NHH

INSTITUTT FOR SAMFUNNSØKONOMI

DEPARTMENT OF ECONOMICS

SAM 05 2016

ISSN: 0804-6824

March 2016

Discussion paper

Shipping in dire straits: New evidence on trends and cycles in coal freights from Britain, 1919-1939

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Shipping in dire straits: New evidence on trends and cycles in coal freights from Britain, 1919-1939 *

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March 30, 2016

Abstract

New monthly freight rate indices for 13 coal trade routes from Britain 1919-1939 are presented. The new indices form the basis of a review of the interwar freight markets and their relationship to the timing and severity of general business cycles. New time series of laid-up tonnage provide the background for this discussion. The Great Depression starting in the autumn of 1929 created a shipping cycle of unusual length and severity. Real freight rate indices used as a cross-check on productivity gains in shipping raise some doubt on previous estimates of productivity growth in British shipping in the interwar years.

JEL Classification: N74,N14,D24

*I am grateful to Bob Castelein for providing me with the *Fairplay* dataset. Helpful discussions on econometric methods with Erik Ø. Sørensen and on shipping economics with Stig Tenold are gratefully acknowledged.

1 Introduction

In the interwar years the British coal export trade was an industry in decline. Coal exports remained well below pre-WWI levels throughout the 1920s and 1930s except during the French occupation of the Ruhr coalfields in 1923. Still, coal freights were by far the most important source of revenue for ships clearing from British ports to other countries. In a survey of British tramp shipping undertaken in 1935, 96.6 per cent of freight revenues from Britain to foreign (non-empire) countries originated from coal freights.[1] In the period 1920-1938 coal accounted for 79.3 per cent of the weight of all British exports.[2] Other low-value bulky goods, such as iron, chemicals, salt and clay, were carried as tramp cargoes at freight rates that to a large extent fluctuated in tandem with coal freights.

The remainder of exports, the more valuable export goods such as textiles and other manufactures, went mostly by liners. The gross tonnage of British cargo liners was approximately equal to that of tramps in 1935, but information on actual liner freight rates is scarce. Freight schedules were set for extended periods in advance in liner conferences, but undercutting of rates was common.[3] Coal freights thus provide the most reliable and comprehensive source of information on outward freight rates.

No separate freight rate indices exist for outward freights. The general freight rate indices which cover the interwar years, including those derived by Isserlis (1938), *The Economist* and the Chamber of Shipping, are to a varying degree computed on the basis of outward freight rates, which are lumped together with inward freights in the construction of aggregate index numbers.[4]

In this paper monthly freight rate indices for 12 outward trade routes from Britain and an index for the UK coastal coal trade are presented, covering the period 1919-1939. The indices are constructed from a database comprising more than 50,000 fixtures of coal freights in this period.

A peculiar feature of these data is the fact that even in this large dataset all individual time series of coal freights from a British port to a specific foreign port have missing observations for some months. Even for such major trade routes as Cardiff to Rouen there are 15 months when no fixtures were recorded; to Buenos Aires, another major route, there are 21 missing observations in the sample of 252 months. This presents a problem for index construction because a way must be found to bridge the gaps in the data. Two approaches to index construction which can tackle this problem in a general manner will be presented and compared here.

The new indices form the basis of a review of the interwar freight markets and their relationship to the timing and severity of general business cycles. The interwar period has been referred to as the 'the troubled years' for the shipping industry.[5] In particular, the years from

[1] See Isserlis (1938, p. 81). In contrast to ships in the liner trade a ship engaged in the tramp shipping trade has no fixed schedule or regular ports of call.

[2] Calculated from data in Sturmey (1962, p. 60).

[3] Isserlis (1938, p. 61), Sturmey (1962, p. 74).

[4] The Economist index is described in the *The Economist*, 21 July 1923, Monthly Supplement, p. 3. Details on the original Chamber of Shipping index were published in the *Statist*, 29 October, 1921, pp. 644-646; a revised version is available from 1937, see Isserlis (1938, p. 78).

[5] Sturmey (1962).

1930 through 1936 were seven lean years for the shipping industry. The Great Depression of the 1930s lasted longer in the shipping markets than for most mainland industries.

Real freight rate indices are also employed as a rough cross-check on productivity growth in shipping in the interwar years. The sample comprises coal freights obtained by both British and foreign vessels. Consequently, such calculations are not specifically confined to British shipping, but should nevertheless be indicative of the productivity performance of the British shipping industry, as about two thirds of coal exports was carried in British ships.[6]

Monthly freight rate indices for 13 trade routes as well as an aggregate outward index are tabulated in the appendix. Annual averages of freights for 50 specific routes from South Wales or the north-east of England are also reproduced in the appendix.

2 The data

The dataset originates from contemporary newspaper reports on actual coal freight fixtures from British ports in the years 1919 through 1939. Seventy-five per cent of the sample comes from *Fairplay*, a leading weekly shipping journal which published a column of 'representative fixtures during the week'. This source has been described in great detail in Castelein (2015). This material contains in principle freight rates and ship sizes for coal and coke shipments from the major British coal ports to all parts of the world. The medium and long distance routes to the Mediterranean and South America are well represented, but the *Fairplay* data source is less comprehensive with respect to short haul freights to Northern Europe. The *Fairplay* data have therefore been supplemented by similar observations from daily newspapers to ensure a better coverage of freight rates to Scandinavia, Baltic, home waters (the Brest-Elbe range), French Bay ports as well as the UK coastal trade.[7]

Some main features of the data are presented in Table 1.

[6] In 1935 the percentage of coal exports carried by foreign ships was 35.2, see Isserlis (1938, p. 85).

[7] The additional newspaper sources include daily issues of *Yorkshire Post and Leeds Intelligencer* and *Hartlepool Northern Mail*. Beginning May 1935 the data coverage in *Fairplay* was expanded to include many more observations of freights to these regions, which made the search for additional data unnecessary after this date.

Table 1: *Freight rate observations and ship size 1919-1939. Index weights.*

Trade route	No. of obser-vations	Average ship size tons	Weights ton-miles 1929	Weights revenue shares 1929
UK Coastal	3,393	2,003	6.2	12.3
Brest - Elbe	9,675	2,054	7.7	13.4
Scandinavia	5,200	2,651	5.4	6.9
Baltic	2,573	2,504	2.0	2.5
French Bay ports	4,387	2,404	1.3	3.3
Spain	2,037	2,747	2.0	3.8
French Mediterranean	3,659	4,148	13.9	16.6
Italy	6,289	5,535	16.4	14.2
Portugal and Atlantic Islands	3,583	3,466	2.7	4.2
Eastern Mediterranean	3,966	5,930	7.9	6.5
South America East Coast	5,594	5,988	30.0	13.8
North America East Coast	1,175	5,237	3.2	1.9
Asia	490	6,301	1.3	0.6
Total	52,126		100.0	100.0

NOTE: A more detailed definition of the various trade routes can be found in the appendix. The data on ship size are in gross tons, extracted from the *Fairplay* sample beginning 1920. The weights in the far-right column reflect relative gross freight revenue shares of coal exports to the various regions in 1929. See text for further details.

The database comprises 52,126 observations distributed on 13 trade routes. These data provide the basis for computing separate monthly freight rate indices for each of the trade routes. The trade routes are chosen with a view to defining regions which are reasonably homogenous with respect to distance, weather conditions and military history. The latter aspect is mainly of relevance regarding the decision to distinguish between Spanish, Italian and French ports in western Mediterranean, because the Italian-Abyssinian conflict in 1935-1936 and the Spanish Civil War 1936-1939 had considerable impact on freight rates. In 1936 there were virtually no freights to Italy due to the sanctions imposed by the League of Nations, and Spanish freights became very scarce in 1937-1939.

It may be noted that the UK coastal trade is included in our calculations. This trade was

dominated by British ships; the foreign market share was only 0.7 per cent in the years 1920-1930. Although in relative decline due to the competition with the railways it was still a fairly large trade, representing 12.3 pr cent of estimated coal freight revenues in 1929.[8]

From Table 1 it will be observed that there is a clear positive correlation between the distance to the export regions and the size of the ships. Coal cargoes to Northern European ports were typically carried in relatively small ships, between 2,000 and 3,000 tons gross, whereas the important coal trade to western Mediterranean ports involved significantly larger ships, in particular to Italy and Egypt, where average ship sizes were a little below 6,000 tons. This was about the same ship size as in the South American trade, which was also of great importance.

Until now nearly all freight rate indices have been calculated as unweighted means of a limited number of freight rates for different trade routes, although an implicit weighting is often achieved by adjusting the number of the various groups according to some notion of 'relative importance'.[9] It may argued that it is more appropriate to employ a weighting scheme that reflects more directly the work that is done by the merchant shipping industry in the various trades. This issue may not be as straightforward as it seems. In February 1939 the Royal Statistical Society discussed a paper on 'The Carrying Trade of British Shipping' presented by Leak (1939). The core issue was how to measure the British share of the world's carrying trade by sea. This was described by the author and discussants, including Dr. Isserlis, as 'a quest for a single figure' that the users of statistics demanded, but it really was a question which the statisticians were loath to answer briefly without lengthy qualifications.[10] One aspect of this issue, which is of relevance to the choice of weights in a freight rate index, is in which units the weights should be measured. Four alternatives were suggested: tons of cargoes, ton-miles, values of the cargoes and the freight earned from the various trades. Leak (1939) seemed to favour the fourth alternative, which is also adopted here.

Table 1 contains two sets of weights, one is ton-miles, which is a conventional measure of the transport work done for example by rail, the other one reflects estimated gross freight earnings from the various trades. The latter measure is constructed by multiplying the quantity of coal exported from Britain to each region by an annual average of freight rates in 1929 from the Tyne or South Wales to three major ports within the region.[11] In contrast to the data used in Isserlis (1938) and Leak (1939) this measure relates to all shipping, both British and foreign. The export volume component is of course the same in both measures, and it may be assumed that relative freight rates to some extent reflect the distance to the port of clearance.

But comparing the two columns of weights in Table 1 it is evident that this relationship is not very close. The North European ports get a higher weight and the long distance routes get a lower weight in the earnings column, in particular South America. The latter observation reflects

[8]The information on the volume of British coastal trade is from Armstrong (1987, 1998).

[9]Some of the major contributions to this literature include Hobson (1914), Isserlis (1938), North (1968), Harley (1988), Harley (1989) and Mohammed and Williamson (2003).

[10]See the discussion following Leak (1939), pp. 257-266 in *Journal of the Royal Statistical Society*, vol 102, 1939.

[11]In order to allocate coal exports to France to the three routes (Brest-Elbe, French Bay, and French Mediterranean) the number of shipments to each region and their average ship size in our sample were calculated for 1929, thus providing a basis for distributing the export volume among the three routes.

the fact that the freight rates to this region were much lower than implied by distance. Outward and inward freights must always be viewed as a joint product, so that a high return freight rate may compensate for a relatively low outward freight. Because of the large grain trade with the River Plate region this was presumably an important factor. Relative freight revenues may also deviate somewhat from ton-miles, as some waters may be more or less easily navigable than a straight-line estimate indicates. Freights may also affected by bad weather, ice, actions of war or expectations of such events. Some ports may be less efficient than others, possibly involving more work for the crew. To the extent that costs of loading or unloading were reflected in the freight rate this fixed-cost element will raise the weights attached to nearby ports, which may go some way towards explaining the higher earnings weights for the nearby ports. The gross earnings weights were consequently preferred to ton-miles, because this measure better reflects the transport work involved.

3 Index methodology

3.1 The special features of the data

There are some features of our data sample that require particular attention regarding the construction of the monthly freight rate indices. Each observation originates from a specific contract (charter) stipulating the freight to be paid for carrying a certain quantity of coal from a port in Britain, say Cardiff, to a port abroad, say Buenos Aires. There are many other details in the contract that our sources do not reveal, such as the time and speed of loading, payment to the shipowner for failure to load or discharge a ship within the time agreed (demurrage), payment of port charges, etc. In many cases the charter party will reflect standardized conditions, so that there is little or no variation between the freight rates of various charter parties fixed at a specific point in time, given the size of the ship. But some fixtures may for example require the ship to start loading on a 'prompt' basis (the details of which may be further specified in the charter), rather than in a month's time, which might warrant a slightly different freight rate. This is one of the reasons that it is not advisable to base the monthly index number of, say, coal freights to South America, on a single fixture for a particular route; in order to reduce sampling error, information from all available fixtures for the same port within the month should be used, if more than one fixture is known.

There are also good reasons for basing the index number on more than one specific trade route from port A to port B. Freight rates to a region depend in general on both the port of loading and unloading, as well as the type of cargo, ship size and various other factors. The relationship between freight rates to individual ports is primarily determined by distance, and to some extent by port facilities, port charges and other fixed elements, but they also reflect factors that may fluctuate over time, such as port congestion and the prospects of obtaining remunerative return cargoes.

A salient feature of a monthly data set of freight rates built along these lines, consisting of freights for carrying goods from port A to port B, is that there will inevitably be many gaps in the time series. This applies even to the most frequently observed combinations of ports. In

our example, South Wales to Buenos Aires, which is among the absolutely most quoted freights, there are quite a few gaps in the series in the early years of the sample. For the less important destinations there are considerably more gaps throughout the sample. In a large sample it is not feasible to circumvent this problem in a straightforward way by interpolating all missing observations or by splicing two or more time series at various points in time.

So, how can these particular features of the freight rate sample be taken care of in the construction of the indices? We suggest two methods to alleviate these problems.

3.2 A repeat sailings index

A type of index extensively employed in the construction of housing price indices, is the *repeat sales* index.[12] One of the key house price indices in the United States, the Case-Shiller home price index, is based on this principle. The repeat sales index has been developed for a market where the price of each object is quoted infrequently and at irregular intervals, which typically characterizes the housing market. The method uses price information on the same house sold at different points in time, which necessitates a very large sample of housing sales to construct an index.

A somewhat similar situation characterizes the ocean freight market: freight quotations for voyages with a coal cargo from port A to port B (referred to here as a *sailing*) are often available only for some months of the year, and there may even be gaps of several years between each time a fixture is observed. In principle this is the same problem as the one encountered in the housing market, but in this case the gaps are in most cases much smaller. For the key sailing routes there may even be extended periods without any gaps. This does not present any problems, because when there are no gaps in the data, this index has the appealing feature of being reduced to an ordinary chain index. But, as argued above, this condition is in general not met in the ocean freight market.

An application of the repeat sales method to freight rate data has previously been made by Klovland (2006, 2008, 2009, 2011) in order to construct monthly indices of ocean freight rates, referring to it as a *repeat sailings index*. It should be noted that in this case the index depends on observations on the same cargo on the same routes; only in rare cases on observations from the same *ship* on the same route, which would be the direct analogue to the repeat sales index applied to the housing market.

Formally, the index is derived from estimating the model

$$\ln(p_{it}) - \ln(p_{i,t-j}) = \gamma_1 D_{i1} + \gamma_2 D_{i2} + \gamma_3 D_{i3} + \ldots + \gamma_T D_{iT} + \varepsilon_{it}$$

where p_{it} is the freight rate of a particular sailing i, say coal from Wales to Buenos Aires at time t; similarly, $p_{i,t-j}$ is the most recently observed freight rate pertaining to exactly the same sailing j months earlier; D represents a set of dummy variables that take on a value of 1 at time t, a value of -1 in month $t-j$ when the last freight rate observation of this particular sailing

[12] The method was first launched by Bailey et al. (1963). The principles of this index are more fully discussed in Shiller (1993).

occurred, and zero elsewhere (so that $D_{it} = 1, D_{i,t-j} = -1, D_{i,t-s} = 0$ for $s \neq 0$ or $s \neq j$); ε_{it} is an error term. The estimates of the vector of γ-parameters can be obtained by standard regression methods. The final stage involves computing the values $X1_t$ of the *repeat sailings index* at time t as

$$X1_t = 100 \cdot \exp(\gamma_t) \qquad t = 1, \ldots T$$

and then rebasing all index values in order to establish a base period value of 100.

Following the suggestion of Case and Shiller (1989) we use a weighted three-step least squares procedure in estimating this model, which gives less weight to observations where there is a long time interval between the observed sailings from port A to port B.

The repeat sailings index offers a number of attractive features. It utilizes much more of the available freight rate information compared with methods that rely on interpolating and splicing data on a few key trade routes. In the sample forming the basis of the repeat sailings index there is no limit to the number of different routes from which information is obtained. The description of each type of sailing can be made very precise, so that the other component of each transaction pair (from which the change in the freight rate is calculated) reflects a charter with exactly the same port of call, cargo and other conditions.

In contrast to the chain index method used by Isserlis (1938) and Mohammed and Williamson (2004) the repeat sailings index not only uses information from the previous month (year in the case of Isserlis), but searches backward until the beginning of the sample is reached for a similar sailing observation. There are thus many 'chains' of unequal length that enter into the index calculation.

3.3 The country-product-dummy method

An alternative approach is the country-product-dummy method (CPD), which was launched by Summers (1973) as a technique to fill gaps in price data in order to obtain a complete set of purchasing power parities for all countries in international comparisons. This method has later been generalized and has gained widespread use as a general method of data aggregation.[13]

In our application of the CPD method it is assumed that the observed freight rates p_{it} depend on the ports of loading and unloading (a *sailing* from port A to port B), and the point in time in which it takes place. This is implemented by constructing a dummy variable for each sailing route, DS_i, taking a value of 1 for the i-th sailing and zero otherwise, and by entering dummy variables for time, DT_t, taking a value of 1 for the t-th month of the sample and zero otherwise. The coefficients on the sailing routes, λ_i, and the time effects, ψ_t, are obtained from the ordinary least squares regression equation

$$\ln p_{it} = \lambda_1 DS_1 + \lambda_2 DS_2 + \ldots + \lambda_S DS_S + \psi_1 DT_1 + \psi_2 DT_2 \ldots + \psi_T DT_T + u_{it}$$

where p_{it} is a freight rate on sailing route i in period t, and u_{it} is an error term which is assumed to be independently and identically distributed.[14]

[13] Rao (2005), Diewert (2005).

[14] Note that, due to the fact that there may be more than one observation for the i-th sailing in period t, this

The modification to the original setup of the CPD method is that we have substituted S sailing routes for commodities and T periods of time for countries. In the original framework, cf. Rao (2005), the observed price of commodity i in country j, P_{ij} was modelled as depending on the price of the i-th commodity relative to a numeraire good and the purchasing power parity of the currency of country j (relative to a benchmark currency). The corresponding regression model is then

$$\ln P_{ij} = \pi_1 D_1 + \pi_2 D_2 + \ldots + \pi_N D_N + \eta_1 D_1^* + \eta_2 D_2^* \ldots + \eta_M D_M^* + u_{ij}$$

where D_i are the N commodity dummy variables and D_j^* are the M country dummy variables. u_{ij} is a random disturbance term. In contrast to the original problem we are not primarily interested in filling the gaps in the price (freight rate) data, but rather in the estimated values of the ψ_t coefficients which reflect the time effects. In analogy with the repeat sailings method the index value in period t is computed as

$$X2_t = 100 \cdot \exp(\psi_t) \qquad t = 1, \ldots T$$

and then normalized relative to a benchmark period.

3.4 An empirical comparison of the index methods

Both methods rely on estimating models with time dummies, from which the index number series can be derived. The CPD-method basically uses information on the relative price (freight rate) structure within each particular month to pin down the coefficients on the time dummy variables. The repeat sailings index, on the other hand, uses its memory of freight rates for the same sailing in previous months for the same purpose. The theoretical relationships between the error terms may be rather intricate and difficult to interpret in an intuitive manner; in any case, our concern here is more directed towards the issue of how these methods work out empirically.

In order to get some idea of the performance of these two methods the two index number series derived from one particular trade route, the UK coastal trade are shown in Figure 1. A further comparison can be made with the most frequent route within this trade, the Tyne to London route, which accounted for 23 per cent of the sample observations. The sample period is from January 1919 to December 1939. Note that there are no data for the period May through October 1926 due to the nationwide miners' strike in Britain.

The two dominating features of this graph are the very significant decline in freight rates from the beginning of 1920 through 1921 and the steep rise from September 1939, the latter emanating from wartime disruptions. Between these two extreme periods the indices and the Tyne-London rate produce much the same pattern of major cycles in this period, with cycle peaks in 1923, 1929 and 1937. The depressed state of the market in the first half of the 1930s is also common to all series. The short-run fluctuations are fairly similar, but there is a slight tendency for the two indices to drift apart during certain time periods, most notably in 1925-1928

model does not correspond to a standard panel data setup. The model is estimated by ordinary least squares after selecting an arbitrary time dummy variable as numeraire to avoid perfect multicollinearity.

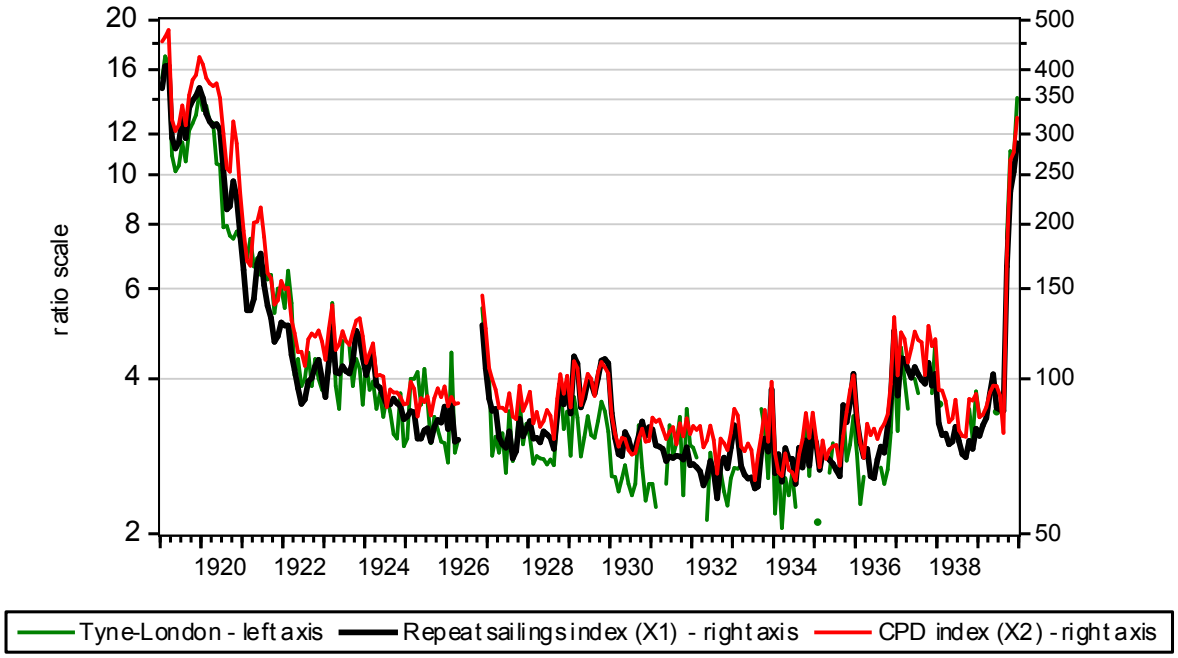

Figure 1: *Nominal freight rate indices for UK coastal trade (average of 1929=100) and Tyne-London freight rates, 1919-1939.*

and in the middle of the Great Depression 1931-1933.[15] The rates of change during the sample period, excluding the abnormal first and last years, from January 1921 to December 1938, are quite close, however, being about minus 4 per cent per year for both the repeat sailings index and the CPD index.

Although a single 'representative' route, such as the Tyne-London route, mimics the more comprehensive indices fairly well, we see that there are some notable differences. The London series is more volatile than the indices, and even in this case there are quite a few missing observations. In this study we report the index numbers originating from the repeat sailings index, but on the basis of the test reported above we anticipate that the resulting data series would in broad terms be quite similar with the use of the alternative CPD method.

4 The index numbers

Figure 2 shows the indices for North European trades, UK coastal, Home waters (Brest-Elbe range), Scandinavia and the Baltic. These indices are shown with the averages for 1913 set equal to 100.[16] The decline in nominal freight rates from January 1920 to the middle of 1922 is even

[15]Note that the averages of the 12 monthly values of the data series in 1929 are both set equal to 100.

[16]Freights to Scandinavian ports were sometimes quoted in local currencies (Danish or Norwegian krone or Swedish krona), and freights to French ports on the Atlantic south of Brest and the Mediterranean were mostly stipulated in French francs. These freight rates have all been converted to pound sterling at the monthly average exchange rate.

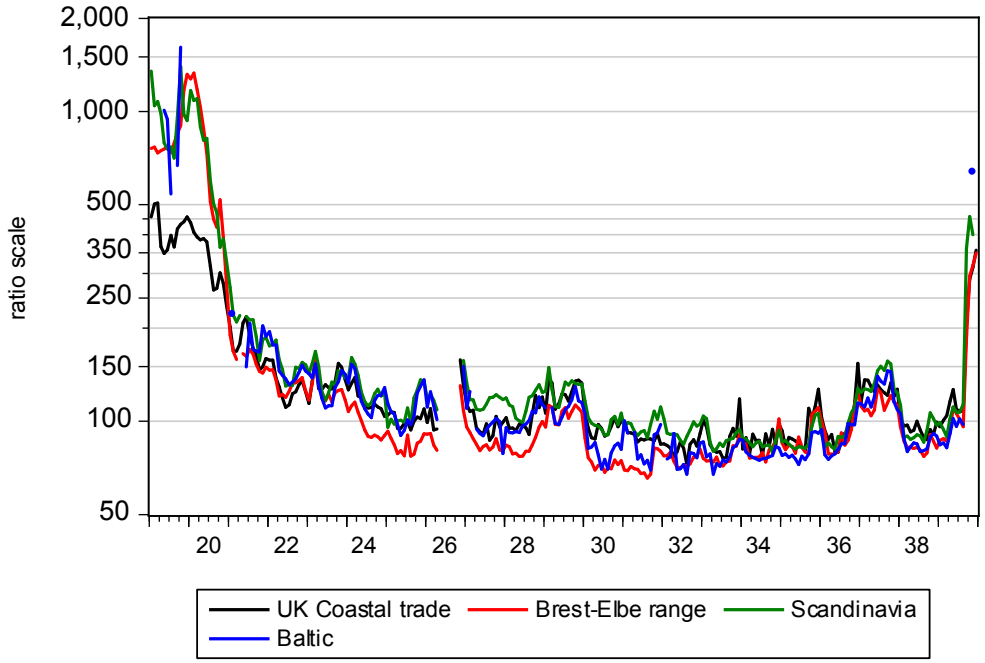

Figure 2: *Nominal freight rate indices for north European trade routes (average of 1913=100), 1919-1939.*

more dramatic for the Brest-Elbe and Scandinavian routes than for the UK coastal trade that was highlighted above. In the case of Brest-Elbe range the index number fell from well above 1,300 early in 1920 to about 160 in the middle of 1922. There is a similarly dramatic fall in the Scandinavian index. For the Baltic route the data are patchy until June 1921, but the few quotations available indicate the same pattern in this case.

The huge wartime increase in freight rates had brought these rates to unprecedented heights, and, after a short interlude of somewhat lower rates after the Great War ended in November 1918, there was a renewed expansion in the second half of 1919 during the postwar restocking boom.[17] Even taking into account the steep fall in the general price level from 1920 to 1922, which equalled approximately 50 per cent, this is a clear indication of how severe the collapse in the freight market was in 1920-1921.[18] As an example of the huge decline in freight rates in this period it may be noted that the freight rate for coal from the Tyne to Copenhagen, which had been (in decimal terms) 5.2 shillings on average in 1913 was quoted at 63 shillings in March 1920, subsequently falling to 7 shillings in September 1921.[19]

The rest of the 1920s are characterized by short and relative mild cycles, interrupted by the coal strike in 1926. When coal shipments were resumed towards the end of the year freight rates were temporarily raised relative to the level before the labour dispute paralyzed the coal trade,

[17]For data on the wartime freight markets, see Klovland (2016).

[18]The Board of Trade wholesale index number (Capie and Collins (1983, p. 32)) fell from a peak of 196 in April and May 1920 to a fairly constant level of about 96 in the first half of 1922.

[19]See also the annual averages of coal freights for most important routes in the appendix.

but soon fell back again. It is evident from Figure 2 that the shipping market was in a depressed state throughout much of the 1930s. It was only in 1937 that a more persistent improvement set in, coinciding with the general business cycle expansion.

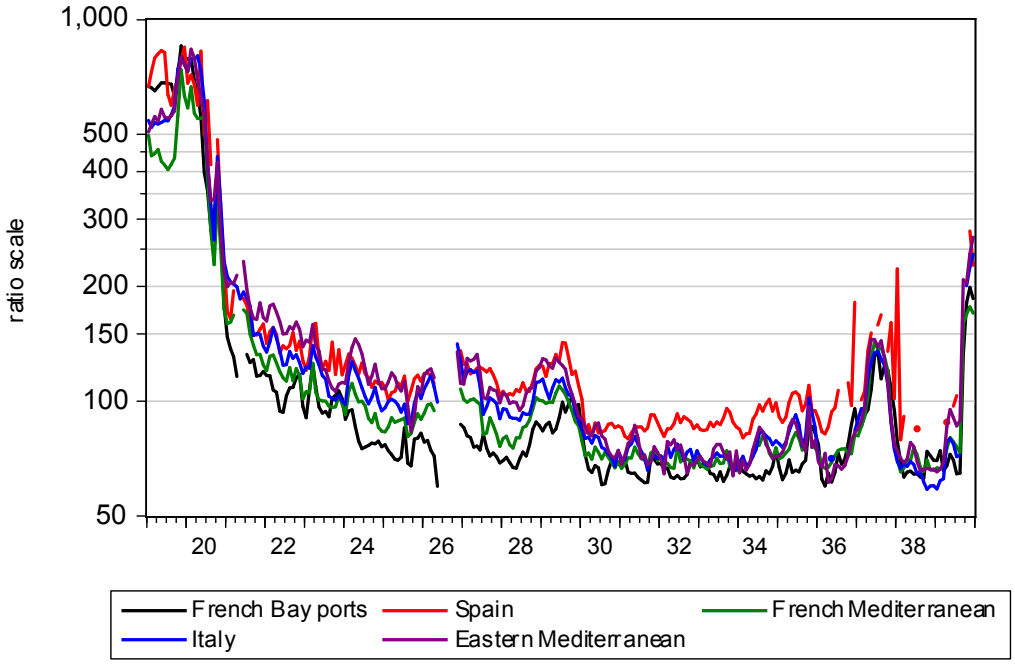

Figure 3: *Nominal freight rate indices for south European trade routes (average of 1913=100), 1919-1939.*

In Figure 3, where the indices for coal freights to Southern Europe are depicted, we see much the same pattern as for the North European trades. Freights were falling steeply to 1922, hovering around this level during most of the 1920s. The impact of the Great Depression is in this case very marked; in 1930 freights shifted downwards by about 30 per cent, a level which is largely maintained until the 1937 boom. The eastern Mediterranean routes, basically Port Said and Alexandria, were particularly depressed. The Abyssinia conflict caused a cessation of coal shipments to Italy in 1936, and the Spanish Civil War made quotations for Spanish ports quite irregular from 1936, otherwise the index numbers for the various southern routes are quite synchronized.

A largely similar picture is given by the indices for Atlantic and Far East routes shown in Figure 4. The South America and Atlantic Islands (Madeira, Canary Islands and Cape Verde) routes, the latter also comprising Portugal and Western African ports, were the most important ones. A notable feature is the marked downward shift in freight rates to South American ports relative to the level in 1913. The coal trade with North America was less active, but from the middle of 1922 coal shipments to Canadian ports and the U.S. Northern Range did take place on a fairly regular basis. Freights relating to the long-distance trade with the Persian Gulf, East Indian and Chinese ports were rather few and the available freight rates provided a less reliable

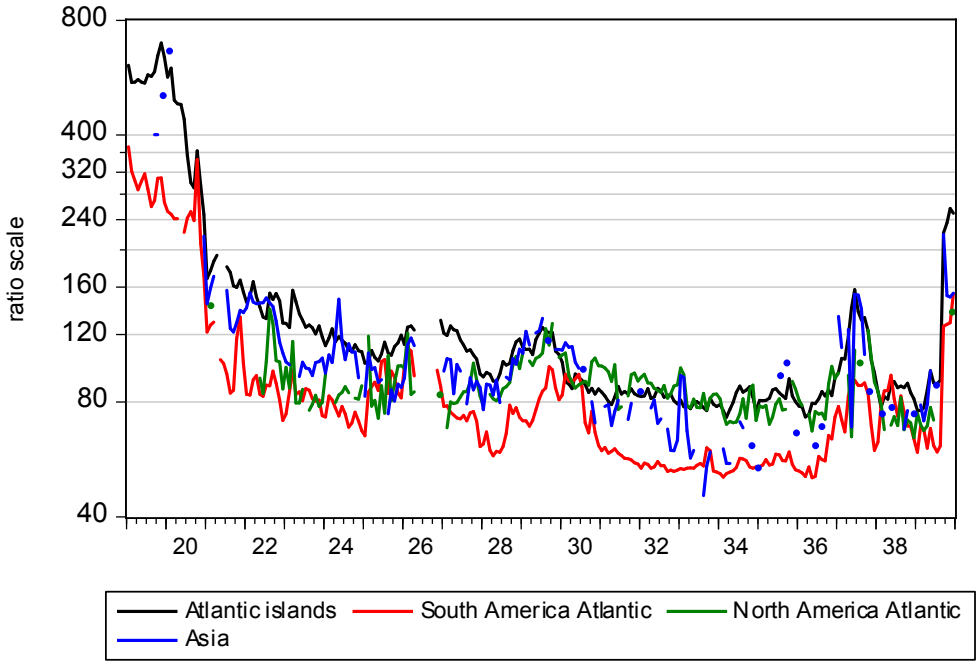

Figure 4: *Nominal freight rate indices for Atlantic and Far East trade routes (average of 1913=100), 1919-1939.*

basis for constructing an index during some periods.

5 A closer look at freight rates in the 1930s

Some features of the nominal coal freight indices for the various trade routes in the 1930s are shown in Table 2. The index values for 1929, with 1913=100, are shown in the first column. Average index values for the lean years 1930-1936 and the rate of change from the 1929 peaks are shown next. As seen from the graphs above, freight rates in these years were relatively steady at a low level, presumably close to long-run marginal costs, with only some short periods of temporary buoyancy towards the end. Accordingly, the averages for 1930-1936 can be viewed as representative of the level during the shipping depression of the 1930s.

The proportion of coal exports carried in British ships in 1935 is also shown in the far right column, computed from data in Isserlis (1938). Coal exports to the eastern seaboard of South and North America and the Eastern Mediterranean (mainly Egypt) and the French Mediterranean were the routes in which British shipping had a market share of above 50 per cent. To Northern Europe, however, in particular Scandinavia and the Baltic, foreign shipping dominated the trade.

Table 2: *Index numbers for the various routes 1929 and 1930-1936 (1913=100), percentage carried by British ships.*

Trade route	Index average in 1929	Index average 1930-1936	Percentage change from 1929 to 1930-1936	Percentage carried by British ships in 1935
UK Coastal	124.0	90.7	-31.2	99.3
Brest - Elbe	106.0	80.0	-28.2	37.8
Scandinavia	128.4	92.4	-32.9	11.3
Baltic	110.8	81.1	-31.2	17.9
French Bay ports	92.0	67.7	-30.7	45.6
Spain	125.9	91.1	-32.3	33.0
French Mediterranean	99.2	71.8	-32.3	50.6
Italy	105.7	75.4	-33.8	41.4
Portugal and Atlantic Islands	115.0	82.9	-32.7	46.5
Eastern Mediterranean	117.2	74.6	-45.1	60.4
South America East Coast	81.5	59.2	-31.9	66.5
North America East Coast	109.6	84.6	-26.0	71.3
Asia	117.2	74.9	-44.7	26.5
Total	106.8	77.1	-32.5	38.0

NOTE: The calculations regarding the percentages of the volume of exports of coal carried by British ships in 1935 are in some cases approximate only because the underlying data, taken from Isserlis (1938, p. 85) are not sufficiently detailed to ensure a unique distribution among the various trade routes as defined here. The same principles as used for the index weights are employed, see Appendix A. The figure for the UK coastal trade, based on Armstrong (1998), applies to the period 1920-1930. The index numbers in the final row refer to the total weighted index; the percentage carried by British ships is for total coal exports, thus excluding the coastal trade.

In the peak year of 1929 freight rates in most trades had risen above the prewar level (all indices have 1913 as base year), but on average only by 6.8 percentage points.[20] The UK coastal trade did seemingly well in 1929 as far as freight rates are concerned, but the volume carried by coasters was far below the prewar quantity. The net registered tonnage of ships entering UK

[20]This is nevertheless a more favourable outcome than in the case of inward routes, which, according to the Economist index, only stood at 96.8 in 1929.

ports in the coasting trade with cargoes fell from 34,759 tons in 1913 to 24,021 tons in 1929.[21] Two other routes also did well in 1929 compared with 1913; Scandinavia and Spain. In both cases this may have been due to a relatively good performance of the economies. The Great Depression came late to Norway and Sweden — in 1929 and parts of 1930 economic activity was still high in these countries.[22] Being on on a silver standard, Spain largely escaped the deflationary impulses from the gold standard.[23]

A peculiar feature of Table 2 is the uniform decline in freight rates from the 1929 peaks to the average level in the depression years 1930-1936. Irrespective of the level in 1929 a decline slightly in excess of 30 per cent is seen across nearly all trade routes; only the Eastern Mediterranean and the eastern seaboard of North America stand out, with a decline of 45 per cent.

The behaviour is thus quite similar across the routes, the dismal state of affairs was present everywhere. But there are some routes which performed somewhat worse than others: South America and French Bay ports had registered a significant decline already in 1929 relative to 1913 and did not fare any better in the 1930s. The coal trade with Egypt, which dominated the Eastern Mediterranean route, was not bad in 1929, but fell more than the other routes during the depression. Looking at the percentage carried by British ships it emerges that these were all trades in which British ships had a large market share. The North America trade is an exception, but the volumes exported were quite small in this direction.

Sturmey (1962) has reviewed the various reasons for the poor performance of the British tramp shipping industry in the interwar years. Some factors were beyond the control of the shipping industry, such as the relative decline of Britain in world trade and the subsidy and preferential policies of other countries. The trend of coal exports from Britain was also in decline in the interwar years, depriving British shipping of employment in which it had a natural advantage. Other causes originated within the industry, 'a failure of enterprise and a lack of flexibility' according to Sturmey (1962, p. 81). It is also the case that Britain obviously lagged behind in technological development, in particular concerning investment in ships using diesel propulsion.

So, can the fact that coal freights in the trade routes, in which British shipping had the largest market shares, also were the routes which exhibited the largest decline during the Great Depression bring in an additional factor to the list of British misery in interwar shipping? From the evidence in Table 2 this proposition may at first glance seem have some foundation. Freight rates were in general relatively low compared to prewar levels in trades dominated by British ships. South America, in particular, but also French Bay ports and French and Eastern Mediterranean were trades in which British shipping was important and in which rates had fallen most compared to 1913.

But, as stated previously, the interrelatedness of inward and outward freights imply that looking at outward coal freight rates alone does not provide conclusive evidence in this matter. If, say, grain freights from South America were maintained on a higher level than other inward trades this would compensate for the low coal freights to Brazil and the River Plate. In want

[21] Armstrong (1998).
[22] Klovland (1998).
[23] Martín-Aceña et al. (2012).

of a representative inward freight rate index for the various trade routes this issue cannot be firmly decided at this stage. However, evidence from comparing individual shipping freights in the South American homeward trade (grain from River Plate to UK) with other key homeward rates do not indicate any particular buoyancy in the South American homeward trade. Average annual rates for the years 1930-1936 (1913=100) were 92 for grain from the River Plate to the UK and 106 for similar cargoes from Rosario.[24] For the East Mediterranean homeward trade (cotton from Alexandria to London) the index number is 110; wood from Miramichi and other Canadian ports to Bristol gives an index of 96, and Spanish iron ore freights, represented by Bilbao to Cardiff, is 121, all relative to 1913=100. Consequently, the evidence seems to rule out the possibility that the low outward coal freights to South America were compensated by relatively high return freights. Thus, we may possibly have identified another case of dead weight in the British carrying trade in the interwar years. Whether this was just bad luck or whether there were mechanisms on the supply side of British shipping that resulted in low earnings from this trade is an issue that may warrant further attention.

6 Aggregate indices

6.1 Aggregate nominal freight rate indices

There are two other monthly freight rate indices for tramp shipping covering the interwar period, encompassing both outward and inward routes: The *Economist* Index of Shipping Freights and the Chamber of Shipping Voyage Freight Index.[25] Both are shown in Figure 5 as rebased time series with the average of the index for 1913 set equal to 100. Both indices are derived as a fixed-weight index of quotations from a limited number of trade routes. It emerges from the graph that the two indices give very much the same picture of the course of freight rates during the interwar years.

A widely used index of tramp shipping freights is the annual index constructed by Isserlis (1938), which extends back to 1869. This index is derived from the mean of the highest and lowest rates for each year for a varying number of inward and outward routes, with data taken from the annual reports of the broker firm of Angier.[26] Isserlis (1938, p. 79) himself warned against relying too much on using high-low averages to represent the true annual average freight rate, particularly in years of huge fluctuations in rates such as 1920. The same argument was put forward by several of his critics following the reading of his paper before the Royal Statistical Society in December 1937.[27] The most interesting remark was made by Mr. E. A. V. Angier, from which firm the data originated, stating that 'The Angiers had never been able to convince themselves that there was any satisfactory way of ascertaining average rates of freight which could be applied universally. Most outward coal freights treated by the method used by Dr.

[24] Annual average freight rates for a number of key shipping freights can be found in Statistics Norway (1949).

[25] The data on The Economist index are taken from Capie and Collins (1983), the Chamber of Shipping from Pigou (1947) and Statistics Norway (1949).

[26] These data were published in *Fairplay*. The 1920 volume of *Fairplay* contains all the reports of previous years, beginning in 1869.

[27] *Journal of the Royal Statistical Society*, 1938, pp. 135-146.

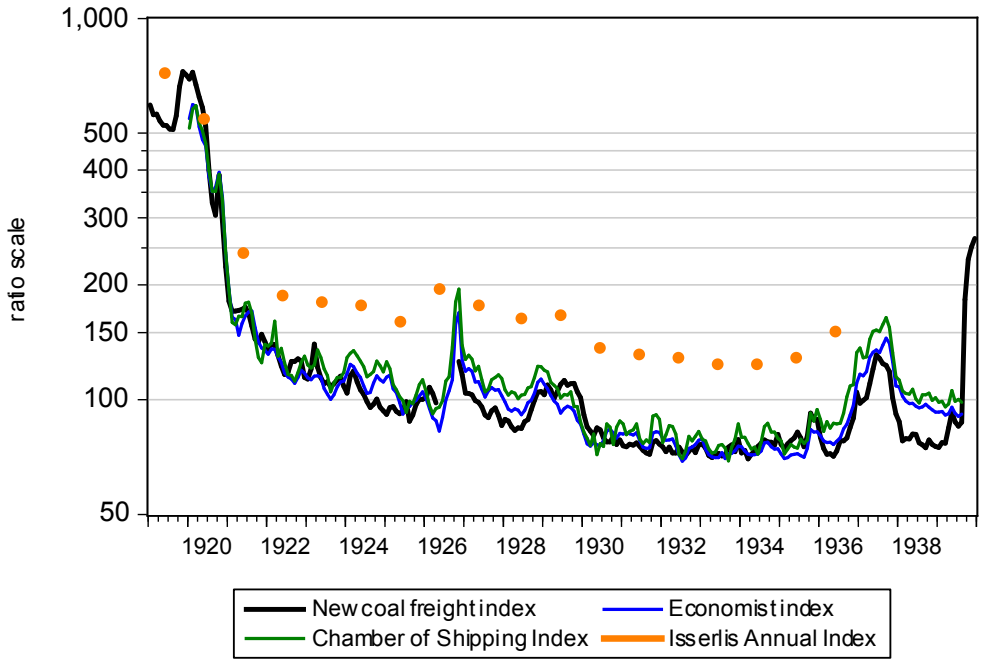

Figure 5: *Aggregate nominal freight rate indices (average of 1913 = 100), 1919 - 1939.*

Isserlis would yield results approximating the truth, but almost no homeward freights.' The annual Isserlis index numbers are shown in Figure 5 as orange dots, assigned to June of each year in the graph.

The thirteen subindices for the various coal trade routes estimated by the repeat sailings method were weighted together to form an aggregate outward coal freight index, using revenue shares in 1929 as weights as reported in Table 1.[28] The new index is shown in Figure 5.

It is important to note that these three established indices all comprise both outward and inward freight routes. In the monthly Economist index 14 out of the 28 routes are outward coal freights. The Isserlis (1938) annual index is an unweighted index of a varying number of homeward and outward coal freights; in 1929/1930 there are 38 homeward and 23 outward observations. Deviations between the new coal freight index and the contemporary indices may therefore be due to different behaviour of inward and outward freight rates, but there might also be some impact of using different data samples and methods of index construction, which must be borne in mind when comparing these indices.

The *Economist* and Chamber of Shipping indices share with the coal freight index the steep

[28] As can be seen from the tabulation of the monthly index values in the appendix, there are a few gaps in the individual indices. These were filled by linear interpolation before aggregating the data. The series for the Baltic only begin in June 1921 and North America is not included until May 1922. There are several alternative ways of treating the missing data, one of which would be to disregard the missing observations and reduce the sum of weights accordingly. This was done by Isserlis (1938, p. 92) in the monthly Chamber of Shipping index discussed above, but it was pointed out by one of his discussants that this might lead to arbitrary fluctuations in the index numbers, see *Journal of the Royal Statistical Society*, 1938, pp. 138. In addition to Italian ports in 1936 and Spanish ports in 1937-1939 this problem basically arises for trade routes with low weights in the index.

decline in the first half of the 1920s. Using average values for the year 1913 as a common basis, it appears that coal freights were less buoyant than inward freight rates in the second half of the 1920s.[29] Coal freights were at times even more depressed than the averages of outward and inward routes during the 1930s, particularly from 1936 onwards. This observation is a reminder that using inward freights or total indices as representative of outward freights is problematic for the 1930s.

This decade was a dismal period for the shipping industry, in particular this applied to the revenues from coal freights from Britain. This point has been forcefully made by Armstrong (1998), who argued that the existing indices gave a biased and conflicting view of the course of freight rates relevant to coastal trade in the 1920s. From Figure 5 it will be seen that the annual Isserlis index deviates substantially from the other indices in the interwar period, showing much higher figures than the other indices.[30] Whereas the Isserlis index is 51 per cent above the 1913 level in 1936, the last year for which this index was published, the new coal freight index is on average 20 per cent below the 1913 level in 1936. The Economist index is closer to the coal freight index, being 15 per cent below the level of 1913.[31] These results cast doubt on the reliability of the Isserlis index in the interwar years. Even if a comprehensive index has not yet been constructed for both inward and outward trades the quite similar long-run behaviour of the *Economist* index, in which one half of the weighting refers to inward routes, and the new coal freight index, indicates that the Isserlis Index grossly underestimates the decline in freight rates in the interwar period. It may therefore be suggested that discussions of the shipping industry in the interwar years should avoid using the Isserlis index for comparisons of pre-WWI and post-WWI freight rates.

6.2 Deflated freight rate indices

Because of the great fluctuations in the general price level in the interwar years, particularly in the early 1920s, it may be asked to what extent the nominal freight rate indices reflect general price movements. A further reason to look at a real freight rate index, i.e. a nominal index deflated by a general price index, is to get some information on productivity gains in shipping from 1913 to the interwar years, although this evidence is very indirect and imprecise, as explained below.

Figure 6 shows the new coal freight index and the *Economist* total index deflated by the Board of Trade wholesale price index.[32] Apart from the brief but very severe 1920-1921 cycle, which was very dominant also in real terms, both real indices are fairly constant during the interwar years, hovering around 70, i.e. a fall of about 30 per cent in real terms from 1913. The main exceptions are the boom years, 1929 and 1937, and, of course, the onset of WWII.

[29]The Chamber of Shipping index only begins in 1920. It was shifted to a 1913 basis by applying the same rate of change as the *Economist* index between 1913 and 1920.

[30]Mohammed and Williamson (2004) also found that the Isserlis index understated the fall in freight rates in the interwar period.

[31]The Chamber of Shipping index, as presented here, is 4 per cent below, but this figure rests on the assumption that it behaved like the Economist index between 1913 and 1920.

[32]The unadjusted price series reproduced in Capie and Collins (1983, p. 32) was seasonally adjusted by the X11 method and converted to a 1913=100 basis using the information in Mitchell and Deane (1971, p. 477).

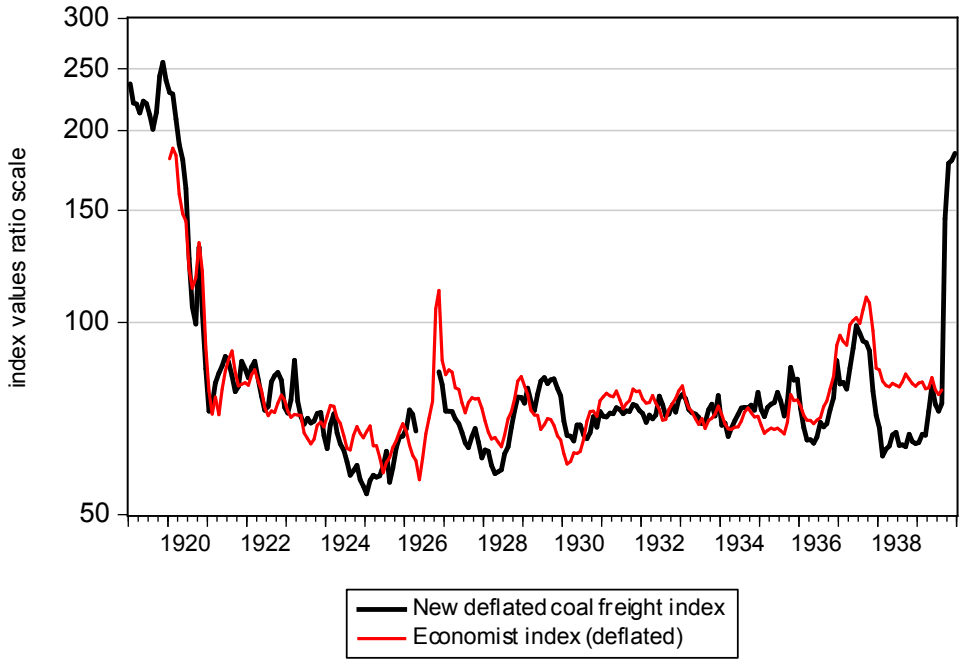

Figure 6: *Aggregate real freight rate indices 1919-1939 (average of 1913=100).*

There is virtually no trend movements in these time series between 1922 and 1938. Regressing the log of the real coal freight index on a linear time trend yields a coefficient of 0.1 per cent per year. The corresponding estimate for the Economist index is 0.6 per cent per year, but neither estimate is significantly different from zero. Thus, this evidence leads to the conclusion that *trend* values of real freight rates, after having fallen by about 30 per cent from the prewar years, showed no further change after 1922.

7 Nominal and real shipping cycles

The nominal and real freight rate cycles shown in Figure 7 for the years from 1919 to 1928 are constructed by taking the difference between the actual values (in logs) and estimated trend values of the series.[33] Also shown here is a seasonally adjusted time series on the net tonnage of British and Norwegian vessels laid up.[34] In July 1932, at the time when the idle tonnage was at its highest, 17.9 per cent of the tonnage of British and Norwegian ships was laid up,

[33]Trend values were estimated by applying a Hodrick-Prescott filter to the series. The smoothing parameter lambda was set equal to 140,000, which ensures flexible but rather smooth trend series.

[34]The Norwegian data can be found in Statistics Norway (1949). The series is interpolated between half-yearly figures 1920-1924, quarterly 1925-1929. Beginning 1930 the data are monthly. The British data are quarterly, beginning in January 1920, taken from various issues of *The Economist*, *Fairplay* and *Brassey's Naval and Shipping Annual*, supplemented by Helander (1928). The data were seasonally adjusted and converted from quarterly to a monthly series by straight line interpolation in the 1920s. For the 1930s the procedure suggested by Litterman (1983) was employed, using the Norwegian data as a related monthly series. Data in the last quarter of 1920 were interpolated, assuming no laid-up tonnage prior to November 1920.

accounting for 34.2 per cent of the world's known laid-up gross tonnage.[35] Because information on the world's laid-up tonnage is not wholly complete this percentage may correspond roughly to the two nations' share of actual world gross tonnage, which was 30.6 per cent, thus being fairly representative of the dismal situation in world shipping in the early 1930s.

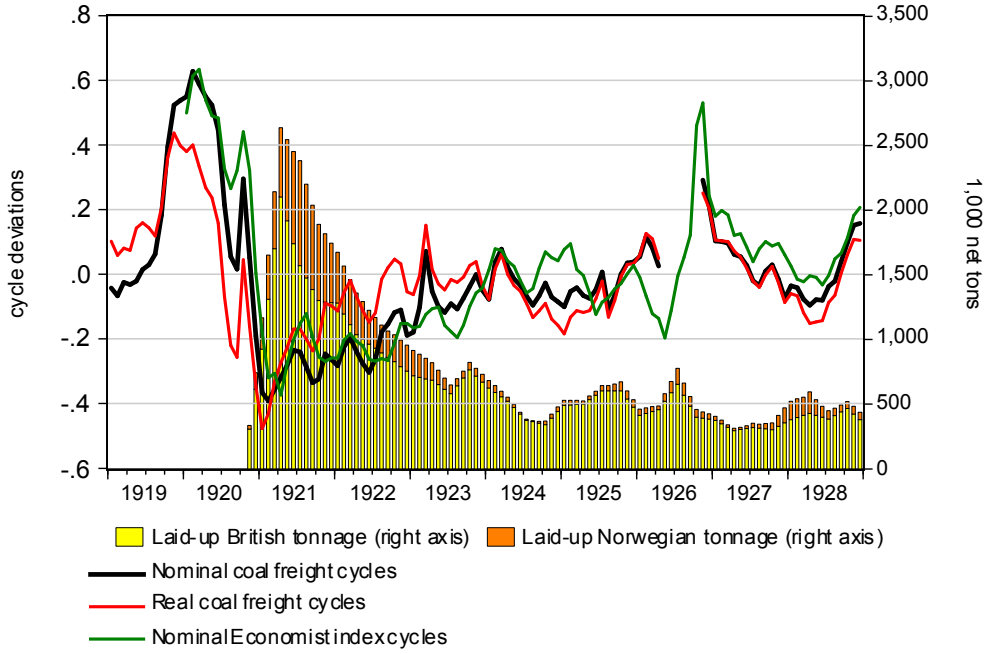

Figure 7: *Shipping cycles, January 1919-December 1928.*

The nominal 1920 shipping cycle peaked in February or March and reached a trough a year later.[36] The deflated coal freight cycle follows much the same pattern as the nominal cycle, but the turning points occur 1 to 3 months earlier. The nominal *Economist* index coincides well with coal freights. The 1920 business cycle emanated from the international postwar restocking boom that followed the dismantling of controls on trade flows after WWI. It is characterized by a worldwide surge in economic activity and price inflation from the middle of 1919 until some months into 1920, thereafter there was an extremely steep decline, which brought about a short but unusually severe depression in 1921.[37] The shipping cycle nearly coincides with the turning points for the British economy determined by the National Bureau of Economic Research (peak in March 1920, trough in June 1921).[38]

But there were special features in the shipping world which added to the severity of the cycle. Port facilities were in still in disarray after the Great War and port congestion was a serious problem which contributed to the inefficiency of shipping.[39] Shipbuilding activity had

[35] League of Nations (1933a).
[36] Fayle (1927, pp. 371-391) and Aldcroft (1961) present good surveys of this shipping cycle.
[37] See Eichengreen (1992, pp. 107-124) for an account of the international business cycle.
[38] Zarnowitz and Moore (1986).
[39] Aldcroft (1961).

been geared up during the final stages of the war as a response to the losses of merchant shipping to submarine warfare in 1917, getting a further impetus from the high postwar freight rates. Once the restocking demand for import goods had culminated, the demand for shipping services began to shrink, while the supply of carrying capacity continued to expand month by month. The intersection of demand and supply shifted downwards with unprecedented speed, leaving nominal freight rates in the spring of 1921 at one fourth of the level a year earlier. Ship prices followed the same pattern.

In addition to these developments the British coal industry had not yet recovered from the wartime disruptions. Exports of coal in 1920 were only 38 per cent of the 1913 figure. Labour disputes in the coal mining industry led to a further reduction in output in 1921.

The tonnage laid up responded to the slump in freights by a lag of a few months, reaching a peak about the middle of 1921.[40] Thereafter idle tonnage declined gradually, but at a slow pace due to the severity of the depression. Only in the middle of 1923 did laid-up tonnage reach a more normalized level, which was maintained until 1928. In these years world trade and the world's merchant fleet grew steadily and produced no great cyclical fluctuations in freight rates.[41] The protracted miners' strike in Britain in 1926 led to some irregularities in freight rates. Inward rates rose appreciably, partly because of the fact that coal for European destinations to some extent had to be brought from the United States, which required more carrying capacity. But there is also a general business cycle effect from expanding world trade. Freight rates fell through 1927 and until the spring of 1928, leading to a slight increase in laid-up tonnage.

Figure 8 extends the shipping cycle picture to the summer of 1939. This period contains the mother of all business cycles, the Great Depression, following the cycle that peaked in 1929. The peak of the coal freight cycle is in the late summer or early autumn of 1929, corresponding exactly to the turning point of the business cycles in the United Kingdom and the United States.[42] The *Economist* index, on the other hand, leads the downturn by 7 or 8 months, peaking as early as December 1928. This probably reflects the weakness of the world's commodity markets at the time.[43]

Laid-up tonnage rose rapidly in 1930 following the collapse of freight rates, reaching an unprecedentedly high level for a sustained period. Some reduction took place beginning 1934, more due to scrapping of old tonnage than to more remunerative freight rates. The years from 1930 through 1936 were indeed seven lean years for the shipping industry.

It is interesting to note that there were two short-lived episodes of nascent buoyancy in the coal freight market, late in 1934 and in the second half of 1935. In both episodes there was a marked decrease in laid-up tonnage. The Coal freight index held up better than the total *Economist* index in 1934-1935, but slumped again in the spring of 1936. No relief was forthcoming until June 1936, when a real shipping boom materialized in connection with the worldwide marked business cycle expansion. For the first time since the fabulous 1920 boom

[40] It is difficult to pin down the exact month of the peak of laid-up tonnage in 1921 because the underlying data are quarterly and half-yearly in this year.

[41] See e.g. Stopford (2009, p. 116) for an illustration of the course of world trade and merchant fleet in 1920s.

[42] These were July and August 1929 for the UK and United States, respectively, according to the NBER (Zarnowitz and Moore (1986)).

[43] See League of Nations (1933b) for evidence on production and prices prior to the Great Depression.

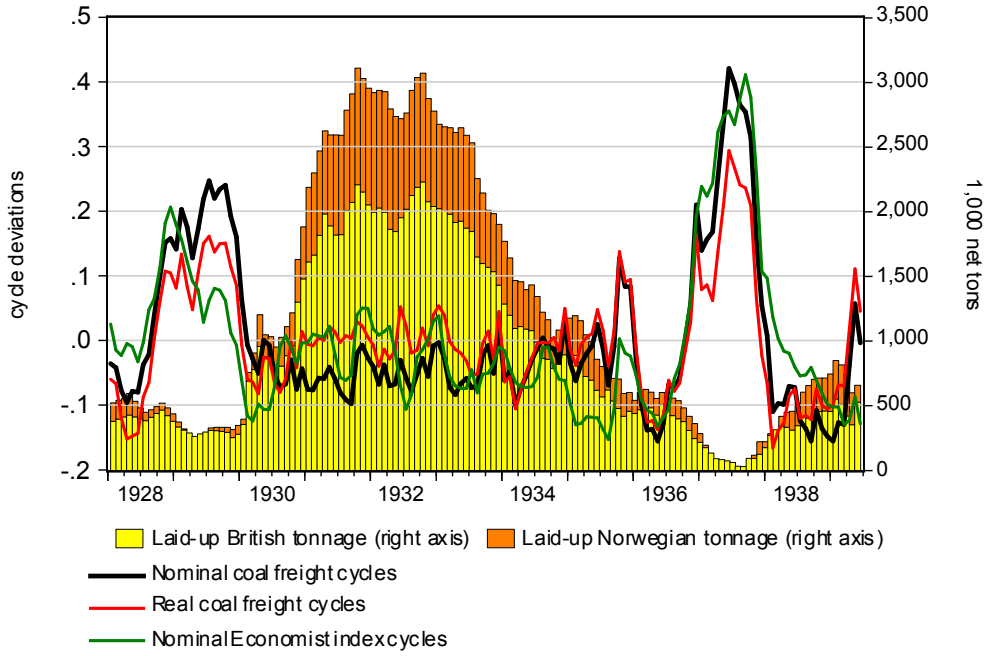

Figure 8: *Shipping cycles, January 1928-June 1939.*

very little tonnage was unemployed and nominal and real coal freights rose to a level that had not been seen since early in 1922. Freight rates fell steeply again from the summer of 1937, when the business cycle expansion was over, and 1938 was once again characterized by idle capacity and low freight rates. In the spring of 1939 coal freights increased again, but the subsequent fluctuations are so intertwined with the coming of the war that normal cyclical relationships were no longer to be expected.

8 The timing of real shipping cycles and business cycles

The close connection between shipping cycles and business cycles in the interwar period is evident from the discussion above. What can be said about the timing of these cycles in general? Figure 9 relates real shipping cycles to the timing of general business cycles in Britain. The business cycle turning points are derived from the monthly estimates of British industrial production for the years 1920 to 1938 in Mitchell et al. (2012).[44] The peaks and troughs of the business cycle computed here largely correspond to those determined for Britain by the National Bureau of Economic Research, being mostly within three months of the latter, except for 1920, when the

[44]Turning points were determined from a detrended series of 3-month averages of monthly industrial production with the help of the Bry and Boschan (1971) algorithm as implemented in RATS, version 9. Visual inspection was applied to determine the peak at the beginning of the sample (June 1920) and the trough at the end (September 1938). Two minor cycles in the 1930s were discarded. Industrial production was preferred to real GDP, which is also available in Mitchell et al. (2012) because the cyclical pattern is somewhat more pronounced in the former series.

NBER peak is in March in contrast to July here.[45]

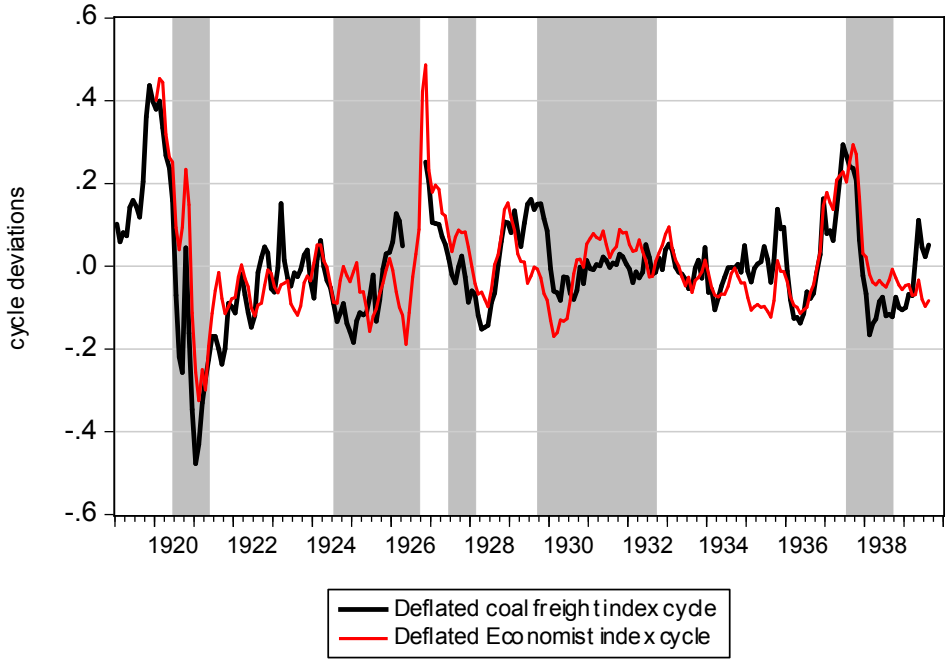

Figure 9: *Shipping cycles and British business cycles, January 1919-August 1939. Business cycle recessions are shaded.*

A glance at Figure 9 reveals that there is general tendency for freight rates to fall during business cycle recessions and to rise in expansion periods, although this pattern does not fit equally well to all cycles. The main exception is the 1924-1926 recession, when coal freights in particular were relatively buoyant. It should be borne in mind, however, that this cycle is very much influenced by the negative business cycle impulses in Britain created by the strong currency appreciation connected with the resumption of the gold standard at the prewar gold parity of pound sterling in 1925.[46] Another idiosyncratic factor is the unprecedented labour dispute in Britain in 1926. Ocean freight rates, on the other hand, largely depended on world economic conditions, which were fairly good in the mid-1920s.

The procyclicality of ocean freight rates is a well established empirical regularity.[47] World

[45]The business cycle peaks identified here are June 1920, July 1924, June 1927, September 1929 and July 1937; the troughs are May 1921, September 1926, February 1928, August 1932 and September 1938. The NBER turning points can be found in Moore and Zarnowitz (1986). The early dating of the peak of the postwar restocking boom of 1919-1920 in the NBER files is also criticized by Mitchell et al. (2012), who suggest August 1920 on the basis of GDP data. It should be added however, that it is not clear whether the NBER used a classical (data in levels) or a growth cycle (detrended) concept in determining the turning points, see Romer (1994). The latter measure is used here.

[46]Broadberry (1984).

[47]This was observed before WWI by Isserlis (1938), Meuldijk (1940) and Tinbergen (1959). The latter study was published in Dutch in 1934. Additional evidence from the nineteenth century and the years before WWI is presented in Klovland (2004). The more recent experience is reviewed in Stopford (2009). In an empirical study of the oil market Kilian (2009) has even employed a deflated index of shipping freights as the preferred variable

economic activity is the major driver of the demand for ocean transport, and the preponderance of demand shocks is the reason that a strongly positive correlation of freight rates and the business cycle is generally observed.

However, there is more to the story of shipping cycles than the straightforward transmission of demand shocks. Shipbuilding is largely procyclical, but due to decision lags and the time it takes to build new ships, the shipbuilding cycle may follow the business cycle with a substantial lag in time. A further supply factor impinging on freight rates is the process of scrapping old ships, which is accentuated as periods of freights at or below long-run marginal costs linger on. Therefore supply shocks complicate the timing of the relationship between freight rates and economic activity.

Figure 9 illustrates nicely how the interplay of these forces worked out in the interwar shipping markets. Let us first look at business cycle expansion periods. The effects of a high demand for shipping services increase freight rates as the economic activity is expanding. In the later stages of the expansion, when practically all idle tonnage has been recommissioned, the supply curve may become very steep, so that further positive demand shocks lead to substantial freight rate increases. But at this late stage of the expansion period it is also likely that new ships enter the market at a higher frequency than before, thus exerting a downward pressure on rates. In general, therefore, it may be expected that the peak of the freight rate cycle comes near or a little before the peak of the business cycle. This is in fact largely what is observed from Figure 9. Freight rates peak well ahead of the business cycle in 1920 and 1927, partly also in 1929, while the turning point is more coincident in the 1937 cycle. Interestingly, the *Economist* index, which comprises homeward rates as well, turned down many months before the onset of the Great Depression, whereas the coal trade index remained at a high level right until world economic activity collapsed in the autumn of 1929. Accordingly, freight rate indices often, but not always, seem to behave as leading indicators with respect to the course of the business cycle.

Turning to business cycle recessions it seems that the cyclically lowest values of freight rates coincide fairly well with the troughs of the business cycle. This is observed in 1921, 1926 and 1928, and a bit more ambiguously in 1938. It may be noted from Figure 7 and Figure 8 that, with the exception of 1921, these turning points were characterized by a relatively small volume of idle tonnage. In such cases positive shocks to demand are readily converted into freight rate increases. The Great Depression, however, represents, as is often the case, a peculiar exception. When the economy turned upwards again in the late summer or autumn of 1932 in Britain, in March 1933 in the United States, there was a huge reserve of laid-up tonnage. World production posted significant gains in the coming years, albeit from a very low level, but world trade was slow to regain any momentum due to the proliferation of trade restrictions. The volume of world trade, rose by 10 per cent from 1932 to 1935, but was then still 18 per cent below the 1929 level.[48] As noted above, the freight rate indices bounced back several times in 1935-1936 after it looked as if a revival was about to come, each time held back by a rush of entries from the vast pool of laid-up tonnage. By 1936 recommissioning and scrapping of old ships had reduced

representing worldwide real economic activity.

[48] League of Nations (1937, p. 68).

the idle tonnage to more normal levels and freight rates again responded to positive demand shocks.

9 Productivity growth in the shipping industry

There is a large literature which employs real freight rates as measures of productivity growth in shipping.[49] This dual approach is often seen as a complement to the direct approach of measuring total factor productivity as output growth minus a weighted average of growth rates of input factors. It may therefore be of some interest to compare briefly the real freight rate series in Figure 6 with the direct productivity estimates for British shipping in Broadberry (2006, pp. 220-230).

However, some caveats should be mentioned before making this comparison. The first point is that such calculations should be made on the basis of total real freight rate indices, rather than outward coal freights alone. The outward and inward legs of a voyage are best considered as a joint product, so that a relatively low freight on the outward part can be compensated by a relatively high freight on the inward part.[50] This pricing mechanism was frequently observed in the freight market; there are numerous instances in which the weak outward freight rates are explained by the buoyancy of the homeward fixtures.[51] This is a valid point in general, in particular for studying short-term cycles. However, here the focus is on trend values, and it may be observed that the trends in real coal freights and the real *Economist* index are very much the same. The second point to be made is that our use of a wholesale price index is a shortcut for a weighted index of input prices, comprising ship prices, wages, port charges and coal prices. A problematic feature of this approach is that reliable information on ship prices and port charges may be difficult to obtain. A further complication is that the cost shares of these input factors may vary considerably between the various trade routes. Consequently, as pointed out by Harley (1988), such calculations should be made for specific trade routes rather than for aggregate indices.[52] A final point is that the use of real freight rate series for this purpose should take care to eliminate the extreme values of the shipping boom periods in calculating the trend values of the real freight rates series. The freight rate data use 1913 as the benchmark year, which was a relatively good year for shipping, although decidedly less remunerative than the very prosperous year 1912. Still, using a longer run of prewar data might have reduced the estimated fall in real freight rates between the prewar and the postwar era to the extent that the 1913 freight rates were above the trend value, as is in fact suggested by the Economist index.

Various profitability calculations made by Vergottis et al. (2010) show that there were signif-

[49] North (1958), North (1968), Walton (1967), Harley (1988), Mohammed and Williamson (2004), van Zanden and van Tielhof (2009).

[50] Harley (1989).

[51] In the report on the freight market in *Fairplay* 30 April 1936, p. 186, it was stated that 'even the slight improvement in outward values to South America has not been held, owners succumbing to lower rates in this direction immediately the homeward market began to show signs of some life.'

[52] From the analysis of the profitability of the Northern European coastal coal freight market in Vergottis et al. (2010) it emerged that there is considerable uncertainty about the level of port charges and handling costs in the coal trade. It is likely that this cost factor may be quite significant in short haul freight markets, but it is sometimes neglected in the analysis of long-distance trades, cf. Mohammed and Williamson (2004).

icant productivity gains in the Tyne to London steamer trade in the half century before WWI, chiefly due to economies of scale and improvements in port efficiency. The total factor productivity estimates in Harley (1988) and Mohammed and Williamson (2004) show that there were large productivity gains in long-distance trades as well. With a further rise in ship size, improvements in ship building and mechanization of port handling we would expect to see a solid productivity gain between pre-WWI and the 1920s. Broadberry (2006, p. 222) found that total factor productivity in British shipping rose from 102.9 in 1911 (1924=100) to 109.6 in 1929, implying a productivity gain of about 6.5 per cent from prewar conditions towards the end of the 1920s. This is considerably lower than the estimate derived from the real freight series, which indicate an increase in productivity from 1913 to 1928-1930 of around 30 per cent, taking a 3-year average to attenuate the influence of the 1929 boom. Assuming that 1929 was on par with 1913 as representing reasonably full employment of resources would have reduced the fall in real freights to 22 per cent in the case of coal freights, but hardly makes any change in the case of the real *Economist* Index. Mohammed and Williamson (2004) have estimated TFP growth between the years 1909/11 and 1932/34 for two routes, one of which is roughly in line with the thirty per cent productivity increase suggested here (UK - Alexandria), the other being significantly higher (UK - eastern seaboard of North America). These results are difficult to reconcile with those of Broadberry (2006). Moreover, Broadberry's estimates show that all of the productivity increase took place between 1921 and 1929. In contrast, the freight rate calculations presented here imply that all of the productivity gains had materialized by the early 1920s, with no further gains in this decade, which is in line with the results obtained by Mohammed and Williamson (2004). For the 1930s, however, the correspondence between the calculations is good, both approaches show that there was little or no change in productivity in the shipping industry in this decade.

It should be recalled that the productivity calculations in Broadberry (2006) are specifically based on British data. The freight fixtures underlying the freight rate indices derive in part from foreign-owned shipping. This should be of little concern regarding the revenue side of the calculations, however, because of the competitive nature of the shipping trade; the freight rates obtained by British shipping could not deviate notably from the market rates. Substituting factor input costs for a general price index might entail more national differences, though.

Such discrepancies between primary and dual approaches to measuring productivity growth in shipping are not unique, as witnessed by the study of productivity change in early Dutch shipping by van Zanden and van Tielhof (2009). The real freight rate calculations can only be interpreted as suggesting that there might be a puzzle here, more definite conclusions must await the construction of broader total freight rate indices comprising both outward and inward routes for both the prewar and postwar years. In addition more specific estimates of factor costs must be ascertained, but this is beyond the scope of the present study.

10 Some concluding remarks

The new monthly coal freight indices presented here provide a firmer basis for studying the interwar shipping market in more detail. The application of the repeat sailings index method, similar to the repeat-sales method well known from the housing market, allows for using data on freight fixtures originating from all combination of ports. The traditional indices are often restricted to data from a few 'representative' trade routes, often encountering problems with gaps in the data series and entailing consequent ad hoc procedures for splicing the data series.

The indices presented here give broadly the same aggregate picture of freight rate fluctuations in the interwar years as the monthly *Economist* and Chamber of Shipping indices. It appears that the warning given by Armstrong (1998) against relying too much on the widely used Isserlis (1938) annual index for the interwar period is warranted. The latter underestimates the fall in nominal freight rates between the pre-WWI years and the interwar period, at least regarding coal freights.

In the interwar years there were significant structural changes in the world fuel trade, as the coal trade was shrinking and the trade in petroleum products expanded. With the relative decline in coal exports some of the competitive advantage to British tramp shipping from providing outward cargoes for British ships was therefore negatively affected. This concerned in particular the long-distance trades in which Britain held a strong position before WWI. In the short-haul trades in coal, in which exports did not decline as much, the market share of British shipping was considerably lower.[53] In addition to these adverse affects we have also identified a tendency for coal freights to show the largest and most persistent decline in the trades in which British shipping held the strongest position at the outset.

The most severe shipping cycle in the interwar period in terms of amplitude was created by the collapse of the post-WWI restocking boom early in 1920. Freight rates fell like a stone and laid-up tonnage very rapidly soared to unprecedented levels. This cycle differs in character from the shipping cycle associated with the Great Depression starting in 1929. The 1920 cycle was short and unusually severe, but the recovery was fast and well sustained, beginning in the summer of 1921. The salient feature of the 'mother of all cycles' starting in 1929 is its persistence. Just as for aggregate business cycles it looked like an ordinary cycle to begin with. The decline in nominal as well as real freight rates was smaller than in the 1920 and 1937 cycles, but the recovery phase never seemed to materialize. In the shipping market the crisis conditions, as evidenced by the huge laid-up tonnage, lingered on longer than in many other sectors of the economy. Coal freight rates as well as inward freight rates did not reach their lowest point until the middle of 1936, nearly four years after the world economy had begun growing again.

Many general economic factors may account for the long duration of this cycle, not least the retardation of world trade following the Great Depression, but some effects may also derive from government policy towards the shipping industry and conditions within the industry itself. Government subsidies to shipping, which traditionally had taken the form of such measures as subsidies to mail routes, discriminating port dues and reservation of coasting trade to domestic

[53] Sturmey (1962, pp. 62-63).

shipping, were now extended to operating, construction and various forms of indirect subsidies and undertaken on a large scale in nearly all leading countries.[54] In 1935 a scheme of operating bounties was introduced for British tramp shipping, but it was abolished when freight rates rose again in 1937. A particular problem was the large American fleet built during WWI which crowded out much foreign shipping, partly with government support, in the very important North Atlantic trade. Although primarily a feature of the liner trade, some international initiatives to fixing rates above the market clearing level were also made in tramp shipping in the 1930s.[55] All these measures may have may have contributed to prolonging the shipping slump of the 1930s.

[54]See Calvin and Stuart (1925), Fayle (1933) and Sturmey (1962).

[55]One example is provided by the Schierwater Plan, which aimed at cartelization of the oil tanker market in 1934. See Sandvik and Storli (2011).

References

Aldcroft, D. H. (1961). Port Congestion and the Shipping Boom of 1919-20. *Business History*, 97–106.

Armstrong, J. (1987). The Role of Coastal Shipping in UK Transport: An Estimate of Comparative Traffic Movements in 1910. *Journal of Transport History*, *8*, 164–178. Reprinted in John Armstrong (ed.), The Vital Spark. The British Coastal Trade 1700-1930, Research in Martime History, no. 40, St. John's, Newfoundland, 2009.

Armstrong, J. (1998). Climax and Climacteric: The British Coastal Trade, 1870-1930. In Starkey, D. J. and A. G. Jamieson (eds.), *Exploiting the Sea: Aspects of Britain's Maritime Economy since 1870*, 37–58. Exeter. Reprinted in John Armstrong (ed.), The Vital Spark. The British Coastal Trade 1700-1930, Research in Martime History, no. 40, St. John's, Newfoundland, 2009.

Bailey, M. J., R. F. Muth and H. O. Nourse (1963). A Regression Method for Real Estate Price Index Construction. *Journal of the American Statistical Association*, *58*, 933–942.

Broadberry, S. (2006). *Market Services and the Productivity Race, 1850-2000: British Performance in International Perspective*. Cambridge University Press, New York.

Broadberry, S. N. (1984). The North European Depression of the 1920s. *Scandinavian Economic History Review*, *32*, 159–167.

Bry, G. and C. Boschan (1971). *Cyclical Analysis of Time Series: Selected Procedures and Computer Programs*. Technical Paper 20. National Bureau of Economic Research, New York.

Calvin, H. C. and E. G. Stuart (1925). *The Merchant Shipping Industry*. John Wiley & Sons, New York.

Capie, F. and M. Collins (1983). *The Inter-War British Economy: A Statistical Abstract*. Manchester University Press, Manchester.

Case, K. E. and R. J. Shiller (1989). The Efficiency of the Market for Single-Family Homes. *American Economic Review*, *79*, 125–137.

Castelein, R. B. (2015). The Fairplay freights: Compiling a dataset of interwar coal freight rates. *International Journal of Maritime History*, *27*, 302–327.

Diewert, E. (2005). Weighted Country Product Dummy Variable Regressions and Index Number Formulae. *Review of Income and Wealth*, *51*, 561–570.

Eichengreen, B. (1992). *Golden Fetters: The Gold Standard and the Great Depression, 1919–1939*. Oxford University Press, Oxford.

Fayle, C. E. (1927). *The War and the Shipping Industry*. Oxford University Press, London.

Fayle, C. E. (1933). *A Short History of the World's Shipping Industry*. George Allen & Unwin, London.

Harley, C. K. (1988). Ocean Freight Rates and Productivity, 1740-1913: The Primacy of Mechanical Invention Reaffirmed. *Journal of Economic History*, *48*, 851–876.

Harley, C. K. (1989). Coal Exports and British Shipping, 1850-1913. *Explorations in Economic History*, *26*, 311–338.

Helander, S. (1928). Die internationale Schiffahrtskrise und ihre weltwirschaftliche Bedeutung. Tech. Rep. 42, Schriften des Instituts für Weltwirtschaft und Seeverkehr an der Universität Kiel, Jena.

Hobson, C. K. (1914). *The Export of Capital*. Constable, London.

Isserlis, L. (1938). Tramp Shipping Cargoes, and Freights. *Journal of the Royal Statistical Society*, *101*, 53–134.

Kilian, L. (2009). Not All Oil Price Shocks Are Alike: Disentangling Demand and Supply Shocks in the Crude Oil Market. *American Economic Review*, *99*, 1053–1069.

Klovland, J. T. (1998). Monetary Policy and Business Cycles in the Interwar Years: The Scandinavian Experience. *European Review of Economic History*, *2*, 309–344.

Klovland, J. T. (2004). Business Cycles, Commodity Prices and Shipping Freight Rates: Some Evidence from the pre-WWI period. Unpublish manuscript, Norwegian School of Economics, Bergen. [Paper presented at Workshop on Market Performance and the Welfare Gains of Market Integration in History, Florence, Italy].

Klovland, J. T. (2006). A Repeat Sailings Index of Ocean Freight Rates for the 1850s. Discussion paper SAM 40, 2006, Norwegian School of Economics and Business Administration.

Klovland, J. T. (2008). The Construction of Ocean Freight Rate Indices for the Mid-Nineteenth Century. *International Journal of Maritime History*, *20, No. 2*, 1–26.

Klovland, J. T. (2009). New evidence on the fluctuations in ocean freight rates in the 1850s. *Explorations in Economic History*, *46*, 266–284.

Klovland, J. T. (2011). A great hundred years of timber freights, 1757-1876. *Research in Maritime History*, *46*, 1–28.

Klovland, J. T. (2016). Navigating through torpedo attacks and enemy raiders: Merchant shipping and freight rates during World War I. unpublished manuscript (forthcoming), Norwegian School of Economics, Bergen.

League of Nations (1933a). *Statistical Year-Book of the League of Nations 1932/33*. Geneva.

League of Nations (1933b). World Production and Prices 1925-1932. Geneva.

League of Nations (1937). World Production and Prices 1936/37. Geneva.

Leak, H. (1939). The Carrying Trade of British Shipping. *Journal of the Royal Statistical Society*, *102*, 213–257.

Litterman, R. D. (1983). A Random Walk, Markov Model for the Distribution of Time Series. *Journal of Business and Economic Studies*, *1*, 169–173.

Martín-Aceña, P., E. Martínez-Ruiz and P. Nogues-Marco (2012). Floating against the Tide: Spanish Monetary Policy, 1870-1931. In Ögren, A. and L. F. Øksendal (eds.), *The Gold Standard Peripheries: Monetary Policy, Adjustment and Flexibility in a Global Setting*, 145–173. Palgrave Macmillan, Basingstoke.

Meuldijk, J. (1940). Der englische Schiffbau während der Periode 1870-1912 und das Problem des Ersatzbaues. *Weltwirtschaftliches Archiv*, *52*, 524–549.

Mitchell, B. R. and P. Deane (1971). *Abstract of British Historical Statistics*. Cambridge University Press, London.

Mitchell, J., S. Solomou and M. Weale (2012). Monthly GDP estimates for inter-war Britain. *Explorations in Economic History*, *49*, 543–556.

Mohammed, S. I. S. and J. G. Williamson (2003). Freight Rates and Productivity Gains in British Tramp Shipping 1869-1950. Working Paper 8631, NBER, NBER.

Mohammed, S. I. S. and J. G. Williamson (2004). Freight rates and productivity gains in British tramp shipping 1869-1950. *Explorations in Economic History*, *41*, 172–203.

Moore, G. H. and V. Zarnowitz (1986). The Development and Role of the NBER's Business Cycle Chronologies. In Gordon, R. J. (ed.), *The American Business Cycle: Continuity and Change*, 735–779. University of Chicago Press, Chicago.

North, D. (1958). Ocean Freight Rates and Economic Development 1750-1913. *Journal of Economic History*, *18*, 537–555.

North, D. C. (1968). Sources of Productivity Change in Ocean Shipping, 1600-1850. *Journal of Political Economy*, *76*, 953–970.

Pigou, A. C. (1947). *Aspects of British Economic History 1918-1925*. Macmillan, London.

Rao, D. (2005). On the Equivalence of Weighted Country-Product-Dummy (CPD) Method and the Rao-System for Multilateral Price Comparisons. *Review of Income and Wealth*, *51*, 571–580.

Romer, C. D. (1994). Remeasuring Business Cycles. *Journal of Economic History*, *54*, 573–609.

Sandvik, P. T. and E. Storli (2011). Confronting market power: Norway and international cartels and trusts, 1919-39. *Scandinavian Economic History Review*, *59*, 232–249.

Shiller, R. J. (1993). *Macro Markets*. Clarendon Press, Oxford.

Statistics Norway (1949). *Statistiske oversikter 1948 (Statistical Survey 1948)*. Statistics Norway, Oslo.

Stopford, M. (2009). *Maritime Economics*. Routledge, London and New York, 3rd edn.

Sturmey, S. G. (1962). *British Shipping and World Competition*. Athlone Press, London. Reprinted as Research in Martime History, no. 42, St. John's, Newfoundland, 2010.

Summers, R. (1973). International Price Comparisons Based upon Incomplete Data. *Review of Income and Wealth*, *19*, 1–16.

Tinbergen, J. (1959). Tonnage and Freight. In *Jan Tinbergen Selected Papers*, 93–111. North-Holland, Amsterdam. [Originally published in Dutch in De Nederlandsche Conjunctur in March 1934, pp. 23-35.].

van Zanden, J. L. and M. van Tielhof (2009). Roots of growth and productivity change in Dutch shipping industry, 1500-1800. *Explorations in Economic History*, *46*, 389–403.

Vergottis, A., W. Homan-Russell, G. Hui and M. Voutsinas (2010). Recreating the profit and loss account of voyages of the distant past. In Grammenos, C. T. (ed.), *The Handbook of Maritime Economics and Business*, 259–316. Lloyd's List, London.

Walton, G. M. (1967). Sources of Productivity Growth in American Colonial Shipping, 1675-1775. *Economic History Review*, *20*, 67–78.

Zarnowitz, V. and G. H. Moore (1986). Major Changes in Cyclical Behavior. In Gordon, R. J. (ed.), *The American Business Cycle: Continuity and Change*, 519–572. University of Chicago Press, Chicago.

A Appendix: Trade routes

UK coastal All UK ports, of which by far the largest share is represented by London.

Brest-Elbe All French ports *to the north-east of* Brest, all Belgian, Dutch and German North Sea ports.

Scandinavia All Danish, Norwegian and Swedish ports. Also including a few fixtures to Iceland and Finnish ports in Upper Gulf of Bothnia north of Wasa.

Baltic All German and Russian ports from Flensburg to St. Petersburg and Finnish ports up to and including Wasa.

French Bay ports French ports in the Bay of Biscay from Brest to Bayonne.

Spain Both Atlantic and Mediterranean Spanish ports.

French Mediterranean French Mediterranean, Algerian and Tunisian ports.

Italy All Italian ports, including Trieste.

Portugal and Atlantic islands Portugal, Gibraltar and West African ports from Tangier to St Paul do Loando (Angola), Canary Islands, Madeira, Azores and Cape Verde Islands.

Eastern Mediterranean Non-Italian Adriatic ports, Greece, Black Sea, Turkey, Egypt and North Africa east of Tunisia, including Malta and Cyprus.

South America East All ports on the eastern seaboard of America south of the United States, but largely dominated by Rio de Janeiro and River Plate.

North America East Eastern seaboard of the United States and Canada.

Asia From Suez and eastwards, mainly Aden, East Indian and Chinese ports.

Pacific Australia and western seaboard of North and South America. These observations are not included in the aggregate index.

Table A1. Coal freight rate indices monthly 1919 - 1939

1913 average = 100

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVR
1919													
UK coastal	456	503	506	366	349	358	398	365	418	432	441	457	420.7
Brest-Elbe range	761	767	735	747	757	771	737	790	851	899	1169	1317	858.4
Scandinavia	1351	1045	1077	985	791	756	768	708	961	1397	978	935	979.3
Baltic					1009	944	542		669	1614			∗ 955.7
French Bay ports	670	663	651	667	683	683	680	678	627	716	854	783	696.2
Spain	667	731	794	813	831	821	636	596	657	707	783	848	740.2
French Mediter.	497	440	446	456	425	416	404	418	434	561	739	631	489.0
Italy	544	522	536	532	538	545	543	563	594	743	800	762	601.7
Atlantic Islands	610	549	550	559	551	547	576	570	587	646	697	640	590.2
Eastern Mediter.	507	532	557	541	582	555	551	560	577	705	798	764	602.4
S America Atl.	373	322	304	288	303	317	289	260	269	308	309	267	300.6
Asia									401	401		515	∗ 439.1
INDEX	593.2	558.7	561.5	537.9	524.4	524.0	512.5	511.0	555.8	661.7	726.0	710.6	581.4
INDEX SA	608.2	555.8	549.5	527.9	512.0	513.4	531.7	533.9	591.4	654.1	678.9	716.0	581.1
1920													
UK coastal	437	407	393	385	389	379	316	265	269	301	279	236	338.1
Brest-Elbe range	1274	1332	1177	1034	880	735	511	449	423	519	393	278	750.5
Scandinavia	1169	1085	1101	893	807	820	596	503	471	364	388	328	710.5
French Bay ports	790	792	692	641	556	398	356	284	302	411	278	179	473.2
Spain	681	716	676	596	827	500	613	416		484	313	230	∗ 550.2
French Mediter.	587	666	569	551	551	561	383	279	228	341	251	174	428.4
Italy	734	790	787	804	734	613	421	327	265	437	330	233	539.5
Atlantic Islands	568	599	494	484	481	440	354	300	291	364	295	248	409.8
Eastern Mediter.	730	836	794	697	628	565	423	335	339	423	275	220	522.1
S America Atl.	253	248	241	242		222	243	252	239	345	208	171	∗ 242.2
Asia		667										218	∗ 442.4
INDEX	693.5	722.9	669.8	621.4	584.1	521.3	399.3	328.1	304.5	388.6	294.3	223.0	479.2
INDEX SA	712.3	718.5	653.5	609.3	572.5	513.9	413.1	341.6	321.9	384.1	276.3	225.4	478.5

NOTE: Asterisks (∗) denote cases where the annual averages in the far right-hand column are based on less than 12 monthly observations. Gaps in individual series have been interpolated before computing the aggregate INDEX. This series has been seasonally adjusted by the X11 method, shown as INDEX SA The weights reflect estimated freight revenues from the various coal trades in 1929, see text for further details.

Table A1. Coal freight rate indices monthly 1919 - 1939

1913 average = 100

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVR
1921													
UK coastal	202	169	169	178	208	217	189	172	163	146	150	160	176.8
Brest-Elbe range	190	168	158		165	162	171	165	153	145	143	150	∗ 160.9
Scandinavia	270	220	209	219		218	212	213	187	157	184	186	∗ 207.0
Baltic		227				150	207	171	169	167	203	188	∗ 185.2
French Bay ports	147	137	131	116			133	126	129	116	117	119	∗ 127.0
Spain	172	164	195		188	186	178	163	150	149	154	159	∗ 168.8
French Mediter.	160	161	168			173	170	150	140	132	132	124	∗ 151.1
Italy	212	205	203	200	185	193	187	177	149	150	150	139	179.2
Atlantic Islands	168	177	187	194			181	175	161	160	167	155	∗ 172.4
Eastern Mediter.	200	205	203	214		232	196	176	165	164	181	166	∗ 191.1
S America Atl.	122	127	129		103	101	95	84	86	117	134	101	∗ 109.0
N America Atl.		146											∗ 145.8
Asia	145	159	171				157	125	122	129	139	137	∗ 142.5
INDEX	181.0	170.3	170.7	171.4	172.4	174.8	168.4	155.9	144.0	141.4	148.4	141.7	161.7
INDEX SA	187.1	168.5	165.5	167.9	169.9	173.7	173.7	161.4	150.5	139.7	140.6	143.9	161.9
1922													
UK coastal	157	158	138	129	119	111	113	123	125	131	135	124	130.2
Brest-Elbe range	146	147	136	121	122	120	125	133	133	135	138	125	131.8
Scandinavia	175	177	183	158	147	130	131	131	149	148	155	152	153.0
Baltic	195	177	176	145	141	137	131	134	137	144	152	145	151.1
French Bay ports	117	116	107	105	94	93	103	108	109	115	117	97	106.9
Spain	142	152	156	149	134	140	137	140	151	136	144	128	142.3
French Mediter.	120	131	132	126	120	115	113	123	113	122	117	101	119.3
Italy	135	143	155	146	136	124	125	135	129	132	126	118	133.7
Atlantic Islands	146	151	165	151	142	133	132	154	148	154	147	129	146.1
Eastern Mediter.	162	178	179	171	162	150	150	157	154	161	154	139	159.8
S America Atl.	84	83	92	94	84	83	89	88	96	90	81	71	86.1
N America Atl.					92	84	102	140	128	103	102	86	∗ 104.7
Asia	141	155	146	145	145	145	150	145	142	130	115	107	138.9
INDEX	135.1	139.6	139.7	130.4	122.5	116.3	118.3	125.9	126.1	127.9	126.1	114.2	126.8
INDEX SA	140.5	137.5	134.3	127.5	121.6	116.4	121.1	130.2	130.4	126.4	121.1	116.4	126.9

NOTE: Asterisks (∗) denote cases where the annual averages in the far right-hand column are based on less than 12 monthly observations. Gaps in individual series have been interpolated before computing the aggregate INDEX. This series has been seasonally adjusted by the X11 method, shown as INDEX SA The weights reflect estimated freight revenues from the various coal trades in 1929, see text for further details.

Table A1. Coal freight rate indices monthly 1919 - 1939

1913 average = 100

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVR
1923													
UK coastal	114	134	157	128	127	131	128	127	134	154	149	136	135.1
Brest-Elbe range	117	132	161	132	120	116	122	116	124	126	127	117	125.8
Scandinavia	143	154	168	150	125	117	124	134	130	146	144	138	139.2
Baltic	142	138	153	131	119	110	112	112	129	134	146	142	130.6
French Bay ports	90	107	125	109	96	93	94	91	102	103	106	102	101.6
Spain	120	131	158	160	130	122	127	120	143	117	136	117	131.8
French Mediter.	106	105	126	105	101	100	100	97	96	97	103	98	102.8
Italy	123	122	140	131	124	117	114	103	102	100	104	100	114.9
Atlantic Islands	129	125	157	147	136	131	126	127	125	120	127	118	130.6
Eastern Mediter.	144	143	158	140	135	121	121	113	108	106	111	112	126.0
S America Atl.	74	85	97	84	85	81	87	86	82	80	81	74	82.9
N America Atl.	99	87	115	79	80	86		76	79	83	78	80	∗ 85.6
Asia	102	100			93	102	98	98	94	101	102	104	∗ 99.4
INDEX	113.1	120.0	140.0	121.5	114.0	110.1	111.4	107.9	110.0	112.5	115.2	108.4	115.3
INDEX SA	117.9	117.3	133.4	118.6	113.9	110.9	113.7	111.7	112.6	111.0	112.0	110.9	115.3
1924													
UK coastal	126	133	139	121	119	115	110	111	114	111	110	104	117.6
Brest-Elbe range	108	112	115	107	100	94	89	89	90	89	87	90	97.5
Scandinavia	138	161	153	141	124	115	112	115	123	127	121	123	129.4
Baltic	133	153	148	129	116	110	105	103	117	121	121	128	123.7
French Bay ports	90	94	95	86	79	75	76	77	78	77	78	76	81.6
Spain	125	133	129	124	118	126	118	115	109	113	111	112	119.3
French Mediter.	92	106	111	104	100	100	97	90	88	93	85	83	95.8
Italy	98	117	127	120	115	108	103	98	102	109	100	94	107.6
Atlantic Islands	112	118	124	115	119	116	114	109	108	113	109	108	113.8
Eastern Mediter.	111	126	138	146	141	133	121	110	116	125	113	108	124.1
S America Atl.	73	83	81	77	73	78	74	69	70	75	71	67	74.4
N America Atl.	94			80	83	85	88	85		82	81	88	∗ 85.1
Asia	95	106	101	118	149	115	103	114	108	108	92		∗ 110.0
INDEX	104.0	115.5	118.8	111.1	106.1	103.1	98.8	95.2	97.2	100.4	95.4	93.4	103.3
INDEX SA	108.3	112.2	112.6	108.3	106.4	104.4	100.6	99.0	99.1	98.8	93.7	95.6	103.3

NOTE: Asterisks (∗) denote cases where the annual averages in the far right-hand column are based on less than 12 monthly observations. Gaps in individual series have been interpolated before computing the aggregate INDEX. This series has been seasonally adjusted by the X11 method, shown as INDEX SA The weights reflect estimated freight revenues from the various coal trades in 1929, see text for further details.

Table A1. Coal freight rate indices monthly 1919 - 1939

1913 average = 100

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVR
1925													
UK coastal	105	107	107	95	95	98	99	94	100	103	102	110	101.2
Brest-Elbe range	93	88	84	79	80	77	90	77	78	85	86	91	84.1
Scandinavia	96	102	98	100	101	99	110	99	119	126	136	135	110.0
Baltic	114	107	105	98	90	93	101	97	104	123	130	136	108.2
French Bay ports	77	74	72	70	70	71	85	69	68	80	80	82	74.8
Spain	109	101	105	106	111	109	116	100	106	114	117	113	109.0
French Mediter.	83	85	90	88	89	89	90	81	82	88	93	89	87.3
Italy	96	100	101	100	98	94	98	87	88	99	106	101	97.3
Atlantic Islands	101	102	109	105	102	107	115	107	106	112	114	120	108.3
Eastern Mediter.	108	112	119	115	109	106	113	97	83	92	109	105	105.7
S America Atl.	65	85	88	90	86	102	103	84	96	93	84	82	88.2
N America Atl.		119	78	81	72	88	75	106	81	90	99	100	∗ 89.8
Asia	83	107	97	98	90	91		75	86	80	89	87	∗ 89.5
INDEX	91.4	95.4	95.9	93.1	91.8	93.9	98.8	87.8	91.1	97.0	100.1	100.1	94.7
INDEX SA	94.9	91.9	90.6	90.8	92.2	95.3	100.9	91.6	92.8	95.2	98.5	102.6	94.8
1926													
UK coastal	99	110	94	94							158	130	∗ 114.1
Brest-Elbe range	91	91	84	81							130	108	∗ 97.5
Scandinavia	118	122	117	109								157	∗ 124.6
Baltic	111	125	112	101								151	∗ 119.9
French Bay ports	78	79	74	72	60							87	∗ 75.0
Spain	118	118	117	111								135	∗ 119.9
French Mediter.	93	98	98	94								108	∗ 98.2
Italy	108	112	117	109	99						141	128	∗ 116.2
Atlantic Islands	113	125	127	123								131	∗ 123.9
Eastern Mediter.	117	120	121	115							135	111	∗ 119.9
S America Atl.	99	111	109	94							97	88	∗ 99.5
N America Atl.	98	121	84	85								85	∗ 94.5
Asia	92	113	118	112									∗ 108.8
INDEX	101.5	107.7	103.8	97.9							126.0	116.1	108.8
INDEX SA	105.3	103.6	98.1	95.6							120.7	111.3	105.7

NOTE: Asterisks (∗) denote cases where the annual averages in the far right-hand column are based on less than 12 monthly observations. Gaps in individual series have been interpolated before computing the aggregate INDEX. This series has been seasonally adjusted by the X11 method, shown as INDEX SA The weights reflect estimated freight revenues from the various coal trades in 1929, see text for further details.

Table A1. Coal freight rate indices monthly 1919 - 1939

1913 average = 100

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVR
1927													
UK coastal	113	108	108	95	92	91	98	87	90	104	96	99	98.5
Brest-Elbe range	96	92	88	84	80	83	84	81	83	88	81	80	85.0
Scandinavia	133	117	117	109	108	109	114	119	119	122	120	117	117.2
Baltic	110	125		94	91	90	94	97	99	102	100	79	∗ 98.3
French Bay ports	85	81	80	76	76	74	82	75	72	73	72	69	76.3
Spain	125	125	118	119	122	123	121	119	122	117	112	104	118.9
French Mediter.	101	99	101	101	99	98	82	83	90	86	82	76	91.6
Italy	113	119	121	119	120	109	92	97	102	101	99	90	106.7
Atlantic Islands	121	120	127	124	123	116	113	109	109	106	104	95	113.8
Eastern Mediter.	111	130	127	129	133	119	102	101	109	107	107	99	114.3
S America Atl.	78	78	75	74	73	72	74	71	75	75	71	61	73.1
N America Atl.		68	80	79	80	82	85	85	90	101	91	83	∗ 84.1
Asia	96	104	103	84	100	96		79	92	86	91	87	∗ 92.6
INDEX	104.0	103.7	103.0	99.3	98.4	95.7	91.1	89.6	93.5	95.1	90.8	85.5	95.8
INDEX SA	105.6	104.9	105.3	104.0	101.0	97.0	91.5	91.3	91.8	90.5	87.2	82.0	96.0
1928													
UK coastal	103	95	95	93	98	97	95	91	105	121	111	120	102.0
Brest-Elbe range	84	83	78	79	77	77	80	80	84	89	96	100	83.8
Scandinavia	119	113	112	102	100	99	108	119	121	126	131	124	114.5
Baltic	95	92	92	93	92	97	98	100	108	106	120	113	100.4
French Bay ports	70	71	69	67	67	71	74	72	77	84	88	86	74.6
Spain	106	103	104	104	107	106	112	106	106	112	122	124	109.3
French Mediter.	80	81	77	75	80	80	85	86	89	95	102	100	85.9
Italy	95	95	91	90	90	89	93	92	92	100	112	112	96.0
Atlantic Islands	93	95	94	91	90	95	102	100	101	109	115	117	100.1
Eastern Mediter.	105	104	98	99	99	95	97	105	108	108	120	123	105.1
S America Atl.	62	67	60	58	59	59	61	66	78	75	77	73	66.2
N America Atl.	78		84	81	81	82	87	88	90	100	105	98	∗ 88.5
Asia	76	89	89	83	91	80		93	92	104	100	110	∗ 91.5
INDEX	88.7	88.0	84.8	83.0	84.3	84.0	87.5	88.7	94.0	99.5	104.7	105.0	91.0
INDEX SA	90.0	89.2	86.7	86.8	86.2	85.0	87.9	90.3	92.4	94.7	101.0	101.1	90.9

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Table A1. Coal freight rate indices monthly 1919 - 1939

1913 average = 100

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVR
1929													
UK coastal	106	137	133	109	114	123	122	116	125	135	136	133	124.0
Brest-Elbe range	96	113	111	98	97	108	111	102	107	113	110	107	106.0
Scandinavia	125	149	127	111	111	122	134	131	135	133	131	132	128.4
Baltic	111		111	98	98	103	109	112	117	129	116	115	∗ 110.8
French Bay ports	83	87	88	82	85	91	99	94	98	103	97	98	92.0
Spain	123	116	125	125	133	127	142	142	129	117	120	110	125.9
French Mediter.	100	99	100	99	105	109	107	104	99	94	88	86	99.2
Italy	114	107	102	108	114	112	115	108	104	103	93	89	105.7
Atlantic Islands	111	110	110	106	116	121	125	123	122	121	109	106	115.0
Eastern Mediter.	129	128	124	122	130	126	124	121	110	104	98	91	117.2
S America Atl.	71	71	69	72	76	82	85	87	99	97	87	81	81.5
N America Atl.	107		102	100	104	105	107	124	113	128		105	∗ 109.6
Asia	107	123	113		121	123	132		116		110	110	∗ 117.2
INDEX	103.0	109.3	106.0	100.8	105.0	109.7	112.4	109.0	110.1	110.4	104.8	101.1	106.8
INDEX SA	104.2	111.0	108.6	105.0	106.8	110.3	112.9	110.9	108.5	105.3	101.7	97.6	106.9
1930													
UK coastal	106	95	89	88	98	95	90	91	96	102	96	100	95.4
Brest-Elbe range	88	76	74	70	72	72	68	71	70	75	72	75	73.6
Scandinavia	116	103	99	97	96	94	90	91	101	104	97	106	99.5
Baltic	106	82	83	85	78	70	75	70	79	83	85	81	81.4
French Bay ports	83	72	66	65	68	67	60	61	66	70	71	68	68.1
Spain	101	82	87	81	88	82	83	84	87	87	85	86	86.1
French Mediter.	79	72	73	70	76	73	70	73	71	69	67	69	71.9
Italy	84	80	80	78	81	80	76	75	73	71	67	74	76.6
Atlantic Islands	102	90	89	87	95	93	91	89	85	87	84	86	89.7
Eastern Mediter.	90	86	82	81	86	88	81	79	74	72	71	74	80.3
S America Atl.	83	95	91	90	92	94	87	71	66	76	67	62	81.1
N America Atl.	106	107	94	90	87	89	90	91	88	102	104	100	95.6
Asia	109	114	111	112	102	98		99		80	70		∗ 99.5
INDEX	91.3	84.8	82.7	80.5	84.4	83.3	79.2	77.5	77.5	80.1	76.2	78.4	81.3
INDEX SA	92.0	86.3	84.7	83.6	85.6	83.3	79.7	78.9	76.5	76.7	74.6	75.7	81.5

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Table A1. Coal freight rate indices monthly 1919 - 1939

1913 average = 100

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVR
1931													
UK coastal	99	92	92	91	86	88	87	88	88	86	91	84	89.2
Brest-Elbe range	70	69	71	70	70	68	68	66	67	82	82	80	71.9
Scandinavia	95	99	98	93	90	92	93	88	98	108	102	111	97.3
Baltic	100	92		92	75	78	73	75	70	90	92	98	∗ 84.9
French Bay ports	68	70	65	65	65	63	62	61	61	71	70	68	65.8
Spain	85	81	80	82	85	86	85	84	85	92	92	88	85.4
French Mediter.	67	68	71	71	76	73	71	70	67	73	74	70	70.9
Italy	71	70	76	77	81	77	74	71	66	70	72	71	72.9
Atlantic Islands	85	83	80	79	82	88	84	85	84	86	84	83	83.6
Eastern Mediter.	68	72	77	79	86	80	71	72	68	69	76	73	74.3
S America Atl.	60	61	59	59	60	59	58	57	57	56	55	55	58.0
N America Atl.	99	98	96	91	100	76	78		83	94	95	91	∗ 91.0
Asia		78	79	69	75	81			72	79			∗ 76.2
INDEX	75.6	75.2	76.3	76.0	77.1	75.4	73.6	72.5	71.8	77.3	78.1	76.4	75.4
INDEX SA	75.9	76.4	78.4	78.6	77.9	75.1	74.1	73.6	71.0	74.4	77.1	73.4	75.5
1932													
UK coastal	85	83	82	77	80	86	82	73	84	87	83	91	82.7
Brest-Elbe range	77	77	79	74	71	71	72	72	73	77	77	81	75.1
Scandinavia	102	92	91	91	90	87	84	89	94	100	97	98	92.8
Baltic		76	77	91	70	70	73	67	79	79	76	85	∗ 76.6
French Bay ports	69	67	67	63	63	64	63	63	64	70	70	70	65.9
Spain	84	81	84	85	87	93	88	91	90	88	85	87	86.8
French Mediter.	72	69	69	67	67	75	69	71	70	70	67	71	69.6
Italy	72	70	77	71	75	77	75	70	73	75	70	74	73.2
Atlantic Islands	83	83	87	82	82	87	85	82	83	84	80	79	83.1
Eastern Mediter.	71	64	78	77	79	75	77	72	65	68	68	70	72.0
S America Atl.	54	55	55	54	54	56	54	54	53	53	53	53	53.9
N America Atl.	93	94	90	89	87	86	85	88	82	84	88	89	87.9
Asia	86			77	81	70	72		68	60	60	64	∗ 70.8
INDEX	75.2	72.9	75.0	72.4	72.5	75.0	72.9	71.3	73.1	74.8	72.6	76.1	73.6
INDEX SA	75.3	74.1	77.2	74.7	73.2	74.6	73.5	72.2	72.3	72.0	72.0	72.6	73.6

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Table A1. Coal freight rate indices monthly 1919 - 1939

1913 average = 100

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVR
1933													
UK coastal	101	96	84	81	79	80	76	77	90	95	89	118	88.7
Brest-Elbe range	76	74	75	74	77	72	72	74	74	83	83	91	77.0
Scandinavia	104	102	86	80	81	85	83	87	87	88	92	94	89.1
Baltic	86	77	78	67	73	72	75	74	77	82	83	87	77.6
French Bay ports	67	69	68	65	64	62	65	62	64	67	68	69	65.8
Spain	84	84	84	88	86	88	87	90	96	94	88	86	87.8
French Mediter.	68	67	66	67	68	71	69	69	74	67	66	66	68.2
Italy	71	69	68	70	71	73	72	72	71	70	65	67	69.9
Atlantic Islands	81	78	78	77	79	80	79	77	76	82	79	78	78.6
Eastern Mediter.	71	69	69	67	75	77	77	74	70	74	64	74	71.7
S America Atl.	54	53	54	54	54	55	55	54	61	60	53	52	54.8
N America Atl.	98	94	78	77	81	77	77	84	76	82	84	84	82.8
Asia	94	93	67	57	60			45	54	59			∗ 66.2
INDEX	76.4	74.6	71.2	70.4	71.6	72.2	71.2	71.5	75.0	76.1	73.0	78.5	73.5
INDEX SA	76.5	75.9	73.8	72.5	72.6	71.8	71.7	71.9	74.3	73.3	72.5	74.4	73.4
1934													
UK coastal	81	88	78	91	87	87	77	91	83	94	84	98	86.7
Brest-Elbe range	86	84	76	76	76	77	79	74	81	83	87	102	81.7
Scandinavia	88	88	85	83	85	86	83	84	84	79	87	93	85.3
Baltic	87	80	78	76	76	75	76	76	77	78	83	82	78.5
French Bay ports	68	65	64	64	64	63	63	62	66	64	67	74	65.4
Spain	84	80	82	82	90	92	98	94	98	101	94	99	91.2
French Mediter.	65	69	68	68	72	76	77	81	79	73	71	75	72.9
Italy	69	72	68	69	72	75	83	83	81	80	77	79	75.5
Atlantic Islands	79	76	73	76	80	85	88	85	86	88	82	76	81.1
Eastern Mediter.	65	70	66	68	75	80	85	83	77	74	71	71	73.8
S America Atl.	52	51	52	52	53	54	57	57	56	54	54	54	53.8
N America Atl.	82	74	70	71	71	71	74	81	72	86	88	71	76.1
Asia		60	55	55			71	68			62		∗ 62.0
INDEX	72.4	73.5	69.9	71.9	73.5	75.4	76.9	78.3	77.4	77.4	75.9	81.0	75.3
INDEX SA	72.6	75.2	72.9	74.2	74.8	74.8	76.9	78.1	76.5	74.1	75.3	76.9	75.2

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Table A1. Coal freight rate indices monthly 1919 - 1939

1913 average = 100

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVR
1935													
UK coastal	93	83	89	88	86	85	82	80	110	102	111	127	94.7
Brest-Elbe range	85	81	84	83	79	89	83	80	78	105	108	111	88.7
Scandinavia	86	86	84	83	81	83	83	82	84	96	105	106	88.2
Baltic	77	78	76	78	75	72	77	75	78	92	93	91	80.4
French Bay ports	67	62	65	70	65	66	65	68	70	85	86	82	70.9
Spain	91	88	91	99	105	106	104	94	98	110	94	94	97.8
French Mediter.	71	71	73	75	79	83	80	74	78	88	78	75	77.1
Italy	77	76	78	83	88	92	87	76	81	102	93	85	84.8
Atlantic Islands	81	81	81	82	86	87	84	83	82	92	83	80	83.4
Eastern Mediter.	72	74	77	86	89	87	82	77	74	97	76	79	80.7
S America Atl.	54	55	56	55	55	58	58	56	56	59	55	53	55.9
N America Atl.	78	77	78	70	73	79	81	76	76		91	86	∗ 78.8
Asia	54							95		101			∗ 83.6
INDEX	76.3	74.4	76.6	78.1	79.2	82.2	79.4	75.3	80.2	92.2	88.5	88.8	80.9
INDEX SA	76.8	76.9	80.8	81.0	80.9	81.2	78.6	74.2	78.8	87.5	87.7	85.0	80.8
1936													
UK coastal	103	93	87	91	80	79	86	92	89	100	114	154	97.4
Brest-Elbe range	100	92	78	78	79	80	92	84	87	94	113	125	91.8
Scandinavia	91	83	85	83	81	89	89	90	99	107	111	128	94.5
Baltic	94	78	75	77	78	81	84	85	98	97	97	114	88.4
French Bay ports	77	62	60	65	61	65	73	68	70	77	87	95	71.8
Spain	90	83	82	86	94	96	107			112	97	181	∗ 102.7
French Mediter.	73	67	67	67	69	72	74	75	75	73	73	82	72.2
Italy	70				71							84	∗ 74.8
Atlantic Islands	78	77	73	74	79	79	81	85	83	86	83	92	81.0
Eastern Mediter.	69	67	73	61	63	68	68	66	68	72	79	82	69.7
S America Atl.	53	52	51	54	51	51	58	56	56	65	64	73	57.0
N America Atl.	81	78		74	67	76	74	75	72	89	99	92	∗ 79.7
Asia	67					62		69					∗ 66.3
INDEX	79.6	74.5	71.8	72.1	71.1	73.2	78.0	77.9	79.4	84.5	89.4	104.6	79.7
INDEX SA	80.6	77.9	76.4	75.1	72.7	72.3	76.7	76.1	77.4	79.4	88.1	101.7	79.5

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Table A1. Coal freight rate indices monthly 1919 - 1939

1913 average = 100

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVR
1937													
UK coastal	115	136	136	129	125	131	127	123	121	133	120	127	126.9
Brest-Elbe range	112	108	109	104	109	127	123	109	115	121	116	113	113.8
Scandinavia	124	127	127	125	132	145	151	146	156	153	127	124	136.3
Baltic	114	111	119	111	120	140	135	132	145	144	115	109	124.6
French Bay ports	85	86	92	95	107	131	135	114	124	121	108	95	107.7
Spain		101	106	136	151		158	169		135	161	102	∗ 135.3
French Mediter.	81	86	91	103	131	142	137	138	131	120	89	76	110.4
Italy	89	95	96	115	127	134	135	129	124	111	88	75	109.8
Atlantic Islands	95	104	104	119	141	158	138	131	133	123	103	95	120.3
Eastern Mediter.	85	89	97	128	145	145	139	144	130	113	90	77	115.0
S America Atl.	78	72	67	83	91	91	88	88	90	84	69	60	80.0
N America Atl.	95			94	65	109		103		123	105	90	∗ 98.0
Asia	134	111		124	69	153	152	140	106		86		∗ 119.5
INDEX	97.7	99.6	101.1	110.2	120.4	131.0	128.1	124.2	123.0	118.4	101.0	91.5	112.2
INDEX SA	99.4	105.4	108.2	114.9	123.3	129.2	125.0	120.3	119.1	110.6	98.9	90.6	112.1
1938													
UK coastal	102	96	97	92	94	100	94	88	87	94	91	99	94.5
Brest-Elbe range	96	86	82	82	82	82	81	77	79	91	86	82	83.9
Scandinavia	113	89	90	87	88	90	90	86	94	107	102	97	94.3
Baltic	106	88	80	83	85	85	80	80	81	89	91	90	86.5
French Bay ports	78	69	63	65	65	64	64	63	63	74	72	70	67.6
Spain	222	79	91				86						∗ 119.5
French Mediter.	70	65	67	70	70	75	72	67	65	70	66	66	68.7
Italy	69	67	68	68	69	68	64	65	61	59	60	60	64.9
Atlantic Islands	85	77	83	81	89	90	87	88	87	90	84	81	85.3
Eastern Mediter.	74	71	69	70	78	76	69	66	66	67	66	66	69.8
S America Atl.	63	79	85	86	94	81	73	83	75	69	69	64	76.8
N America Atl.	85	79	68		69	73	69	82	68	72	70	64	∗ 72.7
Asia			75			78			68	76		76	∗ 74.6
INDEX	87.5	77.9	78.9	78.9	81.2	81.1	77.1	76.2	74.7	78.4	76.3	75.4	78.6
INDEX SA	89.3	82.8	85.0	82.2	83.2	80.1	74.8	73.5	71.8	72.8	74.3	75.7	78.8

NOTE: Asterisks (∗) denote cases where the annual averages in the far right-hand column are based on less than 12 monthly observations. Gaps in individual series have been interpolated before computing the aggregate INDEX. This series has been seasonally adjusted by the X11 method, shown as INDEX SA The weights reflect estimated freight revenues from the various coal trades in 1929, see text for further details.

Table A1. Coal freight rate indices monthly 1919 - 1939

1913 average = 100

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVR
1939													
UK coastal	96	101	104	116	127	109	108	108	205	287	314	357	169.2
Brest-Elbe range	87	88	86	92	111	106	101	96	184	294	319	349	159.4
Scandinavia	99	94	89	102	111	107	107	113	361	458	401		∗ 185.6
Baltic	84	85	82	91	102	96	102	98			652		∗ 154.7
French Bay ports	70	74	66	68	73	70	64	65	132	181	199	186	103.9
Spain				89		97	103				279	227	∗ 159.0
French Mediter.	67	66	68	75	80	78	76	73	160	169	177	170	104.9
Italy	59	62	63	79	80	77	72	72		201	225	242	∗ 111.8
Atlantic Islands	76	76	77	86	96	90	89	91	222	236	257	249	137.1
Eastern Mediter.	65	66	69	85	95	90	86	89	208	204	243	269	130.8
S America Atl.	59	69	68	61	68	61	59	61	126	128	129	154	86.9
N America Atl.	75	70	67	69	77	72						140	∗ 81.4
Asia		79	71	79	96		89		220	152	151	154	∗ 121.2
INDEX	74.9	77.1	76.9	84.3	92.8	87.3	85.1	87.2	182.8	233.4	251.3	264.6	133.2
INDEX SA	76.6	82.0	83.1	87.9	95.1	86.3	82.5	84.0	174.8	216.5	244.8	268.3	131.8

NOTE: Asterisks (∗) denote cases where the annual averages in the far right-hand column are based on less than 12 monthly observations. Gaps in individual series have been interpolated before computing the aggregate INDEX. This series has been seasonally adjusted by the X11 method, shown as INDEX SA The weights reflect estimated freight revenues from the various coal trades in 1929, see text for further details.

Table A2. Average annual coal freights from the North-East (N) and South Wales (W)

	1913	1920	1921	1922	1923	1924	1925
1 N - London	3.83	9.95	6.52	4.46	4.22	3.56	3.51
2 W - London	4.04	14.07	7.10	5.25	5.23	4.73	3.39
3 W - Falmouth	5.25	13.71	6.33	4.75	4.65	3.84	4.59
4 W - Devonport	2.67				4.13	3.04	2.50
5 W - Elbe					5.75	4.48	3.69
6 W - Antwerp	4.31	31.68	7.15	5.49	4.95	3.76	3.07
7 W - Havre	4.84	37.04	7.21	6.16	5.95	4.35	3.81
8 N - Rouen	5.15	38.59	7.46	6.17	5.46	4.42	3.86
9 W - Rouen	5.62	38.53	8.02	6.60	6.09	4.50	3.94
10 N - Copenhagen	5.16	28.06	8.33	8.09	7.75	8.54	5.45
11 W - Copenhagen	6.05	43.83		7.88	7.38	6.94	5.17
12 N - Gothenburg	4.50	33.00	11.18	8.23	6.43	6.70	5.88
13 N - Sundsvall	5.49	51.55	8.50	11.50	8.50	5.97	7.13
14 N - Oslo	5.59	22.29	11.25	7.63	7.13	9.50	
15 N - Bergen		17.10		6.56		5.15	6.75
16 N - Stettin	5.69		9.25	7.34	7.06	6.86	5.54
17 N - Memel	4.80		8.63	7.47	7.00	6.61	5.75
18 N - Helsingfors	5.70		9.75	7.64	8.60	6.06	6.28
19 W - Brest	4.82	39.75	7.11	5.84	5.85	4.50	3.57
20 W - Nantes	7.01	32.05	7.92	6.97	6.50	4.60	4.18
21 W - La Rochelle	6.48	41.00	7.69	6.75	6.84	4.93	4.36
22 W - Bordeaux	7.08	33.60	8.09	6.73	6.42	4.99	4.27
23 W - Barcelona	9.83	43.13	17.63	14.66	12.93	12.13	10.48
24 W - Bilbao	6.61		10.58	7.73	7.75	8.83	7.81
25 W - Huelva	7.72	46.25	13.35	10.85	10.49	8.83	8.34
26 W - Cadiz	8.51	52.50	15.50	10.00	14.00	9.25	9.57
27 W - Marseille	10.94	44.25	15.14	11.89	9.90	9.89	8.92
28 N - Algiers	8.30	32.50	14.04	10.96	10.21	9.21	8.83
29 W - Algiers	10.17	37.42	12.94	11.13	9.90	9.39	8.46
30 W - Oran	10.81	37.83	13.81	12.00	10.54	9.28	8.53
31 N - Genoa	9.35	50.75	16.51	12.21	10.32	9.79	8.83
32 W - Genoa	9.06	45.68	15.99	12.00	9.97	10.12	8.98
33 W - Naples	9.15	57.50	16.16	11.99	10.70	10.41	9.16
34 W - Venice	10.90	67.14	18.63	14.39	12.23	12.35	11.06
35 W - Lisbon	7.11	36.72	13.14	11.08	9.56	8.61	7.84
36 W - Las Palmas	8.83	30.80	12.29	10.71	9.30	9.19	8.71
37 W - St Vincent	9.45	31.93	12.31	10.96	9.86	9.22	8.63
38 W - Alexandria	9.92	58.61	17.89	14.54	10.81	11.60	10.11
39 W - Port Said	9.65	53.21	15.65	13.89	10.72	11.38	10.15
40 W - Malta	7.91	40.52	13.84	11.40	9.86	9.40	8.33
41 W - Piraeus	9.77	37.60	16.03	14.35	11.63	11.74	10.38
42 W - Rio de Janeiro	16.61	40.18	17.79	15.08	13.94	12.80	14.33
43 W - Montevideo	16.59		17.90	14.69	14.31	12.61	15.05
44 W - Buenos Ayres	18.97	37.50	17.31	14.68	14.19	12.66	15.71
45 W - Montreal				10.50	8.25	7.35	6.96
46 W - St John New Brunswick				9.94	8.69	8.67	7.75
47 W - Northern Range USA				9.63	7.96	7.75	8.25
48 W - Aden	11.54	90.00	19.08	19.75	13.00	14.13	13.13
49 W - Bombay	12.48		17.83	20.28	14.00	13.38	14.00
50 W - Hong Kong	17.88		21.50	25.50	17.88	18.42	17.67

Table A2. Average annual coal freights from the North-East (N) and South Wales (W)

	1926	1927	1928	1929	1930	1931	1932
1 N - London	3.87	2.88	3.04	3.24	2.58	2.71	2.62
2 W - London	3.88	3.16	2.75	3.63	2.48	2.33	2.13
3 W - Falmouth	5.00	4.06	3.81	4.47	3.36	3.33	3.18
4 W - Devonport	2.65	2.60	2.71	3.63	2.33	2.32	2.00
5 W - Elbe	3.71	3.88	3.93	4.48	3.42	3.48	3.58
6 W - Antwerp	3.47	3.16	2.80	3.43	2.49	2.39	2.42
7 W - Havre	3.81	3.70	3.71	4.71	3.46	3.23	3.65
8 N - Rouen	4.25	4.00	3.75	4.67	3.63	3.60	3.73
9 W - Rouen	4.15	4.03	4.05	4.97	3.60	3.53	3.88
10 N - Copenhagen	6.17	5.43	6.29	6.55	4.68	4.60	4.13
11 W - Copenhagen	6.75	6.04	5.88	6.33	5.13	4.73	4.36
12 N - Gothenburg		6.00	5.15	6.17	4.69	4.75	4.64
13 N - Sundsvall	11.50	6.25	5.75	6.38	5.50		4.08
14 N - Oslo	4.22	6.44	7.81				
15 N - Bergen		4.48	4.13	4.75	3.63	3.75	3.25
16 N - Stettin	5.29	5.67	5.25	5.65	4.36	4.13	4.75
17 N - Memel	6.00	5.00	5.31	6.42		5.00	4.44
18 N - Helsingfors	6.25	5.22	5.25	6.20	4.63	4.56	3.92
19 W - Brest	3.94	3.93	4.05	4.57	3.75	3.75	3.72
20 W - Nantes	4.65	4.36	4.38	5.45	4.05	4.08	4.18
21 W - La Rochelle	4.75	4.51	4.50	5.68	3.93	4.11	4.20
22 W - Bordeaux	4.63	4.46	4.46	5.76	4.04	4.18	4.25
23 W - Barcelona	12.81	11.93	11.55	12.53	8.63	8.01	8.43
24 W - Bilbao	8.50	8.31	8.59	9.72	7.60	6.88	7.00
25 W - Huelva	9.53	9.21	9.09	10.47	7.50	7.19	7.00
26 W - Cadiz	10.28	9.09	8.92	10.28	7.30	6.73	6.75
27 W - Marseille	10.25	9.61	8.54	9.79	7.06	7.09	7.32
28 N - Algiers	9.69	8.99	8.49	9.38	7.28	7.35	7.29
29 W - Algiers	9.94	9.44	8.61	9.49	7.18	7.14	7.36
30 W - Oran	9.50	9.15	8.61	9.36	7.34	7.05	7.70
31 N - Genoa	10.21	9.14	8.18	9.41	6.55	6.15	6.37
32 W - Genoa	10.59	9.33	8.20	9.12	6.49	6.33	6.11
33 W - Naples	9.95	10.77	8.17	9.76	7.19	6.53	6.68
34 W - Venice	12.73	11.79	10.38	11.41	7.80	7.50	7.15
35 W - Lisbon	9.05	8.52	7.84	8.85	6.75	6.72	6.82
36 W - Las Palmas	9.56	9.26	8.43	9.74	7.63	6.94	6.94
37 W - St Vincent	9.85	9.39	8.34	9.60	7.25	7.06	7.00
38 W - Alexandria	12.63	11.69	10.41	11.40	7.48	6.99	6.71
39 W - Port Said	12.29	11.06	10.14	11.05	7.31	6.74	6.54
40 W - Malta	9.75	9.21	8.35	9.08	6.76	6.43	6.55
41 W - Piraeus	12.20	11.36	10.64	11.44	7.34	6.95	7.16
42 W - Rio de Janeiro	16.65	12.41	10.60	12.93	12.45	8.68	8.03
43 W - Montevideo	18.00	12.82	11.58	13.06	14.00	9.31	8.59
44 W - Buenos Ayres	17.30	13.23	11.48	13.85	14.28	9.67	9.08
45 W - Montreal	8.38	7.07	6.11	7.50	7.50	7.00	7.19
46 W - St John New Brunswick		8.75	10.75	11.00	8.75	9.38	7.50
47 W - Northern Range USA	9.13	7.50	6.33	7.75	7.19	6.92	6.81
48 W - Aden	17.00	14.90	12.75	16.25	12.83	10.25	9.25
49 W - Bombay		14.75	11.25	15.25		11.25	11.25
50 W - Hong Kong	21.75	20.82	15.19	18.50		12.17	11.50

Table A2. Average annual coal freights from the North-East (N) and South Wales (W)

	1933	1934	1935	1936	1937	1938	1939
1 N - London	3.04	2.89	2.97	2.87	3.78	3.75	8.32
2 W - London	2.26	2.13	2.18		4.00		3.00
3 W - Falmouth	3.35	3.75	3.58	3.00	4.17	3.25	4.92
4 W - Devonport	2.13	1.79	1.75	2.00	4.03	2.90	3.09
5 W - Elbe	3.71	3.63	3.69	3.85	5.76	4.14	4.89
6 W - Antwerp	2.46	2.48	2.84	2.88	4.56		12.98
7 W - Havre	3.52	3.50	3.96	4.41	5.67	3.99	5.75
8 N - Rouen	3.85	3.92	4.32	4.59	6.05	4.16	5.56
9 W - Rouen	4.03	3.78	4.64	5.03	6.08	4.25	6.39
10 N - Copenhagen	3.97	3.99	4.46	4.91	6.49	4.45	4.79
11 W - Copenhagen	4.09	3.89	4.29	4.51	6.80	4.67	7.70
12 N - Gothenburg	4.34	4.21	4.13	5.00	6.45	5.25	6.84
13 N - Sundsvall	4.69	3.95	4.29	7.00	9.17	5.47	5.69
14 N - Oslo		4.79	4.46	4.88		5.50	16.50
15 N - Bergen	3.39	3.27	3.17			3.75	18.00
16 N - Stettin	4.19	4.32	5.33	6.38		5.38	6.69
17 N - Memel	4.10	4.83	4.56	4.79	7.58	4.90	5.34
18 N - Helsingfors	4.00	3.94	4.38	4.40	8.45	4.67	5.31
19 W - Brest	3.75	4.04	4.25	4.57	5.75	3.76	5.82
20 W - Nantes	4.07	4.40	4.62	4.56	7.04	4.14	4.87
21 W - La Rochelle	4.13	4.26	4.41	4.62	7.26	4.26	5.41
22 W - Bordeaux	4.20	4.35	4.57	4.90	7.66	4.21	6.84
23 W - Barcelona	8.46	8.77	9.46	10.14			25.00
24 W - Bilbao	6.88	7.46	7.55	7.25			
25 W - Huelva	7.19	7.13	7.81	6.88	10.13		
26 W - Cadiz	6.70	6.94	7.27	8.25			
27 W - Marseille	7.08	7.58	7.52	7.01	11.33	7.06	10.77
28 N - Algiers	6.99	7.16	7.61	7.33	10.96	7.20	10.30
29 W - Algiers	7.14	7.56	7.39	7.03	10.42	6.92	9.09
30 W - Oran	7.16	7.75	7.53	7.36	10.60	6.86	9.38
31 N - Genoa	5.81	6.24	7.13	6.50	10.18	6.10	10.77
32 W - Genoa	5.74	6.28	7.45	6.94	9.97	6.01	9.63
33 W - Naples	6.05	6.50	7.16				
34 W - Venice	7.17	7.67	8.26		11.52	6.80	12.53
35 W - Lisbon	6.57	6.74	6.98	6.72	9.81	6.60	10.20
36 W - Las Palmas	6.89	7.09	6.86	6.72	10.50	7.18	12.06
37 W - St Vincent	6.88	7.25	6.75	7.58	10.13	7.25	11.58
38 W - Alexandria	5.98	6.58	7.51	6.59	10.73	6.44	11.25
39 W - Port Said	5.93	6.43	7.16	6.39	10.56	6.44	11.42
40 W - Malta	6.18	6.35	6.75	5.64	10.40	6.66	9.46
41 W - Piraeus	6.63	7.26	7.20	6.83	10.69	7.20	12.45
42 W - Rio de Janeiro	8.15	8.18	7.94	8.19	11.07	10.83	12.01
43 W - Montevideo	8.39	8.35	8.20	8.66	11.33	11.83	14.26
44 W - Buenos Ayres	9.35	9.08	8.91	9.03	12.52	12.38	12.40
45 W - Montreal	6.66	6.25	6.84	6.88	9.88	6.17	5.83
46 W - St John New Brunswick	7.75	7.50	8.79	6.88			7.63
47 W - Northern Range USA	6.44	6.08	6.55	6.25	8.83	7.00	6.25
48 W - Aden	11.00	10.50			16.75	12.50	24.50
49 W - Bombay		11.50			22.50		
50 W - Hong Kong	14.75					12.00	35.00

NOTE: Coal freight averages for 1939 may differ according to whether they include data from the last quarter of the year.

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