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Explaining nineteenth-century bilateralism: economic and political determinants of the Cobden–Chevalier network[1]

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This study investigates the empirical determinants of the treaty network of the 1860s and 1870s. It makes use of three central theories about the determinants of Preferential Trade Agreement (PTA) formation, considering economic fundamentals from neoclassical and 'new' trade theory, political-economy variables, and international interaction due to trade diversion fears (dependence of later PTAs on former). These possible determinants are operationalized using a newly constructed dataset for bilateral cooperation and non-cooperation among 13 European countries and the US. The results of logistic regression analysis show that the treaty network can be explained by a combination of 'pure' welfare-oriented economic theory with political economy and international interaction models.

Did nineteenth-century commercial bilateralism make any economic sense? At first glance, it presents a fascinating experience of decentralized liberalization. Lazer states that the Anglo-French treaty of commerce of 1860 (the Cobden–Chevalier treaty) started a 'free trade epidemic' that infected the European continent and led to a 'swift break with centuries of protection'.[2] The virus, bilateral preferential trade agreements (PTAs)[3] that stipulated preferential tariffs and unconditional most-favoured nation (MFN) treatment, was disseminated in a contagion process in which outsiders aimed for equal treatment on insiders' markets, thereby causing further outsiders to be exposed to discrimination and the incentive to sign treaties. Over a period of 15 years, this led to the conclusion of 56 similar PTAs in Europe, forming an authentic 'spaghetti bowl' (figure 1) and liberalizing trade to an extent that was internationally unmatched until the end of the Tokyo round of the General Agreement on Tariffs and Trade (GATT).[4]

[1] This article was written while the author was a Research Fellow at the University of Münster and was revised during his post-doc at the Department of Economics of the University of Copenhagen. It forms part of the research project 'Causes and effects of international trade regimes: the Cobden–Chevalier network, *c.* 1860–77', funded by Fritz Thyssen Stiftung. The author benefited from the drawing skills of his wife, Julia Dávila-Lampe, for fig. 1, and constructive comments and research assistance from Carsten Burhop, Sonja Lohmann, Thorsten Lübbers, Robert Pahre, Ulrich Pfister, Paul Sharp, Antonio Tena, three referees, and participants of workshops at Universidad Carlos III and the FRESH French Alps meeting.

[2] Lazer, 'Free trade epidemic', p. 447.

[3] The term PTA is used throughout this article. It is defined following Panagariya, 'Preferential trade liberalization', p. 288, as a treaty that establishes 'a union between two or more countries in which lower tariffs are imposed on goods produced in the member countries than on goods produced outside'.

[4] The term 'spaghetti bowl' was coined by Jagdish Bhagwati in the 1990s and refers to a large amount of bilateral agreements on trade, investment, and so on, besides unilateral or multilateral trade policy making, as depicted in fig. 1. See, among others, Baldwin, 'Multilateralising regionalism'.

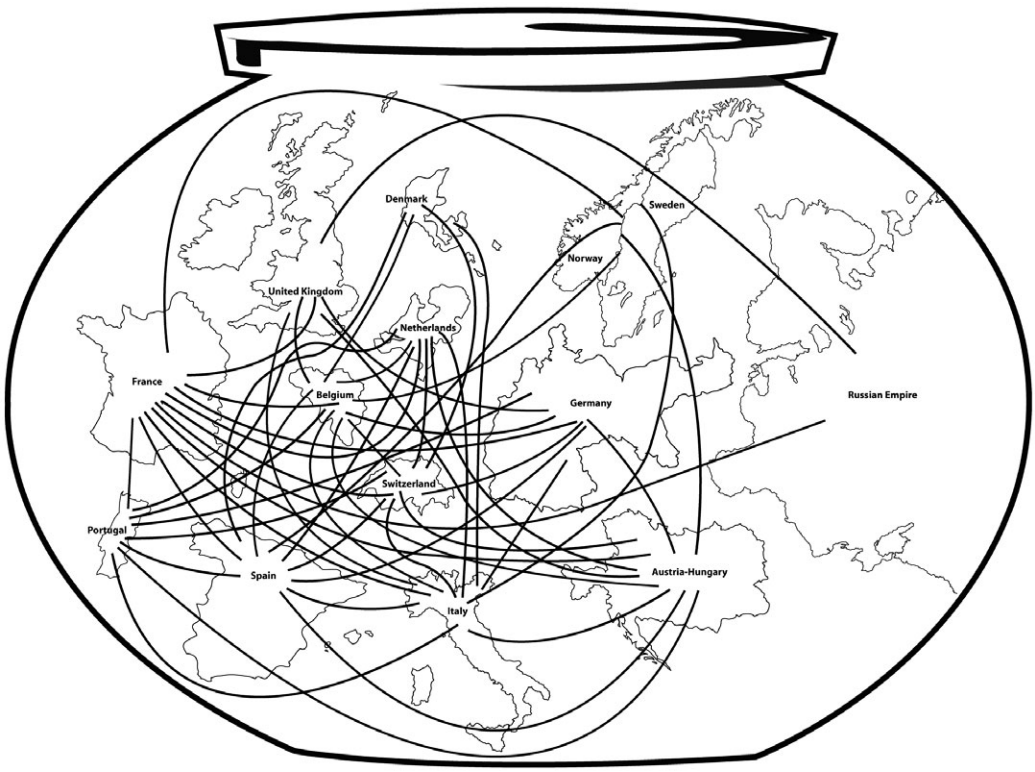

Figure 1. *The 'mother of all spaghetti bowls': the Cobden-Chevalier network in 1875*
Notes and sources: Lines represent unconditional MFN-PTAs signed between 1857 and 1875, as in Lampe, 'Bilateral trade flows', app. 2; the map is based on IEG/A. Kunz, *Europa 1871*, at http://www.ieg-maps.uni-mainz.de.

At second glance, numerous problems were inherent in this decentralized system, most notably the increasing tendency after 1865 to sign MFN-only treaties, in which no further liberalization was achieved. This development can be seen as an instance when the desire to liberalize faded, especially due to the incentive to free-ride on the unconditional MFN clause, and casts doubt on the sustainability of the system.[5] Recently, Accominotti and Flandreau have combined these institutional weaknesses with their finding that treaties were ineffective and concluded that they were intended to be so:

> Liberalization was the cool thing to do and policymakers made a lot of noise to be noted (and succeeded quite well). At the same time they may have avoided upsetting their constituencies and managed to implement more or less meaningless liberalization efforts (again, well done). Paraphrasing Keynes, we conclude that later political scientists, economists, and economic historians, when writing enthusiastically about the Cobden–Chevalier treaty, have fallen prey to dead policymakers.[6]

On closer inspection, the conclusion by Accominotti and Flandreau does not follow from an investigation of the determinants of the treaties, but is suggested as

[5] See Pahre, *Politics*, pp. 283–95, and Irwin, 'Multilateral and bilateral trade policies', p. 101, for details.
[6] Accominotti and Flandreau, 'Bilateral trade treaties', p. 181.

an explanation of the results of an econometric analysis of their effects. This analysis has been challenged for expecting something from the treaties that they were not intended to deliver, namely increases in overall trade, since stipulations were commodity-specific and can be shown to have had positive commodity-specific effects.[7]

Hence, it is time to have a systematic look at the possible causes of the formation of a 'spaghetti bowl' by the PTAs of the 1860s and 1870s. This will serve to assess if they were political and diplomatic 'noise to be noted' or motivated by meaningful economic determinants, seeking either to maximize domestic welfare or to serve the interests of specific interest groups. The latter, among others, investigates the impact of interest groups behind the spread of the treaty network.

While previous research has focused mainly on in-depth political history studies of the negotiations of individual treaties,[8] the present study makes empirical use of three central theories about the determinants of PTA formation: neoclassical international trade theory, theory of the political economy, and economic theories of international political interaction. It incorporates central ideas from the contagion simulation in Lazer and Pahre's work, which covers a wider context and is discussed below,[9] into the first comprehensive in-depth analysis of the determinants of the Cobden–Chevalier network based on a systematically elaborated and comparative dataset for the insiders and central outsiders in the formation of the Cobden–Chevalier network.

The results of this historical case study also facilitate systematic comparison with present-day bilateralism and regionalism, which is one of the most important fields of recent research in international economics. That research, mostly theoretical, deals with PTA formation in the context of the slow advancement of the last GATT/WTO rounds. It generally models PTAs only in the context of Article XXIV GATT[10] and asks whether they are 'stepping stones' to multilateral integration or 'stumbling stones', and as such pernicious to world trade and world welfare.[11] In the 1860s and 1870s multilateralism was not on the horizon (except for the Zollverein in the context of German unification), and therefore historical decision-makers could more freely decide on bilaterally optimal treaties, especially when it came to potentially discriminatory tariff reductions and exceptions for 'sensitive' domestic branches. This should be beneficial for the results of the present study.

The rest of this article proceeds as follows. The three most relevant testable theoretical explications of the formation and spreading of PTAs are outlined.

[7] Lampe, 'Effects'.

[8] An overview of the detailed historical literature can be found in the working paper version of the present article: M. Lampe, 'Explaining nineteenth-century bilateralism: economic and political determinants of the Cobden-Chevalier Network', Universidad Carlos III, Departamento de Historia Económica e Instituciones, Working Papers in Economic History, no. 10-06 (2010), app. 4. See also Bairoch, 'European trade policy', and O'Rourke and Williamson, *Globalization*, pp. 36–43.

[9] Lazer 'Free trade epidemic'; Pahre, *Politics*.

[10] Art. XXIV (8) GATT 1994 allows departure from MFN-treatment if a subset of countries forms a customs union or free trade area, 'in which the duties and other restrictive regulations of commerce . . . are eliminated on substantially all the trade between the constituent territories in products originating in such territories'. In other words, such arrangements have to embrace practically all trade, and not only be 'preferential'. The full text Art. XXIV of the General Agreement on Tariffs and Trade with subsequent complements and updates can be found at http://www.wto.org/english/tratop_e/region_e/regatt_e.htm.

[11] For an overview of theories, see Panagariya, 'Preferential trade liberalization'. Baldwin, 'Multilateralising regionalism', surveys the empirical aspects.

Then, the empirical setup for testing these theories and the dataset elaborated to conduct the tests are presented, followed by the empirical results. Subsequently, these findings are interpreted in the light of theory and historical context. The final section concludes.

I

Economic theories of PTAs assume that both countries have to be potentially better off with the final agreement than without it. The two main theoretical schools, 'pure' international trade theory and political-economic theory, differ in whether governments base their decision-making entirely on welfare maximization or take into account the contributions of interest groups for tariff-setting and international trade policy cooperation.

In neo-classical models, initially without physical or political barriers to trade, unilateral free trade leads to optimal domestic as well as world welfare outcomes, because it allows international specialization following differences in technology or in factor endowments. Although free trade always leads to optimal world welfare, the introduction of different market sizes can lead to outcomes in which larger countries influence the world price. This gives them the possibility to set 'optimum tariffs' in order to improve domestic terms of trade and increase domestic welfare at the cost of other countries. A possible implication in a world of several large countries is that other countries might do the same (retaliation), and hence an inefficient Nash equilibrium is established in which all countries (including the small ones) are worse off than without tariffs. This prisoners' dilemma can be overcome by cooperative agreements on reciprocal tariff reductions that leave the bilateral trade balance unchanged. If there are more than two countries, such bilateral tariff reductions may lead to trade diversion, that is, an increase of trade between collaborating countries at the expense of others. In neo-classical models, trade diversion can lead to highly ambiguous outcomes concerning the welfare of both countries involved, but unambiguously bilateral 'preferential' agreements lead to lower world welfare than free trade. This is why they are, at most, 'second best' solutions.[12]

Incorporating production with increasing returns to scale operating under monopolistic competition, and consumers' love of variety into the model, it can be shown that PTAs may be concluded to ensure access to larger markets. This may make production cheaper and widen the range of product varieties available to consumers. Nevertheless, in most such models of the 'new trade theory', optimum world welfare will still be achieved only under unilateral, or alternatively multilateral, tariff abolition.[13]

Research in the political economy of trade agreements takes into account that governments' decision-making might not be based entirely on welfare optimization.[14] Approaches such as the 'protection for sale' literature (following Grossman and Helpman) include campaign contributions of domestic-producer interest groups into the function maximized by governments and are able to explain both the existence of tariffs and preferential commercial policy cooperation on this

[12] See Bagwell and Staiger, *Economics*, pp. 13–51.
[13] See Goyal and Joshi, 'Bilateralism'; Furusawa and Konishi, 'Free trade'.
[14] See Rodrik, 'Political economy', and Bagwell and Staiger, *Economics*, for comprehensive introductions.

basis: while import-competing interest groups lobby for unilateral tariffs and against their reduction, their influence might be nullified or outweighed by exporter interest groups if bilateral cooperation promised better market access for the latter. As exporter interest groups tend to value preferential access to bigger markets more highly, their lobbying might discriminate against smaller markets and harm arrangements that are optimal for world welfare.[15]

Many of these models imply explanatory variables that are not empirically observable. In order to keep this section focused, only models that yield testable hypotheses are discussed. Baier and Bergstrand combine traditional and 'new' trade theory under the assumption of welfare-optimizing governments. Their model will serve as a 'baseline model' that will be combined with two political-economy approaches: Pahre's political support theory of domestic tariff formation and resulting likelihood of PTA cooperation, and Baldwin's domino theory that models international interaction based on the potential trade-diversion effects of PTA formation on interest groups in non-participating countries.[16]

Baier and Bergstrand provide a general equilibrium model to identify a set of determinants of bilateral trade agreements, which they call 'economic fundamentals'. Building on 'new trade theory' models by Krugman, and by Frankel, Stein, and Wei, they differentiate between inter- and intra-continental transport costs to account for the fact that geography plays an important role in the formation of prevalently regional PTAs. Their model includes two factors of production and two monopolistically competitive industries that produce with increasing returns to scale. The decision to conclude a PTA is taken by social planners who maximize the welfare of their countries' representative consumer.[17]

Baier's and Bergstrand's analysis yields seven hypotheses about factors influencing the net welfare gain from a PTA and the corresponding probability that it is concluded. First, it increases for countries that are located closer to each other (that is, it decreases with higher transport costs). Second, it increases with the remoteness of the country pair from the rest of the world for trading partners on the same continent. While the former accounts for the fact that integration becomes more attractive if transportation between markets is relatively cheap, the latter hypothesis models the opportunity costs and possible welfare losses from the bilateral PTA in question which are lower if all other countries are relatively far away.

Because economies of scale increase with market size, the third and fourth hypotheses are that potential welfare gains increase if both countries are large and if the difference in their economic size is small, while the fifth hypothesis states that it decreases if the national income of both countries is relatively small in comparison to the rest of the world (that is, the national income of all other countries). In the context of the 1860s and 1870s, hypotheses three to five are questionable, as economies of scale might have been rather unimportant in the context of the first industrial revolution. Less controversial in our context, the model's sixth prediction is that, due to gains from inter-industry specialization, larger differences in the

[15] Grossman and Helpman, 'Protection'; idem, 'Politics '. See also Aghion, Antràs, and Helpman, 'Negotiating'.
[16] Baier and Bergstrand, 'Economic determinants'; Pahre, *Politics*; Baldwin, 'Domino theory'.
[17] Baier and Bergstrand, 'Economic determinants'; Krugman, 'Move toward free trade'; Frankel, Stein, and Wei, 'Trading blocs'.

country pair's factor endowments increase the welfare gains from a PTA. However, according to their seventh hypothesis, it decreases if the difference between both countries' factor endowments and those of the rest of the world are comparatively high, because welfare gains from inter-industry trade with the other countries are likely to exceed those of a PTA with the partner in question.

To model the influence of domestic interest groups on the government's trade policy decisions, Pahre developed an empirically testable endogenous tariff and cooperation theory, which is mathematically simpler than the 'protection for sale' approach, but allows him to be much more comprehensive in stating and testing hypotheses. It does not build on the Baier–Bergstrand model, but might be combined with it. The main virtue of this approach is that it was designed with nineteenth-century decentralized treaty-making in mind.[18] The theory starts by explaining unilateral tariff-setting from a political support theory of policy-making, and then proceeds to hypothesize about the likelihood of international cooperation via trade agreements. At the domestic level, it involves the government and two economic sectors, import-competers and exporters. Sectors do not represent firms only, but include all individuals that either gain or lose from foreign trade, and hence constitute two opposing political forces. Import-competers' incomes increase when domestic prices rise in comparison to world prices, while exporters' incomes decrease because they have to pay the domestic price for inputs and charge the world price. The government takes decisions in order to maximize political support from both sectors. Support is a positive function of each sector's income, but with diminishing returns. Governments can redistribute income by imposing positive unilateral tariffs that raise domestic prices above world prices. Domestic forces interact with the world economy in that changing world prices and tariffs in other countries affect domestic politics.

When assessing the likelihood of PTAs using Pahre's approach, one has to be aware that he focuses on the national level, that is, his dependent variable is the 'cooperativeness' of a country with certain characteristics in comparison to others, not the country pair. Nevertheless, regarding the probability of trade agreements, we might draw the following conclusions from his hypotheses.[19] First, low-tariff countries are more likely to cooperate in general, but if the other country has (initially) high tariffs a PTA will be more stable than if it is a low-tariff country.[20] Second, regarding country size, Pahre's theory yields somewhat different outcomes than the model of economic fundamentals above. Pahre finds that at the domestic level, large countries have higher tariffs than smaller ones because they can manipulate world prices for their imports downwards through the effect of tariffs on domestic demand.[21] Although following this reasoning, small countries should be more cooperative because of their lower tariffs, they are less likely to sign trade treaties than large countries, because they have smaller markets and therefore are less attractive as 'targets' of PTAs. Although Pahre does not address this explicitly, his finding implies that the difference in market size should be the more

[18] Pahre, *Politics*. On pp. 68–71, he compares his theory with others from political science and economics.

[19] Pahre, *Politics*, pp. 177–246. The summary given here skips the effects of changes in the terms of trade on 'cooperativeness' because it is difficult to frame for the country pair and cannot be tested with the present dataset.

[20] These hypotheses imply that if trade agreements are more stable they should also be more likely to be signed.

[21] Pahre, *Politics*, pp. 88–90.

relevant of the two economic fundamentals, since small countries might cooperate with small countries due to the relative lack of other partners, while larger ones prefer larger countries.[22]

Additional considerations concerning historical factors lead Pahre to findings on fiscal constraints, that is, whether tariff revenue was essential for the budget, and on democratization. Democracies are more likely to cooperate than autocratic states, and endogenous, that is, weak, self-imposed, and revocable fiscal constraints make treaties more likely. Meanwhile, exogenous, 'hard' fiscal constraints have a less clear-cut impact, which is surely less positive than that of endogenous constraints, and possibly negative.[23]

A third aspect of the formation of the Cobden–Chevalier network, the trade diversion and fear of discrimination underway during the 'general treaty-mongering all over Europe',[24] can be modelled using the 'domino theory of regionalism' presented by Baldwin.[25] It analyses the effects of regional integration on industries in non-member countries and subsequent political action by their governments. Again the model abstracts from economic fundamentals—all countries are symmetric—but can be combined with Baier–Bergstrand. As in Pahre's theory, the government also responds to the support of interest groups, but the theory does not focus on the domestic level, but on international interaction. In Baldwin's model, there are two types of interest groups, organized firms (exporters) and non-economic anti-cooperation lobbies.[26] Organized firms base their efforts on expected gains from PTAs, because their profits depend on transport costs which are lower for intra-PTA trade than for exports to non-members, between non-members, and from non-members to PTA parties. This is most simply explained by low tariffs established by the PTA in comparison to the rest of the world. In Baldwin's original model, a PTA can comprise an unlimited number of countries. The number of actual PTA members is determined by the size of contributions of non-economic interest groups which are modelled by Baldwin as marking the only difference between countries. If a 'trigger event' happens, that is, a development inside the trade bloc that lowers relative intra-PTA trade costs (for example, regulatory homogenization), firms in non-member countries suffer from increased relative costs and potential trade diversion, and hence increase their lobbying activities. Ceteris paribus, this will lead to accession of those countries whose non-economic anti-accession lobbies had just been big enough to impede accession before. The accession of at least one additional country increases the relative costs for exporting firms of remaining outsiders and makes their accession more likely. In the end, a new equilib-

[22] Ibid., pp. 204–46.

[23] Ibid., pp. 105–31, 204–46. This does not, however, imply that democratic countries have lower tariffs. Depending on other factors, they can even have significantly higher tariffs; see ibid., pp. 132–56, and O'Rourke and Taylor's ('Democracy') median voter/factor endowment model and their empirical results. On the impact of democracy, see also Milner and Kubota, 'Why the move?', Wu, 'Measuring and explaining', and the literature cited there.

[24] Louis Mallet to Richard Cobden, 6 Feb. 1861, cited in Metzler, *Großbritannien*, p. 164.

[25] Baldwin, 'Domino theory'.

[26] Without going into detail, his approach is similar to the 'protection for sale' theory following Grossman and Helpman, 'Politics'. The decision-maker has a fixed-weight linear objective function consisting of two components: welfare and contributions from interest groups. Contributions work like binding contracts. If decision-makers accept them, they will have to take into account the corresponding group's interest.

rium with an increased number of PTA members emerges. Unfortunately, multilateral PTA formation is not the subject of the present study. However, in a later article Baldwin stated that if the multilateral PTA is a closed club, 'the new political economy flames may find vent in preferential agreements among excluded nations'.[27] We therefore might interpret the bilateral PTAs of the Cobden–Chevalier network as 'closed PTAs' with two members. The conclusion of one PTA then will lead to the conclusion of new PTAs if the markets in question are big enough that the resulting discrimination affects outsider firms' profits. As they cannot become a party of, say, the Anglo-French treaty, they will try to form a new PTA with each of its parties to assure (and widen) market access under equal (or better) conditions.

In subsequent work, Baldwin studies a situation where different country sizes and prevalently bilateral PTA formation are likely to lead to 'hub-and-spoke bilateralism', where small countries are highly interested in concluding bilateral treaties with bigger countries, but not so much among themselves. He develops an empirical measure of 'Hubness', which is $s_{ij}^{X}\left(1-s_{ij}^{M}\right)$, where s stands for share, X for exports, M for imports, i is the country that evaluates the PTA, and j is the market in question, so that s_{ij}^{X} is the share of i's exports that goes to j and s_{ij}^{M} the share of i's imports that originate in j. Higher Hubness of j is said to increase i's willingness to sign a bilateral PTA.[28] In a dynamic perspective, additionally, the share of i's imports from other markets already covered by an agreement should be of importance.

Table 1 sums up the theoretical predictions (and in part the empirical findings) for the explanatory variables that can be derived from the aforementioned theories.[29] Underlying data and ways of calculation are subjects of the next section.

II

Now, we turn to the empirical implementation of tests for the determinants of the PTA network of the 1860s and 1870s based on the theories outlined above. As all treaties of the network were bilateral, the natural level of analysis is the country pair. The dataset includes all 13 countries visible in figure 1 plus the US, and in principle consists of 91 unique undirected dyads.[30] The dataset starts in 1857 and ends in 1875, and hence comprises 19 annual time-periods, of which only 18 are used because some variables are included with one-year lags (see below). The analysis aims to explain only unconditional MFN treaties that were signed and finally put in force between the countries in the sample; in other words, the treaties in figure 1 plus the Swiss–US PTA of 1855 are considered.[31] They are included for

[27] Baldwin, 'Causes', p. 878. Cf. Yi, 'Endogenous formation', and Pahre, *Politics*, pp. 299–301.

[28] Baldwin, *Spoke trap*, pp. 27–30.

[29] Other potential determinants of trade flows can be found in the literature and have been empirically explored with the present dataset. As none of them showed significant coefficients, they are omitted here.

[30] For example, France–Spain and Spain–France constitute *one observation* only.

[31] Other treaties with non-European countries seem to have been concluded without too much consideration: 'In February, 1864, following the fashion at that time, a commercial treaty was concluded with Japan, and one afternoon Sir John Bowring, an old friend of Switzerland, visited Berne as an extraordinary minister of the king of the Hawaii Islands, Kamehameha V, to advance the Swiss-Honolulu relationships through the conclusion of a treaty of friendship, settlement and commerce (20 July 1864)'; Frey, 'Schweizerische Handelspolitik', p. 481. Treaties had also been concluded before 1857; most of them contained the conditional MFN clause which

Table 1. *Theoretical determinants of PTAs (summary)*

Variable	*Direction of association*	*Abbreviation in subsequent tables*
Economic fundamentals (Baier and Bergstrand, 'Economic determinants')		
Natural (inverse of distance)	+	Natural
Remoteness (average distance from rest of world if on the same continent, 0 otherwise)	+	Remote
Bilateral difference in factor endowments	+	dKLR/dLLR (see section II)
Difference of relative factor endowment of the country pair in question and that of countries outside PTA	–	dKLRRow/dLLRRow (see section II)
Economic sizes of both countries (sum of national incomes)	+	GDPs
Bilateral difference of economic sizes	–	dGDP
Economic size of countries outside PTA (rest of world)	–	*Excluded from the analysis*[a]
Domestic political-economy environment (Pahre, *Politics*)		
Autonomous tariff (as 'initiator'/as 'target')	– / +	MinTariff/MaxTariff
Economic size	(+/–)[b]	dGDP, GDPs
Democracy	+	MinPolity2
Endogeneous fiscal constraint	+	MaxEndogenConstraint
Exogeneous fiscal constraint	~	MaxExogenConstraint
International interaction (Baldwin, 'Domino theory', et al.)		
Hubness	+	MaxHubness/MinHubness
Trade partner PTA coverage	+	MaxPartnerPTAcoverage/ MinPartnerPTAcoverage

Notes: a Excluded from econometric analysis by Baier and Bergstrand, 'Economic determinants', because the economic size of the rest of the world was very similar across countries, and hence the difference showed a very small degree of variation.
b From the 'target' perspective: negative for small countries, positive for big countries.
Sources: See text.

the year the treaty was signed, not for the year it came into force.[32] Since during their stipulated minimum duration of 10 to 12 years the treaties could not be denounced, observations of '1' for a dyad in the years after the treaty was concluded do not reflect new decisions to keep the treaty in force, but automatically follow from the treaty itself. They are therefore not independent observations and are removed from the sample. This implies that for country pairs with an unconditional MFN-PTA in force before 1857, that is, Austria-Hungary and the Zollverein (1853) and Switzerland and the US (1855), all observations are dropped before estimating.[33] As the network evolved in Europe, the main analysis focuses on the 13 European countries of the sample (77 dyads), and the US is additionally included for robustness checks. The estimations therefore are made with 985 and 1,201 observations, respectively, instead of the theoretical maximum of 1,638.

required additional negotiations, if preferences granted in later PTAs with other countries were to be granted to previous trade partners. A mix of conditional and unconditional PTAs was in force most importantly for Sardinia/Italy in the early 1860s. This caused considerable uncertainty for partner countries; see Cova, 'Österreich(-Ungarn)', pp. 656–62; Frey, 'Schweizerische Handelspolitik', p. 470; Henderson, *Zollverein*, p. 261.

[32] Observations on the latter are likely distorted by formalities; for example, treaties concluded by the Zollverein with all countries except Austria would enter into force only after the expiration of the February treaty of 1853 in 1865.

[33] As none of the treaties was effectively denounced during the period under study, there is no switch back to the non-treaty state. Therefore, signing a PTA can be treated as an 'absorbing event'.

The dataset includes all economic fundamentals from Baier and Bergstrand enumerated in table 1. These are the distance-related variables Natural and Remote, as well as the sum (GDPs) and difference (dGDP) of economic sizes, and the bilateral difference in factor endowments and the country pair's relative factor endowments in comparison to the countries not part of the dyad in question.[34] Because the US is the only non-European country in the dataset, the variable Remote is problematic for our analysis, as it is an interaction term between a distance-related measure and a 'same continent' dummy. It is therefore not included in the basic model, and only included in the robustness check with the US-inclusive sample, and afterwards excluded, because it is highly correlated with Natural (the inverse of bilateral distance). Due to the lack of comprehensive capital stock data for the 1860s and 1870s, land–labour ratios were constructed instead (in other words, hectares of cultivated area per person in the economically active population). This coincides with Rogowski's argument that land–labour ratios provide sufficient information about the position of workers in the late nineteenth century in commercial policy matters.[35] Therefore, the difference of both countries' land–labour ratios (dLLR) and the average difference of both countries' land–labour ratios from those of the rest of the world (dLLRRow) substitute the original variables for capital and labour (dKLR and dKLRRow). National income data are purchasing power parity adjusted 'real' GDP data in Baier's and Bergstrand's original article, while the present analysis uses historical national accounting reconstructions of nominal GDP.[36] These data as well as geographical distances are from the same sources as Lampe's gravity estimates; land–labour ratios have been calculated from the data compiled by Mitchell.[37]

To deal with endogeneity, all variables mentioned so far are included with their 1857 values only. This can be interpreted as governments having formed a picture about the other markets and their characteristics in that year, which was not updated during the negotiation wave of the Cobden–Chevalier network. Given the sparse historical records and the absence of contemporary national accounting, this seems to fit the negotiators' state of information. Technically, this implies that 'instantaneous' data are treated as 'enduring' in the analysis, which as a consequence is based on cross-dyad differences for the variables in question only. This should not be too problematic, because differential increases in incomes or changes in factor endowments are unlikely to have caused the formation of the Cobden–Chevalier network.[38] However, the question whether 1857 was a 'typical

[34] See app. 1 for the formulas.

[35] Rogowski, *Commerce and coalitions*, p. 6. Note that O'Rourke and Taylor, 'Democracy', demonstrate that a model without capital is not complete for 1870 to 1914. Tentative estimates with existing scattered capital stock and gross investment estimates for about half of the countries in the dataset have been undertaken, but achieved no stable results. As also stressed by O'Rourke and Taylor, this is supposedly due to the poor quality of capital stock data for the period under study, especially if they are reconstructed from relatively short gross investment data series.

[36] In addition, Baier and Bergstrand's double-value land-distance ('Economic determinants') was used in comparison to sea-distance in *Natural* and *Remote*, while the figures used here reflect geographical 'great circle' distance only.

[37] Lampe, 'Effects'; Mitchell, *International historical statistics*.

[38] A referee raised the concern that ex ante trade volumes might explain the conclusion of PTAs, and hence PTAs would be endogenous to trade, which in turn is to a considerable degree explained by the economic fundamentals of market size and distance, as gravity models explain. This endogeneity could not be accounted for directly using the present dataset, and the author was unable to find theoretical solutions to the problem.

year' merits discussion, given the accounts of a great commercial crisis in that year. However, what is essential for the present research is that economic fundamentals and trade shares were not atypical in that year. Since the pace of structural change is generally much slower than the business cycle fluctuations, we can suppose that this was the case. Referring to trade shares, the geographical distribution of import shares for six important European countries in 1857 is highly correlated with that of 1859 and the average of the years 1857–75.[39]

Furthermore, the variables from Pahre's domestic political economy-based approach as well as from the Baldwin-based international interaction theory are framed for individual countries, not for dyads. Since it takes both parties' positive judgement to conclude a bilateral agreement, I generally use the bilateral maximum or minimum of a variable, making the choice dependent which implies clearer constraints or incentives to treaty-making. For example, because autocratic countries are predicted to be less cooperative, I use the bilateral minimum of the democracy score, which is common in political science. For details concerning other variables, see below.[40]

To test Pahre's predictions, four variables were constructed: Autonomous bilateral tariffs, Endogenous fiscal constraints, Exogenous fiscal constraints, and a democracy variable called Polity2. The impact of country size is subsumed under the sum and difference of national income variables of the Baier–Bergstrand setting. Autonomous bilateral tariffs, that is, the tariff rates applied to commodities from non-PTA countries (in contrast to preferential rates stipulated in PTAs), have been calculated from the national tariff laws based on the 21 commodity groups of Lampe's dataset and classification (see appendix 2). For the analysis, the resulting commodity-group specific ad valorem rates for each country have been weighted individually with each partner country's export structure (in 1865) to model the importance of every country's tariffs to every single partner's export structure. The maximum and the minimum of both countries' bilateral average tariffs are included in the regressions, since the prediction from Pahre's model can be that either low tariffs or high tariffs induce cooperation.

However, it was estimated whether 1857 trade volumes and trade potentials (residuals of a gravity model with data for 1857) had a traceable impact on PTA probability, *net* of market size and distance. The results were insignificant with coefficients tentatively pointing to a positive impact of trade on PTA probability. Cf. also the results for the Hubness measure below.

[39] Pearson's r = 0.96 for 1857 vs. 1859 based on the shares given in Lampe, 'Bilateral trade flows', tab. 11a–f, pp. 127–32 (uncorrected, that is, 'perceived trade' figures). Pearson's r with the mean for 1857 to 1875, which includes changes due to the treaties, is 0.93 for 1857 shares and 0.9 for 1859 shares; this indicates that 1859 would probably have been a more 'untypical' choice.

[40] It should be mentioned that in discussions of research methods regarding the 'democratic peace', political scientists such as Huth have discussed widely how dyadic studies have to be cautious about the coding of country-specific variables at the country-pair level. Therefore, in cases where the true constraint in the underlying theory is not clear, as for the autonomous tariff, I have tested both minimum and maximum values to make sure my decisions do not affect the results qualitatively. 'Monadic' or 'directed dyad' approaches like those discussed in the case of the 'democratic peace' cannot be easily implemented for the current study, since bilateral treaties have no clear equivalent to the concepts of conflict initiation and escalation in that literature. It could, however, be interesting to look at trade wars in later decades in this way. See Huth and Allee, 'Questions'; Rousseau, Gelpi, Reiter, and Huth, 'Dyadic nature'.

Endogenous and exogenous fiscal constraints have been coded into dummy variables following Pahre.[41] They enter the estimations with the maximum of both countries' value in each year. Constraints proxies are not lagged, because current, rather than past, fiscal constraints determine PTA conclusion. Their maximum is used because otherwise the proxy would only have the value of '1' for a dyad in which both countries have a constraint, although only one country's constraint suffices to affect the probability of bilateral cooperation. The democracy proxy also follows Pahre's study, as it is the lower of both countries' Polity2-score from the Polity IV database.[42]

To test Baldwin's political-economy theory of international interactions based on trade diversion forces, values for his Hubness measure have been calculated from the bilateral import and export shares for all country pairs. As Hubness is measured for each country in a pair separately, it enters the analysis as the minimum and the maximum of both partners' values. To model the amount of discrimination in the export market, Trade partner PTA coverage has been constructed as the share of imports in the export market in question that are covered by PTAs with third countries.[43] To avoid endogeneity problems, this variable is based on 1857 import shares as weights, but with actual treaties counted as the spread of the network evolved. Again, one-year lags are employed. Additionally, there are various problems to take into account when working with mid-nineteenth-century trade data. Lampe has shown that the historical statistics were plagued with unaccounted third-country transit. In other words, statistics recorded direct trade partners (last land border crossed or port visited by an incoming ship), but not 'real' countries of origin or destination. In the construction of Lampe's dataset, the resulting proximity bias was accounted for using partner transit statistics. This was carried out for a sample of 21 commodity groups using the historical statistics for seven of the 14 countries in question.[44] For the present study, this dataset had to be supplemented with trade data for the other countries, especially for the trade between them, as trade flows from and to the seven countries of the original dataset are available there. Appendix 3 explains how the original and additional data were combined.[45] However, one might suppose that contemporary decision-makers based their judgement more on 'perceived' trade flows as reported in their national statistics than on the reconstruction of 'actual' trade flows. Hubness and Trade partner PTA coverage therefore have been calculated from the corrected data for 1857, and alternatively using 'perceived trade' from original, uncorrected trade statistics. In principle, I include both the maximum and the minimum of these

[41] Pahre, *Politics*, pp. 105–31, esp. tab. 4.4, p. 126. His 'endogenous??'-value for the Netherlands and the 'exogenous??'-value for Belgium were coded as no constraints due to being highly doubtful. The author assumes that France had an 'exogenous constraint' from 1871 to 1875 due to the reparations of the Franco-Prussian War.

[42] Jaggers and Marshall, *Polity IV project*.

[43] This variable relates to a homonymous variable in Mansfield and Reinhardt, 'Multilateral determinants', which counts but does not weight PTA coverage. Import shares were calculated after deducting imports from the trade partner in question to deal with simultaneity issues. After the preparation of the present manuscript, R. Baldwin and D. Jaimovich, 'Are free trade agreements contagious?', Center for Research on Contemporary Economic Systems, Graduate School of Economics, Hitotsubashi Univ., discussion paper 12 (2009), presented a similar measure labelled 'contagion index'.

[44] Lampe, 'Bilateral trade flows'.

[45] Additionally, data for British North America (modern-day Canada) were also included but are not used in the analysis, because it was a British dependency.

variables. As we will see below, in the case of Trade partner PTA coverage the maximum—which represents the stronger potential for trade diversion—is clearly preferable, while for Hubness the results are less clear.[46] As the dataset consists of discrete duration data, the analysis is undertaken as a series of pooled logit models. Following the suggestion by Carter and Signorino, a linear, a squared, and a cubed time trend are included in all estimations to account for duration dependency of the underlying hazard rates.[47]

Estimation starts with the economic fundamentals model which is then gradually extended by including first the domestic political economy and then the international interaction variables. The basic analysis is carried out for the European members of the Cobden–Chevalier network. As the US is the only geographical outsider in the dataset and outsider to the treaty network—it did not conclude any treaties between 1857 and 1875—for which reliable data could be constructed the same models are re-estimated with the US-inclusive dyads for robustness checks. The variable Remote is only included in the latter specification. The results are shown in table 2 for the core sample and in table 3 for all countries including the US.

All economic fundamentals coefficients are signed as expected. At the 10 per cent level, all variables except the average land–labour ratios relative to the rest of the world (dLLRRow) and the common market size indicator (GDPs) are statistically significant for the core sample. In some specifications, the bilateral difference in land–labour ratios (dLLR) also hits the hurdle by a small margin. The smallness and statistical insignificance of the coefficient for dLLRRow might be explained by the relatively low variation across countries: all were relatively highly developed in comparison to the rest of the world. Additionally, dLLRRow and GDPs are highly correlated and disturb each other's estimates, and dLLRRow is therefore dropped from the subsequent estimates, as is Remote, because it is highly (negatively) correlated with Natural. The estimation of the reduced basic model now provides a much more precise estimate for GDPs, while the results for the remaining economic fundamentals are stable across all variations. A country pair whose members are closer to each other (Natural), and have a potentially large 'common market' (GDPs) and different factor endowments (dLLR), is more likely to conclude a PTA, while higher GDP differences (dGDP) make PTAs less likely (presumably to the disadvantage of smaller countries). When adding further variables to the models, correlation between right-hand side variables leads to imprecise estimates for coefficients and standard errors of GDPs, which are unsatisfactory from a theoretical point of view and statistically troubling. This is

[46] T. Holmes, 'What drives regional trade agreements that work?', Graduate Institute of International Studies, Geneva, Economics, HEI working papers, 07-2005 (2005), favours the minimum of bilateral export shares, a simpler version of Hubness, in her estimates, thus indirectly focusing on the disadvantages of having a small market. However, I do not find such clear empirical results; see below, section II and n. 52.

[47] See Beck, Katz, and Tucker, 'Taking time seriously', and Carter and Signorino, 'Back to the future'. Probit estimation does not lead to substantially different results. Panel logit techniques are not applicable due to the small sample size especially for later cross-sections. Following Mansfield and Reinhardt, 'Multilateral determinants', some political scientists use a variable called 'PTA density' to capture the influence of PTAs concluded by other than the two countries of a dyad. Unfortunately, for the present dataset, 'PTA density' is highly correlated with the linear time trend (Pearson's $r = 0.97$). Although an interesting candidate to proxy for 'contagion', this variable was not included in the regressions.

Table 2. *Regression results (core sample)*

Model	*Economic funda-mentals*	*Economic funda-mentals (reduced)*	*. . . plus Domestic political-economy (MinTariff$_{-1}$)*	*. . . plus Domestic political-economy (MaxTariff$_{-1}$)*	*. . . plus Domestic political-economy (reduced)*	*. . . plus International interactions (actual trade)*	*. . . plus International interactions (perceived trade)*	*Eclectic approach (perceived trade)*
Variable	*Coeff. (p-value)*	*Coeff. (p-value)*	*Coeff. (p-value)*	*Coeff. (p-value)*	*Coeff. (p-value)*	*Coeff. (p-value)*	*Coeff. (p-value)*	*Coeff. (p-value)*
Natural	1.04 (0.000)	0.99 (0.000)	0.98 (0.003)	0.92 (0.003)	0.92 (0.003)	0.83 (0.016)	0.94 (0.011)	1.00 (0.003)
dLLR	0.45 (0.084)	0.33 (0.126)	0.57 (0.017)	0.54 (0.032)	0.55 (0.019)	0.50 (0.063)	0.42 (0.137)	0.41 (0.109)
dLLRRow	−0.50 (0.375)	—	—	—	—	—	—	—
GDPs	0.17 (0.124)	0.24 (0.004)	0.16 (0.221)	0.17 (0.181)	0.34 (0.000)	0.31 (0.088)	0.17 (0.243)	0.24 (0.016)
dGDP	−0.56 (0.000)	−0.56 (0.000)	−0.71 (0.000)	−0.67 (0.000)	−0.62 (0.000)	−0.65 (0.000)	−0.68 (0.000)	−0.61 (0.000)
MinTariff$_{-1}$			2.59 (0.037)	—	—	—	—	—
MaxTariff$_{-1}$				2.08 (0.013)	2.36 (0,003)	3.13 (0.000)	3.04 (0.001)	2.94 (0.000)
MinPolity2$_{-1}$			0.23 (0.000)	0.26 (0.000)	0.22 (0.000)	0.27 (0.000)	0.24 (0.000)	0.24 (0.000)
MaxEndogenConstraint			1.08 (0.040)	1.03 (0.055)	—	—	—	—
MaxExogenConstraint			−0.23 (0.605)	−0.23 (0.610)	—	—	—	—
MinHubness						4.81 (0.971)	−2.40 (0.787)	—
MaxHubness						−2.60 (0.380)	3.42 (0.291)	—
MinPartner PTAcoverage$_{-1}$						−0.63 (0.731)	−0.24 (0.886)	—
MaxPartner PTAcoverage$_{-1}$						3.60 (0.000)	3.47 (0.002)	2.84 (0.001)
Time	1.47 (0.003)	1.48 (0.003)	1.67 (0.003)	1.84 (0.002)	1.79 (0.002)	1.70 (0.004)	1.65 (0.004)	1.66 (0.003)
Time^2	−0.14 (0.013)	−0.14 (0.012)	−0.16 (0.009)	−0.17 (0.007)	−0.16 (0.009)	−0.18 (0.003)	−0.17 (0.005)	−0.16 (0.005)
Time^3	0.00 (0.024)	0.00 (0.023)	0.00 (0.014)	0.00 (0.011)	0.00 (0.018)	0.01 (0.004)	0.01 (0.006)	0.01 (0.008)
Constant	−3.84 (0.184)	−6.06 (0.004)	−4.26 (0.225)	−5.78 (0.101)	−9.96 (0.000)	−9.55 (0.042)	−5.90 (0.141)	−6.91 (0.021)
Pseudo-R^2	0.11	0.11	0.16	0.17	0.16	0.21	0.19	0.18
Log-pseudo-likelihood	−175.51	−175.88	−165.44	−163.94	−166.99	−157.06	−160.70	−161.56
N	985	985	985	985	985	985	985	985

Notes and sources: Author's calculations (logistic regression with robust standard errors; dependent variable: PTA yes/no).

Table 3. *Robustness check: regression results including the US*

Model	*Economic funda-mentals*	*Economic funda-mentals (reduced)*	*. . . plus Domestic political-economy (MinTariff$_{-1}$)*	*. . . plus Domestic political-economy (MaxTariff$_{-1}$)*	*. . . plus Domestic political-economy (reduced)*	*. . . plus International interactions (actual trade)*	*. . . plus International interactions (perceived trade)*	*Eclectic approach (perceived trade)*
Variable	*Coeff. (p-value)*	*Coeff. (p-value)*	*Coeff. (p-value)*	*Coeff. (p-value)*	*Coeff. (p-value)*	*Coeff. (p-value)*	*Coeff. (p-value)*	*Coeff. (p-value)*
Natural	1.09 (0.000)	1.28 (0.000)	1.50 (0.000)	1.50 (0.000)	1.50 (0.000)	1.53 (0.000)	1.56 (0.000)	1.58 (0.000)
Remote	0.36 (0.000)	—	—	—	—	—	—	—
dLLR	0.43 (0.101)	0.27 (0.209)	0.41 (0.075)	0.28 (0.226)	0.27 (0.214)	0.20 (0.435)	0.18 (0.512)	0.13 (0.579)
dLLRRow	−0.43 (0.448)	—	—	—	—	—	—	—
GDPs	0.18 (0.117)	0.22 (0.013)	0.03 (0.823)	0.05 (0.730)	0.22 (0.012)	0.09 (0.550)	0.06 (0.685)	0.11 (0.278)
dGDP	−0.56 (0.000)	−0.58 (0.000)	−0.69 (0.000)	−0.68 (0.000)	−0.57 (0.000)	−0.59 (0.002)	−0.69 (0.001)	−0.58 (0.000)
MinTariff$_{-1}$			2.72 (0.017)	—	—	—	—	—
MaxTariff$_{-1}$				1.15 (0.153)	1.50 (0.044)	2.30 (0.005)	2.31 (0.008)	2.22 (0.006)
MinPolity2$_{-1}$			0.14 (0.003)	0.13 (0.002)	0.09 (0.013)	0.10 (0.005)	0.11 (0.008)	0.11 (0.005)
MaxEndogenConstraint			1.01 (0.045)	1.04 (0.049)	—	—	—	—
MaxExogenConstraint			−0.36 (0.388)	−0.22 (0.594)	—	—	—	—
MinHubness						−4.46 (0.539)	−13.4 (0.89)	—
MaxHubness						−1.10 (0.724)	4.99 (0.116)	—
MinPartner PTAcoverage$_{-1}$						1.92 (0.175)	1.50 (0.317)	—
MaxPartner PTAcoverage$_{-1}$						3.10 (0.000)	3.44 (0.003)	3.21 (0.000)
Time	1.48 (0.003)	1.51 (0.003)	1.73 (0.002)	1.76 (0.002)	1.70 (0.002)	1.49 (0.005)	1.49 (0.005)	1.56 (0.003)
Time^2	−0.14 (0.013)	−0.14 (0.013)	−0.16 (0.006)	−0.16 (0.006)	−0.15 (0.009)	−0.17 (0.003)	−0.16 (0.005)	−0.16 (0.006)
Time^3	0.00 (0.023)	0.00 (0.024)	0.00 (0.010)	0.00 (0.010)	0.00 (0.019)	0.01 (0.003)	0.00 (0.007)	0.00 (0.008)
Constant	−6.27 (0.035)	−3.66 (0.053)	1.79 (0.564)	1.24 (0.689)	−3.01 (0.145)	−4.99 (0.786)	1.31 (0.672)	0.13 (0.955)
pseudo-R^2	0.15	0.14	0.17	0.17	0.15	0.21	0.20	0.19
Log-pseudo-likelihood	−176.61	−179.31	−172.20	−173.20	−176.20	−164.35	−166.15	−168.75
N	1,201	1,201	1,201	1,201	1,201	1,201	1,201	1,201

Notes and sources: Author's calculations (logistic regression with robust standard errors; dependent variable: PTA yes/no).

especially true for the inclusion of fiscal constraint dummies and Hubness.[48] With the exception of the endogenous fiscal constraint dummy, none of these variables shows statistically significant results. The endogenous fiscal constraint dummy causes problems because 57 per cent of all observations have at least one country with a 'weak fiscal constraint' involved, and hence the dummy is likely to capture effects not related to fiscal constraints.[49] Both fiscal constraint dummies and Hubness are therefore removed from the favoured specifications, where the effects of national income remain as described.

The remaining domestic political economy variables perform well: the less autocratic the country so the lower the Polity2-score ($MinPolity2_{-1}$), the more likely is international collaboration in commercial policy. This is in line with Pahre's findings. Furthermore, the inclusion of Polity leads to a higher and more precisely estimated coefficient for the dLLR variable. The difference in land–labour ratios is weakly correlated ($r = 0.07$) with the $MinPolity2_{-1}$ score and more strongly correlated with a polity ratio ($MaxPolity2_{-1}/MinPolity2_{-1}$; $r = 0.30$). This indicates that countries with wide differences in the land–labour ratio also differ in their degree of relative democracy and autocracy. While the former variable indicates welfare gains from trade, the difference in the degree of autocracy and the degree of autocracy itself are negatively related to the conclusion of PTAs, statistically as well as theoretically (see section I). Hence, in the initial estimate, dLLR partially captures an effect that is isolated by including the Polity-score.

The consistently significant and positive coefficients for bilateral autonomous tariffs indicate that higher autonomous tariffs make (partner) collaboration more likely. The estimates are finally made with the bilateral maximum ($MaxTariff_{-1}$) because of the slightly higher explanatory power of the model including this formulation for the core sample.[50] These findings partially contradict Pahre's theory that countries with lower tariffs are more collaborative, but on the other hand sustains the argument that high partner tariffs make collaboration more likely.

Regarding the third group of variables, those concerning international interaction, the Hubness variable does not perform well. Neither its minimum nor its maximum shows significant results in the analysis.[51] Thus, Hubness does not

[48] Hubness is theoretically related to GDPs because it is modelled with market size in mind. In the extended sample the estimate for GDPs and for dLLR is also sensitive to the inclusion of PTA coverage. A possible explication includes a combination of two factors: first, the US had the highest national income and the second highest land-labour ratio of all countries in the sample, but did not conclude any MFN-PTAs during the observation period due to domestic reasons potentially missing in the model. This works against the economic fundamentals. Additionally, the US had in force (until 1866) a non-unconditional MFN-PTA with British North America, which was coded in PTA coverage because trade with British North America was included in the sample. One might expect a considerably discriminatory effect of this PTA, but in effect this was not the case because it covered only bilateral trade in raw materials which the US did normally not import from Europe.

[49] Consistent with expectations from Pahre's theory, the coefficient for the endogenous fiscal constraint dummy is positive. It is statistically significant at the 10% level. The exogenous constraint dummy has the value of '1' for 68% of all observations, even more than the endogenous constraint proxy.

[50] For the extended sample the contrary is true. The reason is that the US has the higher tariff rate in the majority of country pairs it forms part of, but concluded no treaties.

[51] At first sight, the results for Hubness calculated with perceived trade in the extended sample seem to back Hubness as a substantial determinant of PTAs. Nevertheless, the statistical significance of the effects is spurious and results from suppressor effects, as can be seen when the minimum and the maximum of Hubness are included individually, or when economic fundamentals, Pahre's variables, and the time effects are dropped from the model. Coefficients are insignificant in all these estimates, and sometimes show signs opposite to those in table 3.

systematically model forces at work in the formation of the Cobden–Chevalier network.[52]

In contrast, the coefficient of the maximum of the discrimination proxy Trade partner PTA coverage (that is, MaxPartnercovered$_{-1}$) is positive and significant throughout. This means that potential trade diversion played an important role in the formation of the network, and that countries became more attractive 'targets' for the formation of PTAs, the more PTAs they had already concluded.

III

The empirical analysis has shown that all three classes of theories contribute valuable insights about the formation of the Cobden–Chevalier network and can be combined in an eclectic approach. This section presents a new, systematic view of the determinants of the network based on this consolidated model, represented in the last columns of tables 2 and 3. The relative weight of the respective theories in the eclectic approach can be assessed from the evolution of the goodness of fit statistics as the model is enhanced with more variables. Of the total pseudo-R^2 of the final model (0.18),[53] 35 per cent is due to the economic fundamentals alone, and 24 and 15 per cent are added by domestic political-economy-based variables and the international interaction variable Partner PTA coverage, respectively. The remaining explanatory power (26 per cent) is due to the constant and the time dummies and indicates that further contagion forces not captured by Partner PTA coverage might have been at work, or that overall changes in international trade, such as the spread of railways and industrial production over the European continent, made foreign trade less costly and enhanced the potential benefits of integration.[54] In the following section, I first interpret the findings for every variable and highlight connections and interactions between them. Afterwards, a general interpretation of the logic behind the Cobden–Chevalier network and its implications is presented.

The economic fundamentals, which model the welfare expectations from PTAs, have to form the basis of every interpretation of the Cobden–Chevalier network and account for the major part of the goodness of fit. Their significant and theoretically consistent coefficients confirm the importance of welfare-oriented political decisions for the conclusions of PTAs, as highlighted by Baier and Bergstrand using data for 1996.[55] This demonstrates that today, as in the past, in principle policy-makers based their decisions on the same considerations: if a PTA is to be concluded, both partners should be (a) relatively nearby (Natural), thus avoiding physical barriers to trade resulting in higher bilateral transport costs; (b)

[52] This contradicts results of Holmes, 'What drives regional trade agreements?' (see above, n. 46), who used bilateral export shares (a simplification of Hubness), and found their bilateral minimum to be positively and significantly related to the formation of 'effective' PTAs in force in 2002. However, her models only include 'distance' as an economic fundamental.

[53] The goodness of fit of the models is reasonable, but far from the 0.7 obtained by Baier and Bergstrand, 'Economic determinants', p. 43, with data for 1996 for the economic fundamentals alone. This most likely is due to the small sample size and the relatively low variation in the dataset, as the observations are clustered in the core of the world economy. The goodness of fit is however not too far below that obtained by Mansfield and Reinhardt, 'Multilateral determinants',pp. 849–50, in estimations with *c.* 150,000 observations with modern data (0.39).

[54] Cf. Lazer 'Free trade epidemic'; Nye, 'Changing French trade conditions'.

[55] Baier and Bergstrand, 'Economic determinants'.

differently endowed with production factors (dLLR) to exploit potential gains from comparative advantages; and (c) comprise a relatively big 'common market' (GDPs), in which ideally both individual markets should be of equal size (dGDP).

However, economic fundamentals do not tell the whole story. First of all, the findings for the market size-related variables GDPs (size of the 'common market', positive coefficient) and dGDP (difference in individual market sizes, negative coefficient) cannot solely be explained by potential welfare gains from economies of scale and intra-industry trade, as suggested by the new trade theory. Instead, based on historical accounts and theoretical contributions by Pahre and others, the author of the present study suggests a political-economy interpretation of market sizes: additional political support achieved through a PTA depends on the potential market access for domestic exporters and the amount of increased competition on the domestic market. In principle, if PTAs are reciprocal and non-MFN, bilateral preferences will be balanced and free from externalities, and hence the size of the partner will not be important. Nevertheless, it becomes important after realistically introducing PTA negotiation costs into the political support function, that is, costs of consultation of domestic parliamentary bodies, export commissions, and interest groups. If we reasonably assume that a considerable part of these costs is fixed, then they affect the net benefits of PTAs with small countries more than those with large countries. This is especially true in combination with expectations that preferences will be transmitted to other, larger countries (and their exporters) via MFN. This mechanism causes PTAs with big countries to be comparatively more attractive, especially for larger countries.[56] Hence, it is not surprising that the present results suggest and the historical evidence shows that large countries were more likely to negotiate first among each other, and only subsequently (if at all) with smaller countries. Additionally, small countries found themselves in a disadvantageous situation of having to 'accede' to the state of negotiation established by the bigger countries and only being able to bargain on issues not covered by the initial treaties.[57]

Turning to the genuine political economy variables, the level of democracy (or the relative absence of autocracy) has significantly positive impact in all specifications. This confirms theories that highlight the positive correlation of wider suffrage and political cooperation, as well as Pahre's empirical findings. Furthermore, an additional interaction between political and economic determinants could be uncovered. Differences in land–labour ratios and in relative democracy are correlated, but show adverse signs as determinants of PTAs: while the former indicate gains from specialization, the latter show that countries with a higher degree of autocracy are more difficult to cooperate with. Only disentangling both effects shows that each of them has a consistent influence on the formation of PTAs.

At first glance, the present findings on tariffs are contradictory to those of Pahre, who finds that countries with lower tariffs are more cooperative.

[56] See Horn and Mavroidis, 'Economic and legal aspects', for a deeper review of the literature.

[57] Consider, for example, the remarks of French foreign minister Drouyn at the beginning of the Franco-Swiss negotiations that it was not the purpose of the current negotiations to alter the preferences it had made in its prior PTAs with the UK and Belgium. These would be transmitted to Switzerland, but French concessions would be limited to items not included in these treaties (Brand, *Die schweizerisch-französischen Unterhandlungen*, pp. 127–8). It is unlikely that the French government would have undertaken the large industrial enquête it conducted in the context of the Cobden–Chevalier treaty (Dunham, *Anglo-French treaty*, pp. 123–42) for a treaty with Switzerland.

Nevertheless, if we see tariffs not as political fundamentals, but as something that can be manipulated through international interaction, we are able to discover their strategic importance. This does not necessarily imply that tariffs were chosen at the domestic level to improve the home government's bargaining position. It simply means that high duties—however they were motivated when imposed—constituted political barriers to trade whose removal would lead to better market access for partner countries' exporters.[58] The positively signed bilateral tariffs coefficient therefore shows that political barriers to trade (like the physical barriers to trade proxied by Natural and Remote) were important determinants of PTA conclusion.

Dynamic international interaction in the formation of the PTA network is evident from the significantly positive coefficient for Partner PTA coverage, that is, the maximum of every potential treaty partner's trade shares already covered by PTAs with other countries. Following Baldwin's domino theory and the historical accounts given above, one should interpret this dependence of later PTAs on earlier ones as having been caused by fears of bilateral trade diversion.[59] Dependence of later PTAs on earlier ones is also confirmed in recent research on post-1945 PTAs.[60]

The results for the individual variables can be joined into a general interpretation of nineteenth-century bilateralism. In particular, the strategic interaction patterns behind the results for Partner PTA coverage and Autonomous bilateral tariffs indicate that the potential of expansion and the sustainability of the network were affected by the same forces that led to its expansion.

First, the combination of a positive influence of Partner PTA coverage and Natural (corresponding to a negative influence of distance) explains why the network was geographically constricted to Europe, and was unable to expand after the inclusion of all European countries. Higher distance decreased the probability of PTA conclusion, which led to potentially lower Partner PTA coverage for peripheral countries, and hence to relatively low economic welfare potentials and trade diversion fears outside Europe. In the real setting of the 1860s and 1870s this implies that the Atlantic Ocean, the Mediterranean Sea, and the Russian Empire constituted a sort of natural border for the expansion of the network. Hence, after 1875, only newly independent states in south-eastern Europe (Romania, Serbia, Bulgaria, and Greece) could be drawn into the treaty network, whose centre moved eastward.

Second, if the network was a phenomenon of European commercial integration, one might ask whether it should be seen as the predecessor of a truly common market in Europe; in other words, if it had the potential to lower duties to zero and additionally deepen economic cooperation in other fields. The results for political-economy variables recommend a rather sceptical attitude: in particular, the finding that high autonomous tariffs made (partner) cooperation more likely casts doubt

[58] Pahre's results can be found in *Politics*, pp. 204–46. Strategic tariff-setting occurred after 1880, when two-tier tariffs became common in Europe, establishing retaliatory duties for non-cooperative partners to force them to cooperate. This should be interpreted in the light of the problems of free riding discussed later in this section.

[59] This is found despite the inclusion of time-dependent control variables.

[60] Egger and Larch, 'Interdependent preferential trade agreement memberships'; M. S. Manger, 'The political economy of discrimination: modelling the spread of preferential trade agreements', mimeo (2006); and Baldwin and Jaimovich, 'Are free trade agreements contagious?' (see above, n. 43).

on the potential for a 'second round' of negotiations that might have deepened the results of the treaties concluded up to 1875.[61]

This is not surprising considering Ethier's theory on 'MFN in a multilateral world'.[62] In his models, the unconditional MFN clause diminishes incentives to agree on preferential tariff reductions as the network of PTAs gets larger, because of the following two mechanisms in the political support functions. First, governments give negative weight to the fact that with more countries in the network additional bilateral preferences have to be shared with more countries, and thus are less exclusive for domestic exporters. Second, additional preferences granted to foreign exporters become more costly because they have to be transmitted to more countries via MFN. These resulting externalities lead to incentives for free-riding and evasion of further bilateral liberalization. This is precisely what could be observed in the decades after 1875, when the Cobden–Chevalier network did not collapse, but also did not advance further on the way to free trade.[63] Ethier stresses that the only feasible way to internalize such externalities lies in the multilateralization of negotiations.[64] However, the scope for formal multilateralism was too small in the historical context of the present study. The importance of potential trade diversion and high tariffs highlighted above indicates that it would have taken very strong political determination to multilateralize the network. This seems to have been rather unlikely in the age of 'struggle for colonies' and arms races among European powers that characterized international relations before the First World War.[65]

IV

The research presented in the preceding sections strongly suggests that systematic economic, as well as political, forces were at work in the formation of the bilateral treaties of the 1860s and 1870s. Unless we assume that all contemporary policymakers fell victim to each other in their decision-making or joined a large conspiracy, we can conclude that for them, ex ante the PTAs of the Cobden–Chevalier network made sense (at least on average).

The results offer new insights into the forces behind the treaties. 'Pure' welfare-oriented economic theory combined with political economy and international interaction models show that trade-creation considerations interacted with strategically oriented political-economy forces to explain why the Anglo-French commercial treaty of 1860 did not remain a singular phenomenon. These insights also

[61] Even the sustainability of the negotiated tariff reductions was uncertain, given the stipulated limited durations of 10 to 12 years with a one-year term of notice afterwards.

[62] Ethier, 'Regionalism'; idem, 'Political externalities'. The following is essentially paraphrased from Horn and Mavroidis, 'Economic and legal aspects', pp. 263–6; cf. Pahre, *Politics*, pp. 296–321.

[63] Marsh, *Bargaining on Europe*; Bairoch, 'European trade policy'.

[64] Another possibility might have been to drop MFN (cf. Pahre, *Politics*, pp. 296–321), which would have opened the doors to concession diversion. Without MFN, a comprehensive PTA network would have been rather unlikely in terms of both wide coverage and tariff reductions. The conditional form of the MFN clause also theoretically internalizes externalities from later PTAs, but it requires renegotiation and rebalancing of concessions prior to the transmission of further preferences, which involves large transaction costs.

[65] Cf. Irwin, 'Multilateral and bilateral trade policies', pp. 99–101. Gaston, 'Free trade diplomacy debate', deals with a short-lived initiative for a European congress on tariff schemes by the British Foreign Office in 1875–6. Cobden's vision to collaborate pacifically instead of investing resources in separate military capabilities and rivalries remained politically unfeasible; see Wendt, 'Freihandel'.

make it clear that the driving forces behind the expansion of the network at the same time limited its geographical extension and prevented the deepening of integration.

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Footnote references

Accominotti, O. and Flandreau, M., 'Bilateral trade treaties and the most-favored-nation clause: the myth of trade liberalization in the nineteenth century', *World Politics*, 60 (2008), pp. 147–88.
Aghion, P., Antràs, P., and Helpman, E., 'Negotiating free trade', *Journal of International Economics*, 73 (2007), pp. 1–30.
Bagwell, K. and Staiger, R. W., *The economics of the World Trading System* (Cambridge, Mass., 2002).
Baier, S. L. and Bergstrand, J. H., 'Economic determinants of free trade agreements', *Journal of International Economics*, 64 (2004), pp. 29–63.
Bairoch, P., 'European trade policy, 1815–1914', in P. Mathias and S. Pollard, eds., *The Cambridge economic history of Europe, VIII, The industrial economies: the development of economic and social policies* (Cambridge, 1989), pp. 1–160.
Baldwin, R. E., 'A domino theory of regionalism', in R. E. Baldwin, P. Haaparanta, and J. Kiander, eds., *Expanding membership of the European Union* (Cambridge, 1995), pp. 25–48.
Baldwin, R. E., 'The causes of regionalism', *World Economy*, 20 (1997), pp. 865–88.
Baldwin, R. E., *The spoke trap: hub-and-spoke bilateralism in East Asia* (Seoul, 2004).
Baldwin, R. E., 'Multilateralising regionalism: spaghetti bowls as building blocs on the path to global free trade', *World Economy*, 29 (2006), pp. 1451–518.
Beck, N., Katz, J. N., and Tucker, R., 'Taking time seriously: time-series-cross-section analysis with a binary dependent variable', *American Journal of Political Science*, 42 (1998), pp. 1260–88.
Borries, B. V., *Deutschlands Außenhandel 1836 bis 1856: Eine statistische Untersuchung zur Frühindustrialisierung* (Stuttgart, 1970).
Brand, U., *Die schweizerisch-französischen Unterhandlungen über einen Handelsvertrag und der Abschluss des Vertragswerkes von 1864: Ein Beitrag zur Geschichte der schweizerischen Wirtschaft und Diplomatie* (Berne, 1968).
Carter, D. B. and Signorino, C. S., 'Back to the future: modeling time dependence in binary data', *Political Analysis*, 18 (2010), pp. 271–92.
Cova, U., 'Österreich(-Ungarn) und Italien', in A. Wandruszka and P. Urbanitsch, eds., *Die Habsburgermonarchie, 1848–1918, VI, pt. 1, Die Habsburgermonarchie im System der internationalen Beziehungen* (Vienna, 1989), pp. 630–86.
Dunham, A. L., *The Anglo-French treaty of commerce of 1860 and the progress of the industrial revolution in France* (Ann Arbor, 1930).
Egger, P. and Larch, M., 'Interdependent preferential trade agreement memberships: an empirical analysis', *Journal of International Economics*, 76 (2008), pp. 384–99.
Ethier, W. J., 'Regionalism in a multilateral world', *Journal of Political Economy*, 106 (1998), pp. 1214–45.
Ethier, W. J., 'Political externalities, nondiscrimination, and a multilateral world', *Review of International Economics*, 12 (2004), pp. 303–20.
Frankel, J., Stein, E., and Wei, S.-J., 'Trading blocs and the Americas: the natural, the unnatural, and the super-natural', *Journal of Development Economics*, 47 (1995), pp. 61–95.
Frey, E., 'Die schweizerische Handelspolitik der letzten Jahrzehnte', in Verein für Socialpolitik, ed., *Die Handelspolitik der wichtigeren Kulturstaaten in den letzten Jahrzehnten*, vol. I (Leipzig, 1892), pp. 451–519.
Furusawa, T. and Konishi, H., 'Free trade networks', *Journal of International Economics*, 72 (2007), pp. 310–35.
Gaston, J. W., 'The free trade diplomacy debate and the Victorian European common market initiative', *Canadian Journal of History*, XXII (1987), pp. 59–82.
Goyal, S. and Joshi, S., 'Bilateralism and free trade', *International Economic Review*, 47 (2006), pp. 749–78.
Grossman, G. M. and Helpman, E., 'Protection for sale', *American Economic Review*, 84 (1994), pp. 833–50.
Grossman, G. M. and Helpman, E., 'The politics of free-trade agreements', *American Economic Review*, 85 (1995), pp. 667–90.
Henderson, W. O., *The Zollverein* (2nd edn. 1968).

Horn, H. and Mavroidis, P. C., 'Economic and legal aspects of the most-favored-nation clause', *European Journal of Political Economy*, 17 (2001), pp. 233–79.
Hübner, O., *Die Zolltarife aller Länder: Gesammelt, übersetzt, geordnet* (Leipzig, 1852).
Hübner, O., *Die Zolltarife aller Länder: Gesammelt, übersetzt, geordnet* (Iserlohn, 2nd edn. 1866).
Huth, P. and Allee, T., 'Questions of research design in developing new tests of the democratic peace', *International Interactions*, 28 (2002), pp. 31–57.
Irwin, D. A., 'Multilateral and bilateral trade policies in the world trading system: an historical perspective', in J. de Melo and A. Panagariya, eds., *New dimensions in regional integration* (Cambridge, 1993), pp. 90–119.
Jaggers, K. and Marshall, M. M., *Polity IV project: political regime characteristics and transitions, 1800–2006: dataset users' manual* (Severn, Md., 2007).
Krugman, P., 'The move toward free trade zones', in Federal Reserve Bank of Kansas, ed., *Policy implications of trade and currency zones* (Kansas City, 1991), pp. 7–58.
Lack, H. R., *The French treaty and the tariff of 1860; with an historical sketch of the past commercial legislation of France* (1861).
Lampe, M., 'Bilateral trade flows in Europe, 1857–1875: a new dataset', *Research in Economic History*, 26 (2008), pp. 81–155.
Lampe, M., 'Effects of bilateralism and the MFN clause on international trade: evidence for the Cobden–Chevalier network, 1860–1875', *Journal of Economic History*, 69 (2009), pp. 1012–40.
Lazer, D. A., 'The free trade epidemic of the 1860s and other outbreaks of economic discrimination', *World Politics*, 51 (1999), pp. 447–83.
Mansfield, E. D. and Reinhardt, E., 'Multilateral determinants of regionalism: the effects of GATT/WTO on the formation of preferential trading arrangements', *International Organization*, 57 (2003), pp. 829–62.
Marsh, P. T., *Bargaining on Europe: Britain and the first common market, 1860–1892* (New Haven, 1999).
Metzler, G., *Großbritannien—Weltmacht in Europa. Handelspolitik im Wandel des europäischen Staatensystems, 1856 bis 1871* (Berlin, 1997).
Milner, H. V. and Kubota, K., 'Why the move to free trade? Democracy and trade policy in the developing countries', *International Organization*, 59 (2005), pp. 107–43.
Mitchell, B. R., *International historical statistics*, 2 vols. (5th edn. Houndmills, 2003).
Nye, J. V. C., 'Changing French trade conditions, national welfare, and the 1860 Anglo-French treaty of commerce', *Explorations in Economic History*, 28 (1991), pp. 460–77.
O'Rourke, K. H. and Taylor, A. M., 'Democracy and protectionism', in T. J. Hatton, K. H. O'Rourke, and A. M. Taylor, eds., *The new comparative economic history: essays in honor of Jeffrey G. Williamson* (Cambridge, Mass., 2008), pp. 193–216.
O'Rourke, K. H. and Williamson, J. G., *Globalization and history: the evolution of a nineteenth-century Atlantic economy* (Cambridge, Mass., 1999).
Pahre, R., *Politics and trade cooperation in the nineteenth century: the 'agreeable customs' of 1815–1914* (New York, 2008).
Panagariya, A., 'Preferential trade liberalization: the traditional theory and new developments', *Journal of Economic Literature*, 38 (2000), pp. 287–331.
Rodrik, D., 'Political economy of trade policy', in G. M. Grossman and K. S. Rogoff, eds., *Handbook of international economics*, vol. III (Amsterdam, 1995), pp. 1457–94.
Rogowski, R., *Commerce and coalitions: how trade affects domestic political alignments* (Princeton, 1989).
Rousseau, D. L., Gelpi, C., Reiter, D., and Huth, P. K., 'Assessing the dyadic nature of the Democratic Peace, 1918–88', *American Political Science Review*, 90 (1996), pp. 512–33.
Wendt, B.-J., 'Freihandel und Friedenssicherung: Zur Bedeutung des Cobden-Vertrags von 1860 zwischen Frankreich und England', *Vierteljahrschrift Für Sozial- Und Wirtschaftsgeschichte*, 61 (1974), pp. 29–64.
Wu, J. P., 'Measuring and explaining regional levels of integration', in P. de Lombaerde, ed., *Assessment and measurement of regional integration* (Abingdon, 2006), pp. 162–79.
Yi, S.-S., 'Endogenous formation of customs unions under imperfect competition: open regionalism is good', *Journal of International Economics*, 41 (1996), pp. 155–77.

Official publications

Abstract of Reports on the Trades of Various Countries and Places, for the Years 1857-58-59. Received by the Board of Trade (through the Foreign Office), from Her Majesty's Ministers and Consuls. No. 7 (P.P. 1859, XXX), Report by Mr Crowe, British Consul at Helsingfors, upon the Trade, &c., of the Grand Duchy of Finland for the Year 1857; General Report by Lieutenant-Colonel Simmons, R.E., C.B., British Consul General at Warsaw, upon the Condition and Industries, &c., of Poland.
Annales du Commerce Extérieur. Faits commerciaux. Ser. *Colonies anglaises de l'Amérique du Nord, Italie, Portugal, Suède et Norwége, Suisse* (Paris, 1843–78).
Annales du Commerce Extérieur. Législation commerciale. Ser. *Colonies anglaises de l'Amérique du Nord, États-Sardes, Royaume d'Italie, Portugal, Russie, Suède et Norvége, Suisse* (Paris, 1843–78).
Commerce-Collegii Underdåniga Berättelse om Sveriges Utrikes Handel och Sjöfart, år 1857 (Stockholm, 1858).
Estadistica General del Comercio Exterior de España con sus posesiones de ultramar y potencias extranjeras en 1857, Dirección General de Aduanas (Madrid, 1858).

Preußisches Handels-Archiv. Wochenschrift für Handel, Gewerbe und Verkehrsanstalten (until 1855: *Handels-Archiv*; Berlin, 1847–78).

Tabeller over Kongeriget Danmarks, Hertugdömmet Slesvigs og Hertogdömmet Holsteens Vare-Indførsel og Udvörsel, Skibsfart og Brændeviinsproduction, m. m. for Aaret 1857 (Statistisk Tabelværk II, 16) (Copenhagen, 1858).

APPENDIX 1: FORMULAS FOR THE CALCULATION OF THE ECONOMIC FUNDAMENTALS[66]

Countries included in a dyad are i and j; third countries are subsumed under k. The total number of countries is N (in our case: $N = 14$). Distance is always measured in kilometres, cultivated area (*Land*) in hectares and economically active population (*Labour*) in absolute number of persons. Accordingly, the land-labour ratio (*LLR*) measures hectares of cultivated area per person in the economically active population. GDP is in £ sterling, converted at contemporary annual average exchange rates.

$$Natural_{ij} = \log\left(\frac{1}{Distance_{ij}}\right)$$

$$Remoteness_{ij} = Continent_{ij} \star \left(\frac{\log\left(\frac{\sum_{k=1,k\neq j}^{N} Distance_{ik}}{N-1}\right) + \log\left(\frac{\sum_{k=1,k\neq i}^{N} Distance_{jl}}{N-1}\right)}{2}\right),$$ with Continent$_{ij}$ = 1 if Continent$_i$ = Continent$_j$, 0 otherwise.

$$GDPs_{ij} = \log(GDP_i) + \log(GDP_j)$$

$$dGDP_{ij} = |\log(GDP_i) - \log(GDP_j)|$$

$$dLLR_{ij} = |\log(LLR_i) - \log(LLR_j)|$$

$$dLLRRow_{ij} = \frac{\left|\log\left(\frac{\sum_{k=1,k\neq j}^{N} Land_k}{\sum_{k=1,k\neq j}^{N} Labour_k}\right) - \log\left(\frac{Land_i}{Labour_i}\right)\right| + \left|\log\left(\frac{\sum_{k=1,k\neq i}^{N} Land_k}{\sum_{k=1,k\neq i}^{N} Labour_k}\right) - \log\left(\frac{Land_j}{Labour_j}\right)\right|}{2}$$

APPENDIX 2: CALCULATION OF AD VALOREM EQUIVALENTS OF AUTONOMOUS TARIFFS

As most of the original tariffs were specific (for example, in French francs per 100 kg), they had to be converted into ad valorem equivalents to be comparable and summarizable across the 21 commodity groups constituted for Lampe's dataset.[67] As most commodity groups consisted of more than one item, and tariff

[66] Baier and Bergstrand, 'Economic determinants', pp. 38–50.

[67] Lampe, 'Bilateral trade flows', app. 1, p. 154.

schemes varied from country to country, the rates from national tariff schemes first were mapped on to the French scheme, which was the most systematic among the more detailed ones available, and additionally enabled using the detailed import prices of French trade statistics to calculate the ad valorem equivalents. For each country, the duties corresponding to each item of the French scheme in every year between 1857 and 1875 were collected from national tariff laws, decrees, orders, and circulars as reported in *Preußisches Handels-Archiv*, the Prussian official commercial periodical, and *Annales du Commerce Extérieur*, the French recompilation of consular reports. Information was crosschecked with contemporary compilations by Hübner and Lack.[68]

1865 prices from the French import statistics were then extrapolated into current prices using commodity-group specific 'inflators' calculated from the average prices in Hamburg's trade statistics (which were not sufficiently detailed to be used for the valuation of individual items). To avoid biases resulting from the French structure, inside each commodity group individual items were weighted based on French, British, and Belgian import and export statistics.[69] Given the different elasticities of substitution, import prohibitions have not been substituted by a general equivalent of, say, 100 per cent for all items, but enter the calculations as 1.5 times the highest tariff rate found for the item in question in other countries. For example, import prohibitions of wheat in Spain were treated as a duty of approximately 19 per cent (1.5 times that of Portugal in 1865) and those for dyed percale and calico in France as 118 per cent (based on the Portuguese equivalent in 1857). As in Lampe's work, rates for spirits and liqueurs have been corrected for domestic excises.[70] For Austria-Hungary, Germany, the US, the UK, and the Netherlands, the autonomous tariff rates were calculated for each commodity group based on their customs revenue and imports statistics, as these statistics reported items subject to preferential and non-preferential rates separately or both were the same due to generalization of preferences.

APPENDIX 3: CONSTRUCTION OF TRADE FIGURES USED TO CALCULATE HUBNESS

To extend Lampe's original dataset with trade data between countries not covered by that sample,[71] bilateral import volumes (totals) were collected from other sources. For countries that published official foreign trade statistics for 1857 (in other words, Denmark, Spain, and Sweden), these were used.[72]

For British North America, Italy, Norway, and Portugal, data from the *Faits commerciaux* series of *Annales du Commerce Extérieur* were used. Data for British North America refer to Canada; data for Italy are the sum of those for Sardinia, Sicily and Naples, Tuscany, and the Roman States (port of Ancona).[73] Data for

[68] Hübner, *Zolltarife*; idem, *Zolltarife* (2nd edn.); Lack, *French treaty*.

[69] For full titles of the trade statistics of Austria-Hungary, Belgium, France, Hamburg, the Netherlands, the UK, the US, and the Zollverein, refer to Lampe, 'Bilateral trade flows', app. 2, pp. 154–5.

[70] Ibid., pp. 128–9, tab. 13, and n. 90.

[71] Ibid.

[72] *Tabeller over Kongeriget Danmarks*; *Estadística General del Comercio Exterior*; *Commerce-Collegii Underdåniga Berättelse*.

[73] For Sardinia, more detailed accounts are reported in *Preußisches Handels-Archiv* (1859), pt. II, pp. 1–7, were used.

Norway are for 1856 (no estimate was reported for 1857) and were summed up with the official data for Sweden. Data for Portugal are the sum of the imports reported for Lisbon and Porto; data for 1857 were calculated as the average of the two fiscal years 1856/7 and 1857/8.[74]

Data for Russia were taken from two British consular reports referring to the trade of Russia and Poland, and Finland in 1857. They were summed up to represent the Russian Empire.[75]

Swiss import statistics, for which only very complicated partial direct information on quantities exists, have been reconstructed from bordering countries' export statistics (Austria-Hungary, Sardinia, France, and the Zollverein) as given above. For the Zollverein, data reported by Borries for 1851 were extrapolated to 1857 using Borries' estimates for the development of German export totals.[76]

In the cases of Italy, Sweden and Norway, and the Russian Empire, all trade between the different parts was deducted when summing up the totals to calculate shares.

To calculate the bilateral import and export shares used for the variables Hubness and Trade partner PTA coverage, the shares calculated for the imports by Austria-Hungary, Belgium, France, the Netherlands, the UK, the US, and the Zollverein/Germany were used without changes for the 'actual' (corrected) trade setting from the sum of commodity groups constructed and corrected by Lampe. For trade between countries that are not represented by their own statistics in that dataset, shares in the total of the 14 countries in the present sample plus Canada were calculated. These shares have been interpreted as the part of bilateral imports that was visible for contemporaries and hence used as 'direct bilateral special imports' in the sense of section 6 of Lampe's dataset documentation. To these shares, the third-country 'transited bilateral special imports', which resulted from the transit correction for the seven core countries covered in the original dataset, were added, and new corrected 'total bilateral imports' shares have been calculated. These form the basis of the calculation of the 'actual trade' variables in the sample. Data for 'perceived trade' were calculated from the bilateral totals given in the sources quoted above and from the original bilateral totals from the statistics used for the original dataset for its core countries.[77]

[74] No total foreign trade was reported for these fiscal years, but figures for earlier and later periods confirm the overwhelming importance of both ports.

[75] *Abstract of Reports* (P.P. 1859, XXX), pp. 594–8, 622–45.

[76] Borries, *Deutschlands Außenhandel*, pp. 45, 47.

[77] For the technical terms, see Lampe, 'Bilateral trade flows', pp. 110–21.

