CARTEL ORGANIZATION, PRICE DISCRIMINATION AND THE TRANS-ATLANTIC PASSAGE, 1899-1911

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This paper studies the operation of trans-Atlantic passenger shipping cartels during the period 1899-1911 and its effects on passenger traffic. We systematically document and categorize cartel agreements on the basis of key aspects of internal organization. Then, we exploit the variation in internal organization across markets and over time to investigate whether any specific organizational aspects were more effective in reducing flows from competitive levels. We find some evidence that the assessment of fines for violations of the agreement enhanced collusion, but no evidence that the posting of bonds (to guarantee the fines) or the formation of pooling arrangements had any incremental effect. We also take advantage of the richness of the data on passenger flows to show that collusion had a smaller effect on first and second-class passenger flows relative to third class service. Finally, we provide estimates of consumer substitution across passenger classes due to collusion and show that such substitution was small but non-negligible, especially during periods of normal cartel operation. Our study has broader implications for the theory of collusion, and on how collusion affects the quality, rather than the quantity, of products purchased by consumers.

Keywords: Collusion, migration.

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1. INTRODUCTION

Ocean shipping firms have a long history of cartelization. Within the industrial organization literature, the perspectives have varied from Sjostrom (1989) and Pirrong (1992), who suggest cartels as a solution to the problem of an empty core, to studies examining predation, exclusive contracts, and semi-collusion (Scott-Morton, 1997; Marín and Sicotte 2003; Deltas, Serfes and Sicotte, 1999). In addition, there have been numerous narratives of cooperation among shipping companies in the business history literature (e.g., Hyde, 1975, Keeling, 1999). Despite the existence of this varied literature, there are virtually no direct empirical tests of the effect of these cartels on commerce or travel. A recent exception is Deltas, Sicotte and Tomczak (2008), which found that cartels had a significant impact on the flows of steerage passengers during the heyday of trans-Atlantic migration, and also found that the empirical evidence does not support the notion that cartels stabilize the market as suggested by the empty core literature. In this paper, we study two other key aspects of passenger shipping cartel behavior during the period from 1899 to 1911.

First, we exploit the variation in the internal organization of the different cartels, across geographic space and over time, to study whether some types of cartel agreements or aspects of cartel organization were more effective than others in causing deviations from competitive output levels. We focus on easily verifiable features of cartel agreements related to cartels' internal enforcement capabilities, such as passenger revenue pooling, the assessment of fines for violation of the agreement, and the posting of bonds from which those fines would be automatically drawn. Our source for this information is the set of cartel agreements contained in the records of *U.S. v. Hamburg-American*, an antitrust case brought in 1911. The legal records also contain complete data on the number of passengers carried on each voyage between Europe, the United States and Canada over the period. We find little evidence that variation in cartel organizational form explains the differing effectiveness of collusion across routes or time. The imposition of fines for deviation from the cartel agreement appears to have an effect, but the evidence is inconclusive. Pooling arrangements and bonds seem to have no effect whatsoever.

Second, we take advantage of the richness of the data on passenger flows, which

contain information on the number of passengers by class of service, to examine the differential impacts of cartelization on flows of different classes of passengers. Given that the class of service creates a rank in terms of quality and price, this investigation provides evidence for a possible differential impact of collusion for the high (versus the low) quality products of a cartel. We find strong evidence that collusion resulted in a larger restriction of third class passenger flows. Under the further assumption that higher prices would cause the marginal first class passengers switch to a lower class rather than not travel at all (and similarly for the marginal second class passengers), we calculate the level of passenger substitution between the different classes caused by the higher cartel prices. We find minimal substitution between cabin classes during the periods when cartels were not operating normally (relative to the counter-factual of no cartel operation), and moderate levels of substitution during periods of normal cartel operation. To the extent there is substitution downward in class of service, the estimated steerage (third-class) regression coefficients underestimate the actual effect of collusion on reducing the number of passengers who would have traveled in third class in the absence of cartelization.

Our findings for the effect of cartel organization on flows and the substitution between cabin classes are the same for both the westbound and eastbound directions. However, the effects of cartelization on flows are stronger for the eastbound direction. This finding is consistent across all cabin classes. If cartel effectiveness was equal in both directions of service, this pattern could arise if eastbound traffic contained a large market segment of very price elastic customers and a market segment of price inelastic travelers (e.g., tourists), while the westbound traffic was characterized by a demand elasticity that was more uniform over the demand curve (and of intermediate level). Eastbound cartels would then price to the inelastic market segment and forgo the elastic segment. Such market segmentation for eastbound traffic is plausible.

The results also have implications for our understanding of collusion. Even in the absence of any concerns for detection by anti-trust authorities, a situation that described the cartels that we study, it appears that simple arrangements are nearly as effective as far more complicated ones. It appears that the threat of cartel breakdown is a sufficient threat

to maintain collusion; it is unclear whether the imposition of fines to violators has an incremental effect in facilitating enforcement. This is not totally surprising from the theoretical point of view: a cartel member can decide to cheat on the agreement, and then also violate the clause about paying a fine, except where these fines are legally enforceable. This possible double violation could make the presence of fine mute. Somewhat surprisingly, however, the posting of a bond from which the fine could be paid seems to have no effect over and above any effect from the fine. A possible explanation for this finding is that bonds were of a relatively small amount. For Cunard Line, the nearly $70,000 bond posted under the North Atlantic agreement amounted to just over three percent of total revenues, whereas for Holland-America Line its $30,000 bond was only 2.2% of total revenues.[1] Another possibility is that a bond clause (or even the presence of fines) was not intended to increase the degree of monopolization achieved by the cartel members, but rather to decrease the likelihood of cartel breakdown. In other words, an agreement with and without the bond clause would result in the same observed level of passenger flows and prices than an agreement without it, but it would more durable. This is a conjecture that we cannot test formally with the limited data in our disposal. Our second investigation, on the relative effects of collusion for different classes of service, is of broader value to our understanding of collusion, as well. Indeed, obtaining evidence of how collusion affects the quality of the products purchased by consumers, rather than the overall quantity transacted, is rather novel in this literature.

Our paper also makes contributions to the economic history literatures on migration and the early history of antitrust, as well as the heretofore relatively neglected topic of travel. Insofar as migration, our paper provides additional context and results supporting the hypothesis that collusion in ocean shipping affected the flows of immigrants to North America from Europe, and, to an even greater degree, the eastward steerage flows, many of whom were migrants either returning to Europe temporarily or permanently. Very little has been written about first or second class travel outside of the business history literature,

[1] Calculations based on data in Keeling (2008), and Agreement AA (exhibit 3 of *U.S. v. Hamburg-American*). Under this agreement the bond was 1,000 pounds sterling per percentage point of a firm's cartel quota.

and our data on the flows themselves and the labor market, broader economic and industrial organization influences upon them provide the first econometric investigation of North Atlantic business travel and tourism during this time period.[2] Finally, our study of cartel formation, organization, and prosecution by the antitrust authorities provides a new detailed case study to complement the work by Clay and Troesken (2002, 2003), Lamoreaux (1985), Levenstein (1995a, 1995b), and Taylor (2007).

Our paper proceeds as follows. In the next section, we explain some basic information about passenger travel by ocean before World War I. Section 3 describes the collusive agreements and their functioning, while Section 4 discusses the antitrust case. We follow these sections with a description of our data, empirical model and results. A final small section contains our concluding remarks.

2. THE MARKET FOR TRANS-ATLANTIC TRAVEL

Trans-Atlantic travel in the early 20th century was a heterogeneous product, differentiated principally by class of service, geography, and speed. For the purposes of this paper, we focus on differences due to class of service and ports of departure and arrival. We pay special attention to how these components of differentiation correspond to the various collusive agreements signed by the shipping companies.

Most ships serving the trade offered three classes of accommodations. Third-class was known as "steerage" and catered almost exclusively to migrants. Accommodations were simple, although, with the introduction of more privacy and deck space, steerage was substantially better than what had been available even fifteen to twenty years earlier. Second-class introduced more privacy, better dining options, smoking rooms, and other amenities. Although there are no systematic data on the economic background of those traveling in second class, scholars have provided some estimates. Keeling (2011) estimates the proportion of migrants among second-class passengers at 75%. Mürken (1922) maintains that 20-25% of westbound passengers were Americans (who were presumably

[2] However, see Dupont, Gandhi and Weiss (2012) for a long-run (1820-2000) econometric model of tourism.

not migrants), but they constituted 50-60% of eastbound passengers (chapter 5). First class accommodations were quite luxurious. Business travelers, government officials and tourists accounted for nearly all of the first-class passengers. The presence of a substantial number of both migrants and tourists in second-class service is important for our analysis. It suggests that the marginal passengers in the first class service could consider switching to second-class service and would not find themselves out of place there. It also suggests that the marginal passengers in the second-class service might consider steerage if prices were set higher and second-class service became less affordable. Similarly, passengers could "upgrade" and still be in the presence of others in the same social stratum.

In terms of geography, travelers could choose among a variety of ports of origin and destination, irrespective of their inland point of departure and final destination. Initially, most Italian and southern European immigrants traveled via northern Europe, but by the turn of the century direct service from Italy to the United States was established and expanding rapidly. Many Scandinavian immigrants traveled via the United Kingdom rather than direct, while eastern Europeans and Russians were much more likely to travel by Germany, Belgium, or Holland. Direct service to Russia was established around 1906 from Libau (Liepaja), Latvia, which was then part of the Russian Empire. Austria and Hungary occupied central positions. Both had Mediterranean ports, but travelers had traditionally gone through northern European ports. Then, around 1904, two separate lines established direct service from Austro-Hungarian Mediterranean ports to the United States. The ability of travelers to choose between different ports, and the different sailing schedules that firms established leads us to denote only five different origin port groups: Scandinavia, the United Kingdom, northern France, the Rhine (German, Belgian, Dutch and Russian ports), and the Mediterranean (from Greece to Portugal, including the most important country of origin, Italy). Passengers departing from each of these port groups tended to come from the same catchment areas. Similarly, we have two groups of destination ports: the United States (New York, Boston, Baltimore and Philadelphia accounting for nearly all of the traffic), and Canada (Halifax, St. John's, Quebec and Montreal). Travelers to any of the US ports would become incorporated in the same broad labor market, and similarly for travelers to any of the Canadian ports.

We employ the same aggregation for eastbound traffic. Travelers from the US (and Canadian) ports could originate from broad and overlapping catchment regions extending into the interior of these countries. Upon arrival to Europe, they could distribute themselves to final destinations that broadly correspond to the geographic partitions described in the preceding paragraph. It is worth noting that a substantial fraction of eastward travel consisted of people who migrated to North American a few years earlier, who were effectively "retracing" their steps back to ancestral towns either as reverse migrants or temporarily for personal reasons.

The collusive agreements that we study all denoted the class of service covered by the agreement, and the geographic scope of the ports covered. Further, passenger fares were not uniform for all ships and firms. The cartels set prices for classes of service between ports or sets of ports by ship or company, reflecting both the differences in quality of accommodations within class by ship and firm, the different ports covered, and the different speeds of vessels. Disagreements over these fares were common, and in some instances sparked breakdowns in the cartels. There is nothing approximating a complete passenger fare series, but there are some data that indicate the spread between the different classes. For example, the American Line charged 15 pounds sterling for an off-peak first-class ticket on its steamers Philadelphia and New York from Britain to the New York in 1902, whereas its second-class and third-class fares were 9 pounds and 6 pounds, respectively. The differences are fairly consistent across other vessels for which data are available.[3] The spread on first and second-class fares tended to be a bit higher than the spread between second and third-class fares, and those ratios are relatively consistent across vessels.

[3] See Petitioner's exhibits 10, 11, 729, 730, 740, 741, 757, 762, 763 and 1307 of *United States v. Hamburg-American*.

3. COLLUSIVE AGREEMENTS

3.1. Sources and Definitions

In this section we describe the development of collusion across different geographic and class of service categories. Well before our data series begins in 1899, shipping firms colluded in order to limit competition. Cartels were the rule rather than the exception in ocean shipping from the last quarter of the 19th century. Many authors have noted the coincidence with the rise to pre-eminence of steamships, which tended to have much greater economies of scale than sailing vessels. The trans-Atlantic passenger shipping business adopted steamships relatively early on, and efforts to collude date from the middle of the nineteenth century.

Our information on cartel agreements is of two kinds. First, we obtained general information on the presence and effectiveness of cartel agreements by route and class of service. This was used to summarize when cartels began, when rate wars occurred that disrupted their operations, and when there are reports that the cartels were not fully functional, sometimes due to the non-cooperation of one or more of its members, other times due to the actions of one or more national governments, and sometimes due to external competition. The most important sources for this information were the testimony of shipping executives in the *U.S. v. Hamburg-American* antitrust case, the petitioner's and defendants' exhibits in the case, which included cartel minutes, circulars and private cables between shipping company managers and executives. Additionally, in 1922 Hamburg-American executive Erich Mürken published a remarkably detailed account of the development of North Atlantic shipping cartels. Furthermore, we relied on the contemporary press to confirm the existence and duration of rate wars. The major periodicals consulted were the *Times* of London, the *New York Journal of Commerce*, the *New York Times*, and *Fairplay*. We also consulted the secondary literature; the most useful were Keeling (2005) and Hyde (1975).

Second, we have specific information on the characteristics of the different cartel agreements. As part of the antitrust case, the prosecutors obtained copies of the cartel agreements. These agreements range from little more than one or two-page lists of

minimum rates, to lengthy contracts with dozens of clauses. It is the variation in these cartel agreements across route and over time, combined with the narrative reports on their actual operation in practice that permit us to analyze a number of hypotheses about the effects of particular types of collusion. There are approximately 10 distinct agreements per class of service and direction of travel, and sometimes substantially more. An examination of an agreement specific effect on passenger transport cannot be credibly accomplished, since most of these agreements operated in fewer than 12 quarter-route observations. It would also be less insightful, given that one would have to discuss why some agreements had a larger effect than others, a variation that would surely be present if only by chance given the number of agreements. Therefore, we classify agreements along the following easily identifiable and pertinent characteristics: 1) a formal mechanism for pooling or dividing the market, 2) the existence of a system of fines, and 3) the requirement of a performance bond. Other characteristics that might be of interest were either always present, or never present. For example, all agreements contemplated rate-fixing, and none contained a mechanism to limit investment in new capacity.

Our cartel classifications are summarized in Table 1 (westbound) and Table 2 (eastbound). The details about the evidence that underlies this classification is presented in the following sub-section. For each route, we indicate whether the record reports functioning cartel agreements (dark shade), poorly or imperfectly functioning agreements due to internal or external disruption (light shade), or the absence of a functioning agreement either because there was no attempt at co-ordination or because a price war had completely broken down any prior co-ordination (clear). For each route there are two designations. The left-hand side refers to first and second-class agreements, and the right-hand side refers to steerage agreements. "F" denotes that the cartel employed a system of fines, "B" that it required firms to post a bond, and "P" that there was a pooling mechanism in place. If fines were levied, firms had to pay the fine within a certain time period or the fine would be automatically deducted from the bond deposit. Lines then typically had two

weeks to replenish the deposit or the remainder of the deposit would be forfeited.[4] Note that fines, bonds and pooling could exist in different combinations, and there are a number of observations where a route has a cartel with the categorization "BFP," indicating that all were in use simultaneously. If a cartel existed without any of those three elements, there is simply a dash.

3.2. The Geography of Cartelization in the 1899-1911 Period

In what follows, we discuss the history of cartelization for every major route. We start by listing the agreements that were formed and covered (at least nominally) each route for at least part of the 1899-1911 period. For some years, these agreements, even though nominally in effect, may not have been applied in practice. For some years, there was a complete breakdown in the operation of the cartels, and an active price war between them. For other years, even though the firms were not actively competing against each other, they did bend the collusive agreement occasionally, e.g., for example to counter new entrants who were not part of the agreements. In light of this, each collusive agreement has been assigned a classification on basis of its organization for the period the agreements has been nominally in effect; however, this classification is suppressed in periods of cartel breakdown. We describe the periods of partial or complete breakdown, and how these affect our classification of the cartels for each quarter, at the end of this sub-section.

Addressing first the westbound steerage services from Great Britain to the United States and Canada (Table 1, columns 1 and 2), from 1899 until 1908 these operated under the same agreement, which stipulated rates for the different signatory companies and vessels and fines ranging from 5 to 500 pounds sterling per violation of the agreement (Petitioner's exhibits 736, 737, 752, and 1307 dated 1898, 1903, 1905 and 1907, respectively). In February 1908 the Great Britain to United States traffic fell under the comprehensive North Atlantic cartel Agreement AA (Petitioner's exhibit 3) that introduced a system of pooling and bonds in addition to fines. However, the lines serving Canada

[4] See, for example, clauses 17-21 of Agreement AA (exhibit 3), and clauses 20-23 of the Mediterranean Steerage Agreement (exhibit 6), *United States v. Hamburg-American*.

refused to pool their passengers, so they retained a rate agreement as before (Petitioner's exhibit 757). Therefore, we this agreement on steerage traffic for both routes is designated as "F" for fine only during the period before 1908. From 1908 until the end of the sample, the agreement covering the route from Britain to the U.S. is categorized as "BFP" for bond/pool/fine, whereas the agreement covering the route to Canada remains as "F." First and second-class rate-fixing on these routes was carried out in conjunction with continental lines serving from the Rhine ports to the United States and Canada (Mürken, chapter 5; exhibits 10, 11, 729, 730, 740, 741, 762, 763 from 1898, 1902, 1905 and 1908), and fines were levied for violations as in the original third-class agreement. This cabin traffic was never incorporated into a pool. As Mürken explains, the differences in accommodations both within and across vessels made it impossible for the firms to agree upon a mechanism for firms carrying in excess of their quota to compensate those carrying less than their quota. Such differences were far less pronounced or problematic for steerage accommodations. Therefore, the agreement covering cabin traffic on both routes is designated as "F" for the entire sample period.

The trade from the Mediterranean to the United States (there was no direct service to Canada) operated under a fare agreement during the years 1899 and 1900, but early in 1901 the Italian government began regulating rates. No extant copy of the early rate agreement has been located, nor is it in the exhibits of the antitrust case. What we know comes from Mürken, pp. 69-73, who notes that the agreement restricted advertising and regulated rates but did not pool passengers. There is no mention of fines and bonds, and we assume that none were adopted. Mürken discusses how the German and British steamship lines distrusted the Italian government's methodology for setting rates, which they suspected was implemented in such a way as to favor the Italian companies. Indeed, there was entry by a number of new Italian steamship companies on this route during the years 1901-1908. We therefore classify the period until 1901 as an agreement, but without a bond, pool or fine (denoted by a dash), and from 1901 to 1908 as "no agreement" in the westbound traffic from Italy. There is no explicit discussion of a first and second-class agreement during this period, though this could be subsumed under the broad collusive

arrangement, either explicitly or tacitly, for the years that this agreement was in effect.[5] In 1909, the lines serving Italy formed a comprehensive pooling agreement that included the requirement for firms to post a bond and pay fines for violations of the agreement. This Mediterranean Steerage Agreement (Petitioner's Exhibit 6) was supplemented by side agreements (also pooling with bonds and fines) with Greek lines (exhibit 720) and with northern European lines covering indirect passengers to and from the Mediterranean (exhibit 8). Agreement X (exhibit 725) from the same time period covered cabin passengers, involved fines, but did not involve a pooling mechanism. Therefore, we classify the steerage traffic as "BFP" from 1909 to 1911, and the cabin service as "F" for the same years.

The passenger traffic from France to the United States was carried by the French Line, Compagnie Generale Transatlantique from Havre, and by British lines stopping in Cherbourg en route to and from British ports.[6] Nonetheless, the borders were porous and the French traffic was interdependent to some extent with British and especially other continental traffic. For that reason the French Line joined a pooling agreement (also containing provisions for bonds and fines) with German, Dutch and Belgian lines in 1903 covering its westbound steerage traffic (exhibit 5), and around the same time became a signatory to the abovementioned first and second-class agreements. This steerage pooling agreement was replaced in 1908 by a comprehensive pooling agreement with similar requirements (exhibit 3). Therefore, we classify the westbound steerage service from France to the United States as "no agreement" until 1903, and classify the agreement covering it in subsequent years as "BFP". The agreement covering cabin traffic is designated as "F" from 1903 until 1911, and "no agreement" prior to 1903.

[5] In our default classification, we classify cabin service during these years in the same way we classify steerage service, but we performed a sensitivity analysis by recoding cabin service as free of collusion. The same sensitivity analysis was performed for eastbound service to the Mediterranean where the written record is similarly ambiguous (see the results section).

[6] France here refers to Atlantic French ports. Fabre Line served Marseilles and Italian ports to the United States. Their passengers are under the Mediterranean category, and Fabre was a signatory to the Mediterranean cartel agreements.

Only one firm, Allan Line, served the traffic from France to Canada. This traffic is not shown in Table 1, as it would not be meaningful to characterize it as a potentially collusive market. However, we describe here the arrangements between the Allan Line and other firms serving other markets. Allan Line fixed its first and second-class rates through its adherence to the agreements also covering its service from Britain to Canada. However, the condition of its steerage rates is unclear. Then, in 1908, it agreed to pool its passengers through a side agreement (exhibit 755) with the signatories of the larger North Atlantic pool (exhibit 3). Yet this agreement did not have any requirement to post a bond, but only to pay fines for non-compliance. Allan Line's French traffic is of quite a small magnitude relative to other traffic, and we omit it from the econometric analysis in the paper. As a single firm operating in a particular route, its classification would have also been problematic had it been included in the estimation.

The very large service from Germany, Belgium, Holland and later Russia to the United States and Canada was covered under a comprehensive pool that began in 1892 (exhibit 2). This pooling agreement had a system of performance bonds, fines and arbitration that characterized nearly all pools that followed. The comprehensive North Atlantic pool, which included British traffic, supplanted this agreement in 1908 (exhibit 3). Russian direct service, which began after 1906, was incorporated into this pool via a side agreement (exhibit 756). First and second-class passenger rates from the Rhine were regulated under the aforementioned agreements dating to 1898. Therefore, in the Rhine to the U.S. traffic, we designate the agreement covering steerage flows as "BFP" and the agreement covering cabin flows as "F" throughout the sample period. However, in the case of Canada the situation is more complex. The trade was served by one to three separate lines, depending upon the years, but by far the most important were Hamburg-American Line and the Canadian Pacific Railroad company's steamship service. Hamburg-American's passengers (both steerage and first class) were included in the agreements covering Rhine traffic with the United States. Canadian Pacific's however, were not. CPR did not enter the trade until 1904, at which time they signed a side agreement by which they were promised a quota of passengers (exhibit 760), and that they would not carry cabin passengers. This pooling agreement, however, did not include a bond or fine stipulation. Therefore we

designate the agreement on the Rhine-Canada route by "BFP" for steerage before 1904 and "P" thereafter. For cabin class, the agreement on this route is denoted as "F" for 1899-1911.

The final westbound route is that from Scandinavia to the United States (there was no direct service to Canada). There is no record of an agreement on first and second-class on this route. The Scandinavian-American Line was the only direct line, and it was in competition with British lines who trans-shipped passengers via British ports. They had a series of rate agreements involving fines for violations dating from 1898 (exhibits 734, 738, 753, 1307 and 758). In 1910 they agreed to a pool involving both fines and bonds (exhibit 714). Thus, the route is denoted as "no agreement" for first and second-class fares from 1899-1911.[7] For the years 1899-1909, the agreement on the steerage traffic is designated as "F," and from 1910 to 1911, it is classified as "BFP."

The eastbound agreements follow a very similar pattern. The cabin agreements for the various routes tended to cover both eastbound and westbound fares, but there was more variation in steerage agreements. While the westbound North Atlantic pool (exhibit 3) omitted traffic from Great Britain to Canada, it was included in the eastbound pool (different clauses of exhibit 3). Therefore, both the US-Britain and Canada-Britain steerage agreements are classified "F" from the beginning of the sample through 1907, and "BFP" after the first quarter of 1908. The agreements on the cabin service are designated as "F" for 1899-1911. In the Mediterranean, because the Italian government did not regulate eastbound fares from the United States, those fares were subject to the rate agreement as before (Mürken, pp. 369-408) until both westbound and eastbound steerage traffic was pooled in 1909 (exhibit 6). Therefore, the Mediterranean is designated as agreement without fines, bond or a pool (dash) from 1899 until 1909, and "BFP" afterwards. Whereas the French Line pooled its westbound traffic effective 1903, it did not come to an agreement on pooling eastbound flows until later, and then without agreeing to a bond or fine (exhibit 4). Thus, the agreement on this route is classified as "P" for pool only between

[7] It is possible that, even though formally cabin service from (and also to) Scandinavia was not formally under agreement, the firms did tacitly collude on that service. We performed a robustness check, where we assumed that cabin service was cartelized when steerage from (and to) Scandinavia was cartelized, obtaining similar results.

1904 and 1907 (no agreement prior to 1904). This agreement was abandoned when the French Line joined the North Atlantic pool as a founding member in 1908 (exhibit 3), so the agreement on this route is designated as "BFP" after 1908. The agreement on cabin service to France is classified" identically to the westbound cabin service, "F" from 1903 to 1911. The original eastbound pool from the United States to the Rhine is not included in the exhibits, but is discussed as a mirror to the westbound agreement in Mürken (p. 45), and is therefore designated as "BFP" throughout the sample. Canadian traffic to the Rhine was part of the pool as Canadian Pacific did not carry eastbound passengers to the continent, and Hamburg-American was a full member of all pooling agreements. Because Hamburg-American was the only firm that ever served this traffic, it is not employed in our estimates. Finally, in the traffic from the US to Scandinavia, there exists evidence of rate agreements with fines for steerage (e.g., exhibit 758), but not for first or second class, nor was there ever an eastbound steerage pool. Therefore, the agreement on steerage is classified as "F" from 1899-1911, while the route is classified as "no agreement" for cabin service.

The final point to make with regard to our cartel classification is that there are well-documented periods of general rate wars. The first such rate was began in late 1903, and spread to all routes and classes of service. A major catalyst for the rate war was Cunard's establishment of service from Fiume to New York. This greatly cut into German lines carriage of Hungarian emigrants (Austria-Hungary sent over 500,000 migrants to the United States in 1902-1904, second only to Italy, see Ferenczi and Wilcox, 1929). The German lines retaliated by reducing fares on routes that impacted Cunard, and the knock-on effects resulted in other lines cutting fares as well. Although a complete fare series is unavailable, it is known that in some cases fares fell by more than fifty percent, and firms suffered losses (Keeling, 2005; Mürken, chapter 12).[8] A tentative peace was made among the warring lines in early 1905. In some cases the old agreements were re-invoked, while in others new agreements were established. The narrative accounts suggest that the agreements in force did not function as well during this second collusive period (see

[8] The average fare decline from the rates we were able to obtain from primary sources averages to approximately 30 percent, but there is wide variation around that figure. See also our discussion on price elasticities in section 6.

testimony of Hermann Winter, Arthur Cauty; Mürken, chapter 13; Hyde, chapter 4). There were frequent accusations of rate-cutting, often taking the form of increased commission payments made to agents. This relatively unstable period ended with another rate war, this time precipitated by the entrance of Cunard's Lusitania and Mauretania steamships in late 1907. Although existing steamships were "rated" by the various cartels, and this rating determined the minimum rates that would be charged on them, every time new vessels appeared there was a question as to what their rating should be. At the time they appeared, Lusitania and Mauretania were considered the top-of-the-line steamships (indeed, the Mauretania held the speed record until 1929). Yet the first class fares Cunard was charging were not as high as the other lines wished. The rate war began in late August and early September 1907, and quickly spread across classes of service and routes, with fares falling by approximately 1/3. An eastbound Mediterranean rate war lasted until the pool was established. This rate war did not spread, as the principal adversaries were the Italian lines (on one side) and German and English lines on the other. Since Italian lines did not serve trades outside of the Mediterranean (there was no multi-market contact), the rate war could not be extended outside of this region.

In Tables 1 and 2, the periods in which cartels were said to be functioning normally ("Normal") are shaded darkly, whereas the less well functioning times are shaded lightly, and as stated above the rate war or "no agreement" periods are designated clear in the table. Our designation scheme for cartel organization is suppressed for periods when the cartel may have been on the books, but not functioning at all. We list the organization of a collusive arrangement only for the periods that it was functioning normally or partially disrupted, and explain in the empirical section how the distinction between normal and disrupted operation is reflected in the analysis. As an illustrative example, the agreement covering steerage traffic from Great Britain to the US and Canada has been designated as "F" for all years prior to 1908 (see discussion at the start of this sub-section). But in Table 1, this designation is absent for this route for the 1904 and end of 1907 price wars. As described earlier, we have also performed additional analysis using variations on the cartel agreement classification when the record permits possible different interpretations.

3.3. The Mechanisms of Collusion

In this section we describe in more detail the actual functioning of collusion. Table 3 displays the Herfindahl-Hirschman Index values on the four largest volume routes in our study. The values exhibit quite high levels of concentration, and little discernible trend. An exception is the Mediterranean trade, which became less concentrated over time and had the lowest level of concentration of any of the major routes. The high levels of concentration likely facilitated collusion, not only on rates, but also the more elaborate arrangements for pooling passengers. These pooling agreements were not classic revenue pools, but rather they involved the assignment of proportional quotas to each member firm. A conference (cartel) secretary was appointed under the terms of the agreement. Among the secretary's duties was to collect and distribute statistics of passenger carryings, thereby calculating if each firm was meeting its quota. If a firm was "in the plus," (it carried more than its quota), it would have to send compensation payments to firms "in the minus." These payments differed only slightly by agreement, being approximately four pounds sterling per passenger in each case. The compensation rate was fixed so as to deter firms from carrying more than their proportion as assigned under the agreement, but was not meant to be punitive as in practice even firms that wished to carry precisely their quota would find it hard to do. Consistently running "in the plus" would result in the cartel directing the line to increase its fares.

While the compensation payment provided incentives for a firm to not consistently carry more than its quota, it was still necessary to provide incentives for firms to not intentionally carry less than their quota and simply collect compensation payments. There were de jure and de facto reasons to avoid this strategy. De jure, the agreements stipulated that firms were obliged to "arrange its services in such a manner that the number of steerage passengers which it actually carries corresponds as nearly as possible with the number allotted to it by this contract." (E.g., Article 9 of Agreement AA; other pooling agreements had similar requirements) Further, such lines could be directed to reduce their fares and thereby increase their share. The most significant incentive to meet a line's

quota was de facto, however, because in any future renegotiation of quota proportions, consistent undercarriage would be viewed as a justification for lowering the quota. The assignment of quota proportions was typically agreed upon the basis of past shares (see testimony of Arthur Cauty, passenger manager of White Star Line, pp. 1088-89, 1097-98; and Mürken).

The pooling agreements that did exist only pertained to third-class passengers, as we noted earlier. Further, only the Rhine had a pooling agreement in place for the entirety of our sample period (at least "in the books" if not actually in effect). Steerage traffic in other routes was either subject to no agreement or to a simpler rate agreement for at least some of the time (the Rhine agreement was also not operational during periods of price wars). Similarly, first and second-class traffic was never pooled, despite attempts to negotiate such an agreement (testimony of Hermann Winter, pp. 1182-1183). Mürken dedicates a chapter of his tome to explaining why efforts to pool first and second-class traffic failed. The problem was that because of the heterogeneity of firms' fleets and first and second cabin accommodations, there were far larger variations in the fares paid by these cabin passengers compared to steerage passengers. The variations were more sizeable between ships, and within a ship. Therefore, a pool based on the number of passengers carried would not be practicable, only a revenue pool would work. The firms could not come to agreement on a mechanism for allocating these revenue shares (Mürken, pp. 108-118; see also Sickel, 1914).

First and second-class agreements fixed minimum rates on each vessel. For example, under Agreement V of 1908 the minimum first cabin rates from Liverpool to New York ranged from 25.5 pounds for the Cunard liner *Lusitania* to 15.5 pounds for the Allan Line steamer *Hesperian*. Minimum rates for second-class accommodations on the same vessels under Agreement W of 1908 were fixed at 12 and 9 pounds, respectively. Additional restrictions were indicated that the minimum second-class rates had to be fixed at all times at least two pounds more than the steerage rate. In June 1909, Red Star Line and the French Transtlantique requested that second-class rates be raised because the small difference between second and third class rates was causing steerage passengers to

substitute up to second class, and thereby be dropped from the pool (Defendant's Exhibit 1376, p. 4062).

The lines employed monitoring and enforcement mechanisms. As noted in Table 2, nearly all of the pooling agreements required that lines post a performance bond. For example, the Mediterranean Steerage Agreement (1909) required that each line deposit a bank guarantee of 125,000 lire (about 4,800 pounds) through the Banca Commerciale Italiana in Milan. Other agreements made the bond amounts dependent on the participation quota. The NDLV required each line to deposit 20,000 marks for each percentage point of quota. The largest bond was that deposited by Norddeutscher Lloyd: 800,000 marks (about 38,000 pounds). The deposit could be made in cash or negotiable securities, the market value determined by the excecutives, and would be submitted to the Deutsche Reichsbank.

Nearly all agreements had stipulations for fines. For many agreements the fines ranged from five to five hundred pounds, depending on the offense. For other agreements the fines could reach more than 2,000 pounds for a major offense. Fines might be subtracted from the bond amount for agreements with bonds; otherwise the firms had a contractual commitment to pay the fine for a violation (under German law cartel agreements were enforceable, and under the English Arbitration Act decisions of arbitrators were also binding).

Finally, day-to-day discussions were handled in regularly scheduled meetings among the executives or their managers. At these meetings they discussed changes in rates, adjustments in the revenue pools, common policies with respect to agents (maximum commissions), and issues as mundane as what kinds of entertainment to permit on board (they agreed to prohibit variety shows of any kind). One of the most important elements dealt with in these conference meetings, however, was how to deal with entrants. It was precisely these actions that attracted the attention of antitrust authorities and were a focus of the trial.

4. THE ANTITRUST CASE: US V HAMBURG-AMERICAN, ET AL

In January 1911 the United States brought suit against the firms that were signatories to Agreement AA. The prosecution argued that the combination was an illegal restraint of trade under the Sherman Act (Brief for the United States). The documentary evidence of collusion was overwhelming and undeniable. Beyond the printed agreements, the U.S. attorneys also pointed to evidence that the cartel, through subsidiary agreements in conference, had engaged in unfair predatory conduct against outside lines. One of these practices was that cartel lines would jointly finance "fighting ships," or vessels that would mimic the schedule of outside lines, offering extremely low passenger fares just on those sailings (see the exhibits and testimony related to the non conference competition of the Russian Volunteer Fleet, the New York and Continental Line, the Uranium Line and Northwest Transport). The second practice was to demand that any agent selling tickets for cartel lines not sell any tickets for outside lines, and that any agent so doing would be fined and/or prohibited from selling cartel lines' tickets in the future (see the numerous exhibits and testimony related to "Rule No. 9").

The steamship lines claimed that the antitrust laws did not apply because the combination applied to international commerce, and the Sherman Act only applied to interstate commerce. Further, they noted that the combinations were formed overseas and were legal in the European countries where they were formed. They also argued that collusion was necessary to provide stability to the trade, and had been beneficial to consumers as evidenced by the improved conditions across all classes of service over the previous quarter century. The defendants maintained that their actions against outside lines were not unfair, as they "merely protected their own…traffic against the attacks of outside lines." (Brief for North German Lloyd, Brief for the Cunard Line). Their argument received a boost when in spring of 1911 the U.S. Supreme Court decided the *Standard Oil* and *American Tobacco* cases, establishing a "rule of reason" interpretation of the antitrust statutes. Price-fixing did not appear to be per se illegal any more.

As a consequence, when the case was argued in 1912 the prosecutors argued that the rates the cartel charged were unreasonable, whereas the defense argued that they were

reasonable. However, both sides could only attack this question in a manner that bears little resemblance to that employed by contemporary antitrust litigators and their economic consultants. The prosecution succeeded in getting the witnesses to acknowledge that when competition was open, during rate wars, the lower rates attracted an increased volume of passengers, (for example, see testimony of Sidney Lister, Cunard Line, p. 1561). However, the defense argued that such an increase was not a beneficial increase for the United States: "You get during the rate war the dirty people…the very people who in times of regular stable business we are keeping out…every one whatever who has a few shillings to go to America. The natural result is that the steamship companies might be inclined to accept as many passengers as they can to make both ends meet, and the likelihood of the United States being afflicted with a very, very large number, an enormous number, of undesirable passengers." (testimony of Sidney Lister, p. 1515).

The decision of the district court, not issued until 1914, was that the there was not convincing evidence that the rates charged were unreasonable, and that the agreements and restrictions upon the agents were not a violation of antitrust law, except that court deemed the practice of "fighting ships" an "obnoxious feature" of the cartel and issued an injunction against it. In making its decision, the court noted that the House of Representatives Committee on Merchant Marine had recently issued a report on shipping cartels, and found that in the absence of these arrangement, "The lines would either engage in rate wars which would mean the elimination of the weak and the survival of the strong, or to avoid a costly struggle they would consolidate through common ownership. Either would mean monopoly fully as effective, and it is believed more so, than can exist by virtue" of the cartels. (U.S. House Committee on Merchant Marine and Fisheries, pp. 295-303, cited by the court at 216 Federal Reporter 974, October 13, 1914). The case was appealed to the Supreme Court, which ruled that the Sherman Act was indeed applicable to the case, but that it would not rule on the merits because the European War had rendered the agreement void and the case was therefore moot (239 US 466, decided January 10, 1916).

5. DATA AND VARIABLES

In Deltas, Sicotte and Tomczak (2008), we provide econometric estimates that cartels reduced westward steerage flows by approximately twenty percent. In this paper we use much of the same primary data sources, but we construct additional variables to complement some of those used in our previous paper. These new variables and the additional econometric specifications that we estimate are necessary to extend our knowledge of these cartels in two important directions.

First, we test whether the variation in the nature of the cartel agreements can explain any of the differences across routes and across time in the effectiveness of collusion. For this research question, the most important variables are the various cartel organization attributes and the extent to which a cartel agreement was in effect. The construction of these variables is based upon the exhibits in the antitrust case and a reading of the contemporary press and literature, and is described in the preceding sections. The values of these variables are schematically depicted in Tables 1 and 2. The variable $AGREEMENT_{jt}$ takes the value of 1 if there is a cartel operating in route *j* in period *t*; this variable takes the value of 0 in periods that no cartel agreement was signed that covers route *j* and in periods that a cartel agreement was signed for route *j* but there was a price war. Values of 1 for this variable correspond to dark and light shaded cell in Tables 1 and 2. The variable $NORMAL_{jt}$ takes the value of 1 for route *j* and period *t* when there is an agreement that operates normally, i.e., when firms co-operate as stipulated by the agreement; it takes the value of 0 in all other periods. Values of 1 for this variable correspond to dark shaded cells in Tables 1 and 2. Note that in the regression model, the variable $NORMAL_{jt}$ captures the incremental effect of a normally operating cartel agreement beyond any effects reflected in the coefficient of $AGREEMENT_{jt}$. The cartel organization variable $FINE_{jt}$ takes the value of 1 if a cartel is operating and contains a clause that specifies fines to be paid for violations of the agreement, and the value of 0 otherwise. The letter F is displayed in a cell when $FINE_{jt} = 1$. Except for one cartel agreement in each traffic direction (which also carries very little traffic), bond clauses and pooling agreements are always jointly present, and cannot be separately identified in a meaningful sense. Therefore, we construct the

variable $BONDPOOL_{jt}$ that takes the value of 1 if there is either a bond clause or a pooling agreement (or both) in route *j* and period *t*. When a cell in Tables 1 and 2 displays the letter B and/or the letter P, then $BONDPOOL_{jt} = 1$. We also construct interactions of the last two variables with $NORMAL_{jt}$, to help us test whether the relevant agreement clauses had a differential effect during periods of normal cartel operation.

The second question we investigate is whether the cartel agreements had a differential impact on the passenger flows of each class of service, and the extent to which cartel operation led to substitution between the three service classes. To address this question, we obtain data series on passenger flows by service class from the exhibits in the antitrust case. Although reported by voyage, we aggregate the data by quarter and by the routes shown in Tables 1 and 2. Figures 1-3 display the eastbound first, second and third class flows for the three highest volume routes and total flows. The distinct seasonal patterns of the flows are evident, as is the significant positive shock whose timing is apparently associated with the U.S. Panic of 1907. The corresponding westward flows are shown in figures 4-6. The last figure is a reproduction from Deltas, Sicotte and Tomczak (2008), and is included in this manuscript only for completeness.

We also utilize a number of economic variables that are expected to affect the demand for travel. These variables relate to labor market and macroeconomic conditions in both origin and destination countries and are the same as those employed in Deltas, Sicotte and Tomczak (2008).[9] We provide here a very brief description of them for completeness. We use the real wage series from Williamson (1995) to construct real wage indexes for the origin and destination regions of our routes. Because most of the European regions consist of more than one country, we weight the real wages of those countries by the proportion of migrants that they supplied during our sample period. The variable $DESTWAGE_{jt}$ is the deviation from trend in the wage in the destination region, while the variable $ORIGINWAGE_{jt}$ is the deviation from trend in the wage in the origin region. We also used factory employment for the US (NBER) and US unemployment for the United States

[9] See chapter 3 of Hatton and Williamson (1998), chapter 7 of O'Rourke and Williamson (1999) and references therein for discussion of the link between these measures of economic conditions and transatlantic travel and migration.

(Lebergott, 1964). The variable $FACTEMPL_{jt}$ takes the value of the first difference of factory employment, while the variable $USUNEMPL_{jt}$ takes the value of the US unemployment in routes that terminate or originate from the US, and the value of zero for routes that originate and terminate from Canada.[10] We also used Williamson's (1995) GDP data for the individual countries, and constructed GDP series for our regions using the same methodology employed for the wage series. The variable $DESTGDP_{jt}$ is the deviation of destination GDP from its trend, capturing whether the destination economy is on business cycle trough or peak. Similarly, the variable $ORIGINGDP_{jt}$ is the deviation of origin GDP from its trend. As with the wage variables, destination and origin regions correspond to the route destination and origin regions. Further information on the construction of these variables and figures displaying the time series of the data by region are in Deltas, Sicotte and Tomczak (2008). As demonstrated in that paper, the use of these economic variables is not sufficient to capture the very strong effects of the 1908 economic crisis in North America. A use of a dummy variable for year 1908 yields more appropriate (and more conservative) results on cartel effects. Whereas we expect the economic variables to take signs consistent with immigration "push" and "pull," tourist traffic should be increasing in economic activity on both sides of the Atlantic.

6. EMPIRICAL ANALYSIS

6.1. The Econometric Model

The empirical strategy follows Deltas, Sicotte and Tomczak (2008), modified to allow us to investigate questions relating to the effects of cartel organization and how collusive effects vary across cabin classes. This strategy and its modifications are summarized in this sub-section. We take advantage of the panel nature of the data and employ a modified difference-in-difference estimation approach, where the effects of interest are identified from the over-time variation in cartelization in particular cabin class and routes,

[10] We were unable to identify employment data for Canada. Therefore, for some specifications we use the US series as a proxy, while for others we set the value of zero for the Canadian routes for the employment-related variable.

controlling for a secular trend in flows, and using a number of additional controls. Our dataset is not rich enough to allow us to employ time fixed effects, in lieu of the linear trend, since many agreements start or end in the same period. However, note that seasonal effects are accounted for through the use of indicator variables.

The general specification takes the form

$$\log(Q_{jt}) = \boldsymbol{\alpha_A AGRCLAUSES_{jt}} + \boldsymbol{\beta_E ECONOMIC_{jt}} + \boldsymbol{\gamma_C CONTROLS_{jt}} + \varepsilon_{jt}$$

where $\boldsymbol{AGRCLAUSES_{jt}}$ is a vector of cartel agreement indicator variables, including agreement clauses, $\boldsymbol{ECONOMIC_{jt}}$ is a vector of variables that account for economic activity that shifts demand for travel, $\boldsymbol{CONTROLS_{jt}}$ are a set of other controls, $\boldsymbol{\alpha_A}$, $\boldsymbol{\beta_E}$, and $\boldsymbol{\gamma_C}$ are the corresponding parameter vectors, and ε_{jt} is a disturbance term. The distribution of ε_{jt} is characterized by large heteroskedasticity, with variance differing systematically both across different routes and different quarters.[11] Therefore, all variants of this linear model are estimated via Generalized Least Squares (GLS) which improves estimation efficiency by attaching higher weights to observations that are characterized by lower variance.[12] A linear trend is included in the control variables. Thus, passenger flows are assumed to be trend-stationary with deviations from trend being driven by a list of stationary variables. Separate regressions as estimated for Westbound and Eastbound travel, since many of the included variables may not only have a different effect quantitatively, but may even differ in terms of sign for the two traffic directions. For similar reasons, regressions are also specific to a particular class of travel. [13]

[11] For brevity, we do not report the variance regressions. However, we note parenthetically that the variance results are not supportive of the empty core literature's implied claim that collusion stabilizes flows: when operating normally, cartels seem to have no effect of flow variability.

[12] The log specification drops all observations with zero flows. However, for almost all of the routes used in our estimation, there are positive third class flows in all quarters and positive first and second-class flows in almost all quarters. Therefore, the amount of censoring is limited and around 6 percent for third class flows, and 12 to 17 percent for first and second class flows (depending on the direction of travel).

[13] The evidence on cartel formation and breakdown does not suggest any possible correlation between unobserved demand for travel and the cartel agreement variables *conditional* on the set of economic controls and route fixed effects we use. Therefore, there is little (if any) need for an IV estimation strategy, which would also be difficult to implement and would carry its own pitfalls.

The cartel and economic variables are lagged by two quarters. First, we do so because the passenger data is for arrival date at the destination. Although the ocean part of the journey might be as short as one week depending upon the route and vessel, the inland journey might have begun much earlier. This is especially true for migrants from Eastern Europe, which often had to cross numerous borders, making several train connections, and also endure squalid conditions at border "control stations" for lengthy periods (Szajkowski, 1977). The full journey could take months. Further, tickets were very often purchased in advance or in installments, as a large percentage of migrants had tickets prepaid in North America by relatives or friends, who made a lengthy series of monthly installments (for example, see the testimony of steamship agent Oscar Richard in *US v. Hamburg American*; Baines, 1994; Magee and Thompson, 2006). Furthermore, Hourwich (1911) estimates that immigration reacted to economic fluctuations with a quarter lag, and the full effects took another quarter to be felt. In sum, migrant travel required months for planning, saving, and execution. First-class travel was often purchased as a round-trip, and as much as six months in advance. Related to the issue of lag structure is the possibility that collusion largely redistributed flows across time. If that were the case, then the various cartel-related coefficients would appear larger in absolute value in our regressions. Deltas, Sicotte and Tomczak (2008) provides evidence that, once the data is lagged by two quarters as explained here, there is no evidence for such inter-temporal substitution. That paper also describes analysis and discussion that supports this lag choice. We provide next an overview of our variable sets, before turning to the description of the results in the next subsection.

In all of the reported results, the set of controls in the vector $\boldsymbol{CONTROLS_{jt}}$ consists of a quarterly trend, seasonal dummies, and route fixed effects. The quarterly trend is meant to capture secular changes in the industry; the seasonal dummies capture the very large impact that prevailing weather conditions had on the scheduling of trans-Atlantic voyages, while the fixed effects capture the different baseline traveler volume between any two regions. The presence of route fixed effects implies that any of the effects we obtain are identified from the within route variation in the variables of interest. Cross-section variation is not utilized for the identification, though the pooling of many routes provides

more observations and thus the increases information used for the estimation.[14]

Our economic controls consist of two different sets. Some specifications use one of the sets, while the remaining specifications use the other set. Both sets are based on the premise that a large number of passengers are immigrants, and thus economic conditions on both the origin and destination region are of first order importance. Some passengers may be "reverse-migrants" while others may be traveling for pleasure or for business. The first set consists of output or volume related variables, and in particular of the factory employment variable, $FACTEMPL_{jt}$, and the deviation-from-trend GDP variables $DESTGDP_{jt}$ and $ORIGINGDP_{jt}$. This first set captures the robustness of all economic activity, as measured by aggregate GDP changes from a baseline and changes in the activity of the industrial sector (the first difference in employment is much more likely to reflect changes in industrial production than technological change). The second set of economic controls consists more narrowly of labor market information, and may be of higher relevance to passengers who are migrating and seeking employment. This set of controls consists of US unemployment rate, $USUNEMPL_{jt}$ and the deviation-from-trend wage variables, $DESTWAGE_{jt}$ and $ORIGINWAGE_{jt}$. Both sets of economic controls also include a dummy variable for the year 1908, which coincided with a very deep recession in North America, and which is therefore expected to have disproportionately large negative effects on migration to the US.[15]

We now to turn to the variables of primary interest, which constitute the variable set $\boldsymbol{AGRCLAUSES_{jt}}$. We have two major sets of questions with regards to cartel agreements. First, we test whether particular cartel agreement clauses influenced the cartel's ability to restrict output. Second, we test whether the effects of cartels on passenger flows were different for the first, second and third class passengers. Because there is little variation in

[14] For the relatively short period that we study, route fixed effects effectively subsume the level of population and full-employment GDP on route pairs, i.e., they effectively generalize the typical "gravity" models found in some migration models.

[15] In a robustness check, we have employed a dummy variable for every year, which effectively requires dropping all other economic controls since they are obtained at an annual frequency. The identifying power of this specification is very weak, given that many agreements start and terminate in the same year, but the results (which are not reported) are for the most part consistent with those in obtained in the models using a linear trend.

cartel form for first and second-class passenger cartels, we focus our attention only on steerage passenger cartels when investigating the first question. Because bond clauses seem to present nearly always in conjunction with pooling arrangements, we capture the effects of Bond or Pool operation by a single variable, often allowing these effects to differ in periods that cartels are operating normally from periods that they are not.[16] Moreover, since there is only one agreement (the Mediterranean) without a fine, bond or pool, in some specifications we do not estimate a separate effect for it, but merge agreements with no clauses with the agreements that contained a fine. For the second question, on differential impact of collusion across cabin classes, we only distinguish cartels with respect to whether they were operating normally or not. The reason is that bond and pool clauses appear to have no marginal effect on third class flows and they were always absent from first and second- class agreements.

6.2 Cartel Organization and Steerage Flows

Table 4 presents results from six regressions on westbound steerage flows, the first three using GDP/volume economic controls while the second set of three uses labor market economic controls. The first (and fourth) regression investigates whether the posting of a bond or the use of a revenue pooling arrangement had an incremental effect on passenger traffic, recognizing that these arrangements may have head a differential impact during periods of normal cartel operation (versus years in which cartel operation was disrupted, albeit still in effect). For this first investigation, $\boldsymbol{AGRCLAUSES_{jt}}$ consists of the variables $AGREEMENT_{jt}$, $NORMAL_{jt}$, $BONDPOOL_{jt}$, and the interaction of $NORMAL_{jt}$ with $BONDPOOL_{jt}$. Disrupted cartel agreements seem to have (negative) insignificant effects on passenger flows with or without bonds or pooling arrangements. Cartels operating normally did have a strong and negative effect on passenger flows of approximately 25%, but the presence of bonds or pooling arrangements did not have a significant incremental effect. The second (and fifth) regression lumps together agreements not operating

[16] We also estimate a variation in which we investigate the joint effects of Bond *and* Pool operation, obtaining very similar results.

normally and investigates whether the presence of fines, or bond/pooling arrangements had an incremental effect on normally operating agreements. None of these clauses have an incremental effect relative to price agreements with no fine provisions (i.e., relative to the Mediterranean price agreement). In the third (and sixth) regression, we no longer distinguish a different baseline effect for normally operating cartel agreements. Rather, we attribute any differences in the performance of these agreements to their utilization of different clauses (which are assumed to have no effect on a agreement that is operating as intended). Implicitly, this merges the Mediterranean agreement with those that are not operating normally, treating the absence of any clauses in that agreement as an indication of imperfect co-ordination. When the agreements are viewed this way, it appears that the flow reductions of normally functioning agreements are coming from their use of fines (with an incremental effect of 20 to 29 percent relative to agreements with no clauses or agreements that were not functioning normally). The use of bonds or pooling arrangements has no significant incremental effect. The results are robust to the different choice of controls. The economic controls have the correct signs, and are highly statistically significant for destination GDP and real wages, factory employment and unemployment. The origin (European) effects appear to be somewhat muted, particularly in the case of wages. All of the models consistently show an increasing trend to flows, and the seasonal dummies show the regular variation, with a strong peak in the spring of each year. The year 1908 stands out as a major deviation from that trend, with flows off by more than fifty percent that year.

Table 5 presents our eastbound results using the same specifications. Here the coefficients of $AGREEMENT_{jt}$ and $NORMAL_{jt}$, are stronger than on the westward specifications, implying more effective collusion. The effects of $BONDPOOL_{jt}$ and its interaction of $NORMAL_{jt}$ continue to be small and statistically insignificant. For eastbound flows, the interaction of $NORMAL_{jt}$, with $FINE_{jt}$ is statistically significant (and negative, as with westbound flows) only when GDP/volume economic controls are used. With regards to the economic and other control variables, the eastbound traffic also exhibits an increasing trend, but the seasonal variation is somewhat different. The coefficients on

spring, fall and summer are much closer to one another, but all signify a much higher volume than during winter. The Year 1908 indicator is positive and significant; as expected, the financial crisis contributed to a substantial reverse migration. Among the economic variables in the first three specifications, the only statistically and economically significant impacts are from North American GDP. However, when labor market economic controls are used, there are strong effects of higher US unemployment and European wages deterring eastward steerage flows. These results suggest that, in accordance with the historical literature, a significant portion of the eastward flows consisted of recent immigrants from Europe who had some success in North America and returned to Europe for a visit.

To summarize the effects of agreement organization, there is some evidence that assessing a fine for breaking the agreement had an incremental effect, with this evidence being stronger for westward flows but still quite weak. There is no evidence that posting a bond or creating revenue pool had an impact on passenger flows. The lack of significance of the cartel form variables might be consistent with a situation in which firms design and amend cartel agreements so as to maintain some (optimal, or maximal) collusion level. This optimal level of co-ordination may be achievable in some routes with relatively simple agreements, while in other routes or other periods of time, it may require a deeper collusive structure. In other words, cartels would add a pooling arrangement or require the posting of a bond or the payment of a fine when they are needed, but would not add them when they are not needed. This is just a conjecture. However, Mürken (1922) documents the efforts to construct pools, with most of those efforts taking place on the heels of price wars during that period when the cartels were not functioning normally. On the other hand, it is also the case that the attempts to create pooling agreements for cabin class service always failed, and perhaps this accounts for the relatively smaller effects of collusion on first and second-class flows, as we report in the next sub-section.

We conclude the discussion of the results by noting that the collusive arrangement and cartel clauses may affect the stability and duration of collusion rather than its extent. For example, the information sharing required by a revenue pool might reduce the ability

of cartels members to secretly deviate from that agreement for a long period of time, thus making deviation less profitable. Or the posting of bonds might make breaking up the cartel agreement more expensive for a firm that is tempted to do so by a transient demand or cost shock. We cannot credibly investigate this possibility or perform any meaningful duration analysis with the data in our disposal. We would like to point the reader to the recent work by Levenstein and Suslow (2011) who provide evidence in support of this conjecture. They find out that some internal transfer mechanism among cartel members allows the cartel to ride out variations in demand, while cartels that rely solely on punishment are less likely to do so. Taylor (2007) is another relevant contribution to this topic.

6.3 The Collusion-Induced Substitution between Cabin and Steerage

If collusion narrows (or widens) the price differences across classes, travelers may substitute between them. In this sub-section, we estimate how the effect of cartelization differed across the three classes of services. We then use these estimates to compute the counter-factual flows in the absence of cartelization for each of the service. Combining these counter-factual flows with a simple model of vertical differentiation, we obtain estimates of the shifts between the service classes induced by collusion. Obtaining evidence of how collusion affects the quality of the products purchased by consumers, rather than the overall quantity transacted, is rather novel in this literature. Because the first and second-class agreements had essentially no variation in form, we omit the cartel clause variables used in the previous sub-section. Instead, $\boldsymbol{AGRCLAUSES_{jt}}$ consists of the variables $AGREEMENT_{jt}$ and $NORMAL_{jt}$, (with the latter variable omitted from some specifications). Separate regressions using the same explanatory variables are estimated for each class of service, and the parameter estimates of $AGREEMENT_{jt}$ and $NORMAL_{jt}$ compared across service classes. The estimation results are reported in Table 6 for westbound traffic and Table 7 for eastbound traffic. The first three specifications in each table report the regressions with $AGREEMENT_{jt}$ as the sole cartel variable, while the last three specifications report the regressions using both $AGREEMENT_{jt}$ and $NORMAL_{jt}$.

On westbound traffic (Table 6) there is no statistically significant effect of cartelization on either first or second-class. Indeed, the second-class coefficient is positive, though not statistically significant. However, the predicted effect of collusion on steerage is strongly negative (more than 20%), consistent with the results reported in the previous sub-section. When distinguishing periods of normal cartel operation from those when cartels were disrupted, there is a reduction in flows for all classes of service during the period of normal operation, with the reduction being largest for third-class service (recall that the coefficient of $NORMAL_{jt}$ represents the marginal effect of normal cartel operation relative to disrupted operation; the total effect of normal operation on passenger flows is given by the sum of the coefficients for $AGREEMENT_{jt}$ and $NORMAL_{jt}$). A likely explanation for this is that the cartels raise steerage fares more than they raise second and first class fares, as suggested by Keeling's (2008) imputed series of Cunard Line fares between New York and Liverpool. The fare quotes we were able to obtain are also consistent with this explanation (see the sub-section on demand elasticity). The coefficients on the economic and seasonal variables tend to support the view that few first class passengers were migrants (Keeling estimates 10%), as the coefficient on origin GDP is zero, but negative for second and third class passengers. The second-class coefficients were a mix of tourists and migrants, and the intermediate position that most of their economic variable coefficients occupy is consistent with that view.

On eastbound traffic (Table 7) the negative effect of cartel operation on traffic is more pronounced. The cartel agreement coefficients on both first and second class are negative, although still statistically insignificant for first class. As with westbound flows, the negative impact is larger for all three classes when cartels operated normally. The parameter estimates for third class remain larger than those for first and second-class. Economic effects have no impact on eastbound first class traffic. For second and third-class traffic, the economic controls are consistent with those reported in Table 5.

There are two instances when the record in our disposal is not conclusive with regards to cabin service. The record indicates that there was no formal agreement on first and second-class service to and from Scandinavia throughout the period we study, and we

have classified that service as free of collusion. However, the possibility arises that the firms coordinated tacitly, given that they did form an agreement on the more important steerage service. We have repeated the analysis coding cabin service involving Scandinavia in the same way we coded third-class service, and obtained nearly identical results. A second robustness check involves the Mediterranean agreement in its early period (see section on cartel classification). This has been coded as being collusive, but the record makes no explicit mention of a distinct agreement covering cabin service. The most reasonable interpretation is that coordination covered all classes of service in a similar manner, but we have re-estimated the tables coding this service as competitive in the early period. When Mediterranean cabin service is classified as collusion-free, the estimated effect of collusion appears smaller. This suggests that the Mediterranean route did appear observationally similar to routes operating under firm coordination for the years in question, as we assumed in our standard classification.

The estimates reported in Tables 6 and 7 can be used to construct counter-factual flows in the absence of collusive activity. We combine these estimates with a simple model of vertical differentiation to calculate the effects of collusion by intended class of service in the absence of collusion. That is, we calculate how many passengers, who would have traveled in a particular class of service in the absence of collusion, will travel in a different class of service (or not at all) in the presence of collusion. The premise in these calculations is that at the new price equilibrium, the marginal first-class passengers may choose to downgrade to second-class, but they will not choose to forgo travel altogether or travel in steerage. This presumption is reasonable given that the low end of the distribution of first class passengers are probably not too different in their preferences than the high end passengers in second-class service. Similarly, the second-class passengers may choose to upgrade to first class (if the price difference between those cabin services becomes smaller), or downgrade to steerage; they will not choose to forgo travel altogether. The presumption is reasonable given that the low-end of second-class passengers are migrants (like most of the steerage passengers), who simply happen to have more funds at their disposal. A higher cost should not deter them traveling altogether, since steerage travel would be still be affordable to them. Under this reasoning, the only passengers who would

forgo travel due to the increase in prices would be those traveling in steerage. Though clearly to some extent a simplification, this reasoning is formally based on a model of vertical differentiation, in which consumers differ in the willingness to pay for products that differ in terms of quality (see, for example, Mussa and Rosen 1978 and Tirole 1988). In these models, consumers are distinguished by their marginal willingness to pay for quality, denoted by θ. There will be a threshold cut-off in willingness to pay, θ_1, such that consumers with higher willingness to pay, i.e., consumers with $\theta > \theta_1$, will purchase the premium product (first-class service). There will be a second cut-off, θ_2, so that consumers with willingness to pay for quality that falls between these two cut-offs, i.e., consumers with $\theta_1 > \theta > \theta_2$, will purchase the product of intermediate quality (second-class service). Finally, there will be a third lower cut-off, θ_3, so that consumers with willingness to pay that is below the second cut-off but above the third cut-off, i.e., consumers with $\theta_2 > \theta > \theta_3$, will choose to purchase the base product (third-class service), while consumers with even lower willingness to pay, $\theta < \theta_3$, will purchase none of the variants (will not travel). Changes in prices of the products will shift these cut-offs, but consumers switch at most one category up or down the quality ladder (as long as changes in relative prices are not too large).

In Table 8 we present the substitutions and displacements of passengers between classes that these econometric estimates imply, averaged over the period of cartel operation.[17] This table has eight panels, each corresponding to groups of three regressions (one for each class) listed in Tables 6 and 7. We describe carefully the construction of the top panel; the other panels are constructed similarly. This panel corresponds to westbound passenger flows and computes the effect of collusion over the period that $AGREEMENT_{jt} = 1$. We start by inserting in the number of observations that correspond to this period for each of the three classes of service, excluding those that involve Scandinavia (this is the

[17] In computing the average per period, we recognize that cabin class flows in some periods are zero, but we assume that the number of periods of zero flows is unaffected by cartel operation. Thus, the per period average for cabin class is computed by removing the effect of collusion on each period of positive cabin class flows by "adding back" the effect implied by the cartel agreement coefficients. Then, we multiply by the number of periods of positive cabin class flows and divide by the number of periods of positive steerage flows.

only route for which collusion in steerage was not accompanied by collusion in cabin service). There are 199 observations with positive westbound first class flows during the collusive regime, 215 observations with positive second class flows, and 222 observations with positive third class flows. The difference in observations across passenger classes is a function of the accommodations available in the ships on each route. We then insert the total number of passengers that have actually traveled in each class during this period divided by the number of observations with positive *steerage* flows (we need a common denominator so that we can make appropriate per-period comparisons). For each of the 222 observations with positive steerage flows, we compute the average number of passengers traveling for each class: 4,455 for first class, 7,870 for second class, and 33,751 for third class. We then compute the counter-factual flows for each class and observation by dividing actual flows by e^{α_c} where α_c is the coefficient of $AGREEMENT_{jt}$ for class of service *c*, sum them up over all observations of positive flows for service *c*, and divide by the number of observations with positive steerage flows. These counterfactual totals are listed under the head "Total" on the right-most column of the panel. Since the number of actual first-class passengers (always per route-quarter) is smaller than the counter-factual number, we attribute on the basis of the model that all 4,455 passengers that traveled first class under the collusive regime would have traveled first class in the absence of collusion. The remaining 4,546-4,455=92 passengers who would have travelled first class in the absence of collusion, traveled second-class given that collusion took place. Uniquely for this panel, our estimates imply that more people chose second-class travel under collusion (7,870) than would have in its absence (7,434). Therefore, the second-class passengers under the collusive regime consist of the 92 passengers who downgrade from first-class, all of those would have traveled first class in the absence of collusion, plus 7,870-92-7,434=345 passengers who upgrade from steerage. This upgrading could take place if the relative price gap of steerage and second-class service has been narrowed under the collusive regime, which seems to indeed have been the case. Finally, moving to steerage, we see that without collusion 43,921 passengers would have traveled per route-quarter, while only 33,751 actually did travel in the presence of collusion. The difference between these two numbers consists of the 345 passengers who upgraded to second-class and 9,825

passengers who were displaced and did not travel at all. The other three panels were constructed in a similar manner. In fact, their construction is simpler since no passengers upgraded classes due to collusion. For these cases, collusion shifted some first-class passengers to second-class, some second-class passengers to third-class and led many third-class passengers to forgo travel.

Summarizing the results presented in Table 8, we see that there is limited downgrading from first to second or second to third class when cartels raise fares. In fact, when averaging over all periods of cartel operation (including the period of disrupted operation), there is no downgrading at all for westbound traffic. The estimated shifts between classes are more noticeable when we restrict our attention to periods of normal cartel operation; they are also somewhat higher eastbound. However, even these larger estimated shifts from cabin class to steerage (1,365 passengers per route-quarter in the bottom panel) are dwarfed by the overall reduction in steerage passengers that are displaced from travel altogether (over 11,000) per route-quarter. Nonetheless, the presence of generally positive shifts from cabin to steerage that occur from cartel operation imply that the displacement of steerage passengers is larger than it would appear from simply looking at the regression coefficients in the third-class specifications. This is because the regression coefficients for steerage give the reduction in the number of people who travel steerage, not how many of the people who would have traveled in steerage would be displaced from traveling at all.

6.4. Evidence from Passenger Fares and Implied Demand Elasticities

In this section we corroborate our econometric evidence of the estimated effects of cartelization with evidence that we gathered on changes in passenger fares from times when cartels when operating normally, in the sense described in the previous sections, and times when collusion had broken down and price wars occurred. Our goal is to check whether or not the price changes appear to be substantial enough to have driven the observed quantity changes, or, to put it another way, whether the elasticities implied by our econometric estimates and the observed price data are within a plausible range. The

passenger fares that we have are at a very disaggregated level: they refer to the fares charged on a particular vessel or shipping line for a particular class of service on a given route at a particular time. For periods of cartel operation, these fares are from cartel fare schedules as obtained from the exhibits of the antitrust case (exhibits 10, 11, 33, 713, 715, 716, 717, 725, 729, 730, 731, 733, 734, 736, 737, 738, 740, 741, 752, 753, 757, 758, 762, 763, 937, 950, 1026, 1307, and 1869), as well as reporting in the Journal of Commerce (New York), the New York Times, and as discussed by Erich Mürken (1922) and Francis Hyde (1975). These price quotes are for the periods of collusion only, but we were able to identify 122 rate quotes for the same vessel/line/route/class combinations for adjacent time periods during which firms were engaged in open competition. For such periods of price wars, we use data from the Journal of Commerce, the New York Times, Hyde, and Mürken. The discussion below pertains to these 122 price comparisons.

There is a large variation in the price effects of the breakdown in collusion across the different lines. Given that the analysis of flows is at the route level, we have computed the average of the fare changes induced by a price war by averaging the price quotes at the route and direction of flow level. Most of the route/direction/cabin class combinations contain no quotes comparing collusive and price war fares. Moreover, the route level fares are extremely noisy, with less than a handful of quotes for most of the routes where quotes are available. Perhaps for this reason, the route level changes contain substantial variation, ranging from a 61% decline in the steerage fares from UK to Canada to a 10% decline in steerage fares from the Rhine to the US. Further aggregating fares at the direction/cabin class, we are able to obtain fare changes for five out of six possible combinations. The number of quotes for first and second class eastbound is 50 and 38, respectively; for westbound steerage it is a (still respectable) 22 fares. This increases our confidence that these three averages represent a reasonable approximation to the price discounts offered by firms during the price war. There were only 9 quotes for eastbound steerage service, and 3 for westbound first class service: these figures are still very noisy. There is no price information on second class westbound service.

These prices effects, albeit imprecise in some cases, provide some useful measure of how collusion has affected prices. Combined with the parameter estimates of Tables 6 and 7, these price effects could yield estimates of demand "elasticity" for each of the three cabin classes. However, the "elasticity" that would be computed is not be based on the partial effect of own price change (which is the reason the word is placed in quotes). Rather, it is based on the effects of joint price changes across all three classes. The reason is that price wars did not affect the price of only one of the cabin classes, but the prices of all classes of service. The sporadic nature of our price quotes makes it impossible to separate the effects of these simultaneous price changes to compute the counter-factual of a single price change; even if such data would have been available, a structural econometric framework would have been needed. Nonetheless, we believe there is some value to reporting demand elasticities based on joint price changes (and having made this point, we will henceforth drop the quotes).

The price comparisons are between periods in which cartels were operating effectively versus periods when there was an effective price war or complete absence of price co-ordination. Therefore, the relevant regression parameter estimates to use for the corresponding quantity effects would be those corresponding to "Normal Cartel Operation." With collusion increasing steerage prices by nearly two-thirds and reducing volume by nearly 30%, the corresponding demand elasticity is of the order of 0.40-0.45 (all elasticity figures are in absolute value). The effect of collusion on prices for second class service appears to be smaller, raising them by about a quarter. The effect on volumes is also smaller, at approximately 16%, but not proportionately so. Thus, the implied elasticity for second class service is noticeably higher, at around 0.60-0.65. Finally, collusion seems to raise first class prices by a quarter to two-fifths (mainly depending on direction), while equilibrium flows tend to decline by about 10 percent westbound and 8 percent eastbound. The implied elasticity values range from a fifth to two fifths. A difference in elasticity between eastbound and westbound first class service may seem peculiar, given that most first class passengers would travel round trip. It could be driven by small differences in eastbound and westbound volume: eastbound and westbound first class flows differ by about 10%, so there were clearly some passengers who traveled one-way or who traveled

in a different class in the away and return trips. Or the difference in the price effects of collusion on first class fares between the two directions might be an artifact of the very small sample size on which the westbound price changes are based. A more comprehensive set of prices might have revealed higher westbound price effects, and thus a lower westbound elasticity.

Comparing the demand elasticity for the three cabin levels, it appears that it is highest for second class service and lowest for first class service. A high elasticity for second class service is not surprising, given that there are two margins at which potential customers can substitute towards: they can either upgrade to first class service, or they can downgrade to steerage. Third class service, which has the second higher elasticity, also has two margins on which consumers can substitute towards: upwards, towards second class service, or downwards, towards no travel. But the second margin is qualitatively more distinct in comparison to traveling in a different service level. First class service, which appears to have the smallest elasticity, is characterized by a single margin of substitution. These elasticity values are somewhat lower than that reported in Deltas, Sicotte and Tomczak (2008), but in the same ballpark. The reason for the difference is that the current estimates are based on more quotes, having done a thorough investigation of the information in the historical record. As Deltas, Sicotte and Tomczak (2008) argue, an elasticity of demand in the range of 0.7 is plausible, and the somewhat lower values we obtain here are even more plausible. We conclude the discussion by re-iterating that the definition of elasticity is not a particularly clean one, given that multiple prices change simultaneously; rather, they give a measure of demand responsiveness when prices are all simultaneously increased or all decreased.

7. CONCLUSIONS

We test two sets of hypotheses about the effect of collusion on Trans-Atlantic travel in the early 20th century. In our examination of the effect of cartel organization on steerage flows, we find only limited evidence that the precise form of cartels was relevant for the effectiveness of collusion. When cartels operated normally, there were significantly greater

reductions in flows from collusion, but that the marginal impact of the organization form is barely detectable (with the possible exception of fines). Insofar as our second set of hypotheses, we find that first class and second-class flows were, in contrast to steerage, much less affected by cartels, although there is a more significant impact on eastward flows. Collusion likely displaced some modest numbers of passengers into lower classes of travel, thereby exacerbating the degree to which passengers who would normally travel in third class were affected by collusion on steerage traffic. This last set of results suggests that collusion has a bigger impact in the purchase decisions of the lowest income consumers, than those at the upper ends of the income distribution.

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Table 1. Classification of Westbound Cartel Status

Year	Quarter	Route						
		GB-US	GB-Can	From Medit	France-US	Rhine-US	Rhine-Can	Scand-US
1899	I	F | F	F | F	- | -		F | BFP	F | BFP	| F
	II	F | F	F | F	- | -		F | BFP	F | BFP	| F
	III	F | F	F | F	- | -		F | BFP	F | BFP	| F
	IV	F | F	F | F	- | -		F | BFP	F | BFP	| F
1900	I	F | F	F | F	- | -		F | BFP	F | BFP	| F
	II	F | F	F | F	- | -		F | BFP	F | BFP	| F
	III	F | F	F | F	- | -		F | BFP	F | BFP	| F
	IV	F | F	F | F	- | -		F | BFP	F | BFP	| F
1901	I	F | F	F | F	- | -		F | BFP	F | BFP	| F
	II	F | F	F | F			F | BFP	F | BFP	| F
	III	F | F	F | F			F | BFP	F | BFP	| F
	IV	F | F	F | F			F | BFP	F | BFP	| F
1902	I	F | F	F | F			F | BFP	F | BFP	| F
	II	F | F	F | F			F | BFP	F | BFP	| F
	III	F | F	F | F			F | BFP	F | BFP	| F
	IV	F | F	F | F			F | BFP	F | BFP	| F
1903	I	F | F	F | F		F | BFP	F | BFP	F | BFP	| F
	II	F | F	F | F		F | BFP	F | BFP	F | BFP	| F
	III	F | F	F | F		F | BFP	F | BFP	F | BFP	| F
1904	IV							
	I							
	II							
	III							
1905	IV	F | F	F | F		F| BFP	F | BFP	F | P	| F
	I	F | F	F | F		F| BFP	F | BFP	F | P	| F
	II	F | F	F | F		F| BFP	F | BFP	F | P	| F
	III	F | F	F | F		F| BFP	F | BFP	F | P	| F
	IV	F | F	F | F		F| BFP	F | BFP	F | P	| F
1906	I	F | F	F | F		F| BFP	F | BFP	F | P	| F
	II	F | F	F | F		F| BFP	F | BFP	F | P	| F
	III	F | F	F | F		F| BFP	F | BFP	F | P	| F
	IV	F | F	F | F		F| BFP	F | BFP	F | P	| F
1907	I	F | F	F | F		F| BFP	F | BFP	F | P	| F
	II	F | F	F | F		F| BFP	F | BFP	F | P	| F
	III							
	IV							
1908	I	F | BFP	F | F		F | BFP	F | BFP	F | P	
	II	F | BFP	F | F		F | BFP	F | BFP	F | P	| F
	III	F | BFP	F | F		F | BFP	F | BFP	F | P	| F
	IV	F | BFP	F | F		F | BFP	F | BFP	F | P	| F
1909	I	F | BFP	F | F	F | BFP	F | BFP	F | BFP	F | P	| F
	II	F | BFP	F | F	F | BFP	F | BFP	F | BFP	F | P	| F
	III	F | BFP	F | F	F | BFP	F | BFP	F | BFP	F | P	| F
	IV	F | BFP	F | F	F | BFP	F | BFP	F | BFP	F | P	| F
1910	I	F | BFP	F | F	F | BFP	F | BFP	F | BFP	F | P	| BFP
	II	F | BFP	F | F	F | BFP	F | BFP	F | BFP	F | P	| BFP
	III	F | BFP	F | F	F | BFP	F | BFP	F | BFP	F | P	| BFP
	IV	F | BFP	F | F	F | BFP	F | BFP	F | BFP	F | P	| BFP
1911	I	F | BFP	F | F	F | BFP	F | BFP	F | BFP	F | P	| BFP
	II	F | BFP	F | F	F | BFP	F | BFP	F | BFP	F | P	| BFP
	III	F | BFP	F | F	F | BFP	F | BFP	F | BFP	F | P	| BFP
	IV	F | BFP	F | F	F | BFP	F | BFP	F | BFP	F | P	| BFP

Notes: F denotes presence of a Fine; B indicates the presence of a bond; P indicates a pooling arrangement; a dash "-" indicates an agreement with none of these features. In each cell, upper class (1st and 2nd class) cartel attributes are listed first, steerage (3rd class) cartel attributes are listed second. Dark (turquoise) shaded areas correspond to the normal operation of a cartel. Light (grey) shaded areas correspond to disrupted cartel agreement. Unshaded areas correspond to the absence of a cartel or a price war. Note that there is no collusion upper class service from Scandinavia, despite collusion in third class service. Sources: see text.

Table 2. Classification of Eastbound Cartel Status

Year	Quarter	Route						
		US-GB	Can-GB	US-Medit.	US-France	US-Rhine	Can-Rhine	US-Scand
1899	I	F | F	F | F	- | -		F | BFP		| F
	II	F | F	F | F	- | -		F | BFP		| F
	III	F | F	F | F	- | -		F | BFP		| F
	IV	F | F	F | F	- | -		F | BFP		| F
1900	I	F | F	F | F	- | -		F | BFP		| F
	II	F | F	F | F	- | -		F | BFP		| F
	III	F | F	F | F	- | -		F | BFP		| F
	IV	F | F	F | F	- | -		F | BFP		| F
1901	I	F | F	F | F	- | -		F | BFP		| F
	II	F | F	F | F	- | -		F | BFP		| F
	III	F | F	F | F	- | -		F | BFP		| F
	IV	F | F	F | F	- | -		F | BFP		| F
1902	I	F | F	F | F	- | -		F | BFP		| F
	II	F | F	F | F	- | -		F | BFP		| F
	III	F | F	F | F	- | -		F | BFP		| F
	IV	F | F	F | F	- | -		F | BFP		| F
1903	I	F | F	F | F	- | -	F | -	F | BFP		| F
	II	F | F	F | F	- | -	F | -	F | BFP		| F
	III	F | F	F | F	- | -	F | -	F | BFP		| F
1904	IV							
	I							
	II							
	III							
1905	IV	F | F	F | F	- | -	F| P	F | BFP		| F
	I	F | F	F | F	- | -	F| P	F | BFP		| F
	II	F | F	F | F	- | -	F| P	F | BFP		| F
	III	F | F	F | F	- | -	F| P	F | BFP		| F
	IV	F | F	F | F	- | -	F| P	F | BFP		| F
1906	I	F | F	F | F	- | -	F| P	F | BFP		| F
	II	F | F	F | F	- | -	F| P	F | BFP		| F
	III	F | F	F | F	- | -	F| P	F | BFP		| F
	IV	F | F	F | F	- | -	F| P	F | BFP		| F
1907	I	F | F	F | F	- | -	F| P	F | BFP		| F
	II	F | F	F | F	- | -	F| P	F | BFP		| F
	III							
	IV							
1908	I	F | BFP	F | BFP		F | BFP	F | BFP		
	II	F | BFP	F | BFP		F | BFP	F | BFP		| F
	III	F | BFP	F | BFP		F | BFP	F | BFP		| F
	IV	F | BFP	F | BFP		F | BFP	F | BFP		| F
1909	I	F | BFP	F | BFP	F | BFP	F | BFP	F | BFP	F | BFP	| F
	II	F | BFP	F | BFP	F | BFP	F | BFP	F | BFP	F | BFP	| F
	III	F | BFP	F | BFP	F | BFP	F | BFP	F | BFP	F | BFP	| F
	IV	F | BFP	F | BFP	F | BFP	F | BFP	F | BFP	F | BFP	| F
1910	I	F | BFP	F | BFP	F | BFP	F | BFP	F | BFP	F | BFP	| F
	II	F | BFP	F | BFP	F | BFP	F | BFP	F | BFP	F | BFP	| F
	III	F | BFP	F | BFP	F | BFP	F | BFP	F | BFP	F | BFP	| F
	IV	F | BFP	F | BFP	F | BFP	F | BFP	F | BFP	F | BFP	| F
1911	I	F | BFP	F | BFP	F | BFP	F | BFP	F | BFP	F | BFP	| F
	II	F | BFP	F | BFP	F | BFP	F | BFP	F | BFP	F | BFP	| F
	III	F | BFP	F | BFP	F | BFP	F | BFP	F | BFP	F | BFP	| F
	IV	F | BFP	F | BFP	F | BFP	F | BFP	F | BFP	F | BFP	| F

Notes: F denotes presence of a Fine; B indicates the presence of a bond; P indicates a pooling arrangement; a dash "-" indicates an agreement with none of these features. In each cell, upper class (1st and 2nd class) cartel attributes are listed first, steerage (3rd class) cartel attributes are listed second. Dark (turquoise) shaded areas correspond to the normal operation of a cartel. Light (grey) shaded areas correspond to disrupted cartel agreement. Unshaded areas correspond to the absence of a cartel or a price war. Note that there is no collusion upper class service from Scandinavia, despite collusion in third class service. Striped cells indicate absence of service. Sources: see text.

Table 3. Herfindahl-Hirschman Indexes for selected major routes, by year.

		Westbound			Eastbound		
Route	Year	First class	Second Class	Third Class	First class	Second Class	Third Class
Britain/US	1899	0.231	0.233	0.243	0.234	0.249	0.250
	1900	0.230	0.232	0.253	0.235	0.255	0.268
	1901	0.217	0.215	0.255	0.230	0.231	0.261
	1902	0.216	0.218	0.249	0.215	0.233	0.258
	1903	0.231	0.208	0.256	0.248	0.254	0.280
	1904	0.285	0.263	0.300	0.291	0.296	0.319
	1905	0.285	0.248	0.283	0.267	0.272	0.315
	1906	0.263	0.243	0.287	0.271	0.273	0.300
	1907	0.282	0.250	0.282	0.295	0.287	0.324
	1908	0.321	0.283	0.326	0.325	0.297	0.321
	1909	0.321	0.254	0.301	0.325	0.295	0.324
	1910	0.324	0.253	0.292	0.321	0.298	0.303
	1911	0.354	0.247	0.303	0.354	0.278	0.302
Rhine/US	1899	0.468	0.310	0.328	0.443	0.315	0.316
	1900	0.442	0.319	0.310	0.390	0.303	0.310
	1901	0.376	0.307	0.328	0.366	0.303	0.309
	1902	0.364	0.318	0.317	0.357	0.309	0.312
	1903	0.367	0.318	0.329	0.352	0.316	0.316
	1904	0.360	0.318	0.321	0.368	0.318	0.307
	1905	0.356	0.326	0.308	0.365	0.320	0.299
	1906	0.346	0.298	0.306	0.344	0.307	0.280
	1907	0.345	0.308	0.288	0.348	0.301	0.247
	1908	0.359	0.295	0.264	0.354	0.296	0.253
	1909	0.358	0.273	0.272	0.346	0.293	0.248
	1910	0.372	0.251	0.265	0.335	0.274	0.238
	1911	0.330	0.256	0.261	0.339	0.271	0.206
Medit/US	1899	0.523	0.616	0.195	0.585	0.500	0.288
	1900	0.452	1.000	0.179	0.512	1.000	0.348
	1901	0.358	0.746	0.160	0.449	0.606	0.242
	1902	0.306	0.306	0.132	0.329	0.655	0.176
	1903	0.240	0.289	0.128	0.267	0.687	0.181
	1904	0.212	0.317	0.129	0.238	0.387	0.128
	1905	0.201	0.275	0.110	0.220	0.377	0.133
	1906	0.175	0.248	0.100	0.222	0.373	0.115
	1907	0.161	0.235	0.095	0.202	0.279	0.101
	1908	0.154	0.218	0.109	0.177	0.276	0.083
	1909	0.109	0.191	0.087	0.167	0.251	0.093
	1910	0.113	0.182	0.087	0.154	0.244	0.099
	1911	0.110	0.136	0.084	0.159	0.117	0.079
Britain/Can	1899	0.421	0.430	0.399	0.411	0.427	0.422
	1900	0.398	0.414	0.401	0.372	0.463	0.365
	1901	0.459	0.488	0.440	0.436	0.463	0.418
	1902	0.579	0.585	0.471	0.527	0.571	0.544
	1903	0.543	0.470	0.385	0.485	0.565	0.489
	1904	0.520	0.475	0.422	0.487	0.454	0.479
	1905	0.573	0.487	0.394	0.525	0.462	0.451
	1906	0.461	0.415	0.347	0.449	0.404	0.441
	1907	0.445	0.367	0.327	0.459	0.379	0.416
	1908	0.469	0.387	0.369	0.473	0.367	0.437
	1909	0.418	0.321	0.346	0.389	0.373	0.405
	1910	0.341	0.314	0.306	0.356	0.293	0.321
	1911	0.307	0.272	0.261	0.312	0.264	0.264

Notes: The range of the HHI is in the [0,1] interval. Values correspond to annual average of HHI, computed from quarterly flows.

Table 4. Westbound Third Class Passenger Flows.

	GDP/volume economic controls			Labor market economic controls		
	BondPool	All Effects	Base + Effects	BondPool	All Effects	Base + Effects
Constant	7.320	7.363	7.389	7.593	7.654	7.708
	0.103	*0.099*	*0.097*	*0.119*	*0.119*	*0.119*
Cartel Agreement	-0.017	-0.018	-0.088	-0.052	-0.071	-0.148
	0.071	*0.077*	*0.066*	*0.073*	*0.073*	*0.069*
Normal Cartel Operation	-0.306	-0.283		-0.245	-0.200	
	0.053	*0.129*		*0.050*	*0.119*	
Bond or Pool	-0.018			-0.021		
	0.038			*0.039*		
Normal * (Bond or Pool)	*-0.017*	-0.029	-0.031	0.027	0.009	0.007
	0.041	*0.039*	*0.039*	*0.040*	*0.119*	*0.036*
Normal * Fine		-0.022	-0.284		-0.040	-0.202
		0.130	*0.054*		*0.119*	*0.052*
Factory Employment	0.021	0.015	0.017			
	0.010	*0.011*	0.011			
Destination GDP	0.024	0.026	0.025			
	0.007	*0.007*	0.007			
Origin GDP	-0.012	-0.016	-0.018			
	0.010	*0.010*	0.011			
US Unemployment				-0.046	-0.051	-0.058
				0.017	*0.017*	*0.017*
Destination Wages				0.022	0.018	0.020
				0.006	*0.006*	*0.006*
Origin Wages				-0.003	-0.002	-0.007
				0.009	*0.009*	*0.009*
Year 1908	-0.764	-0.701	-0.744	-0.749	-0.730	-0.769
	0.139	*0.143*	*0.140*	*0.128*	*0.131*	*0.134*
Quarterly Trend	0.020	0.018	0.019	0.016	0.015	0.016
	0.002	*0.002*	*0.002*	*0.002*	*0.002*	*0.002*
Spring	0.709	0.743	0.729	0.782	0.780	0.796
	0.054	*0.055*	*0.058*	*0.049*	*0.051*	*0.050*
Summer	0.199	0.262	0.251	0.275	0.283	0.298
	0.051	*0.052*	*0.054*	*0.045*	*0.044*	*0.045*
Fall	0.098	0.134	0.133	0.155	0.157	0.176
	0.046	*0.049*	*0.050*	*0.042*	*0.042*	*0.043*
Britain-USA	2.648	2.619	2.636	2.603	2.595	2.592
	0.061	*0.054*	*0.059*	*0.048*	*0.050*	*0.049*
Mediterranean-USA	2.835	2.797	2.662	2.805	2.776	2.663
	0.076	*0.087*	*0.081*	*0.069*	*0.081*	*0.072*
Northern France-USA	1.352	1.303	1.319	1.370	1.339	1.358
	0.073	*0.061*	*0.064*	*0.067*	*0.060*	*0.061*
Rhine-USA	3.333	3.274	3.285	3.300	3.269	3.267
	0.091	*0.065*	*0.071*	*0.083*	*0.063*	*0.063*
Britain-Canada	1.830	1.821	1.800	1.677	1.628	1.605
	0.069	*0.064*	*0.067*	*0.107*	*0.106*	*0.108*
Rhine-Canada	0.162	0.146	0.099	0.036	-0.063	-0.068
	1.510	*0.104*	*0.102*	*0.136*	*0.128*	*0.120*
R-squared (unweighted)	0.9173	0.9177	0.9182	0.9162	0.9163	0.9149
R-squared (weighted)	0.9399	0.9438	0.9369	0.9493	0.9476	0.9467

Notes: (i) The omitted route dummy variable is Scandinavia-USA. (ii) The number of observations is 325 for the first three specifications, and 331 for remaining specifications. (iii) Destination and origin wages/GDP are deviations from trend. (iv) Factory Employment is in first differences. (v) US Unemployment applies to US observations only. (vi) Weighted R-squared weighs observations using GLS weights.

Table 5. Eastbound Third Class Passenger Flows.

	GDP/volume economic controls			Labor market economic controls		
	BondPool	All Effects	Base + Effects	BondPool	All Effects	Base + Effects
Constant	5.856	5.924	5.774	6.308	6.318	6.190
	0.161	*0.152*	*0.139*	*0.196*	*0.197*	*0.195*
Cartel Agreement	-0.137	-0.180	-0.233	-0.277	-0.277	-0.354
	0.136	*0.124*	*0.111*	*0.135*	*0.123*	*0.120*
Normal Cartel Operation	-0.307	-0.650		-0.271	-0.491	
	0.098	*0.171*		*0.104*	*0.165*	
Bond or Pool	0.030			0.044		
	0.083			*0.095*		
Normal * (Bond or Pool)	-0.022	0.027	-0.022	0.027	0.066	0.014
	0.080	*0.057*	*0.055*	*0.089*	*0.054*	*0.051*
Normal * Fine		0.312	-0.259		0.264	-0.077
		0.162	*0.086*		*0.152*	*0.090*
Factory Employment	-0.005	-0.014	-0.003			
	0.014	*0.015*	0.014			
Destination GDP	0.004	0.013	-0.004			
	0.019	*0.018*	0.018			
Origin GDP	0.023	0.024	0.027			
	0.013	*0.012*	0.012			
US Unemployment				-0.040	-0.061	-0.067
				0.029	*0.027*	*0.029*
Destination Wages				-0.054	-0.063	-0.046
				0.018	*0.017*	*0.018*
Origin Wages				0.011	0.004	0.020
				0.011	*0.010*	*0.011*
Year 1908	0.337	0.244	0.333	0.337	0.322	0.349
	0.195	*0.185*	*0.195*	*0.118*	*0.107*	*0.125*
Quarterly Trend	0.031	0.029	0.033	0.028	0.030	0.031
	0.002	*0.002*	*0.002*	*0.002*	*0.002*	*0.002*
Spring	0.989	0.989	1.076	0.932	0.949	0.991
	0.081	*0.088*	*0.086*	*0.089*	*0.096*	*0.092*
Summer	0.875	0.901	0.946	0.823	0.849	0.865
	0.076	*0.082*	*0.073*	*0.076*	*0.081*	*0.079*
Fall	0.915	0.956	1.001	0.834	0.930	0.900
	0.078	*0.081*	*0.079*	*0.089*	*0.095*	*0.081*
USA-Britain	2.581	2.580	2.556	2.534	2.507	2.550
	0.094	*0.090*	*0.092*	*0.088*	*0.090*	*0.080*
USA-Mediterranean	2.815	2.953	2.822	2.726	2.823	2.878
	0.099	*0.113*	*0.098*	*0.095*	*0.131*	*0.114*
USA-Northern France	-0.263	0.254	-0.267	-1.037	-1.544	-0.033
	0.542	*0.529*	*0.586*	*0.416*	*0.414*	*0.440*
USA-Rhine	2.769	2.804	2.780	2.631	2.630	2.708
	0.131	*0.114*	*0.102*	*0.125*	*0.115*	*0.106*
Canada-Britain	1.040	1.059	1.099	0.790	0.723	0.779
	0.109	*0.101*	*0.105*	*0.168*	*0.154*	*0.170*
Canada-Rhine	na	na	na	na	na	na
	na	na	na	na	na	na
R-squared (unweighted)	0.7490	0.7465	0.7415	0.7475	0.7313	0.7444
R-squared (weighted)	0.9103	0.9079	0.9204	0.9075	0.9100	0.9079

Notes: (i) The omitted route dummy variable is Scandinavia-USA. (ii) The number of observations is 266 for the first three specifications, and 272 for remaining specifications. (iii) Destination and origin wages/GDP are deviations from trend. (iv) Factory Employment is in first differences. (v) US Unemployment applies to US observations only. (vi) Weighted R-squared weighs observations using GLS weights.

Table 6. Comparison of Westbound Passenger Flows, by Class of Service.

	All inclusive Cartel Variable			Distinguishing Normal Cartel Operation		
	First Class	Second Class	Third Class	First Class	Second Class	Third Class
Constant	3.872	4.766	7.326	3.857	4.718	7.342
	0.080	*0.054*	*0.097*	*0.081*	*0.056*	*0.088*
Cartel Agreement	-0.020	0.057	-0.263	0.082	0.194	-0.018
	0.046	*0.063*	*0.066*	*0.050*	*0.067*	*0.071*
Normal Cartel Operation				-0.106	-0.195	-0.323
				0.039	*0.047*	*0.040*
Factory Employment	0.002	0.007	0.026	0.001	0.003	0.017
	0.007	*0.009*	*0.011*	*0.006*	*0.009*	*0.011*
Destination GDP	0.017	0.015	0.038	0.013	0.003	0.026
	0.006	*0.006*	*0.008*	*0.006*	*0.006*	*0.007*
Origin GDP	-0.001	-0.022	-0.023	-0.004	-0.022	-0.017
	0.011	*0.011*	*0.012*	*0.010*	*0.011*	*0.010*
Year 1908	-0.026	-0.116	-0.595	-0.002	-0.122	-0.685
	0.067	*0.095*	*0.137*	*0.063*	*0.090*	*0.135*
Quarterly Trend	0.014	0.034	0.017	0.015	0.035	0.018
	0.001	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*
Spring	0.713	0.579	0.719	0.719	0.579	0.719
	0.043	*0.048*	*0.055*	*0.041*	*0.048*	*0.054*
Summer	1.563	0.643	0.202	1.579	0.665	0.221
	0.046	*0.048*	*0.057*	*0.041*	*0.044*	*0.051*
Fall	0.963	0.500	0.119	0.970	0.487	0.118
	0.045	*0.047*	*0.051*	*0.040*	*0.049*	*0.045*
Britain-USA	4.001	3.207	1.700	3.955	3.229	2.652
	0.085	*0.077*	*0.072*	*0.088*	*0.087*	*0.058*
Mediterranean-USA	2.509	1.510	2.806	2.520	1.537	2.827
	0.092	*0.105*	*0.077*	*0.093*	*0.102*	*0.073*
North France-USA	1.791	1.370	1.517	1.762	1.304	1.344
	0.089	*0.070*	*0.071*	*0.088*	*0.071*	*0.060*
Rhine-USA	3.684	3.172	3.399	3.654	3.202	3.319
	0.081	*0.074*	*0.070*	*0.079*	*0.068*	*0.065*
Britain-Canada	2.224	2.469	1.858	2.175	2.548	1.830
	0.088	*0.089*	*0.078*	*0.085*	*0.080*	*0.066*
Rhine-Canada	-2.567	-2.660	0.277	-3.050	-2.563	0.135
	1.225	*0.133*	*0.126*	*1.271*	*0.116*	*0.107*
R-squared (unweighted)	0.9266	0.9332	0.9056	0.9277	0.9368	0.9173
R-squared (weighted)	0.9566	0.9658	0.9262	0.9591	0.9693	0.9418

Notes: (i) The omitted route dummy variable is USA-Scandinavia. (ii) The number of observations is 298 for first class, 318 for second class and 331 for third class. (iii) Factory employment is in first differences (iv) destination and origin gdp are deviations from trend. (v) Weighted R-squared weighs observations using GLS weights.

Table 7. Comparison of Eastbound Passenger Flows, by Class of Service.

	All inclusive Cartel Variable			Distinguishing Normal Cartel Operation		
	First Class	Second Class	Third Class	First Class	Second Class	Third Class
Constant	3.951	4.106	6.049	3.731	4.069	5.789
	0.099	*0.083*	*0.133*	*0.099*	*0.083*	*0.134*
Cartel Agreement	-0.047	-0.086	-0.512	-0.041	0.027	-0.165
	0.046	*0.064*	*0.108*	*0.085*	*0.068*	*0.129*
Normal Cartel Operation				-0.084	-0.169	-0.344
				0.063	*0.056*	*0.070*
Factory Employment	0.008	0.012	-0.010	0.012	0.006	-0.006
	0.010	*0.010*	*0.015*	*0.011*	*0.010*	*0.014*
Destination GDP	0.007	-0.013	0.010	-0.005	-0.016	0.009
	0.012	*0.014*	*0.018*	*0.015*	*0.013*	*0.018*
Origin GDP	0.005	0.022	0.044	0.015	0.016	0.025
	0.007	*0.008*	*0.010*	*0.010*	*0.008*	*0.012*
Year 1908	0.021	0.201	0.159	0.059	0.167	0.369
	0.119	*0.096*	*0.193*	*0.133*	*0.099*	*0.189*
Quarterly Trend	0.009	0.025	0.030	0.012	0.026	0.033
	0.001	*0.002*	*0.002*	*0.001*	*0.002*	*0.002*
Spring	1.311	1.400	1.044	1.346	1.394	0.985
	0.053	*0.071*	*0.086*	*0.067*	*0.068*	*0.084*
Summer	0.965	1.110	0.886	0.964	1.101	0.870
	0.052	*0.071*	*0.079*	*0.070*	*0.066*	*0.077*
Fall	0.258	0.595	0.941	0.254	0.613	0.976
	0.047	*0.073*	*0.086*	*0.053*	*0.070*	*0.075*
USA-Britain	4.138	3.297	2.451	4.381	3.281	2.550
	0.095	*0.074*	*0.072*	*0.102*	*0.072*	*0.082*
USA-Mediterranean	3.298	1.748	2.793	3.529	1.828	2.900
	0.127	*0.103*	*0.097*	*0.114*	*0.083*	*0.090*
USA-North France	0.747	1.431	-0.321	0.451	1.347	0.157
	0.543	*0.134*	*0.613*	*0.452*	*0.118*	*0.550*
USA-Rhine	3.861	3.140	2.745	4.031	3.139	2.864
	0.096	*0.080*	*0.073*	*0.099*	*0.074*	*0.079*
Canada-Britain	2.295	2.136	1.074	2.471	2.131	1.143
	0.101	*0.083*	*0.094*	*0.104*	*0.074*	*0.093*
Canada-Rhine	na	na	na	na	na	na
	na	na	na	na	na	na
R-squared (unweighted)	0.8223	0.8784	0.7350	0.8245	0.8823	0.7437
R-squared (weighted)	0.9514	0.9536	0.9085	0.9415	0.9566	0.9138

Notes: (i) The omitted route dummy variable is USA-Scandinavia. (ii) The number of observations is 265 for first class, 258 for second class and 266 for third class. (iii) Factory employment is in first differences, (iv) destination and origin gdp are deviations from trend. (v) Weighted R-squared weighs observations using GLS weights.

Table 8. Collusion-Induced Cabin Class Substitution, excluding routes from Scandinavia

Cabin class under counterfactual of no collusive agreement	Passenger flows for typical route-quarter under collusive status				
	Westbound flows with collusion				
	First Class	Second Class	Third Class	Displaced	Total
First Class	4,455	92			4,546
Second Class		7,434			7,434
Third Class		345	33,751	9,825	43,921
Total	4,455	7,870	33,751	9,825	
Quarters with passengers	199	215	222	na	
	Westbound flows with normally functioning collusion				
	First Class	Second Class	Third Class	Displaced	Total
First Class	4,763	113			4,877
Second Class		8,059	117		8,175
Third Class			33,181	13,635	46,815
Total	4,763	8,172	33,297	13,635	
Quarters with passengers	139	145	151	na	
	Eastbound flows with collusion				
	First Class	Second Class	Third Class	Displaced	Total
First Class	4,734	227			4,961
Second Class		4,353	637		4,990
Third Class			15,400	11,360	26,760
Total	4,734	4,580	16,037	11,360	
Quarters with passengers	194	186	194	na	
	Eastbound flows with normally functioning collusion				
	First Class	Second Class	Third Class	Displaced	Total
First Class	4,727	629			5,357
Second Class		4,177	1,365		5,541
Third Class			13,185	11,027	24,212
All Classes	4,727	4,806	14,550	11,027	
Quarters with passengers	136	128	136	na	

Notes. Numbers may not add up because of independent rounding of counterfactual figures. The averaging of total flows is over the number of periods with positive steerage flows. See text for details.

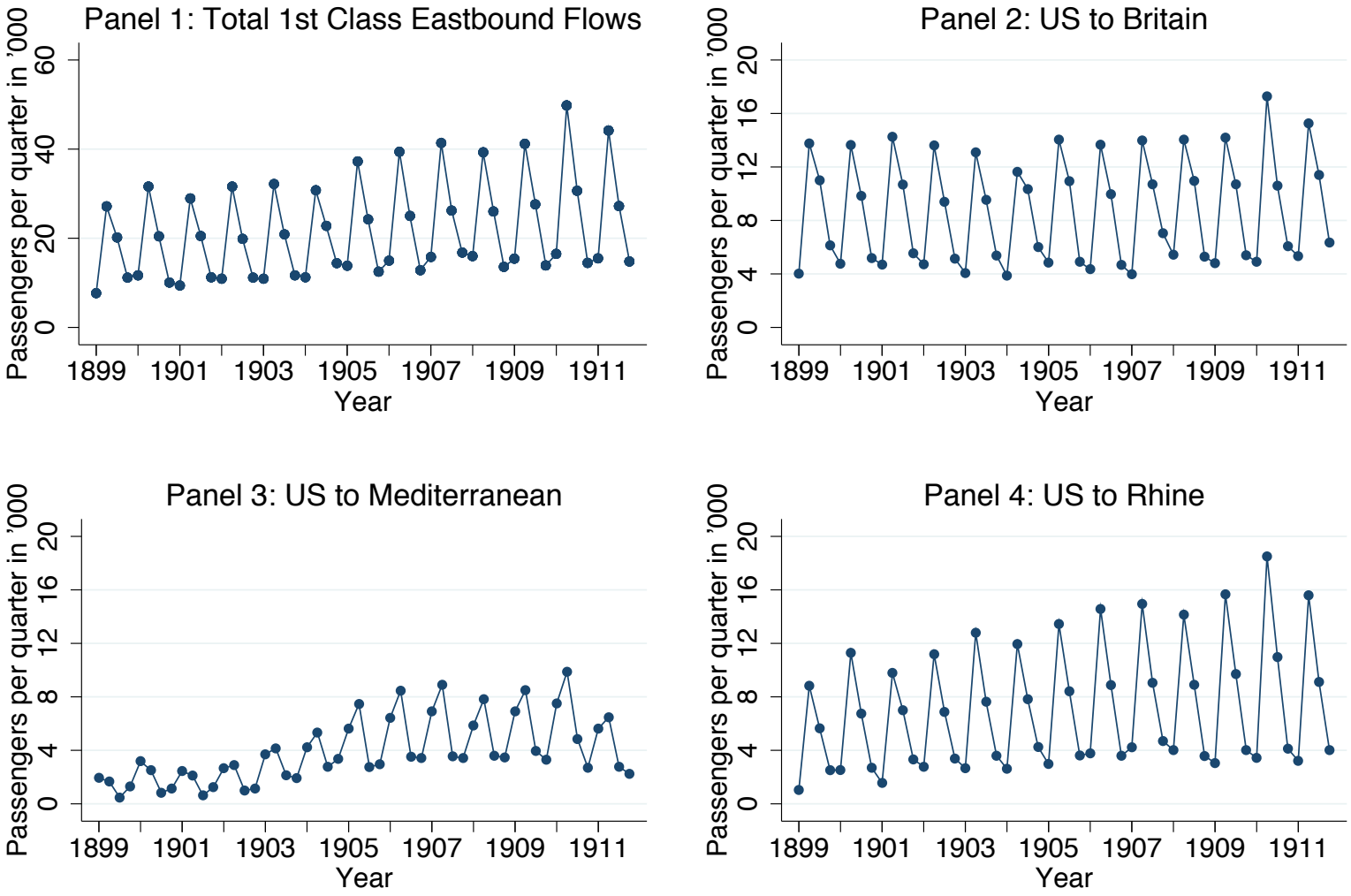

Figure 1: Eastbound First Class Flows

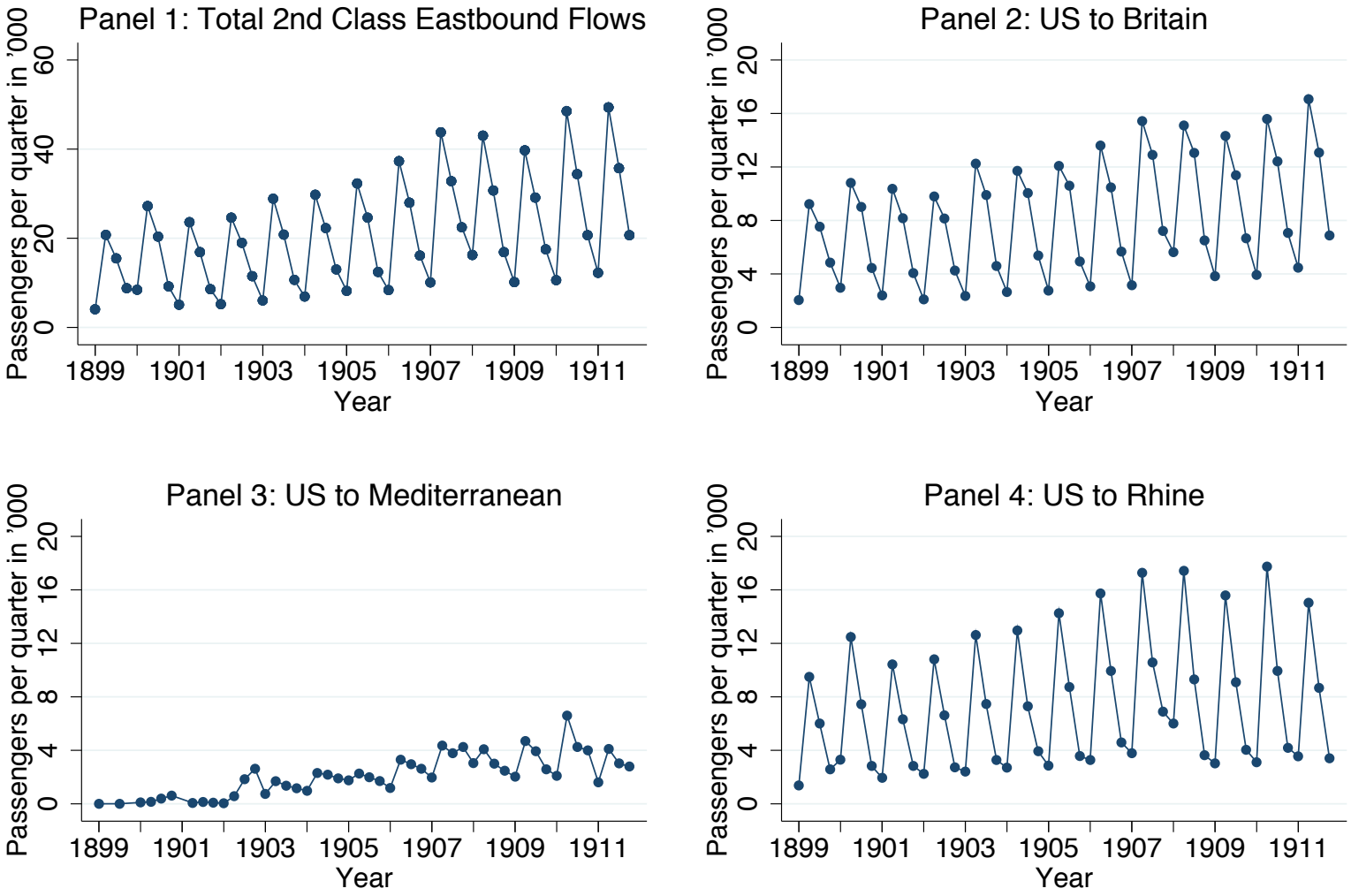

Figure 2: Eastbound Second Class Flows

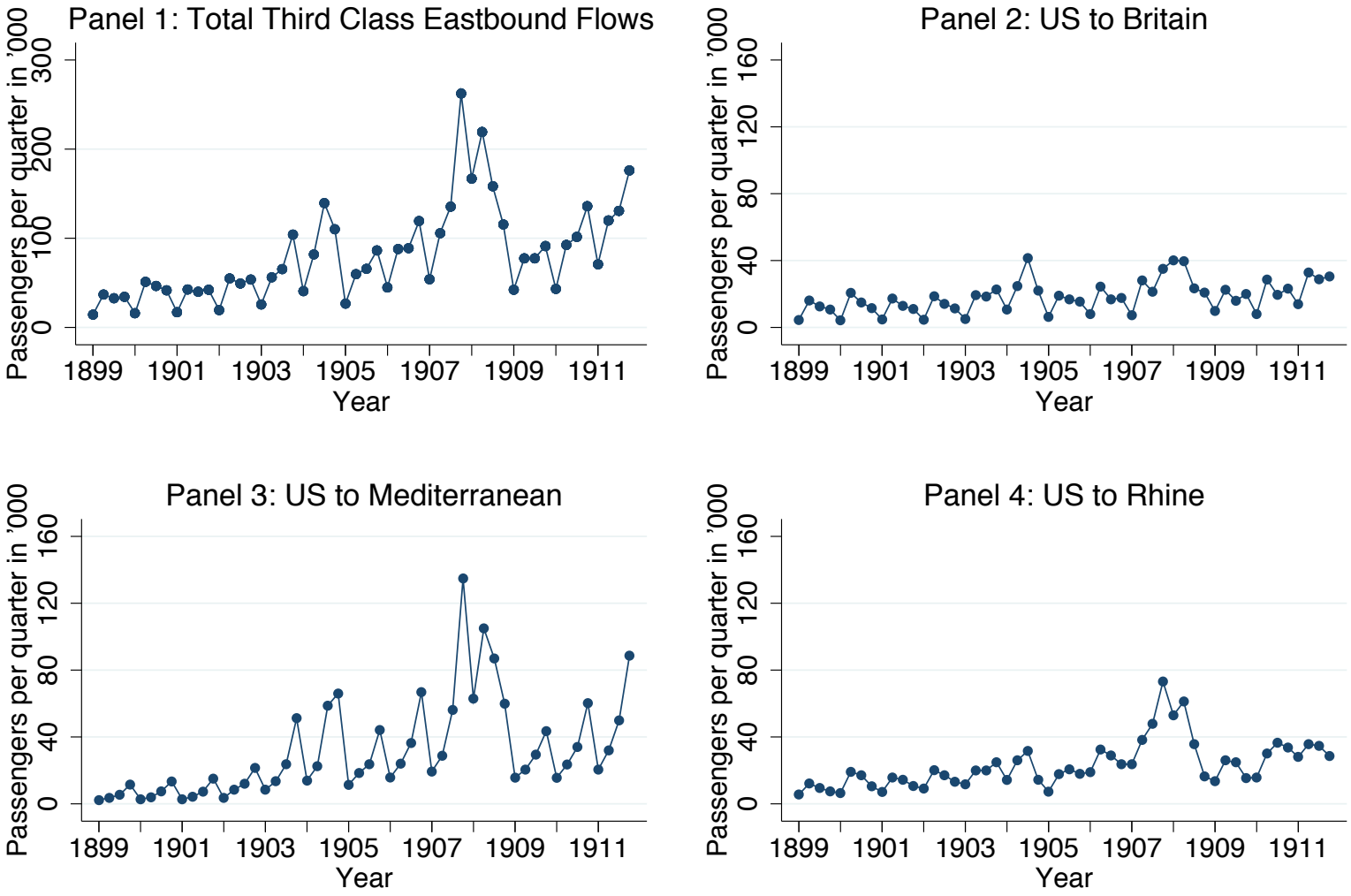

Figure 3: Eastbound Third Class Flows

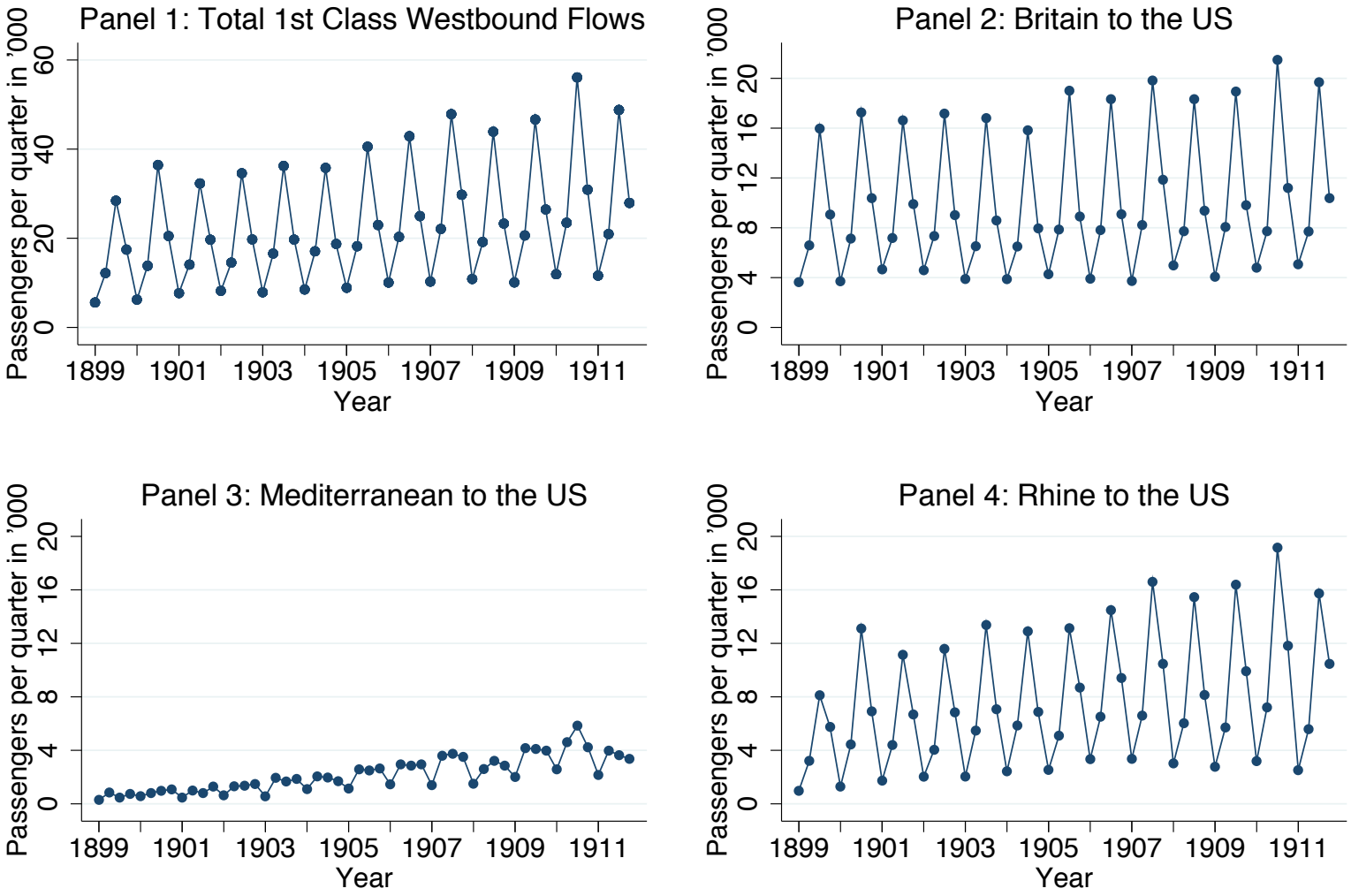

Figure 4: Westbound First Class Flows

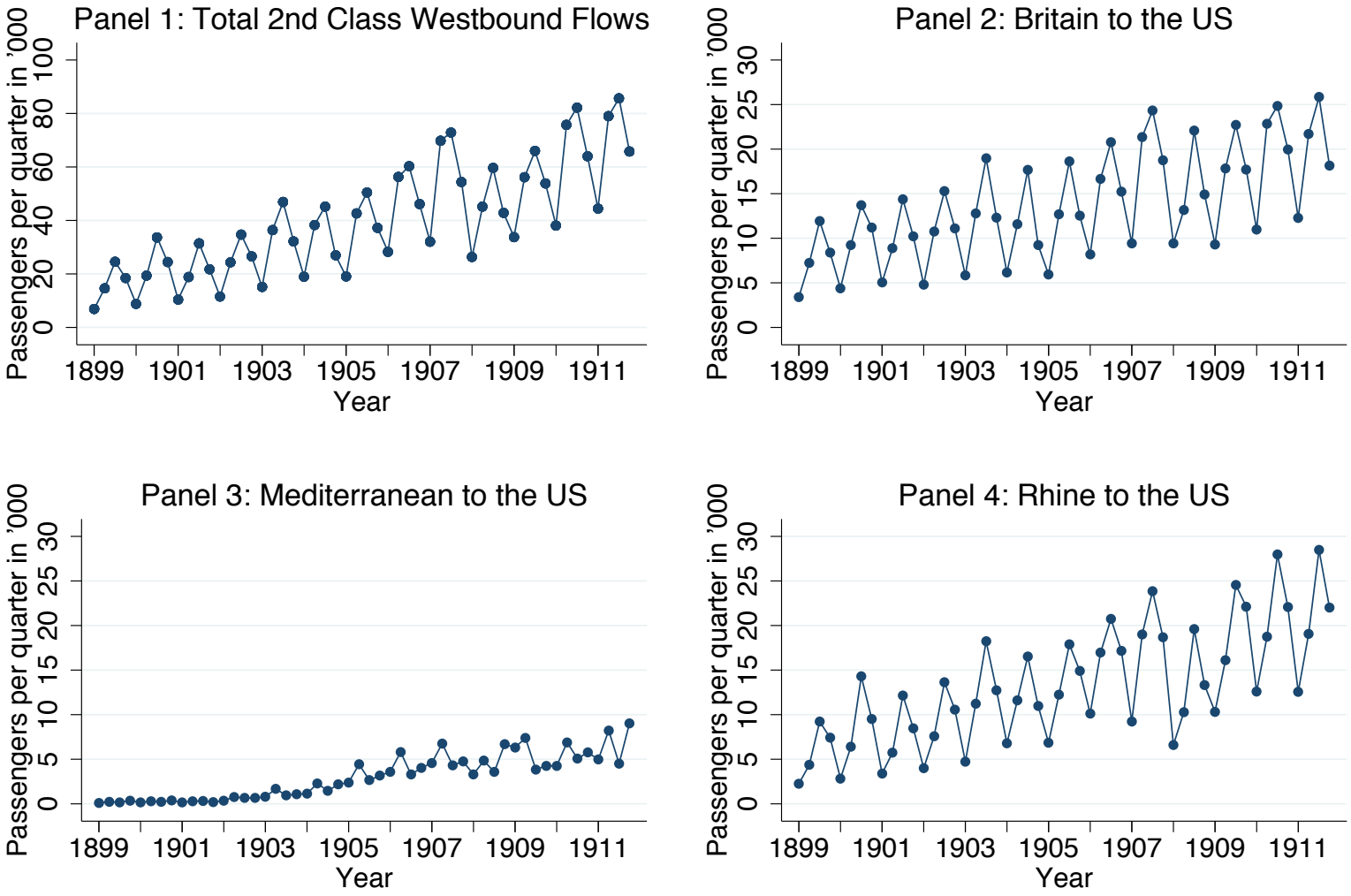

Figure 5: Westbound Second Class Flows

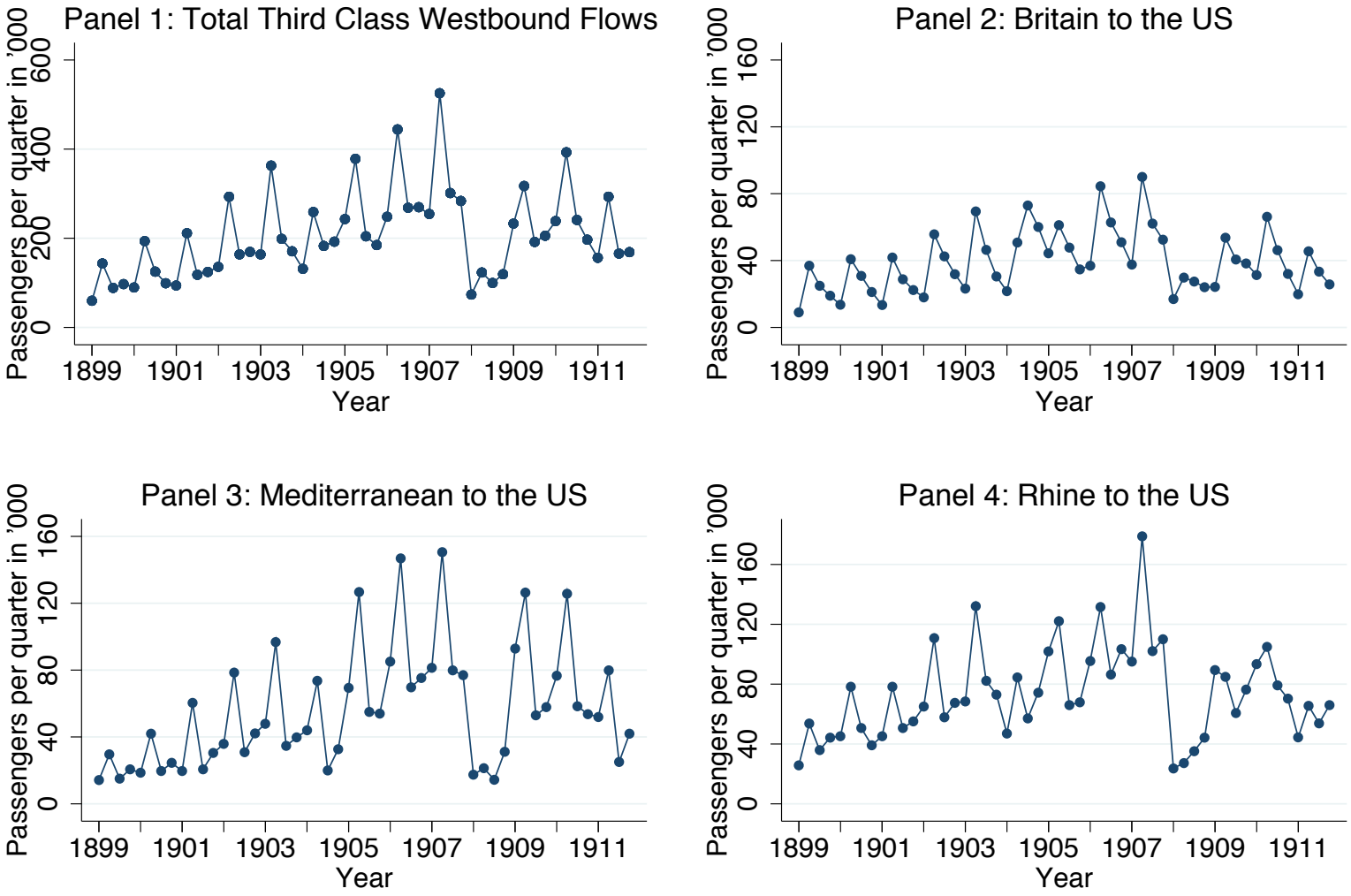

Figure 6: Westbound Third Class Flows