THE TRANSPORTATION REVOLUTION AND TRANSATLANTIC MIGRATION, 1850-1914

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A B S T R A C T

During the nineteenth and early twentieth centuries, innovations in the engines, propulsion, and hulls of transatlantic steamships enabled the increased speed and carrying capacity by which the greatest intercontinental migration in history was effected. Contradicting anecdotal emphasis on the opportunistic exploitation of migrants, more systematic analysis points instead to better travel conditions, not lower fares, as the primary means by which steamship companies facilitated population flows between the labor markets of Europe and the United States.

I. THE UNCLEAR RELATIONSHIP BETWEEN STEAM SHIPPING AND MASS MIGRATION

The greatest intercontinental migration in human history coincided with the emergence of the first global travel industry. In the half century between the Civil War

and World War I, the Atlantic crossing was the common denominator shared by the millions of polyglot Europeans from whom a majority of Americans today are descended.

Between 1840 and 1914, transatlantic migration to the United States and the annual carrying capacity of transatlantic merchant ships both grew roughly eight-fold,[1] but causal mechanisms between the contemporaneous "transportation revolution" and "Great Migration" have not been well-established in previous literature. In particular, earlier analyses of the technical and economic development of 19th century shipping have focused on freight cargoes, leaving passenger conveyance in relative obscurity.

The research of Gerald Graham (1956), Douglass North (1958), Derek Aldcroft (1969), and Knick Harley (1971 and 1988) provides a solid and mostly consistent description of how steamships, over many decades, were eventually able to out-compete their sailing rivals. What Graham called the "the incredible defiance of the Industrial Revolution by sail" underscores a general consensus that the technological diffusion of oceanic steampower and economic adjustments to it were gradual. Route by route, starting with the "short hauls" and progressing to the "long hauls," steamship lines used slowly accumulating technical advantages to undercut sailing ships by offering exporters and importers lower freight rates. However, this is an incomplete maritime saga, for three reasons.

First of all, the largest international shipping market in the late 19th century was the North Atlantic. It was dominated by large shipping lines whose principal business was not freight but passengers, and most of those were migrants. Secondly, the steamers' takeover of the migrant trade from sailing ships was not gradual, and (thirdly) was not based on lower fares.

In order to sketch the general pattern of how oceanic transport technology influenced transatlantic migration, this paper makes use of the concentration of passenger flows during the steamship era. Most Europeans who emigrated overseas before the First World War ended up in the United States. Seventy percent of U.S. immigrants between 1850 and 1914 arrived via the port of New York, in waves closely paralleling the larger pattern fluctuating migratory flows to the United States from aboard. Half of those migrants, and half of all passengers arriving by sea, travelled on the four largest shipping lines: Britain's Cunard and White Star, and the two principal German firms, Norddeutscher Lloyd (NDL), and the Hamburg-America Packet Company (HAPAG).[2] These were the only broadly-based companies with sizable shares of the North Atlantic passenger traffic throughout the entire period. Their large, diverse fleets covered most major European and eastern U.S. ports. Their business volumes and growth strategies are broadly representative of the overall pattern of steamship line development on the North Atlantic.[3]

It has been widely observed that 19th century migrants to America were primarily driven by economic opportunity, especially higher wages in the New World, and that the swings of the North America business cycle explain the severe

fluctuations in annual migration flows. Amidst a variety of additional "pushes" and "pulls," the role of oceanic transport in shaping migration movements has remained unclear, but not because it was ignored by contemporary observers.

Already by the early 19th century, migration was significant enough to compete with trade as a source of public revenue. When the U.S. Supreme Court ruled State "head" taxes on immigrants unconstitutional in 1849, the justices conceded that

> as a branch of commerce, the transportation of passengers had always given profitable employment to American ships, and in the past few years had required an amount of tonnage *nearly equal to that of imported merchandise*.[4] [emphasis added]

In 1907, towards the end of the steam era, passenger liners arriving at New York accounted for about twenty percent of net tonnage entered to the U.S.. By that time, much if not most transatlantic freight was being carried in "tramp" vessels.[5] Thus, if oceanic tonnage volume at U.S. ports was roughly 20% of the global total, that would imply that something less than five percent of the world's ship volume was devoted to migration between Europe and the United States.[6]

However, such an estimation would underrate the economic importance of transatlantic migration to global shipping. Capital costs, operating expenses, and revenues (especially in a migration boom year such as 1907) were clearly many times higher, per shipping ton, on a North Atlantic passenger liner than on a bulk freighter.[7]

The largest international shipping enterprise after the turn of the century was Germany's HAPAG. "The World is my Field" was its slogan and it carried freight and passengers on all seven seas. Measured by the number of round-trips or miles travelled, North Atlantic voyages accounted only about 10% of HAPAG's activity in 1910. However, they comprised 30% of HAPAG's tonnage and generated nearly 60% of its passenger traffic.[8] Most other transatlantic lines were even more heavily concentrated on plying the sea lanes between Europe and North America. Throughout the period, the industry's largest and most expensive ships were consistently assigned to the North Atlantic. Those waters were the prime testing arena for a long series of significant changes in transport technology.

The simultaneity of the transportation revolution and the trans-oceanic movement of migrants on an unprecedented scale, has prompted diverging theories about how the two may have been linked. A recurring refrain is that declining passage fares, analogously to falling freight rates, helped spur migration to the New World.[9] Another enduring notion is that profiteering steamship lines exploited huddled masses, or, worse yet, actively deployed armies of agents in villages throughout Europe in a tremendous "hunt" for gullible peasants to pack into the holds of their vessels.[10] A more mundane possibility, implicit in the writings of many migration historians today[11], is that the explosive growth of transatlantic shipping and migration

were coincidental dramas not related causally in any particularly significant way. None of these hypotheses stands up well to in-depth scrutiny.

It may plausibly be asserted that declines in the *total cost* of moving, including the overland portion of the journey, waiting times at ports, and in-transit risks, helped induce transatlantic migration (although this theory has yet to be substantiated). However, the supposition that steamship companies were part of this cost reduction, through a lowering of *passage prices*, rests on unrepresentative temporary price cuts contradicted by the general long term trend, which was one of little change. [12]

Britain's *Inman* line pioneered the carrying of transatlantic migrants on steamships in the mid-1850s. In contrast to the sailing ships carrying over 95% of transatlantic steerage passengers up until then, Inman offered individual berths for each passenger, three cooked meals per day, a separate compartment for women, towels and soap for washing, an on-board doctor, and a transit time one-half as long. Thanks to these amenities, Inman, after adding New York to its route roster in 1857, quickly garnered the largest share of steerage traffic to America, despite charging twice the fare levied by sailing ships. Inman was able to offer an attractive value per price paid because it possessed a cost advantage: its was the first fleet with all-metal hulls and screw propellers. Such vessels were much more economical and energy efficient than the wooden paddlewheelers of predecessors such as Cunard. Inman used its cost advantage to out-compete sailing ships, not by offering lower fares, but by delivering a higher quality of service. [13]

Not surprisingly, Inman inspired imitators. By 1870, over 90% of immigrants to America travelled on the iron-hulled screwships of a dozen steamship lines. "Year by year," noted the New York Emigration Commission in its 1871 report,

> the proportion of steamers to sailing vessels in carrying emigrants continues to increase...With rates of passage very little in excess of sailing ships, steamers are greatly superior in every essential of comfort, convenience, expedition, and, most important of all, healthfulness.

In the process of expanding "down-market" from Inman's original clientele, the so-called "better class of emigrants," steerage prices levied by steamship lines declined from £ 8 to about £ 5 by the mid 1860s. However, this was still at the high end of the £3-5 range typical on transatlantic sailing ships in the 1840s. [14]

Ten years later, after some cyclical ups and down in the 1870s, transatlantic migrants in the early 1880s were again paying slightly under £5 [15]. With modest regional variation, that remained the average level for steerage fares throughout the remainder of the pre-World War I era. For example, Cunard's Liverpool-to-New York steerage rate averaged £5 during the decade which ended in 1914. During the previous ten years, 1895-1904, the fares had averaged £ 4.[16] Clearly, it was not a reduction in oceanic travel prices which generated a doubling of Cunard's steerage passengers on that route over that same 20 year span: from an average of 22

thousand annually during 1895-1904 to 38 thousand per annum during 1905-14.[17]

The periodic price wars which at times drove rates to below £2, did not alter the generally stable long term average of transatlantic fares. The price wars failed to stimulate migration even in the short term. Most episodes of fare-cutting occurred during cyclical downturns, which were associated with sharp drops in the flow of job-seeking immigrants to America.[18]

There is little doubt that these immigrants were vulnerable to abuse, and that their well-being was rarely a top priority for shipping lines. A long litany of complaints and investigations substantiates this. However, it should be noted that the most flagrant scams occurred not on board ships, but in the ports at either end.[19] Furthermore, most historians have credited the shift of migrant transport from sail to steam as the single event which most notably reduced the risks and hardships of the oceanic journey.[20] Hypotheses of systematic price-gouging and abuse of migrants by shipping companies, after the conversion to steam, are difficult to reconcile with a concurrent absence of either strict barriers against new competitive entrants, or significant constraints on capacity increases by established lines, or prolonged slackening of the long term flow of migration.[21]

Recent scholarship suggests that these flows were facilitated, but not instigated, by steamship agents. Scholars instead cite the advice, remittances, and pre-paid tickets of relatives as more powerful boosts to migration.[22] Steamship agents also had little ability to mitigate declines in migration during cyclical depressions. The general conclusion is that shipping lines responded to demand for travel by migrants, but did not stimulate the overall volume of migration flows in any obvious way.

North Atlantic steamship service and mass migration between Europe and North America did indeed have distinctly different origins. Once ocean-going steam travel became possible, thanks to the development of the marine engine and the surface condenser by the late 1830s, steamship lines were established on the Atlantic, not to carry migrants but to deliver mail.[23] The speed and punctuality of steamers contrasted with the earlier sailing packets whose transit time of a month or more was twice as long, and subject to the variability of wind and currents.[24]

Meanwhile, the hundreds of thousands fleeing the Irish potato famine and the failed revolutions of central Europe travelled almost exclusively on sailing ships. The all-time high of American immigration relative to the U.S. population occurred in 1854, sixteen years before White Star was organized, six years before Cunard started carrying steeragers, two years before the German lines began deploying steamships, and two years before Inman recalled its screwships from Crimean War service to begin the first noticeable transport of migrants by steamship.[25]

Subsequent developments do indicate a growing involvement of steamship lines with migration after the 1850s, and a concomitant decline in the importance of mail carriage: the replacement of exclusive fixed postal contracts with competitive per-piece arrangements in the early 1860s, completion of the transatlantic telegraph

cable in the late 1860s, the liquidation of a large number of American sailing packets during the Civil War, and a sustained growth of European migration to the U.S. (from 80 thousand in 1861 to 400 thousand in the cyclical peak of 1873).[26] However, a more complete understanding of the role which oceanic transportation technology played in shaping migration patterns, requires a more systematic exposition of how the ships changed over time, and what that meant for travellers.

II. SWIFT DECLINE OF SAIL AND THE DEVELOPMENT OF GIANT PASSENGER LINERS

The success of ocean-going steamships in passenger transport was based on three technical advantages over sailing vessels: more power (the marine engine replaced wind power), increasingly efficient propulsion (screw propellers replaced paddlewheels), and stronger hulls designed to reduce friction (metal superseded wood). These technological developments led to three benefits for migrants.

Firstly, the steamers were faster, on average. The replacement of sail by steam cut transit times by two thirds, from about five weeks by sailing ship in the 1840s, to about 12 days by steamer in the late 1860s. Thereafter, more gradual increases in the speed of steam-powered liners brought average transit times down to about 9 days by 1913.[27]

A second change was that metal hulls allowed much bigger ships to be built.[28] As will be discussed below, this ultimately meant more space and comfort for migrant passengers.

Finally, and of most immediate import, metal-hulled screw-driven steamers were much safer. This was partly because they were bigger and therefore less liable to capsizing or to destruction in collisions, against which their greater strength was also an advantage. Lower risk for travellers was, more importantly, a consequence of the shorter passage time, which reduced the potential spreading of infectious diseases, the main source of deaths on board sailing ships. The conversion to steam power reduced death rates on the Atlantic crossing by ninety percent. Other health and safety advantages conferred by steamships included a diminished chance of en-route disruption (propellers were less vulnerable than sails or paddlewheels), a lower probability of fires breaking out (and thus more hot meals), and a lessened danger of being swept off course.[29]

Steamships had one major and lingering disadvantage: the considerable out-of-pocket expense associated with their power source. Steamers required copious quantities of coal, large boilers and engines for converting it first to steam and then into motion, large bins in which to store it, and a small army of stokers to shovel it. This was the main reason for the endurance of sail in freight carriage, especially on the longer routes in the Southern Hemisphere, far from coal mines. Coal was the single biggest expense in oceanic steam shipping. [30]

Marine engineers worked extensively to devise means of cutting coal consumption: this was a prime objective of most of the technical innovations in coal-fired shipping throughout the 19th and early 20th centuries. More efficient propulsion was achieved by the conversion from paddles to screws and by the addition of further screws. Engines were designed with additional cylinders, and made able to operate at higher temperatures and pressures: obtaining more horsepower per unit of fuel. Experiments were also conducted to compare the energy required for various shapes and designs of ships and hulls.

There were three basic ways in which shipping companies could take advantage of improvements in engine fuel efficiency: reduce coal costs or deploy faster or larger vessels. Outside of the North Atlantic liner services, transport-price-sensitive freight movements generally constituted the core business of shipping. In those instances, fuel economies were accordingly used mainly to reduce coal usage, which led to lower operating costs and thereby to lower prices as well. However, on the North Atlantic passenger routes, where market volume was not very sensitive to adjustments in passage prices (as discussed above), shipping companies chose to leave fuel usage relatively unchanged[31], and instead applied most of the improving energy efficiency to the powering of faster and bigger ships.

When and how to add, upgrade, and replace vessels were complex issues faced by steamship lines. It suffices here to note that the major North Atlantic passenger carriers deployed new ships throughout the period, thereby maintaining fleets with average ages of about eight years,[32] and that most new ships possessed all the significant technical developments which had been introduced up to that time. An examination of innovations to transatlantic passenger liners makes it plain that once practical obstacles were overcome,[33] the diffusion of new technologies was swift, not gradual.

Iron hulls and screw propellers were first used on the North Atlantic in 1850 by Inman: by the end of the decade almost all steamers arriving at New York were of that type. The two cylinder "compound engine" debuted in 1869. In 1873 it was already ubiquitous among the steamships bringing steerage passengers to New York during that cyclical peak of immigration. The three cylinder "triple expansion" engine, the second ("twin") screw, and the steel hull were all first deployed on the North Atlantic in the early 1880s. By the early 1890s, they had been widely adopted by all four industry leaders (Cunard, White Star, NDL, HAPAG). The four cylinder, "quadruple expansion," engine first appeared in 1893; by 1910 it was the norm on North Atlantic passenger liners.[34]

These improvements to engines, propulsion, and hulls had impacts on migration travel which fell into two phases. The first phase began with the swifter and safer, yet still affordable, regular steerage service on iron screwships, pioneered by Inman in 1856-57, and the emulation thereof by HAPAG (1856), NDL (1857), and Cunard (1860). That initial phase ended after the boom years of the early 1870s, by which time nearly all European immigrants to North America were crossing on iron-hulled steamships driven by compound engines and screw propellers. To

reiterate, within a decade and a half, the crossing speed was tripled and mortality rates cut to a tenth of what they had been on sailing ships. However, the early steamers were only slightly bigger than their sailing contemporaries.

The second phase of technical innovation influencing migration began in the early 1880s, when migration boomed, steel hulls were introduced, and "twin screws" were adopted. Stronger and lighter hulls, and the safety margin afforded by a second propeller, obviated the need for "auxiliary" sails. That made possible the first appearance of the long, tall "express steamers" or "ocean greyhounds," a type of ship "which remains today, with enormous modernization, the standard oceanic liner." [35] This phase concluded with the hiatus in migration caused by the outbreak of World War I.[36] It was followed by the permanent end of American "open borders," and a gradual replacement of steamships by diesel-powered "motorships," in the mid-1920s.

The evolution of steamship service between Europe and New York, charted in Table 1, shows these two phases, especially the latter phase. In their first decade and half, up to 1873, steamers cut three weeks off the average crossing time required by sailing ships; Over the next 40 years, only about three further days were shaved off.[37] The main effect of technical innovations in this latter phase was to increase the size of ships (detailed in Table 1) and to further improve their energy efficiency.[38]

Increased size and fuel efficiency had been engineering objectives all along, but were overshadowed initially by a focus on winning mail contracts with record-breaking transit times. Most of the space on board the early steamships of the 1840s (wooden-hulled paddlewheelers) was needed for engines and coal storage. (It was the fuel efficiency of the iron screwship which first made it possible for Inman to offer migrants steerage berths at "only" double the fare of sailing packets).[39] By the time the transatlantic telegraph connection was finalized in 1866, the core business on North Atlantic steamships had shifted from mail carriage to migrant transport.

The change in emphasis from mail to passengers greatly increased the need of shipping lines for more on-board space. The oft-cited dilemma of ship builders was thus, whether to design bigger vessels or develop more efficient engines. Actually, the two approaches overlapped. Greater fuel economy was an essential concomitant of bigger ships needing more power. At the same time, the main *long term* advantage of more efficient engines was the ability to build bigger ships, not faster ones. To appreciate this last point, it is useful to observe a central principle of marine engineering: the energy required to move a vessel through water increases less than proportionately with ship size, but more than proportionately with speed.[40]

From the 1890s onward, foregoing much of the possible rise in speed (in order to instead build bigger ships) became increasingly sensible from a marketing standpoint as well. With transit times as low as one-to-two weeks by the 1890s, still further reductions in travel time had diminishing appeal to luxury class passengers

TABLE 1: THE RELATIVE IMPORTANCE OF GROWTH IN SHIP SIZE AFTER 1873

(PASSENGER STEAMERS ARRIVING AT NEW YORK FROM EUROPE)

	Vessels of ALL lines			Vessels of Cunard, WhiteStar, HAPAG, NDL *					
							Averages per vessel **		
Year	# Lines	# Ship Arrivals	Arrivals per line	**** # lines	# Ship Arrivals	Ship Arrivals per line	Knots	*** tons	Tons / Passenger Capacity
1863	11	191	17	3	87	29	10.9	2500	4.4
1873	17	649	38	4	246	62	12.2	3100	3.8
1890	22	914	42	4	378	95	15.0	5100	
1913	26	1091	42	4	434	109	17.1	17700	8.1
Annual % increase (compounded rate) :									
1863-1873:	4%	13%	8%		11%	8%	1%	2%	-1%
1873-1890:	3%	3%	1%		4%	4%	2%	5%	1%
1890-1913:	2%	2%	0%		1%	1%	1%	13%	7%

* for steerage shares of these four lines, see Figure A.1 below

** each vessel weighted by the number of its New York voyages that year

*** "tons" means gross tons (rounded to nearest 100)

**** White Star began in 1871, thus in 1863 the "Big 4" were only three

COMMENT: Sailing ships are not included, thus the sail-to-steam conversion is not traceable in this table. However, the trend of change in North Atlantic passenger steamers is discernible. After 1873, with the takeover by steam largely complete, arrivals per line levelled off, speed (knots) continued to grow,but only slowly, and size (tons) increased markedly. The growth in size was more rapid than the simultaneous growth in passenger berths, as the final column, tons/passenger capacity, shows. See also Figure A.1 below. Regarding the choice of years depicted, see notes to Table A.5.

SOURCES: New York Commissioners of Emigration, U.S. Bureau of Navigation, Morton Allan Directory, Bonsor

and migrants alike. After the turn of the century, steamship firms could charge at most an extra 10% for their "express" service, not enough to compensate for the heavier coal usage and larger engines of these "greyhounds" vis a vis "regular" liners.[41] By cutting transit times in half, the introduction of steam had greatly decreased the risk of the Atlantic crossing. But once mortality had declined to levels found on land (by the late 1870s),[42] there was little room for further reducing health hazards by increasing speed.

With most of the gains from stronger hulls and more efficient energy use after 1870 being applied to the deployment of ever larger ships, the question naturally arises: What use was the additional space being put to ? There are three possible answers to this question which shall be considered in some detail.

Because much of the increase in fuel efficiency derived from the adding of multiple cylinders, and in some cases multiple engines, one possibility to consider is that expanded machinery for driving the ships was taking up most of the increase in space.[43] However, shipping statistics do not support this idea.

"Net tonnage" is a measure of how much space on a ship is available for the carrying of revenue-generating passengers and cargo. Most of transatlantic migration during the steamship era involved transport to America on British, German, and to a lesser extent after 1900, American lines. A comparison of the "net" versus "gross" tonnage of these three countries' commercial fleets indicates that, as ships grew larger, their revenue-generating sections grew almost as quickly (see Table 2).

Of course, these figures include ships plying the Caribbean, the Baltic Sea, and the East Asian straits. However, a similar stability can be seen in the tonnage of ships deployed[44] on the North Atlantic by Cunard, White Star, NDL, and HAPAG in three time periods: 1888-96, 1897-1902, 1903-08. Net tonnage for those vessels was 57%, 60%, and 55% of gross tonnage for the three respective time periods. Clearly, net tonnage available for revenue-generation on the North Atlantic grew almost as dramatically as gross tonnage (see Table 1) did.[45]

But how much of this expanded net tonnage was allocated to passenger transport ? That the passenger business remained dominant is not at issue.[46] For instance, in 1912, a fairly "typical" migration year, about two thirds of the German lines' North Atlantic revenue came from passenger traffic.[47] But was this an increase or decrease over previous years ?

There are anecdotal suggestions of a trend towards increased freight usage after the 1890s. Lamar Cecil refers to the 1896 annual report of the then soon-to-become global leader HAPAG: ."..We have recognized the timely necessity of no longer seeking to make migration the basis of our North American business."[48] Without taking into account that 1896-97 was a cyclical low for American immigration, Cecil concludes that "HAPAG's judgment that the future lay with freight did not prove erroneous."[49] The subsequent annual reports of the company suggest otherwise, at least up until World War I. Compared to 1896, the Hamburg line's total

TABLE 2 Net / Gross Tonnage (%) *

	World	UK, Ger., US	Gross: UK, Germany, US / World	World Gross ('000s)
1894	64%	64%	70%	15,134
1897	64%	65 %	71%	
1900	62%	63%	70%	21,788
1903	62%	63%	70%	
1913	60%	59%	65%	39,644

* of steamers over 100 tons. Sources: Bureau of Navigation tables.

freight volume in 1910 was three and a half times higher, but the number of passengers carried grew four and a half fold. [50]

Available evidence suggests that this relative shift towards passengers was not atypical. Like NDL, White Star was considered a premiere passenger line (except for a brief flirtation with cattle transport in the 1880s, and for a few months after the 1912 Titanic sinking, when bookings declined). On Cunard's U.S. routes, freight declined from 23% of total roundtrip revenue in 1890-99 to 15% in 1900-14.[51]

The foregoing analysis indicates that the main thrust of technical change on North Atlantic liners between the 1870s and 1914 was to produce larger ships, that the resulting space available for freight and especially passengers grew at a rate almost as rapid at that of overall ship size. Shipping data also clearly show that both the number of passengers and space *per* passenger increased substantially during these years[52], and that most of increase was used for the latter.

It then remains to try to estimate how much of the expanded ship space per passenger "trickled down" to the lowly migrants. The turn-of-the-century Atlantic was, after all, the age of the "Grand Saloon":[53] the rococo ballrooms, grand staircases, polished smokerooms, expansive promenades, and four-star restaurants accessible to passengers of the upper deck "cabins." The promulgation of luxury travel during this time depended "above all, on room, room, and more room."[54] While detailed figures are scarce, it is likely that expenditures on elegant furnishings and crew devoted to the first class areas rose disproportionately, and that few migrants partook of such opulence.

The concept of liners as giant floating palaces obviously had little to do with migrant transport. However, increases in size and comfort were not without effect on migratory travel. To what extent seasickness declined as vessel size increased is unclear (perhaps not much)[55] but having more deck space and fresh air certainly did not hurt. More significantly, there was a marked trend, beginning in the 1890s and accelerating after about 1905, in the provision of private "closed" berths in

steerage. By 1914, 1/3 to 1/2 of the steerage accommodations on ships from Northern European ports were of this so-called "new steerage" variety, rather than the older, more crowded, noisy, odorous, and immodest open bunkrooms characteristic of "old steerage." Available deck plans suggest that "new steerage" also correlates with an increase in net tonnage per steerage passenger.[56]

The fastest growing segment of travel after 1900, however, was the second class or "second cabin." This was true on routes from southern as well as northern Europe.[57] Second cabin also grew in terms of space per passenger (although probably not as much as first class), and a growing percentage of those passengers were migrants.[58] There are numerous accounts suggesting that, in terms of food, ventilation, and space, per fare paid, second class was a better bargain than steerage (especially "old steerage") for the growing minority of migrants able to afford it. Some migrants in the cabin class were "repeaters," returning from temporary sojourns back in the Old Country, and enjoying the fruits of their first economic successes in America. Others were families or single women desiring greater privacy than was available in steerage (especially if that steerage was of the "old" open-berth variety). Suggestions that migrants mainly used second class in order to avoid debarment at U.S. entry ports are contradicted by the low incidence of exclusion (less than 1% of immigrants over the 1880-1914 period) relative to the migrant travel in second class (over 10% after 1907, according to table A.1).[59]

The percentage of total passenger slots allocated to second class by Cunard, White Star, HAPAG, and NDL on their North Atlantic vessels rose from 5% during 1880-97 to 11% during 1898-1913.[60] Companies ordered and deployed new ships with a growing percentage of second class berths because expanding that "in-between" travel class helped improve capacity utilization.

Fares in second cabin averaged about $40 (£8) compared with $25 (£5) in steerage (old or new) and $125 (£25) in first cabin. The second class thus attracted both an "upper" tier of migrants and a "lower" tier of tourists: groups with *offsetting travel patterns*. Westward migrant flows peaked in the Spring - a season when (mostly American) tourists were heading east. The growing flow, after 1890, of migrants returning eastward to Europe was concentrated in the second half of the year, during which time American tourists were again mostly moving in the opposite direction (back home).[61] The enhancement to capacity utilization for steamship lines able to fill the same second cabin berths in both directions, in both Spring and Fall, was considerable. By the early 1900s, North Atlantic liner shipping had shifted from the use of crude steerage holds carrying migrants west and freight east, to the provision of more spacious and comfortable quarters for carrying migrants and non-migrants (tourists and business travellers) in in both directions. Undoubtedly, this is one reason why migration became increasingly viewed less as a one-time ordeal and more as a repeatable form of low-cost, back-and-forth travel.[62]

TABLE 3 The Growth of Return Migration, 1875-1914

(' 000s of travellers, all U.S. entry points)

	Inbound Traffic			Outbound Traffic			
	[1]	[2]	[3]	[4]	[5]	[6]	
Years	Arrivals	Non-Immigrants & Citizens	Immigrants	Estimated Return Migrants = *[6] - [5]*	Estimated Eastbound Non-Migrants = *[2]*	Departures	*Estimated RATE of Return Migration = [4] / [3]*
1875-1884	4702	809	3893	497	809	1306	13%
1885-1894	5812	1145	4667	1227	1145	2372	26%
1895-1904	6055	1404	4650	1639	1404	3044	35%
1905-1914	13937	3815	10122	3772	3815	7586	37%

Comment: The estimate of return migration assumes that all "Non-Immigrants" and "Citizens" (classifications of U.S. immigration officials) were non-migrants and, as a group, completed roundtrips within each 10 year span shown. See notes to Table A.1.

Sources: Columns [1], [2], [3] f rom U.S. Statistical Abstracts, column [6] from U.S. Bureau of Immigration annual reports.

III. THE EVOLUTION OF MIGRATION: FROM REFUGEES TO TRAVELLERS

It would be an exaggeration to suggest that transatlantic steamship lines deliberately set out to build ever bigger ships with the primary objective of providing more space for migrant travellers. It would be equally misleading to try to claim that migratory transport was not a crucial and integral element in business development strategies which relied heavily on the use of ongoing technological improvement to provide value to travelling customers of all sorts.

The tenfold increase in ship size over the 1850-1914 period was probably most closely related to desires to attract the acclaim and pocket books of wealthy tourist and business classes. But migrants were also beneficiaries of less crowded and more private accommodations, larger dining rooms, and more deck space, in steerage. In addition, a growing percentage took advantage of an increased offering of moderately-priced second cabin berths. These were tangible improvements which helped to address the frequent complaints of migrants, their lobbying organizations, independent investigators, and governmental inspectors. [63]

As ships grew in size and sophistication, the transatlantic lines chose to pursue a variety of revenue sources, rather than specialize, because this helped improve the capacity utilization so critical in an industry where most of the costs were fixed. Modern airlines and cruise ships rely on price discrimination: so did their predecessors, steamship lines. Higher decks with better views and fresher air could command high prices affordable to elite customers while migrants, paying lower fares, could be housed on more primitive lower decks where Lady Astor and friends would not have travelled at any price.[64]

But this begs the question; Why build such huge multi-layered ships in the first place ? The marketing and cost advantages of size versus speed have already been explicated above. But why not build *more* ships rather than *bigger* ships ? A glance back at Table 1 shows that up to 1873, steamship lines did indeed concentrate more on increasing the number, rather than the size, of their passenger vessels arriving at the Port of New York. There are three reasons why the emphasis was reversed thereafter.

Recall that transatlantic steamship lines were first organized as carriers of mail, winning that business from sailing packets by their superior ability to guarantee regular delivery dates. There were, however, diminishing returns to the frequency of such service.[65] Shipping literature is replete with references to the quantity of vessels of this or that technological generation needed by a given line desiring to offer "weekly service" to New York.[66] Rarely was there much interest in going beyond weekly departure intervals. Before 1873, steamship lines were still building fleets up to the level of once-per-week schedule frequency. Modest improvements in speed thereafter reduced required vessel numbers; this was offset by a slight

increase in the number of European ports connected by regular routes to New York.

In theory, two or three small ships travelling in tandem might have offered greater flexibility of capacity deployment than one large, "indivisible" vessel. However, idling ships in harbor during slack periods is hardly a costless proposition. Furthermore, although difficult to quantify, there is evidence of significant scale economies in construction costs, crews, and docking allocations, which favored deployment of fewer large ships rather than a greater quantity of lower-tonnage vessels.[67] Once the capture of passenger traffic from sailing ships was complete, and the dozen or so major steamship lines had geared up for weekly service, continued long term growth in transoceanic travel was most cost-effectively met by launching larger and larger steamships.

A final advantage of big ships was less tangible, but very real. Before air travel, television, or computers, the massive steampowered ocean greyhounds were technical wonders of their age. Kings and Presidents christened them, their arrivals were front page news, and crowds gathered in the tens of thousands to witness their arrivals and departures.[68] A century hence, in the jaded cyber-world of today, the giant liners still have tremendous popular appeal.[69]

There is considerable anecdotal evidence that large modern, vessels, ideally with three or four huge, billowing smoke stacks, were preferred by migrants.[70] Skepticism is not unwarranted here, but certainly safety was a concern to migrants, and sea disasters were much more common on the much smaller ships of the sail and early steam eras. It is difficult to explain the confluence of risks[71] taken in the design and operation of the Titanic, without reference to widely-held beliefs of "unsinkability."

The attenuated attention to risk exposed by the Titanic's demise, underscores the degree to which technical improvements over the course of six decades of steamship line service had transformed the Atlantic crossing. From an odyssey undertaken by intrepid pioneers or refugees in flight, transatlantic migration had become something more like the seasonal labor flows or rural-to-urban movements which grew with it and overlapped it. A reduced fear of disease and deprivation, more room to breath (or festively mingle), and a reduction in transit discomforts afforded by the provision of more spacious facilities for eating, sleeping, and washing, helped make a more widely-encountered and repeatable experience out of what had once been a rare adventure or last-resort ordeal. The use of gains in fuel efficiency, not to reduce prices, but to improve the quality of the travel experience, corroborates suggestions by Dudley Baines and others that "the main reason for the increase in the rate of return to all [European] countries [after 1900] was the improvement in transport.[72]

Technological innovations used to build faster, safer, and ultimately much larger, ships were only part of a broader series of interactions between transportation and migration in the context of a gradually more and more interconnected "global economy." The 19th century transportation revolution, for instance, began on

land. Railroads were particularly significant for overseas migrants because they facilitated links to and from port cities. Nevertheless, the growth of international migration was more closely connected with the revolutionary application of steam power to ocean travel.

Trains carried daily commuters and other non-migrants not found on ships, whereas ocean liners were much more involved with migrant "traffic" over longer distances. Migrants within Europe or the U.S. used many travel modes, but most who crossed the ocean to America arrived on one of a handful large steamship lines at one of the four largest Atlantic ports.[73] Steamships were larger, more concentrated, more international, and longer-lived corporate carriers of migrants than were railroads.

On the Atlantic, causation also ran *from* migration to transportation. Most major transatlantic lines were founded in periods of high or rapidly growing migration, generally with steerage carriage a major concern, if not the primary objective. Steamship line profits correlate closely with migration from Europe to the U.S., and it was during migration boom years that most of the capital investment in technical modernization took place. The rise of "return" and "repeat" migration helped North Atlantic lines achieve a better east-west balance as they endeavored to match high fixed cost capacity against volatile flows of transatlantic job-seekers.[74]

It also bears mentioning that travel innovation and mass migration did not interact in a political vacuum. Officially-sanctioned oppression (turn-of-the-century Russia) and neglect (mid-century Ireland) encouraged migration, as did the dismantling of barriers to emigration (after 1880 in Italy). What politicians created they could also destroy. The outbreak in 1914 of what became known as the "Great War," and the blockades, submarine attacks, passport controls, and immigration restrictions which followed, brought the "Great Migration" to an end by the early 1920s. In between, during 1850-1914, a series of laws passed in Britain, Germany, the U.S. and elsewhere, regulated and ameliorated travel conditions. The legislation paralleled measures of shipping lines to improve ventilation, hygiene, food, and privacy, and to install innovations such as electric lighting, radio, and refrigeration. Finally, the contemporaneous efforts of those governments to build advanced naval fleets, promote exports, foster overseas colonization, stimulate their shipbuilding industries, and subsidize transoceanic mail service also helped to further accelerate the pace of maritime modernization.

The periodic governmental spotlight on the not inconsiderable problems and abuses of the Atlantic passage, have, however, encouraged a misleading impression that migration by steamship was an essentially exploitative business. Certainly the travel comfort of steerage passengers was infrequently foremost in the minds of shipping executives. Nonetheless, the crude and brutal maneuverings perpetrated by 18th century slave traders, crews of early 19th century canvas-rigged "coffin ships," or late 20th century "coyotes" can not accurately be conflated with the strategies employed by giant multinational travel intermediaries in the

pre-World War I Atlantic labor market. A more valid parallel is with modern airlines, whose transatlantic flights today hark back to the ocean voyages they replaced, as their "cabin crews," introduced by the "captain," march "fore" and "aft" to welcome passengers "on-board."[75]

Investment in technological improvement and the efficient utilization of costly carrying capacity remain as critical in modern air travel as they were in transoceanic migration a century ago. However, legal prohibition of mass migration nowadays means that it is no longer a significant activity in international transport. In today's converging global economy, continuing improvements to transportation, communication, and information transfer are having a less pronounced effect on cross-border migration, in large part because such migration cannot be freely, legally, and widely pursued as a technologically-driven travel business, as it was on the nineteenth century Atlantic.

TABLE A. 1. MIGRANTS IN CABIN CLASS

PASSENGERS ARRIVING AT NEW YORK CITY FROM EUROPE (in '000s)

	Government figures				*Estimates*		*Derived results*	
	[1]	[2]	[3]	[4]	[5]	[6]	[7] = [1] + [2] x [5] + [3] x [6]	[8] = [4] - [7]
Years	"Immigrants"	"Non-Immigrants"	U.S. Citizens	Total Arrivees	% Migrants amongst NON IMM	% Migrants amongst US CITS	Migrants	Non Migrants
1870-73:	1053	12	94	1159	40%	5%	1,063	97
1882-92:	4253	173	626	5052	40%	5%	4,353	699
1907-14:	5970	931	1343	8244	40%	5%	6,410	1,835

	Government / shipping figures		*Derived Results:*	[12] =	[13] =
	[9]	[10]	[11] = [7]	[11] - [9]	[12] / [11]
Years	PASSENGERS IN STEERAGE	CABIN	All Migrants (from above)	Migrants in Cabin = All Migrants minus Steerage Passengers	Migrants in Cabin as % of All migrants
1870-73:	1,009	152	1,063	53	5%
1882-92:	4,100	850	4,353	253	6%
1907-14:	5,500	2,000	6,410	910	14%

NOTES :

1. *Definitions:* Figures generated by U.S. government immigrant authorities distinguished between U.S. citizens ("US CITS") and non-citizens, the latter being divided into "immigrants" and "non-immigrants" ("NON IMM"). However, not all migrants were "immigrants". Some migrants made multiple entries to the U.S., as naturalized citizens, and some arrived as "non-immigrants" on their second or third crossing to America. Many of these "non-immigrants", and most citizens, travelled in cabin class.

2. The "% of Migrants amongst Non-Immigrants and U.S. citizens" (columns [5] and [6]) are based on available statistics of non-citizens "returning to permanent domicile in the U.S.", i.e. "repeat migrants", and on accounts of travel by naturalized citizens (another kind of "repeat migrant"). There is a general consensus that repeat migration grew in the years after 1890. That would imply that the increase in migrants travelling in cabin is understated by this table, which conservatively assumes unchanged percentages in columns [5] and [6]. (Only by assuming an utterly unrealistic substantial decline in those percentages over time, could a decline in the rate of migrants travelling in cabin class be obtained that is consistent with the underlying data (in the other columns)).

3. Statistical gaps, and inconsistencies in the U.S. government's definition of "immigrant", primarily effect data for 1893-1906 - the years not included in this table. In columns [9] and [10], data for a few of the years after 1873 was estimated (because actual figures were unavailable), hence the totals shown are rounded. They are believed to be accurate plus or minus one or two percent.

4. As a simplification, this table ignores three small and mostly offsetting factors:
   a) "Migrants" (column 11) is overstated (by less than 5%) because it includes passengers from non-European ports.
   b) "Migrants in cabin" (column 12) is understated because it ignores non-migrants in the steerage (also less than 5%).
   c) The steerage and cabin figures include would-be-immigrants who arrived but were debarred from entry (about 1%).

5. All figures in the table are for fiscal years or multi-year periods ending June 30.

6. *Sources:* U.S. Statistical Abstracts, New York Commissioners of Emigration, Keeling, *Cartels*, Table 1, Transatlantic Passenger Conferences, U.S. Bureau of Immigration.

TABLE A.2 OFFSETTING SEASONAL FLOWS, 1892-1913

Part 1: *PASSENGER FLOWS ('000s)*

Travel classes:

I = First cabin
II = Second cabin
III = Steerage

Fare weights:

I: $ 125
II: $ 40
III: $ 25

WESTBOUND

Cabin (I+II)	III	*1892*
13	78	Jan-Mar
24	187	Apr-Jun
45	86	July-Sept
39	38	Oct-Dec
121	388	*Totals*

WESTBOUND				*EASTBOUND*				*ROUND-TRIP*			
I	II	III	*1906-13*	I	II	III	*1906-13*	I	II	III	TOTAL
29	87	543	Jan-Mar	47	29	128	Jan-Mar	75	116	671	862
55	161	1002	Apr-Jun	119	114	230	Apr-Jun	174	275	1232	1681
117	184	645	July-Sept	65	75	233	July-Sept	182	259	877	1319
83	148	598	Oct-Dec	36	45	302	Oct-Dec	119	193	900	1211
284	580	2787	*Totals*	266	263	893	*Totals*	550	843	3680	5073
61%	59%	59%	<- Apr-Sep ->	69%	72%	52%	Apr-Sep	65%	63%	57%	59%

PART 2: *FARE-WEIGHTED FLOWS*

(% of roundtrip total, all classes)

WESTBOUND			*1906-13*	*EASTBOUND*			*1906-13*	*ROUND-TRIP*			
I	II	III		I	II	III	Roundtrip	I	II	III	TOTAL
2%	2%	7%	Jan-Mar	3%	1%	2%	Apr-Sep	5%	2%	9%	*16%*
4%	3%	13%	Apr-Jun	8%	2%	3%	=	11%	6%	16%	*33%*
8%	4%	8%	July-Sept	4%	2%	3%	61%	12%	5%	11%	*28%*
5%	3%	8%	Oct-Dec	2%	1%	4%		8%	4%	12%	*23%*
18%	12%	36%	*Totals*	17%	5%	11%		35%	17%	47%	

66% <- West East -> 34%

Comments:

This table shows the incentive shipping lines had for increasing their offering of second cabin rooms to migrants (see table A.1). As a proxy for profits (and relative on-board space used), the actual passenger flows (**Part 1**) are weighted by average fares and the result is shown in **Part 2**. The significance of migration is revealed in **Part 2** by the high volume of steerage class passengers (III) and the dominance of the westbound direction, relative to total flows. Seasonally, while passengers in all classes preferred the warmer months of the year, April-September, their movements diverged within those middle months. 1st cabin flows, mostly American tourists, peaked westward in the 3rd quarter, whereas migrant flows (mostly in III) peaked in the 2nd quarter. By attracting both tourists and migrants, the "in-between" second cabin allowed a more efficient utilization of costly carrying capacity. "1906-13", as used in **Part 1** and **Part 2**, means the total of the three years, 1906, 1910, and 1913.

Sources: See Keeling, *Cartels,* Table 1
1892: Westbound Europe to New York
1906, 1910: Europe to/from North America
1913: Europe to/from US, main routes of Big 4 (HAPAG, NDL, White Star, Cunard).

Table A.4 Dominance of the "BIG 4", Part 2

Passengers between Europe and the U.S. (in '000s)

	" BIG 4 "						ALL LINES						ROUNDTRIP TOTALS		% BIG 4
	Westbound			Eastbound			Westbound			Eastbound					
Year	I	II	III	I	II	III	I	II	III	I	II	III	[1] Big 4	[2] All Lines	[1]/[2]
1900	44	44	248	44	32	87	71	78	459	69	58	150	499	885	56%
1901	43	41	274	44	29	76	69	74	508	66	50	138	506	904	56%
1902	42	47	347	42	30	88	72	86	700	70	54	172	597	1154	52%
1903	46	63	415	45	36	122	74	110	807	72	61	246	728	1369	53%
1904	50	69	414	53	42	200	75	106	698	76	64	369	828	1388	60%
1905	55	77	513	57	43	123	84	123	921	83	68	232	867	1512	57%
1906	59	93	629	60	49	170	91	154	1110	87	79	322	1061	1843	58%
1907	68	111	674	67	60	270	101	179	1222	94	94	528	1249	2218	56%
1908	63	84	201	64	59	286	89	133	354	89	91	621	758	1377	55%
1909	65	105	438	65	52	129	96	180	866	92	83	267	854	1584	54%
1910	70	116	469	70	59	164	106	205	904	101	94	349	948	1759	54%
1911	64	116	314	67	58	217	97	207	608	93	99	466	836	1569	53%
1912	64	123	434	66	59	188	94	222	855	93	100	423	934	1788	52%
1913	68	141	586	68	64	189	98	259	1141	96	111	400	1116	2105	53%
1914	49	82	281	55	47	168	81	183	533	78	96	418	681	1390	49%
1900-14 Totals:	851	1312	6237	866	719	2476	1297	2302	11684	1260	1203	5102	12,461	22,847	55%

Notes: **I** = First Cabin; **II** = Second Cabin; **III** = Steerage; "Big 4" = Cunard + White Star + HAPAG + NDL

Sources: Transatlantic Passenger Conferences reports

Table A.4 Dominance of the "BIG 4", Part 2 (continued)

Passengers between Europe and the U.S. (in '000s)

Notes: I = First Cabin; II = Second Cabin; III = Steerage; "Big 4" = Cunard + White Star + HAPAG + NDL

Sources: Transa Transatlantic Passenger Conferences reports

TABLE A.5 REPRESENTATIVENESS OF THE "BIG FOUR", 1863-1913

Steamers, passengers arriving at New York from Europe, selected years

	"BIG 4"	*INMAN*	*HOLL-AM*	*NGI*
AVERAGE GROSS TONS				
1863	2543	2083	x	x
1873	3104	2599	x	x
1890	5100	6177	3752	2311
1913	17700	x	16039	8697
AVERAGE GROSS TONS / PASSENGER CAPACITY				
1863	4.4	***na***	x	x
1873	3.8	***na***	x	x
1890	4.2	4.2	4.1	3.0
1913	8.1	x	6.0	3.3
AVERAGE SPEED (KNOTS)				
1863	10.9	10.2	x	x
1873	12.2	10.6	x	x
1890	15.0	14.8	12.3	9.5
1913	17.1	x	15.7	15.8
AVERAGE AGE OF VESSELS (YEARS)				
1863	3.8	7.3	x	x
1873	6.2	7.1	x	x
1890	8.1	12.2	11.8	7.5
1913	9.9	x	9.8	5.5
% OF INBOUND PASSENGERS				
1863	22%	28%	x	x
1873	44%	19%	x	x
1890	49%	7%	5%	2%
1913	47%	x	5%	2%

NOTES:

The averages in this table are weighted by the number of arrivals per vessel.

"Big 4" = Cunard, White Star, HAPAG, NDL, "Holl-Am" = Holland America, "NGI" = Navigazione Generale Italia

na = not available

x = years when passenger service between Europe and New York was not provided by the respective lines:
White Star began service in 1871; "Big 4" figures for 1863 (and 1873 "Average Age") cover Cunard, HAPAG, NDL only.
Holland America began service in 1873, NGI in 1882. Inman ceased service in 1894

COMMENTS re choice of years depicted:

These comments also apply to Table 1 and Figure A.1. Due to data limitations, it has not been possible to show complete time series for the measures in these tables. ***1863*** is the first year for which comprehensive figures for North Atlantic passenger liners are available. By then, single- expansion-engin steamships had captured 40% of the steerage traffic from sailing ships. 98% of those migrants originated in Northwest Europe. ***1913*** was the last full calendar year of pre-World War I liner shipping. Over 80% of migrants then were from southern and eastern Europe, and quadruple expansion engines had become the norm on new vessels being deployed. ***1873*** and ***1890*** are interim years in terms of both prevailing technology and migration patterns: ***1873*** - compound engines, 8% of European immigrants to the U.S. coming from South and East Europe, ***1890*** - triple expanion engines, 40% of immigrants from South and East Europe. Cf Table A.1 and *Historical Statistics of the United States.*

SOURCES: see Table 1

TABLE A.6 CUNARD'S FARES, LIVERPOOL-NEW YORK, 1885-1914

Derived Fares in £

	W E S T B O U N D			E A S T B O U N D		
Year	1st Cabin	2nd Cabin	Steerage	1st Cabin	2nd Cabin	Steerage
1885	18.00		3.13	18.30		3.57
1886	19.09	7.33	3.21	18.82	13.00	3.60
1887	18.08	8.33	3.44	17.75	7.00	3.29
1888	18.91	6.80	3.50	18.18	6.33	3.50
1889	18.55	8.50	3.32	17.00	7.67	3.36
1890	17.50	6.80	2.84	16.36	6.25	3.00
1891	16.22	6.67	2.80	16.88	6.25	3.13
1892	17.63	6.86	2.92	15.63	6.50	3.43
1893	18.21	7.91	3.99	17.52	7.50	4.02
1894	18.78	7.20	2.31	18.60	7.37	2.66
1895	19.41	7.47	2.44	19.37	7.45	2.54
1896	20.50	8.00	4.27	19.62	8.02	4.61
1897	23.11	8.35	4.22	23.01	9.10	4.70
1898	23.21	8.37	4.18	23.20	8.95	4.65
1899	19.77	7.46	4.17	19.41	7.65	4.69
1900	21.66	7.97	4.44	21.82	8.31	4.77
1901	20.16	7.98	4.59	20.39	8.49	5.05
1902	21.06	8.22	4.62	21.47	8.80	5.14
1903	22.50	8.36	4.09	21.67	8.38	4.83
1904	19.67	8.00	2.50	18.67	8.88	3.19
1905	21.50	8.80	3.89	23.14	9.29	5.23
1906	22.89	8.77	4.20	22.44	10.13	5.29
1907	22.00	8.94	4.39	23.44	9.36	5.19
1908	25.46	9.41	3.90	26.08	10.54	5.19
1909	30.14	10.60	5.63	28.54	11.27	6.22
1910	32.00	10.59	5.61	32.46	12.27	6.29
1911	29.73	10.65	5.74	31.43	12.27	6.07
1912	30.14	11.06	5.78	31.92	11.73	6.08
1913	30.38	11.13	5.36	32.50	12.40	6.16
1914	31.69	11.31	4.71	32.60	12.11	5.04

Note: For each class, derived fare = Revenue / Passengers

Comment: The general trend, shown here and in Tables A.7 and A.8, was *upward*. This contrasts markedly with the contemporaneous long-term decline in freight rates compiled by North and others. Cf North, Appendix.

Source: Calculated from data in the Cunard Archives

TABLE A.7

CUNARD'S FARES

LIVERPOOL-BOSTON, 1904-14

Derived Fares in £

	W E S T B O U N D			E A S T B O U N D		
Year	1st Cabin	2nd Cabin	Steerage	1st Cabin	2nd Cabin	Steerage
1904	19.17	7.83	2.27	17.53	7.63	3.17
1905	19.55	8.02	3.86	19.41	8.81	5.06
1906	19.30	8.09	4.29	20.02	8.95	5.02
1907	18.10	7.89	4.49	18.47	8.86	4.99
1908	19.20	7.45	3.85	19.43	8.76	4.98
1909	20.51	7.91	5.64	20.73	9.04	5.41
1910	21.04	8.38	5.77	20.74	9.48	5.91
1911	22.72	8.82	5.69	23.87	10.18	5.99
1912	24.27	9.48	5.78	23.23	10.59	6.13
1913	24.58	9.37	5.32	24.78	10.64	5.93
1914	22.58	9.86	5.11	22.99	10.90	5.03

Note: For each class, derived fare = Revenue / Passengers

Source: Calculated from data in the Cunard Archives

TABLE A.8

CUNARD'S FARES

MEDITERRANEAN PORTS–NEW YORK, 1904–14

Derived Fares in £

	W E S T B O U N D			E A S T B O U N D		
Year	1st Cabin	2nd Cabin	Steerage	1st Cabin	2nd Cabin	Steerage
1904	9.89	8.75	4.80	12.54	11.23	3.78
1905	14.40	9.22	5.20	16.24	10.11	3.78
1906	16.12	9.79	5.20	22.34	10.35	5.76
1907	17.13	9.69	5.12	24.75	9.91	5.46
1908	20.70	9.35	5.19	26.23	10.25	4.44
1909	20.07	9.85	5.11	34.47	10.95	5.80
1910	23.61	10.34	4.98	34.20	12.67	6.26
1911	32.56	10.08	4.90	33.09	12.80	6.36
1912	26.51	10.81	5.37	28.45	12.75	6.32
1913	23.68	10.53	3.79	30.93	12.28	6.50
1914	25.57	10.52	3.45	29.45	12.46	5.81

Note: For each class, derived fare = Revenue / Passengers

Source: Calculated from data in the Cunard Archives

TABLE A.9 CUNARD'S VOYAGE COSTS, 1885-1914

Liverpool - New York, roundtrip

(£ 000, except as noted)

Year	*Coal ('000 Tons)*	*Coal Price (£)*	Coal Cost	Wages and Provisions	Port and Loading	Other	TOTAL COSTS	*PERCENT OF TOTAL COSTS* *Coal*	*Wages & Prov.*
1885	174	.77	134	148	82	33	397	**34%**	**37%**
1886	200	.74	148	157	83	32	420	**35%**	**37%**
1887	194	.73	141	153	81	28	403	**35%**	**38%**
1888	232	.72	168	175	101	31	475	**35%**	**37%**
1889	214	.76	162	178	100	42	482	**34%**	**37%**
1890	208	.85	176	185	100	45	506	**35%**	**37%**
1891	220	.86	190	182	92	43	507	**37%**	**36%**
1892	214	.84	179	173	89	40	481	**37%**	**36%**
1893	251	.80	202	193	98	44	537	**38%**	**36%**
1894	267	.77	205	191	89	41	526	**39%**	**36%**
1895	263	.73	193	193	94	36	515	**37%**	**37%**
1896	273	.72	196	184	89	34	503	**39%**	**37%**
1897	290	.69	201	195	98	36	529	**38%**	**37%**
1898	250	.80	200	198	101	37	536	**37%**	**37%**
1899	296	.74	220	208	111	41	580	**38%**	**36%**
1900	251	.82	205	184	102	37	528	**39%**	**35%**
1901	272	.93	252	207	106	42	606	**42%**	**34%**
1902	246	.78	193	174	87	34	488	**40%**	**36%**
1903	303	.77	232	220	130	41	623	**37%**	**35%**

CUNARD'S VOYAGE COSTS, 1885-1914, Liverpool-New York (continued)

(£ 000, except as noted)

Year	*Coal ('000 Tons)*	*Coal Price (£)*	Coal Cost	Wages and Provisions	Port and Loading	Other	TOTAL COSTS	*PERCENT OF TOTAL COSTS* *Coal*	*Wages & Prov.*
1904	319	.76	243	228	122	41	634	**38%**	**36%**
1905	330	.72	237	238	136	42	653	**36%**	**36%**
1906	392	.71	278	286	154	48	766	**36%**	**37%**
1907	422	.80	339	329	175	57	900	**38%**	**37%**
1908	630	.87	545	416	199	67	1227	**44%**	**34%**
1909	605	.83	500	343	183	61	1087	**46%**	**32%**
1910	571	.81	460	334	196	62	1052	**44%**	**32%**
1911	563	.83	469	331	207	58	1065	**44%**	**31%**
1912	497	.85	423	333	215	57	1028	**41%**	**32%**
1913	467	.87	408	333	228	61	1030	**40%**	**32%**
1914	443	.90	397	321	182	79	979	**41%**	**33%**
TOTALS , 1885-1914:			**7,895**	**6,989**	**3,829**	**1,350**	**20,062**		
% TOTAL COSTS:			**39%**	**35%**	**19%**	**7%**			

Note: TOTAL COSTS = Coal + Wages & Prov. + Port/Load + Other

Comment: Throughout the period, improvements in coal efficiency were used not to reduce coal as a percentage of total costs, but to power faster and larger vessels. See Table 1, Figure A.1, Table A.5.

Source: Calculated from data in the Cunard Archives

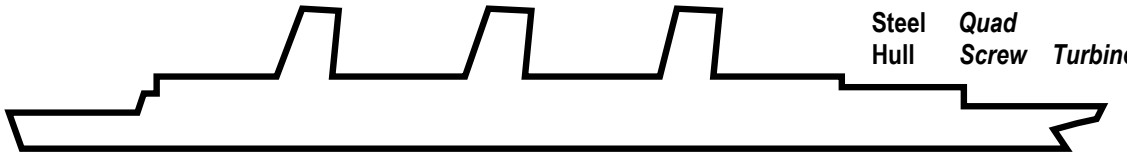
FIGURE A.1 THE EVOLUTION OF ATLANTIC LINERS, 1840-1914

Britannia, 1,135 tons 1840

Bremen, 2674 tons 1858

Oceanic, 3707 tons 1871

Campania, 12950 tons 1893

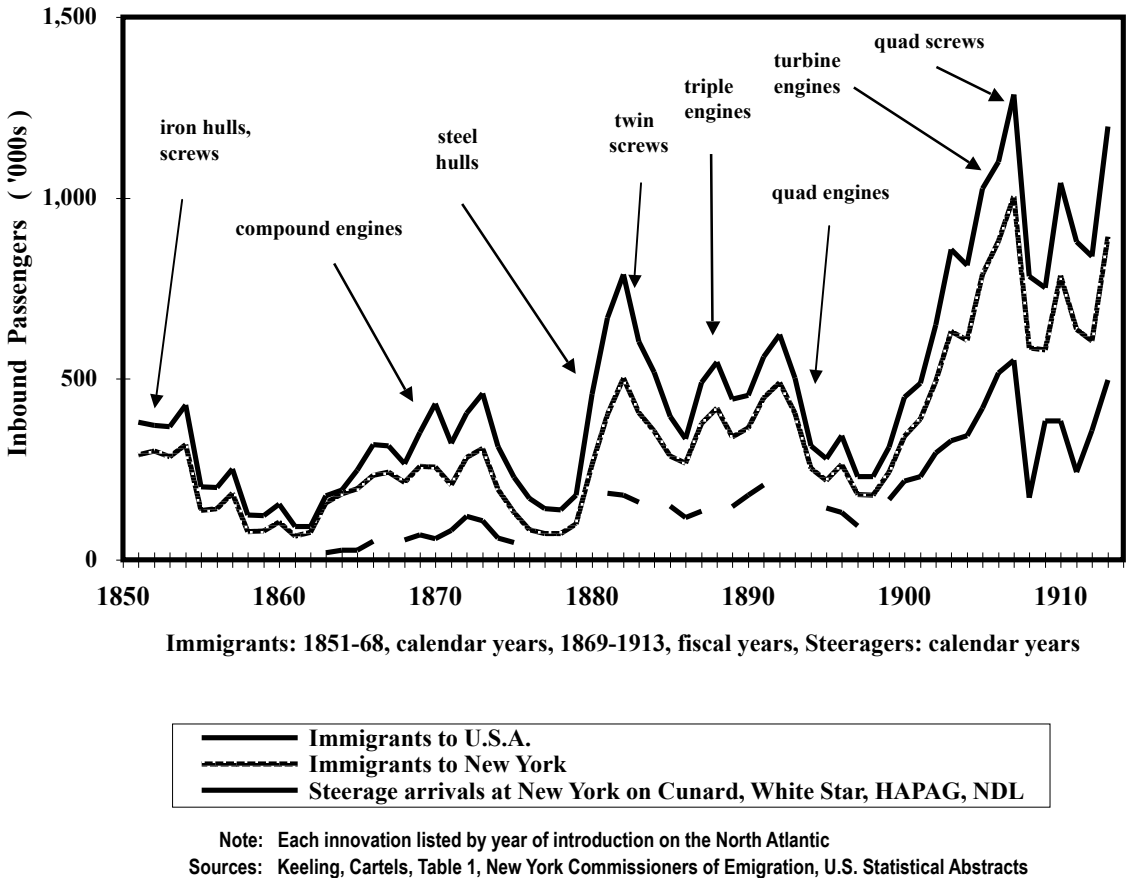


Vaterland, 54282 tons 1914

Line	Hull	Propulsion	Engine	Days to New York	Passenger Capacity 1st	2nd	Steerage
Cunard	Wood	Paddles	Single	14	115		
NDL	*Iron*	*Screw*	Single	13	16	110	400
White Star	Iron	Screw	*Compound*	9	116		1000
Cunard	*Steel*	*TwinScrew*	*Triple Exp*	7	600	400	1000
HAPAG	Steel Hull	*Quad Screw*	*Turbine*	6	750	535	2386

Source: Bonsor, horizontal 1:5000, vertical not to scale

FIGURE A. 2 INNOVATIONS IN STEAM-SHIPPING and PASSENGER FLOWS, 1851-1913



Note: Each innovation listed by year of introduction on the North Atlantic
Sources: Keeling, Cartels, Table 1, New York Commissioners of Emigration, U.S. Statistical Abstracts

A C K N O W L E D G E M E N T

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N O T E S

[1] Estimate based on data from Historical Statistics of the US., Bonsor, Albion, *Square Riggers.* Also Fig. A.1.
[2] See Figure A.2, Tables A.3, and Table A.4 below.
[3] The reasons for this Anglo-German dominance of North Atlantic passenger transport are outlined in Keeling, *Cartels*, pp. 196, 200-01, and Harley, 1985, pp. 182-84. Re "representativeness," see Table A.5.
[4] *Smith v. Turner*, cited in Coleman, *Passage*, p. 232.
[5] "Tramp" ships often dominated transatlantic bulk freight transport because, unlike liners, they did not follow regular schedules and could easily alter departure times and routes to accommodate the most lucrative opportunities. Specializing in bulk cargoes, they handled larger volumes at lower (average) costs. Keeling, *Cartels*, p. 196, Note 4.
[6] Based on Woytinsky, pp. 466-67. U.S. Statistical Abstracts, Bureau of Navigation tables. This very rough estimate makes allowance for non-oceanic voyages, for the more intensive use of tonnage by passenger liners (versus tramp freighters), for the additional component of migration through U.S ports other than New York, and for the portion of transatlantic liners used for non-migrant passengers (e.g. tourists).
[7] See Davies, p. 201.
[8] HAPAG annual reports, HAPAG, NDL Archives, Germany.
[9] Hansen, *Immigrant*, p. 194, Chernow, p. 105.
[10] See, for example, U.S. Bureau of Immigration, annual report 1904, pp. 133-34, Nadell, pp. 270-74, Brattne, p. 177.
[11] who more often analyze migration's effects than its underlying causes.
[12] See Gould, pp. 611-13.
[13] See Haws, p. 94, Coleman, *Passage*, pp.236-38, Brinnin, pp. 208-10, Albion, *Port*, p. 348, Hutchins, p. 319.
[14] See Coleman, *Passage*, pp. 23, 68, 73-74, 135, Albion, *Port*, p. 343, Hansen, *Atlantic*, p.181, New York Commissioners of Emigration, annual reports. Ticket prices tended to be a bit higher from the Continent than from Britain, but the markets were linked since many German and Scandinavian migrants took the "indirect" route: going first to England, and then crossing the Atlantic from there. Cf Cecil., pp. 13-14, Hansen, *Atlantic*, p. 194.
[15] See Hyde, p. 64, Bonsor, p. 821, Cecil, p. 18, Barbance, p. 156.
[16] See Table A.6 and, for comparison, Tables A.7 and A.8 below.
[17] Calculations from data in the Cunard archives. Note: "steerage" is roughly synonymous with "third class."
[18] See Thomas, pp. 83, 93-94. Because most costs were fixed and *overall* passenger demand was relatively unresponsive to price cuts, shipping lines were generally eager to support the price-propping international cartels ("conferences") which became increasingly prominent in the years prior to World War I. Cf Keeling, *Cartels,* pp. 196, 199.
[19] See, for example, Jones in Larsen, Coleman, *Passage*, pp. 72-77,178-87, 215-16.
[20] See Moltmann, p. 311, Jones in Larsen, p. 72, Thomas, p. 36.

[21] The passenger cartels were designed principally to stabilize market shares and discourage price wars, and had limited influence upon the overall supply of transport capacity. Keeling, *Cartels*, pp. 198-200, 204.
[22] See, for instance, Brattne, p. 199, Kamphoefner in Hoerder, p. 28.
[23] See Headrick, pp. 24-25, 36, 37.
[24] British and American organizers of steamship mail services in the late 1830s were probably aware that the last major violence between their two nations, the Battle of New Orleans in 1815, took place two weeks *after* the peace treaty had been signed in Europe, while the news thereof was still sailing across the Atlantic. The victorious general in that battle, Andrew Jackson, went on to 8 years in the White House - a stay which had just ended when Samuel Cunard began preparing for discussions with the British Admiralty, concerning their mail contract. These negotiations led to Cunard becoming the first to offer regular transatlantic steam service in 1840. Cunard's first steamer, the wooden paddlewheeeler *Britannia*, required just 14 days to cross the Atlantic that year, on its maiden voyage from Liverpool to Boston with the chief partner himself aboard. See figure A.1. Also see Brinnin, pp. 93-97, Hyde, pp. 3-6, and Bonsor, vol 1, p. 74.
[25] See Haws, p. 94.
[26] See Harcourt, pp. 9-10, Bastin, pp. 38-40, Aldcroft, p. 237, Historical Statistics of the United States. Also see Figure A.2 below.
[27] These calculations are based on the speeds in Table 1 (p. 17), the packet transit times of Albion, *Square Riggers*, and a rough allowance for relative growth of volume on the longer, slower Mediterranean routes after 1890.
[28] The later development of metal-hulled sailing ships was too little (most of the space above water level was still needed for the sails and rigs) and too late. By the 1890s, twin screws had eliminated the need for back-up sails on steamers and sailing ships no longer carried migrants across the North Atlantic.
[29] Moltmann, pp. 311-12, Dillingham Inquiry, Vol 39, p. 362.
[30]See Table A.9. Also Headrick, pp. 21-25, Graham, pp. 82, Bureau of Navigation annual report 1897, p.22.
[31] For example, coal made up 27% of Cunard's ***total*** costs in the 1890s, 26% during 1900-13. The average coal price paid by Cunard was not much different (about 5% higher) in the latter period. See Table A.9, which shows a breakdown of Cunard's ***voyage*** costs on its principal route (coal was 39%).
[32] See Table A.5.
[33] for instance, the noisiness and gearing complexities of screw propellers.
[34]See Figure A.2 below. Further details are in Bonsor. By 1914, Cunard, White Star, and HAPAG had a few vessels powered by turbine engines, but they were not in widespread use on the North Atlantic until after the First World War .
[35] See Cecil, p.22.
[36] See Figure A.2 below.
[37] Comparing the fastest ships of 1873 and 1913 (rather than the average of Table 1) the difference was also three days: 5 versus 8 , instead of 9 versus 12 days in the table (17 versus 12 knots). Bonsor, pp. 1872-73.
[38] One measure of improving energy efficiency is the reduction in *pounds of coal per "indicated horsepower" per hour*. The single cylinder engines on early migrant-carrying steamships of the late 1850s used 4 lbs, the compound engines of the early 1870s needed only about 2 lbs (Smith, p. 174, Davies, p. 178.) Subsequently, improvement continued at a slower pace. Cunard's *Etruria* of 1885 used 1.8 lbs of coal, consumption further declined to 1.4 lbs on White Star's triple-expansion engine *Oceanic* (1899), and HAPAG's turbine-driven *Vaterland* (1914) required only 1.3 lbs. In addition, more streamlined hulls and more effective propulsion meant a lowering of the *horsepower needed relative to vessel size and speed*. The *Vaterland*, for example, was capable of matching the speed of Cunard's *Lusitania* (1907), but to do so needed only 30% more horsepower, even though her gross tonnage was 70% larger. Calculations based on data from Hyde, Seaton, Braynard, Warren.

[39] See the respective passages in Headrick, pp. 23-24, Harcourt, p. 4, G.R. Taylor, p. 118-112, and Hutchins, p. 319.
[40] See Headrick, p. 30, Manning, pp. 217-20. Re why improvements to fuel efficiency were not used to lower passenger fares (as they were to lower freight rates), see Part I of this article.
[41] See Bonsor, pp. 739-40, Murken, pp. 326-29, Kludas vol. 3, pp. 231-32.
[42] See Moltmann, p. 312.
[43] For instance, NDL's *George Washington* of 1909 (with 25,000 gross tons and 18 knots, a bit larger and faster than the 1913 fleet average shown in Table 1) had no fewer than 12 boilers, each 12 to 20 feet high and 15 feet in diameter (Warren, p. 108).
[44] By date of initial deployment ("maiden voyage"); in other words the Cunard, White Star, NDL, HAPAG series "leads" that of Table 2, although this is offset by the beginning and ending points of the time period being a few years earlier than that of Table 2. Source: Bonsor.
[45] Calculations from data of Bonsor, Bureau of Navigation tables. The available net tonnage figures, used to derive these net/gross percentages, cover 55% of the North Atlantic vessels (accounting for 72% of the gross tonnage) of these four lines.
[46] This is corroborated by Lenz, p. 6, Navin and Sears, p. 320, and by the passenger quarters displayed on the deck plans presented in Warren.
[47] See Murken, p. 584. HAPAG was 56%, NDL 77%.
[48] ”Rechtzeitig die Notwendigkeit erkannten, den Stützpunkt unseres nordamerikanischen Geschäfts nicht mehr in der Auswanderung zu suchen. " HAPAG Annual Report, 1896, p. 1, HAPAG Archives.
[49] See Cecil, p. 25.
[50] Annual reports of HAPAG for 1910 and 1896, all routes (not just North Atlantic). Note that these *physical* volumes understate the shift of *revenues* away from freight carriage; Passenger fares rose slightly after 1900 (Kludas, vol. 3, pp. 231-32) while freight rates fell (North. p. 549).
[51] These observations are based on Drechsel, Bonsor, *Transatlantic Passenger Reports*, and data from the Abstracts of Voyages of Accounts, Cunard Archives.
[52] See Figure A.2, and Table 1 (final column: "Tons / Passenger capacity").
[53] described by Brinnin and Coleman, *Liners*, in colorful detail.
[54] Himer, p. 76, referring to turn-of-the century liners of HAPAG: .”.vor allen Dingen, Raum, Raum, und nochmal Raum."
[55] Cf de Mierre, p. 226.
[56] The Dillingham Commission of 1908-11, made famous for its now rather discredited distinction between "old" and "new" immigration, also coined the terms "old" and "new" steerage. Dillingham Inquiry, vol. 37. Also mentioned in Bonsor, Warren. By 1909, "new steerage" was sufficiently widespread that the New York Herald (12 September, 1909, p. 12), in a claim echoed by later maritime chroniclers, concluded that: .”..today, the third class passenger...[travels]...in a style fully as comfortable, as clean, and as desirable as was the second class accommodation of a few years ago on an average steamship."
[57] A higher percentage of berths were devoted to second cabin on the northern routes, but the percentage increased on both the southern and northern routes to and from the United States after the turn of the century. See Murken, pp. 692-97.
[58] See Figure A.1 below, especially the final column thereof.
[59] Keeling, *Cartels,* pp. 202-05. There were undoubtedly regular instances of migrants with medical or other problems taking advantage of the U.S. Immigration authorities' practice of inspecting cabin passengers only cursorily. However, this does not prove a general trend. Most immigrants were healthy, employable young males with little risk of exclusion, and those with problems had other alternatives (e.g. migration via Canada). This can be seen in the annual reports of the U.S. Bureau of Immigration showing statistics of arriving immigrants excluded from entry to America.

[60] Based on data in Bonsor. Calculated from date when vessel was first deployed - simple percentages of official carrying capacities, not weighted by actual entries into U.S. ports).
[61] See Table A.2 below.
[62] See Keeling, *Cartels*, pp. 202-04.
[63] See Table 1 and Figure A.1. Concerning complaints: Jones in Larsen, pp. 75-76, Nadell, pp. 281-83.
[64] Keeling, *Cartels*, p. 197.
[65] All major Atlantic lines did continue to carry mail and some high-value freight throughout the 1850-1914 period. Cf Bureau of Navigation annual reports, Harcourt. While some individual liners and voyages were strongly oriented towards freight carriage, or cabin class travel, or steerage transport, the advantages of price discrimination and seasonal flexibility (in a business so dependent on effective capacity utilization) severely inhibited specialization by an entire shipping line in any of these three revenue categories.
[66] For example, Bonsor, pp. 107, 514, 518, 520-21, 702, 836, 841, Coleman, *Liners*, p. 62.
[67] See Headrick, p. 30, Davies, p. 186, Harley, 1985, p. 179.
[68] See Coleman, Liners, pp. 37, 94-95.
[69] e.g. the immensely popular 1997 film *Titanic*.
[70] See Drechsel, p. 297, Guthrie, p. 182.
[71] Limited hull/ bulkhead protection, insufficient lifeboats, driving full-speed at night through fields of icebergs, etc.. (Coleman, *Liners*, pp. 61-93).
[72] See Baines, p. 39.
[73] Data from U.S. Statistical Abstracts, Cf also Figure A.2 hereof and Keeling, *Cartels*, p. 196. The four ports: Boston, New York, Philadelphia, Baltimore.
[74] Re cyclicality, see Figure A.2, seasonality, Table A.2, return migration, Table 3. Re profits and capital investments, see company annual reports in the archives of Cunard, HAPAG, NDL. These issues are also discussed in Gould, p.615, Keeling, *Cartels*, pp. 201, 205-06., Hyde, pp. 135, 157, Murken, pp. 121-22.
[75] Keeling, *Cartels*, pp. 196-97, 202, 206.

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