Danube, say between Vienna, Bratislava and Budapest, is taken into account through the use of location dummies.

$$(3) \quad \left| \text{gap}_{ij,t}^k \right| = c_0 + c_1 * \log(\text{raildistance}_{ij,t}) + c_2 * \text{border}_{ij} + \sum_{t=1878}^{t=1910} \sum_{k=1}^J c_{kt} \text{location}_k + \varepsilon_{ij,t}^k$$

Table 4 column 2 shows that the introduction of time-specific city-effects does not alter the estimated patterns of border effects. However, the estimated distance effects are changed insofar as the overall trend towards better integration is now picked up partly by the time-varying city-effects, which tend to decline over time. We conclude that city- and time-specific differences in integration such as varying degrees of integration with neighbouring regions cannot explain the observed emergence of a border effect within the Habsburg economy. The results are not changed if we restrict attention to a balanced sample (Table 4, column 3).

Finally, it is still possible that the estimated border effects capture some effects that just happened to affect some groups of cities more than others, without being related to the course of the future political borders. We can estimate effects of a ‘nonsense-border’ that simply splits the sample of 20 cities into four groups of five cities, located in the south-east, south-west, north-east and north-west of the Habsburg Empire. Table 4 column 4 shows that the effect of such a border is in most cases not significantly different from zero, and has the wrong sign otherwise. Hence, if anything some city pairs appear to be better integrated across than within this hypothetical “border”. The future political borders apparently do capture some trade costs, which cannot be easily explained in terms of infrastructure, natural geography, or external integration. The most plausible explanation seems to be some effect of social networks on trade, which both in absolute terms and relative to other factors gains in importance over the period under review. This is what the next sections turns to.

VI. What role for ethno-linguistic networks?

If our border dummy is in fact capturing the trade creating and diverting effects from ethno-linguistic networks within the Habsburg Empire, the border effect should be explicable by some measure of ethno-linguistic heterogeneity across the Habsburg regions. To this end, we use the language statistics from Table 1 to construct a *bilateral* measure of the ethno-linguistic similarity of the two cities in any one of our 190 city-pairs. We calculate this measure as

$$(4) \quad \text{Language}_{ij,t} = \sum_{k=1}^n (a_{i,t}^k * a_{j,t}^k)$$

where $a_{i,t}^k$ is the percentage share of language k in city i and at time t , and n is the total number of language groups (in our case nine). This is equivalent to summing up over all possible same language encounters between individuals from the two different cities in each pair and dividing by the total number of all possible encounters for that city-pair.⁸

⁸ The underlying absolute figures are truncated to facilitate a full match of the Austrian and Hungarian language groups. The very small group of ‘other languages’ (i.e. those different from the nine main languages referred to in Table 1), which is not reported for Austrian cities and for Hungary available only for 1910, is excluded .

This 'matching probability' varies between 0 (no similarity between two cities i and j) and 1 (no differences) and is, therefore, comparable to the 0/1 border dummy. For example, for 1910 the lowest score is 0.0004 for the city-pair Lemberg-Szeged, the highest is 0.9864 for Graz-Linz. If the emerging border was driven by ethno-linguistic network effects and if these networks can indeed be captured via language statistics (or: if language is a reasonable proxy for network membership), our matching probability might help to explain the estimated border effect. To test this, we re-estimate (3) replacing the border dummy (2) by the bilateral ethno-linguistic 'matching probability' (4). Given the definition of 'matching probability', which increases in ethno-linguistic similarity between city pairs, we expect to find a negative effect on price dispersion. In a further step, we re-estimate the border-effect controlling for language heterogeneity. Table 5 reports the results, where we restrict attention to balanced sample estimations.

[Table 5 about here]

As hypothesized, ethno-linguistic heterogeneity essentially captures the estimated border effect. It has a very similar impact on relative price integration from the mid-1880s onwards insofar as the effect starts to be visible (statistically significant with the expected negative sign) only after the mid-1880s. Furthermore, if we re-estimate the border effect but control for ethno-linguistic heterogeneity, this border effect vanishes, except in one sub-period in the late 1880s, where the border effect is still estimated to be positive and significant, but much smaller than without the control. Overall, we conclude that ethno-linguistic networks as captured by our measure of matching probability almost fully explain the emergence of border effects along the future political borders across the Habsburg Empire. While transport costs and probably other trade barriers declined, the trade creating and trade diverting effects of ethno-linguistic networks stayed high and even gained in relevance, which significantly biased the process of economic integration. To put a number on that effect, according to Table 5 column 1, doubling the 'matching probability' between any two cities in the sample reduces the price dispersion between them by more than a 50per cent reduction in the railway distance between the two cities.

This finding ties in well with recent qualitative work on the prevalence of intra-state economic nationalism in Central and Eastern Europe. This literature suggests that ethnically-based networks increasingly affected trading costs between different ethnic groups by systematically directing trade towards the own group (Jaworski 2004, Lorenz 2006). If so, arbitrage trade between ethnic groups was limited and hence affected price dynamics in a similar way as other, e.g. distance related, trading costs. In his study of rural cooperatives in Galicia, Struve (2006: 229) identifies a key feature that applies not only to the specific case he investigates but more broadly to the late nineteenth century nation-building efforts that evolved within the multi-ethnic Habsburg setting: '(...) different nation-building projects competed with one another'. This 'competition', the evidence suggests, acquired an increasingly exclusionary quality – Bruckmüller and Sandgruber's (2003) 'self-integrating national communities' were indeed alive and ventured to keep 'others' out. The impact of ethno-linguistic networks was, in turn, magnified by the general process of integration due to declining transport costs.

Taken together this explains largely why political borders which divided the empire after 1918 became visible in the price dynamics of grain markets already 25-30 years before the Great War.

VII. Conclusion

What explains the existence of border effects and why do borders continue to matter even in periods of increasing economic integration? This paper explores the idea that border effects measured in terms of non-random deviations from the law of one price (LOP) reflect persistent network effects on trade in an environment of otherwise declining trade costs. We analyse the dynamics of grain markets in the late 19th Habsburg economy at the level of 20 large cities as a natural experiment with some convenient features. The relatively simple nature of these grain markets allows us to exclude explanations of border effects that draw on firm heterogeneity or input-output linkages that may give rise to magnification effects. Instead, the focus is on network effects, more precisely, the effects of ethno-linguistic networks. Further, the evidence from the pre-war Habsburg economy entails the opportunity to explore the possible emergence of significant border effects in the absence of *inter*-national barriers such as tariffs or major *intra*-national administrative barriers: we can trace the effects of the political borders along which the empire was split after 1918. These borders were, obviously, not in place during the period of analysis and so one can exclude the potential impact of unaccounted for administrative trade barriers that are likely to affect the results of other studies.

There are three key results. First, we confirm the findings of Good's (1984) earlier research pointing towards increasing overall integration in Habsburg grain markets, but – significantly – our results show that integration was systematically biased: while there is no evidence of the post-war borders in Austria-Hungary's grain markets for the years 1878-1884, they become visible from the mid-1880s onwards. Second, the emergence and persistence of this 'border-before-a-border' cannot be explained by changes in infrastructure, simple geographical features, asymmetric integration with neighbouring regions, or just random effects. However, third, what does account for the emerging border effect is the extent of ethno-linguistic heterogeneity across regions and cities. While this heterogeneity does not appear to have mattered in the early years of the period studied, it became a force making for asymmetric intra-empire market integration in the later decades. This, the analysis suggests, was the outcome of two factors, in particular. First, as markets became more closely integrated as a result of declining transport costs, the *relative* importance of other non-distance related barriers to inter-regional exchange, such as ethnic or linguistic differences, increased. Second, the *absolute* importance of these differences rose with increasingly ethnically-based forms of social and economic organisation such as the trade co-operatives, especially from the mid-1880s. While the formation of ethno-linguistic networks entailed a lowering of information costs among members and helped diffuse common preferences, it probably also reduced the extent of exchange with non-network members. Thus asymmetric market integration was likely driven by both trade-creating and trade-diverting effects. This paper shows empirically that the presence and strength of ethno-linguistic networks between cities can indeed explain the emerging 'border effect'.

These findings raise several issues. More generally, the results suggests that the persistence of network effects within an environment of overall declining transport costs can give rise to economic

'borders' and may well play a major role in shaping both intra- and inter-national trade patterns by their differential impact on trade costs. Further, explaining such trade patterns will, therefore, require a clearer understanding of the economics of network formation at both the national and international levels. Finally, from a historical perspective, the largely politically motivated re-drawing of the map of Central-Eastern Europe in the aftermath of the First World War may have had less of an adverse impact as thought so far due to the extent that regional integration patterns along the lines of the post-war borders began to emerge already before the war.

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Table 1: Main Languages Spoken (Shares in Total Population)

	German		Czech/Slovak		Polish		Ukrainian		Slovene		Serbo-Croat		Italian		Romanian		Hungarian	
	1880	1910	1880	1910	1880	1910	1880	1910	1880	1910	1880	1910	1880	1910	1880	1910	1880	1910
Vienna	0.958	0.941	0.036	0.054	0.003	0.003	0.001	0.001	0.001	0.001	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.000
Linz	0.984	0.995	0.015	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Graz	0.982	0.991	0.009	0.001	0.000	0.000	0.000	0.000	0.008	0.006	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.000
Innsbruck	0.985	0.976	0.002	0.002	0.000	0.001	0.000	0.002	0.000	0.002	0.000	0.000	0.013	0.016	0.000	0.000	0.000	0.000
Prag	0.165	0.068	0.834	0.930	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Lemberg	0.084	0.024	0.002	0.002	0.650	0.750	0.262	0.223	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000
Cracow	0.039	0.024	0.007	0.012	0.953	0.959	0.001	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Czernowitz	0.266	0.288	0.004	0.003	0.071	0.098	0.479	0.383	0.000	0.000	0.000	0.000	0.000	0.000	0.180	0.228	0.000	0.000
Trieste	0.043	0.062	0.001	0.003	0.000	0.001	0.000	0.000	0.218	0.298	0.001	0.013	0.738	0.623	0.000	0.000	0.000	0.000
Budapest	0.212	0.084	0.065	0.029	0.006	0.006	0.000	0.000	0.000	0.000	0.010	0.005	0.001	0.001	0.001	0.002	0.705	0.872
Pozsony	0.183	0.137	0.456	0.434	0.002	0.002	0.000	0.000	0.000	0.000	0.007	0.005	0.001	0.001	0.000	0.000	0.351	0.421
Pecs	0.347	0.332	0.008	0.007	0.000	0.001	0.000	0.000	0.002	0.002	0.115	0.069	0.001	0.001	0.002	0.000	0.525	0.588
Sopron	0.413	0.387	0.004	0.004	0.000	0.000	0.000	0.000	0.001	0.001	0.117	0.110	0.000	0.001	0.000	0.000	0.464	0.497
Szeged	0.012	0.009	0.004	0.002	0.001	0.000	0.000	0.000	0.000	0.000	0.002	0.004	0.001	0.000	0.001	0.001	0.980	0.983
Kassa	0.069	0.031	0.293	0.181	0.004	0.004	0.003	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.631	0.781
Debreczen	0.017	0.004	0.003	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.978	0.994
Nagyvarad	0.010	0.005	0.011	0.013	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.435	0.413	0.542	0.568
Arad	0.107	0.094	0.012	0.014	0.000	0.000	0.000	0.002	0.000	0.000	0.007	0.005	0.001	0.000	0.639	0.584	0.233	0.301
Temesvar	0.350	0.328	0.016	0.012	0.001	0.000	0.000	0.000	0.000	0.000	0.141	0.133	0.000	0.000	0.421	0.363	0.070	0.164
Kolozsvár	0.042	0.029	0.002	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.612	0.574	0.343	0.395

Sources: Austria – Census (1880-1910); Hungary – Census (1880-1910).

Table 2: Border Effects - Basic Results, Pooled over five grains, 1878-1910
Dep. Var. $\text{abs}(\text{gap}_{ij,t}^k)$

	Pooled OLS	Pooled OLS, Balanced Sample	EGLS with two-way random effects	EGLS with cross- section random and period fixed effects
Variable	Coeff. (t-stat.)	Coeff. (t-stat.)	Coeff. (t-stat.)	Coeff. (t-stat.)
Constant	-0.144 (-10.943)	-0.193 (-7.608)	-0.193 (-3.832)	-0.193 (-3.979)
log(dist)	0.046 (21.088)	0.052 (12.399)	0.052 (6.595)	0.052 (6.588)
Border	0.028 (11.089)	0.030 (6.250)	0.030 (3.272)	0.030 (3.242)
City-Effects	Yes	Yes	Yes	Yes
Period FE	No	No	No	Yes
Period RE	No	No	Yes	No
Cross-Section FE	No	No	No	Yes
Cross-Section RE	No	No	Yes	No
Adj. R2	0.094	0.095	0.283	0.344

FE: Fixed Effects, RE: Random Effects

Table 3: Border Effects – Time Variation, Pooled over five grains, 3-year intervals 1878-1910, Dep. Var. $\text{abs}(\text{gap}_{ij,t}^k)$

	Pooled OLS	Pooled OLS, Balanced Sample	Pooled OLS, Balanced Sample, Wheat-specific effects
Variable	Coeff. (t-stat.)	Coeff. (t-stat.)	Coeff. (t-stat.)
Constant	-0.141 (-11.080)	-0.193 (-7.962)	-0.192 (-8.139)
log(dist)*78_80	0.060 (20.907)	0.082 (10.911)	0.082 (10.975)
log(dist)*81_83	0.054 (20.883)	0.063 (13.280)	0.0644 (13.731)
log(dist)*84_86	0.050 (20.774)	0.055 (12.941)	0.058 (13.647)
log(dist)*87_89	0.466 (19.905)	0.053 (12.385)	0.055 (13.124)
log(dist)*90_92	0.455 (18.362)	0.048 (9.583)	0.052 (10.355)
log(dist)*93_95	0.436 (19.430)	0.047 (10.479)	0.053 (11.553)
log(dist)*96_98	0.045 (20.692)	0.046 (11.474)	0.050 (12.398)
log(dist)*99_01	0.043 (20.090)	0.046 (11.559)	0.049 (12.374)
log(dist)*02_04	0.042 (19.884)	0.046 (11.306)	0.048 (11.939)
log(dist)*05_07	0.040 (19.884)	0.045 (11.220)	0.047 (12.051)
log(dist)*08_10	0.038 (18.143)	0.042 (10.519)	0.042 (10.761)
border*78_80	-0.012 (-0.933)	-0.049 (-1.156)	-0.049 (-1.155)
border*81_83	0.015 (1.414)	0.012 (0.679)	0.019 (1.104)
border*84_86	0.044 (5.186)	0.049 (4.439)	0.067 (5.676)
border*87_89	0.045 (6.079)	0.048 (4.895)	0.066 (6.330)
border*90_92	0.086 (9.322)	0.118 (5.332)	0.145 (6.414)
border*93_95	0.029 (4.817)	0.053 (3.320)	0.088 (5.263)
border*96_98	0.022 (4.333)	0.014 (1.831)	0.040 (4.583)
border*99_01	0.031 (7.876)	0.019 (2.913)	0.041 (5.257)
border*02_04	0.022 (5.108)	0.019 (1.961)	0.032 (3.257)
border*05_07	0.012 (3.616)	0.015 (2.477)	0.037 (5.081)
border*08_10	0.021 (5.602)	0.015 (2.356)	0.035 (4.268)
log(dist)*wheat	-	-	-0.008 (-8.106)
border*wheat	-	-	-0.053 (-7.538)
City-Effects	Yes	Yes	Yes
Adj. R2	0.151	0.176	0.231

Table 4: Explaining Border Effects – Infrastructure, location-specific shocks, random-border effects, 3-year intervals 1878-1910, Dep. Var. $\text{abs}(\text{gap}_{ij,t}^k)$

	Pooled OLS, time-varying railway distance	Pooled OLS, railway distances and time varying city-shocks	Pooled OLS, railway distances and time varying city-shocks, balanced sample	Pooled OLS, railway distances, and random-border, balanced sample
Variable	Coeff. (t-stat.)	Coeff. (t-stat.)	Coeff. (t-stat.)	Coeff. (t-stat.)
Constant	-0.156 (-11.811)	-0.165 (-13.06)	-0.208 (-8.693)	-0.271 (-9.221)
log(raildist)*78_80	0.063 (21.306)	0.055 (12.005)	0.068 (6.006)	0.089 (6.956)

log(raildist)*81_83	0.057 (21.296)	0.046 (10.003)	0.061 (7.908)	0.077 (9.115)
log(raildist)*84_86	0.053 (21.171)	0.044 (11.315)	0.054 (9.194)	0.069 (10.219)
log(raildist)*87_89	0.050 (20.309)	0.036 (9.636)	0.045 (7.807)	0.063 (9.654)
log(raildist)*90_92	0.049 (18.846)	0.041 (9.258)	0.042 (5.017)	0.067 (7.349)
log(raildist)*93_95	0.047 (19.842)	0.048 (15.181)	0.048 (6.607)	0.068 (8.738)
log(raildist)*96_98	0.048 (21.096)	0.062 (21.665)	0.059 (13.437)	0.071 (12.444)
log(raildist)*99_01	0.046 (20.537)	0.061 (23.219)	0.062 (14.695)	0.072 (13.313)
log(raildist)*02_04	0.045 (20.327)	0.060 (22.627)	0.073 (14.062)	0.088 (13.610)
log(raildist)*05_07	0.043 (19.553)	0.046 (19.656)	0.051 (12.791)	0.062 (12.006)
log(raildist)*08_10	0.041 (18.597)	0.050 (19.859)	0.052 (0.052)	0.064 (12.116)
border*78_80	-0.012 (-0.894)	-0.006 (-0.461)	-0.022 (-0.654)	-
border*81_83	0.015 (1.426)	0.004 (0.367)	0.005 (0.283)	-
border*84_86	0.043 (4.989)	0.026 (3.077)	0.033 (2.881)	-
border*87_89	0.042 (5.730)	0.038 (4.951)	0.042 (4.015)	-
border*90_92	0.082 (8.928)	0.076 (7.345)	0.104 (3.841)	-
border*93_95	0.026 (4.366)	0.025 (4.010)	0.043 (2.467)	-
border*96_98	0.019 (3.748)	0.033 (6.315)	0.027 (3.877)	-
border*99_01	0.027 (7.018)	0.034 (8.212)	0.025 (2.898)	-
border*02_04	0.019 (4.435)	0.031 (6.806)	0.022 (3.377)	-
border*05_07	0.010 (2.847)	0.019 (5.319)	0.019 (3.384)	-
border*08_10	0.018 (4.874)	0.028 (7.187)	0.016 (2.473)	-
abord*78_80	-	-	-	-0.075 (-2.616)
abord*81_83	-	-	-	-0.037 (-1.963)
abord*84_86	-	-	-	-0.010 (-0.757)
abord*87_89	-	-	-	-0.016 (-1.288)
abord*90_92	-	-	-	-0.004 (-0.144)
abord*93_95	-	-	-	-0.022 (-1.254)
abord*96_98	-	-	-	0.007 (0.967)
abord*99_01	-	-	-	0.008 (1.153)
abord*02_04	-	-	-	-0.012 (-1.306)
abord*05_07	-	-	-	0.004 (0.573)
abord*08_10	-	-	-	-0.001 (-0.181)
City-Effects	Yes	No	No	No
Time varying City-Effects	No	Yes	Yes	Yes
Adj. R2	0.151	0.228	0.250	0.247

Table 5: Explaining Border Effects – Ethno-linguistic networks, pooled over time and pooled in 3-year intervals 1878-1910, balanced sample, Dep. Var. $\text{abs}(\text{gap}_{ij,t}^k)$

	Pooled OLS, ethno-linguistic networks	Pooled OLS, ethno-linguistic networks, 3-year intervals	Pooled OLS, networks and border	Pooled OLS, networks and border, 3-year intervals
Variable	Coeff. (t-stat.)	Coeff. (t-stat.)	Coeff. (t-stat.)	Coeff. (t-stat.)
Constant	-0.159 (-5.289)	-0.133 (-4.858)	-0.167 (-5.587)	-0.140 (-5.150)
log(raildist)*78_80	0.052 (10.850)	0.055 (5.266)	0.052 (10.783)	0.059 (5.087)
log(raildist)*81_83		0.051 (6.679)		0.053 (6.669)
log(raildist)*84_86		0.047 (7.842)		0.046 (7.371)
log(raildist)*87_89		0.039 (6.752)		0.037 (6.011)
log(raildist)*90_92		0.043 (5.329)		0.041 (4.634)
log(raildist)*93_95		0.042 (6.081)		0.041 (5.427)
log(raildist)*96_98		0.052 (10.988)		0.052 (11.031)
log(raildist)*99_01		0.054 (11.857)		0.055 (12.205)
log(raildist)*02_04		0.066 (12.692)		0.065 (12.237)
log(raildist)*05_07		0.042 (9.840)		0.044 (10.265)
log(raildist)*08_10	0.044 (10.096)	0.044 (10.245)		

border*78_80		-		-0.026 (-0.607)
border*81_83		-		-0.008 (-0.383)
border*84_86		-		0.021 (1.597)
border*87_89		-		0.029 (2.422)
border*90_92		-		0.023 (0.931)
border*93_95	-	-	0.010 (1.785)	0.019 (0.955)
border*96_98		-		0.013 (1.575)
border*99_01		-		-0.001 (-0.092)
border*02_04		-		0.013 (1.294)
border*05_07		-		-0.004 (-0.670)
border*08_10		-		0.004 (0.685)
lang*78_80		0.011 (0.201)		-0.016 (-0.248)
lang*81_83		-0.038 (-1.238)		-0.046 (-1.229)
lang*84_86		-0.068 (-2.625)		-0.046 (-1.544)
lang*87_89		-0.075 (-3.395)		-0.044 (-1.685)
lang*90_92		-0.271 (-5.311)		-0.246 (-4.533)
lang*93_95	-0.065 (-6.588)	-0.098 (-2.747)	-0.054 (-4.851)	-0.078 (-1.864)
lang*96_98		-0.060 (-4.666)		-0.046 (-3.016)
lang*99_01		-0.069 (-5.678)		-0.069 (-4.859)
lang*02_04		-0.055 (-4.255)		-0.041 (-2.753)
lang*05_07		-0.068 (-6.580)		-0.072 (-6.006)
lang*08_10		-0.043 (-3.635)		-0.040 (-3.005)
City-Effects	Yes	No	Yes	No
Time varying City-Effects	No	Yes	No	Yes
Adj. R2	0.099	0.252	0.100	0.253

Map 1: The Habsburg Empire in 1914 Borders, main cities and post-1918 political borders



Figure 1: Cross-section average prices of five grains, 1878-1910

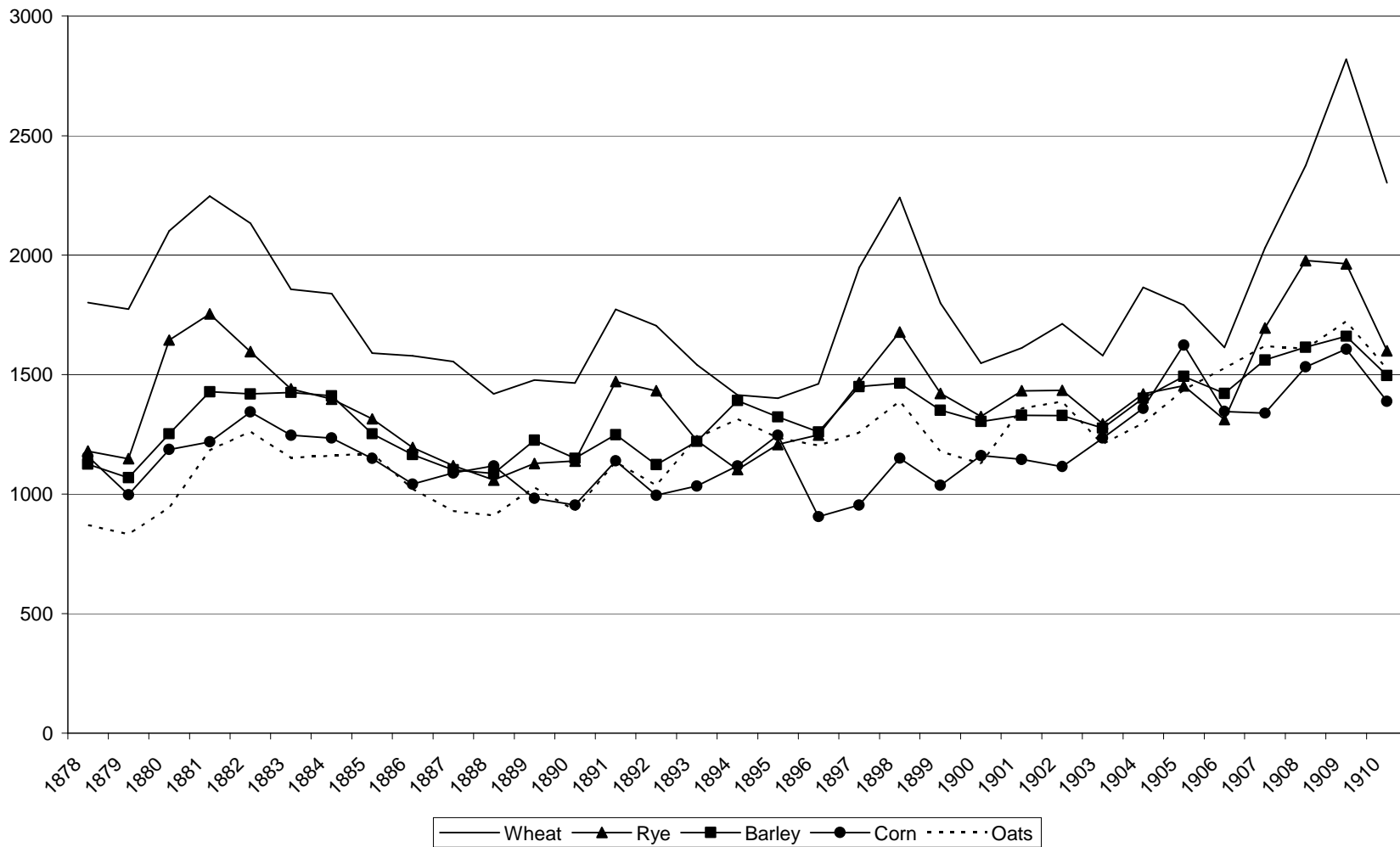
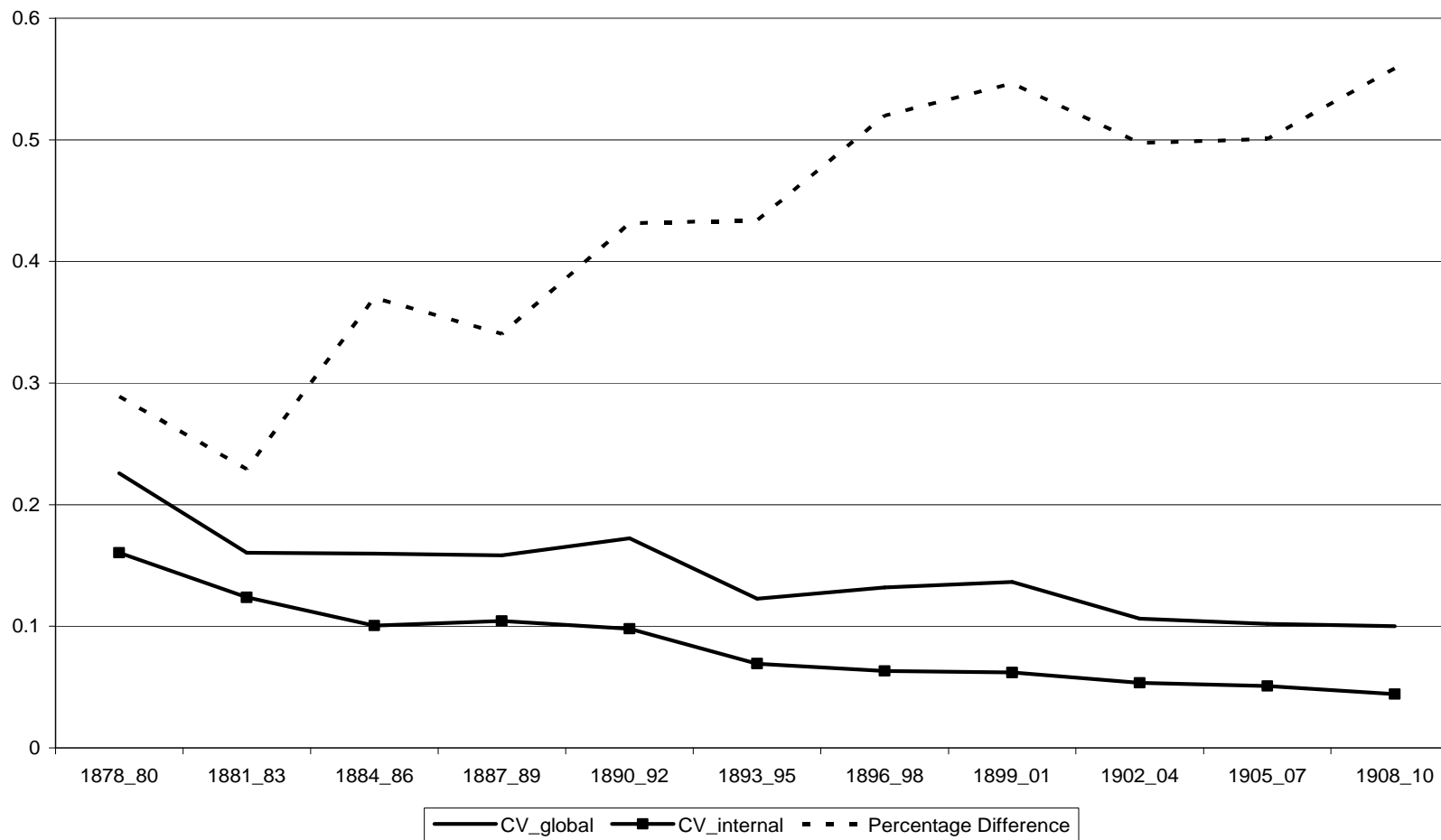


Figure 2: Global and Internal Coefficients of Variations (CV), pooled over five grains, 1878-1910



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