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CHAPTER 1

Composition and Growth of Soviet and United States Freight Transportation

A Railroad Economy

From the point of view of its transportation plant and the allocation of freight and passenger traffic among the several transportation agencies, the Soviet economy is and always has been a railroad economy. Despite the emphasis placed upon the development of other forms of transportation, railroads, which in 1913 had handled 61 per cent of freight traffic, were built up until by 1940 they handled 87 per cent. The economy of the United States has never been so greatly dominated by rail transport as the Soviet economy has during and since the second war, and the trends in this country have been the opposite of those in the Soviet Union. Hence Soviet traffic in recent years can be quite well understood through a study of the railroads alone and the greater part of the subsequent chapters will, therefore, be devoted to Soviet rail operations.

It is impossible for an American familiar with transportation in his own country to study Soviet transportation and to obtain the greatest meaning from his work without making continual comparisons with conditions in the United States which are better known to him and which can serve as background for analysis of the available Soviet data. Moreover, a primary purpose of this study is to examine and compare with the U.S. the growth of Soviet transport, to consider the validity of the Soviet growth, and to secure an understanding of whether and how that growth has been possible from the limited capital inputs which Soviet policy has devoted to the transport sector of the economy. Occasional reference is made to European practice, but the Soviet railroads have in particular sought to emulate U.S. practice as more appropriate to their large tonnages and great distances and, except for Germany, a similar abundance of operating and traffic statistics is not available among the larger European countries.

For someone who is not a student of transportation, it is necessary to provide a clear picture of American conditions if comparisons are to be indulged in, for they have not been understood fully even within the transportation industries. Hence many comparisons between American and Soviet data have been, to a certain extent, misleading. Our approach, therefore, requires some development of data for the United States after we have brought together available traffic data for the

Soviet Union. Only a comparison of aggregate traffic in the two countries will provide some understanding of the comparative supply and growth of transportation, and this will become all the more apparent as we proceed. Air transportation will, however, be neglected for both the Soviet Union and the United States. The emphasis here is almost entirely upon freight transportation which is of primary interest for what it may disclose about economic growth. In neither country has cargo transportation by air reached a sufficient level to have any significant effect upon the aggregate of freight transportation.[1] We shall have occasion to devote a few pages to rail passenger transportation, however, because it affects rail transportation of freight. While civil air transport has been important for urgent and official passenger travel, the volume of traffic remains minor by comparison with that in the United States, and railroads remain the principal means of passenger transport on intercity routes.[2]

A discussion of forms of Soviet transport other than rail in this first chapter will permit their contributions, strengths, and weaknesses to be understood and will provide a background for the presentation of aggregate freight traffic data by all forms of transportation. In later chapters the discussion will focus primarily on rail traffic and operations. It will also be helpful to keep in mind the organizational pattern of the transport system, especially since it often affects the form and content of the statistical materials and sometimes their quality as well. Separate ministries exist for rail, inland river, and maritime transport, and the administration of these forms of transport remains centralized. The People's Commissariat for Water Transport was, in 1939, divided into the River Fleet and Maritime Fleet Commissariats, subsequently renamed ministries. Much water transport was organized under yet another ministry, although considerable motor transport has always

[1] In the United States, goods transportation by air, including the mails, represents approximately 0.02 per cent of the freight ton-miles. In 1958 Soviet air passenger traffic (including international) was roughly one-sixth of the U.S. domestic air passenger volume. Although no absolute data have been published on air cargo in the USSR, its growth appears to have been given much less emphasis than the passenger services. See *ICAO Bulletin* (International Civil Aviation Organization), June 1961, p. 86.

[2] Since 1956 Soviet civil air passenger service has begun a very rapid growth, using newly introduced aircraft of advanced design. For recent traffic estimates, see *Comparisons of the United States and Soviet Economies*, U.S. Congress, Joint Economic Committee, Washington, 1959, Part I, p. 196. For details on routes and aircraft, see George Kish, "Soviet Air Transport," *The Geographical Review*, July 1958, pp. 309-320, and Hans Heymann, Jr., "The Soviet Role in International Civil Aviation," *Journal of Air Law and Commerce*, summer 1958, pp. 265-280. A recent appraisal by Stuart Tipton, "The Soviet Challenge in Civil Aviation," was published in *The General Electric Defense Quarterly*, April-June 1961, pp. 26 ff.

been controlled by nontransport ministries. Control of motor transport has, however, been decentralized along with industry in general. For operating purposes the railroad system is regionalized under railroad administrations, generally referred to as railroads. These do not, of course, have the autonomy of an American railroad corporation, but correspond more nearly with the regions or divisions of an American railroad. Since these railroad administrations do not correspond with the regions to which administration of the majority of economic functions was confided in the decentralization move, some complexity has no doubt been introduced into the relationships between railroad administrations and the administrations responsible for industrial functions. Finally it may be noted that pipeline transportation, quite logically, is administered as a part of the petroleum production organization.

Water Transport

All types of transportation have undergone some development in the Soviet Union. Extensive use had been made of the inland waterways, and maritime traffic had been developed on the Caspian, Baltic, and Black Seas in the period before the revolution. As in other countries, the waterways had provided the principal means of bulk transportation prior to the development of a comprehensive rail network. The Soviet Union, however, has not been favored by nature with many navigable watercourses and the extensive improvement of certain channels has not overcome the fact that the location of the waterway system does not correspond, with some exceptions, to the more important traffic flows generated by resource location and population concentration. Hence, although second only to the railroads in its contribution to traffic, water transportation has experienced only a modest development and one obviously disappointing to the planners[3] and to such officials as Kaganovich and the Minister of Transportation, whose policies have, over the years, sought a more significant relief for railways in waterway development.[4] The complaint repeated over and over again in

[3] By comparison with railways, water-carrier operations—particularly in river transport—usually call for a smaller input of critical materials, particularly iron and steel, to achieve a given ton-mile output. On the other hand, the difficulty of obtaining return loads because of the character of traffic flows is a serious impediment in the Soviet case and, indeed, often limits water-carrier development in transportation systems elsewhere.

[4] Both inland and maritime water transport again failed to reach the levels planned for them in 1950. Compare *Five Year Plan for the Rehabilitation and Development of the National Economy of the USSR, 1946-1950,* London, 1946, pp. 48 ff, with 1940 and 1950 data in series C-41 and C-49 in Appendix C. The shortfall in maritime traffic was the most serious. More recent growth has been of some consequence but has afforded no significant relief to railroads.

speeches of Party and other officials and in the press is of inefficiency and lack of initiative and energy on the part of the water carriers and their administrators. Characteristic of such statements is the following:[5] "Sabotage by enemies of the people and laxity and weak discipline among some of the workers in river and sea transport have caused these sectors to lag. Every measure has been taken by the Government to eliminate this backwardness."

Neither the conditions nor the causes thereof appear to be correctly portrayed by any such statements and, in the light of the attention focused on the prospects of water transport as a relief to the railroads, it is well to pay some attention to the possibilities of a more revealing description.

Soviet water transport falls into three departments: maritime traffic in foreign trade, maritime traffic in domestic trade, and traffic on rivers, canals, and other inland waterways.[6] The first of these will be disregarded here as it is not a portion of Soviet internal transportation, although the readily available data appear in the statistical appendix. The domestic phases of water transport have developed under unfavorable natural conditions. Nevertheless, it also appears that technology in river and domestic maritime trades has lagged behind the best practices elsewhere and that laxity in the handling of cargoes and the lack of solicitation of traffic by the water transport authorities have aggravated the natural disadvantages.[7] At the same time, the shortage of materials and components connecting stages of production appears to have put a premium upon rapidity of movement.

The inland waterways in the areas of older development comprise particularly the Volga and its tributaries, which before the war were reported to account for 45 per cent of the river traffic; the White Sea-Baltic and Moscow-Volga Canals; and the Dnieper and the Don with their tributaries. The Volga, in conjunction with the canals mentioned, provides an inland waterway which extends without interruption from the Caspian to the White Sea, while the postwar Volga-Don Canal extends navigation via the Don into the Sea of Azov and thence into the Black Sea. The route is, however, extraordinarily roundabout, as is frequently true of rivers in relatively flat country.

[5] S. S. Balzak, V. F. Vasyutin, and Ya. G. Feigin, *Economic Geography of the USSR* (translated from the Russian), New York, 1949, p. 476.

[6] Statistical data for all three departments are presented in Appendix C, series C-41 through C-49. Total freight traffic on inland waterways under the jurisdiction of the Ministry and other organizations is not given here since these data are not available after 1932. For maritime traffic, Appendix B should be consulted.

[7] The failure to relate water to rail rates is also, no doubt, of importance and is commented upon in Chapter 2.

The Dnieper and the Don have failed to develop any very significant traffic. Unlike the Volga, they do not reach the important industrial regions of the Northwest. Neither do they effectively tap the Donbas, the principal resources of which are remote from the navigable rivers. No effective water connection exists between the Donbas and the Moscow Basin or the Urals in view of the extreme circuity of the Volga route.[8] In short, these rivers are not well located as regards the basic mineral resources upon which the industrial economy is founded. The Volga, however, is in part a useful water route for the movement of oil from the Caucasus and grain from its tributary areas and for the southbound movement of lumber for transshipment into the Donbas and Caucasus. The less intensive development of railways in the territory served by the lower Volga no doubt contributes to the importance of the river and results, in part, from the relative efficiency of the water route. But the Volga route into the Moscow and Leningrad areas is far too indirect to prove attractive even for low-grade bulk traffic. Hence local movements are characteristic and through traffic the exception. Indeed the joint water-rail petroleum movement northbound has been superseded by all-rail movement to a certain degree, while a short-haul local distribution of petroleum from the "second Baku," the new midcontinent producing field, has come into existence.[9]

The northern rivers of European Russia, notably the Northern Dvina and the Pechora, are vital to the development of the area in the absence of railways. They are devoted largely to the rafting of timber to vessels of the maritime fleet operating in the White and Barents Seas and, in the case of the Pechora, to the movement of coal from Vorkuta. Similarly, the Siberian rivers accommodate considerable lumber traffic. As none of these rivers were tapped by the railroad system from the south within the range of their navigability until recently, they served primarily to feed the Northern Sea Route, and hence were distinctly limited in their

[8] In consequence, heavy capital expenditures have been made to develop principal rail routes between these areas in order to provide accommodation particularly for the traffic in coal, ores, and other bulk commodities which are often amenable to water transportation where the waterways are reasonably well adapted to the resource pattern.

[9] Considerable material has been brought together by Holland Hunter in his *Soviet Transportation Policy*, Cambridge, Mass., 1957, Chapter 8. He is certainly correct in offering the heavy costs of transshipment as a major reason for the failure of joint movements to develop to a greater degree. The "second Baku" lies in the Kuibyshev-Perm area. On this development, see Edmund Stevens, "The World's No. 2 Oil Producer—the U.S.S.R.," *Fortune*, June 1961, pp. 132 ff.

economic usefulness by the extreme shortness and uncertainty of the navigation season along that route. Nevertheless, the rivers of the northwest and the Siberian and Central Asian rivers are said to have accounted for 15.3 and 12.2 per cent, respectively, of the 1937 river traffic.[10] The extension of the northern rail route to the Ob' presumably enables the latter stream to serve as a feeder for the rail system and also to distribute upstream (southward) from railhead at Salekhard. In various parts of the country, rivers—large and small—are employed for the local transportation of agricultural produce, lumber, sand, and other commodities to railhead, but in the aggregate these short-distance movements create no great volume of traffic.[11] Some of this traffic, carried in small boats, may escape the statistics.

Not only are the Soviet inland waterways poorly located with respect to resources long since prospected, but no waterways of importance exist in the areas of newer industrial development; nor are there any which can carry much east-west traffic, which has become of growing importance. Moreover, the disadvantage of circuity is supplemented by the greater disadvantages of seasonality and of unreliability of channel depths. The rivers of European Russia are navigable six to eight months of the year and are closed by ice during the remainder of the year. Those of Arctic Russia are open from five to seven months, but certain of them are accessible from the sea only during a much shorter period and then only by organized convoys traveling the Northern Sea Route in the company of icebreakers, the supply of which has not been adequate. In most parts of the country the navigation season is not only short, but also uncertain, which is an impediment to long-distance movements toward the latter part of the season since they run the risk of being closed out by ice conditions. Similarly, there is a tendency, when pressure to ship is heavy, for a build-up of the river traffic to be slow in the spring, the railroads being used as a precaution against late opening, which might result in traffic being tied up at the ports of transfer.

Not much information has come to hand on the equipment and the character of operations even on the principal streams. No considerable investigation has been made of this subject. It appears, however, that there has been a lag in the technological development of river operations and that the European rather than the American pattern is

[10] Balzak, *et al.*, *Economic Geography*, p. 476.

[11] The absence of a suitable branch-line development over the newer portions of the rail network and the absence of a developed highway network leave many collective farms dependent upon small streams for their access to railway lines.

followed.[12] Moreover, the equipping of ports has lagged. Rail connections to piers have not been provided in some instances and the supply of cranes and particularly of heavy-lift cranes has been inadequate.[13] All principal types of handling equipment known in the United States are, however, employed to some extent. Hence the economy of movement obtained from large integrated tows does not appear to be secured; neither is expeditious transfer between land and water transport universally provided. In the United States, traffic on the inland rivers has been, in recent years, the fastest growing part of the freight business. The activity of aggressive enterprises, whose success depends upon an ability to divert traffic from the land routes and which therefore do their utmost to develop rate and service incentives, to influence industrial location, and to solicit traffic, has certainly been important in stimulating this development. By way of contrast, Soviet waterway operators appear to be passive and not given to the intensive efforts necessary to overcome their natural handicaps. It is also noteworthy that an important and growing part of American inland water transport is by private carrier, i.e., operated by industrial enterprises. The proportion of powered inland water traffic operated in the Soviet Union by organizations other than the Ministry is small and appears to be declining. As has often occurred elsewhere, large expenditures to improve navigation appear to have yielded small dividends in comparison with what was expected. For in 1954 the inland waterway traffic stood at little more than double the 1913 figure although railway traffic had multiplied thirteen times. The lack of a system such as that of the Great Lakes, which is further

[12] American river transportation has relied on tows built up ahead of the towboat, firmly lashed to it, and therefore pushed as a single unit. European operations, on the other hand, have used towed barges strung out behind the towboat, as is common in our coastal waters. The American system on the rivers permits tows that are very large (often exceeding 10,000 tons on the better channels and running as high as 35,000 tons), yet highly maneuverable. Integration of the tow to achieve better underwater form has reduced resistance and permitted a considerable increase in speed. A trend toward self-propelled boats is reported in the USSR, but it appears that the horsepower of Soviet river craft is generally less than in the U.S. See "Inland Waterway Officials Say Russia Plans Diversification of Transportation Facilities," *Traffic World*, October 22, 1960, p. 53.

[13] For a discussion of the astonishing lack of capacity to unload and turn ships at Archangel, see C. B. A. Behrens, *Merchant Shipping and the Demands of War*, London, 1955, pp. 253 ff. The recent mission of U.S. inland waterway officials was, however, well impressed with the coordination between rail and water and referred to new and expanded river-rail terminals being "built everywhere." Moreover containers have evidently come into substantial use, since the Ministry of the River Fleet is said to own 200,000 of them. (See *Traffic World*, October 22, 1960, p. 53.) Joint rail-water shipments have, indeed, grown and now stand considerably above the prewar level. Yet they represent only 10 per cent of the originated river tonnage.

commented upon in Chapter 3, makes the Soviet inland waterway traffic compare poorly in relative volume and in economic significance with that of the United States. Actually, it is not far behind our inland waterway traffic if the Great Lakes are excluded, but does not appear to be enjoying the rapid expansion of our river traffic in the past several years.

Although there has been a growth in joint shipments between rail and water, it has been quite modest by comparison with the growth of all-rail traffic. The reporting of such shipments is, however, evidently far from complete since it records only such shipments as move under through billing. These data are as follows for directly reported joint rail-water shipments in million metric tons originated:

Year	River to Railroad	Railroad to River	Combined	Percentage of Total River Tons Originated
1928	0.50	0.30	0.80	2.0
1932	1.40	0.60	2.00	2.8
1939	2.63	2.19	4.82	6.6
1940	3.01	2.31	5.32	7.2
1945	0.40	1.07	1.47	4.1
1949	2.00	3.31	5.32	7.3
1950	3.29	4.49	7.78	9.1

SOURCE: V. V. Zvonkov, *Vzaimosviaz' otdelnykh vidov transporta i osnovy organizatsii smeshannykh perevozok* [The Interrelation of Different Types of Transport and Principles for Organizing Joint Shipments], Moscow, 1953, p. 5.

In comparison with the 834.3 million tons originated on the railroads in 1950, these joint shipments are small indeed. Soviet data indicate that the costs of river transportation (excluding the costs of channel maintenance) are not notably below rail costs. Thus, for 1956, they show a river cost of 3.41 kopeks per equated ton-kilometer compared with 3.7 kopeks by rail. The closeness of these data results in part, of course, from the relative circuity of many of the river routes.[14]

Domestic maritime traffic is also severely handicapped. The Soviet Union has no connected coastline but has instead limited ranges for maritime coastwise trade in the Black Sea, Baltic Sea, and White Sea and on the Pacific seaboard. Weather and ice conditions prevent large-scale use of the Northern Sea Route despite extensive work to improve Arctic navigation. All routes connecting these several coastal areas require highly circuitous movements. Hence the heaviest coastal traffic is on relatively short hauls within the Black Sea and the Sea

[14] *Transport i sviaz' SSSR* [Transportation and Communications in the USSR], Moscow, 1957, p. 24.

of Azov. Operations on the Caspian also come within the jurisdiction of the Maritime Fleet, but are more akin to lake transportation than to the usual run of coastwise operations. Except for movements for the iron and steel industry and the petroleum trade in the Black, Azov, and Caspian Seas and for the lumber and coal trades in the White Sea, heavy commodity movements are not readily accommodated to maritime transport.

It will be observed from series C-43 and C-49 in Appendix C that there has been a tendency toward a shorter average haul, both in inland waterway and in the coastwise trades, since the early 1930's. Indeed the length of haul upon inland waterways appears to decline markedly as early as 1929, while that in the coastwise trade breaks after 1933. By comparison with the lengthening average haul by rail, that of sea transport is of somewhat equivalent length in recent years, while the inland waterways show a short average haul, indicating the predominance of relatively local traffic. The increasing importance of the short-haul Baltic trade, in line with territorial acquisition, must have had its effect upon the length of haul in maritime traffic, but can hardly fully explain this sharp shift. Notwithstanding the heavy expenditures for the improvement of inland waterways, no evidence appears of the development of large-scale, long-distance traffic over these routes, although the development of predominantly short-haul movements on the northern and Siberian rivers may have some slight influence in holding this datum in the vicinity of 500 kilometers in recent years. It is probable, also, that a part of the tonnage growth and of the shortening of haul results from the inclusion in the data of a larger proportion of the short-haul traffic in recent years. The absence of comprehensive operating statistics, the paucity even of traffic information, and the numerous shifts in coverage and reporting methods all make doubtful the practicability of a detailed study of Soviet water transport. As inland waterways and coastwise operations together account for less than 10 per cent of the total ton-kilometrage in recent years, intensive efforts to augment the data appear inappropriate to this study.

Truck Transport

Freight transportation by motor truck was virtually nonexistent before 1930. It then grew rapidly until 1936 and thereafter maintained a steady level until the eve of war. The prewar level was attained early in 1947, and by 1953 ton-kilometrage had nearly quadrupled, reportedly somewhat exceeding the traffic in the coastwise trade and reaching

approximately one-half that of the inland waterways.[15] The statistics are, however, highly unreliable, particularly those purporting to give ton-kilometers, since estimates of length of haul, especially with less truckload movements, tend to be less reliable than estimates of weight on the vehicles. Purporting to come from the reports by drivers to the Ministry and surveys at check points of a rather small sample blown up to represent the total population, these compilations undoubtedly exaggerate the operations which they are intended to cover.[16] On the other hand, they are probably incomplete, as they appear likely to exclude much trucking which is performed on behalf of collective farms and of industrial ministries in vehicles controlled by those organizations and which is neither reported by drivers nor covered by the check-point surveys. Moreover, the growth of reported traffic has been exaggerated by its increase in coverage.

Enough is apparent from the available data, however, to warrant the complete exclusion of truck transportation from a compilation of Soviet intercity traffic data, just as interplant and local switching movements are excluded from the rail data. For it is apparent that virtually no line-haul transportation by truck exists.[17] Reference to series C-55 will disclose that the average reported haul, probably overstated, has varied over the last fifteen years between 10.4 and 13.2 kilometers. This is primarily traffic of the local cartage variety, performed largely in urban and industrial areas and seldom extending beyond the limits of commercial zones. It is of the type excluded from the intercity transportation data of the United States and of many other countries and of the type about which virtually nothing is known statistically in the United States.[18] It embraces local pick-up and delivery and local distribution services hitherto largely performed by horse dray, but in part substitutes for rail switching moves within terminal areas and over plant railroad systems not a part of the national system. It also embraces rural feeder functions into railheads

[15] See series C-53 for the estimated volume of this traffic.

[16] Soviet methods for surveying motor traffic are similar in principle to those employed by the U.S. Bureau of Public Roads. No detailed investigation of comparative methods has, however, been attempted. A description of Soviet methods is given by E. P. Lebedev, *Transportnaia statistika* [Transportation Statistics], Moscow, 1953, pp. 75 ff, 87 ff.

[17] While the 1946-50 Plan called for the organization of "interdistrict" transport of heavy loads by road and also for an increase of 11,500 kilometers in the network of improved roads, there is nothing in available data to suggest more than occasional truck loads in intercity movement.

[18] The absence of data on other than intercity operations in the U.S. is discussed in Harold Barger, *The Transportation Industries: 1889-1946,* New York, National Bureau of Economic Research, 1951, pp. 221 f.

and rural-to-rural movements which are excluded from available United States data. Truck transportation performs the feeder and distribution role anticipated for it in the United States in the early 1920's.[19]

The limited system of highways and the nearly complete lack of improved highways constitute a serious bar to the development of truck transport.[20] The shortage of petroleum has also stood in the way of its development in the past. As will be observed in Chapter 3, Soviet policy is now to encourage the use of trucks for very short hauls, but to provide sharp incentives for employment of railroads for hauls beyond twenty kilometers. Probably truck transport is more expensive relative to railway in the Soviet Union than in the United States and it should be borne in mind that even in the United States truck transportation is relatively economical only for quite short hauls. From the point of view of resource allocation, the development of long-haul truck transport in the Soviet Union would be an error in other than exceptional circumstances. Yet it should play a role in the opening up of new territory where the volume of traffic early in prospect, while insufficient to justify railroad construction, nevertheless requires overland movement. Extension of the improved highway net will, no doubt, also give rise to a modest intercity truck movement of goods requiring more than usual dispatch, a condition likely to be encountered if a shift toward greater proportions of an increasing variety of consumer goods occurs in the aggregate Soviet output.

Petroleum Pipelines

The pipeline has played an astonishingly minor role in Soviet transportation. Series C-50 through C-52 summarize these results. Not only is the aggregate of minor significance, but the postwar advance over 1940 was, until the last five years, modest, as was the growth in the 1930-40 decade. Comparatively little attention is paid to pipelines in the Soviet transportation literature, undoubtedly because of

[19] To include it in a tabulation for comparison with the United States would slightly inflate the Soviet performance. If, however, value weights were employed, along the lines tested by James Blackman in "Measuring the Volume of Transport in the USSR" (processed, Johns Hopkins Operations Research Office Technical Memorandum 126, Baltimore, 1951), using estimated ton-mile cost of transportation, a serious inflation would be introduced, since Soviet truck transportation appears to be remarkably expensive in comparison with rail and other forms. However, the data on this point are scant and would tend to confirm that the truck transport is of the nature of local cartage in which unit operating costs would be relatively high.

[20] In 1956 there were 1,506,000 kilometers of roads, of which 214,500 were hard-surfaced. Only 47,100 kilometers, however, were cement or black-top surface. See *Transport i sviaz'*, p. 201.

their slight significance up to recent times. Increasing oil production and use, however, are now affording opportunity for further development of the pipeline net, and it is clear from recent discussions and from the Seven Year Plan that considerable pipeline construction is contemplated.

The scant development of pipelines no doubt derives from the small-scale oil production and, more particularly, from its scattered distribution. Economy, compared with rail or water transport, can only be secured when a regular flow can be concentrated into relatively large-diameter pipe. In the United States twenty-four- to thirty-inch-diameter pipe with a capacity for crude of between 220,000 and 300,000 barrels per day appears necessary to attain the economy of the large tanker in coastwise service or of the large integrated tow on the principal rivers. Smaller pipe in the eight- to ten-inch range will achieve an economy approximately that of the railroad, but the flow even in such lines involves a heavy concentration of delivery. Where, therefore, petroleum or petroleum products must be spread out over a vast territory for consumption at low rates at numerous points, economical pipeline transportation becomes impossible to arrange beyond certain break bulk points from which other methods of transportation will have to be employed for distribution. The absence of a large automobile population and the scant farm use of petroleum in the Soviet Union necessitate retail rather than wholesale movements over long distances. In the first stage from the refinery, moreover, maritime and river transport can afford bulk movement to numerous points of transfer to the rail system. It appears that, with increasing petroleum production and an increased density of demand, further pipeline development is anticipated and that this method is coming into favor because of the economy with which it uses materials, particularly steel. Up to the present, however, pipelines have played an exceedingly minor role in Soviet affairs and the railroads have been a correspondingly large factor in total petroleum transportation. Yet, as will appear in Chapter 3, petroleum and petroleum products accounted in 1958 for only 6.9 per cent of rail tons originated, suggesting that petroleum is a much smaller element in Soviet transportation as a whole than is true in the United States.[21]

[21] The Sixth Five Year Plan contemplated virtual replacement of rail transport of petroleum by a considerable expansion of the pipeline system (see *Gudok* [Whistle], March 2, 1956). Yet it is apparently anticipated for 1965 that in spite of marked growth in pipeline traffic, railroad ton-kilometers of petroleum and petroleum-product traffic will rise from 11.8 per cent (in 1958) to 13.6 per cent of total railroad ton-kilometers (see series C-8).

Aggregate Intercity Transportation

Ton-kilometers alone can safely be aggregated to provide a measure of total transportation and, as this datum combines distance with tonnage hauled, it is the most useful traffic statistic for most purposes.[22] Tonnage originated runs the risk of duplication because the same ton may be reported as originated two or more times when it is transferred from one form of transportation to others. No adequate data have been discovered on transfers between forms of transport, although it is known that considerable pipeline and water traffic has a subsequent or prior haul by another form of transport. Transfers between the inland and maritime fleets will even tend to inflate the tonnage originated by water carriers. Soviet transportation is, however, performed so largely by rail that the data on tonnage originated by railroads and its breakdown by commodity groups (discussed in Chapter 3) can hardly fail to be representative of the entire transportation picture and cannot understate the tonnage originated for the transportation system as a whole by more than from 6 to 10 per cent in most years.[23] Rail tonnage originated is, therefore, useful for comparison with production data. Accordingly, although tons originated for each type of transport are shown in the Appendix C, the data relied upon here are metric ton-kilometers which are shown below for selected years for the several types of intercity transport and the total (Table 1, Part A, and Chart 1). These data have also been converted into short ton-miles (Table 1, Part B).

[22] Only ton-miles avoid a double count. Thus a ton moved 500 miles by rail and 200 miles by truck would give two tons originated, but only 700 ton-miles, i.e., total length of haul times the one actual ton involved.

[23] Although rail tonnage originated in the U.S. and the USSR can be compared, tonnage originated data do not exist for U.S. transportation by truck and those for water carriers are of uncertain reliability. While tons handled by truck can be estimated from length of haul for regulated carriers (roughly one-third of the total), no allowance can be made for double counting as a result of multiline truck hauls. Pipeline tons originated include heavy duplication, since the bulk of such traffic moves again by water or truck. The same is true of some rail and truck traffic which receives a prior or subsequent rail haul. The growing piggyback service will produce a double count under piggyback plans I and V, the same ton being shown as a rail ton originated and included in truck tons handled despite continuous movement in a highway semitrailer. Average hauls have been increasing in both countries, but as far as it is possible to make an intelligent guess, the lengthening of hauls is not more rapid in one country than in the other. Thus the representativeness of ton-miles should not have been affected.

TABLE 1

SOVIET FREIGHT TRAFFIC, SELECTED YEARS, 1913-60

Year	Rail[a]	Inland Waterway (powered)[b]	Domestic Maritime[c]	Pipeline[d]	Total	Rail as Per Cent of Total
		PART A: BILLION METRIC TON-KILOMETERS				
1913	65.7	26.2	15.1	0.3	107.3	61.2
1920	14.4	n.a.	n.a.	n.a.	n.a.	n.a.
1925/26	68.9	12.9	n.a.	0.4	n.a.	n.a
1928	93.4	15.9	6.2	0.7	116.2	80.4
1930	133.9	22.9	10.0	2.2	169.0	79.2
1932	169.3	25.1	13.9	2.9	211.2	80.2
1936	323.4	31.1	16.7	3.6	374.8	86.3
1937	354.8	33.0	17.0	3.6	408.4	86.9
1938	370.5	32.0	18.8	3.6	424.9	87.2
1939	391.7	34.6	23.0	3.7	453.0	86.5
1940	415.0	35.8	21.6	3.8	476.2	87.1
1945	314.0	18.3	10.1	2.7	345.1	91.0
1946	335.0	19.9	12.4	3.6	370.9	90.3
1947	350.5	24.4	14.7	n.a.	393.6e	89.0
1948	446.0	30.9	16.6	n.a.	497.5e	89.6
1949	523.8	37.2	19.6	n.a.	584.6e	89.6
1950	602.3	45.5	21.2	4.9	673.9	89.4
1951	677.3	51.0	22.9	5.5	756.7	89.5
1952	741.3	57.1	25.8	6.4	830.6	89.2
1953	798.0	58.6	28.0	7.6	892.2	89.4
1954	856.8	61.7	28.2	10.2	956.9	89.5
1955	970.9	66.6	29.7	14.7	1,081.9	89.7
1956	1,079.1	69.7	31.6	20.5	1,200.9	89.9
1957	1,212.8	75.5	n.a.	26.6	1,346.9f	90.0
1958	1,302.0	84.5	n.a.	33.8	1,452.3f	89.6
1959	1,429.5	92.5	n.a.	41.6	1,595.6f	89.6
1960	1,504.3	98.4	n.a.	51.2	1,685.9f	89.2
		PART B: BILLION SHORT TON-MILES[g]				
1913	45.0	17.9	10.3	0.2	73.5	
1920	9.9	n.a.	n.a.	n.a.	n.a.	
1925/26	47.2	8.8	n.a.	0.3	n.a.	
1928	64.0	10.9	4.2	0.5	79.6	
1930	91.7	15.7	6.9	1.5	115.8	
1932	116.0	17.2	9.5	2.0	144.7	
1936	221.5	21.3	11.4	2.5	256.7	
1937	243.0	22.6	11.6	2.5	279.7	
1938	253.8	21.9	12.9	2.5	291.1	
1939	268.4	23.7	15.8	2.5	310.3	
1940	284.3	24.3	14.8	2.6	326.2	
1945	215.1	12.5	6.9	1.8	236.4	
1946	229.5	13.6	8.5	2.5	254.1	
1947	240.1	16.7	10.1	2.7h	269.6	
1948	305.5	21.2	11.4	2.7h	340.8	
1949	358.8	25.5	13.4	2.7h	400.4	
1950	412.6	31.2	14.5	3.4	461.6	
1951	464.0	34.9	15.7	3.8	518.3	
1952	508.8	39.1	17.7	4.4	569.0	
1953	546.6	40.1	19.2	5.2	611.1	
1954	586.9	42.3	19.3	7.0	655.5	
1955	665.1	45.6	20.3	10.1	741.1	
1956	739.2	47.7	21.6	14.0	822.6	
1957	830.8	51.7	21.9h	18.2	922.6	
1958	891.8	57.9	21.9h	23.2	994.8	
1959	979.2	63.4	21.9h	28.5	1,093.0	
1960	1,030.4	67.4	21.9h	35.1	1,154.8	

NOTES TO TABLE 1

a Taken from series C-1, Appendix C. Data are tariff metric ton-kilometers including company material hauled in "commercial" trains. These do not reflect the physical work performed by the railroads as closely as operating ton-kilometers. They do more closely approximate the useful "product," as they come close to representing the service required in distribution within the confines of the existing railroad plant. See the discussion in Chapter 2.

b Taken from series C-41. Extensive recourse has been had to estimations based on percentage relationships (see notes to series C-41). For 1956-59, series C-41, col. 2, times ratio of col. 1 to col. 2 for 1955.

c Taken from series C-47. Data cover domestic maritime traffic carried in Soviet bottoms. Participation of foreign flags in Soviet domestic traffic was of some significance for a brief period during the early 1930's, but declined after 1936 and disappeared in 1940. Tons originated by foreign flag tonnage exceeded 15 per cent of the total for several years during that period. No ton-kilometers are available, however, for the foreign-flag tonnage. Hence the data for Soviet bottoms only can be employed in this compilation. Data from series C-47 are largely estimated and the notes should be consulted for explanation. See also Appendix B for a general discussion of the problems of estimating Soviet maritime traffic. For 1955-56, derived from the ratio of 1954 estimate to petty cabotage in Table B-10.

d Taken from series C-50.

e Obtained by assuming pipeline traffic was 4 billion metric ton-kilometers in these years.

f Obtained by arbitrarily assuming that domestic maritime traffic was 32 billion metric ton-kilometers in these years.

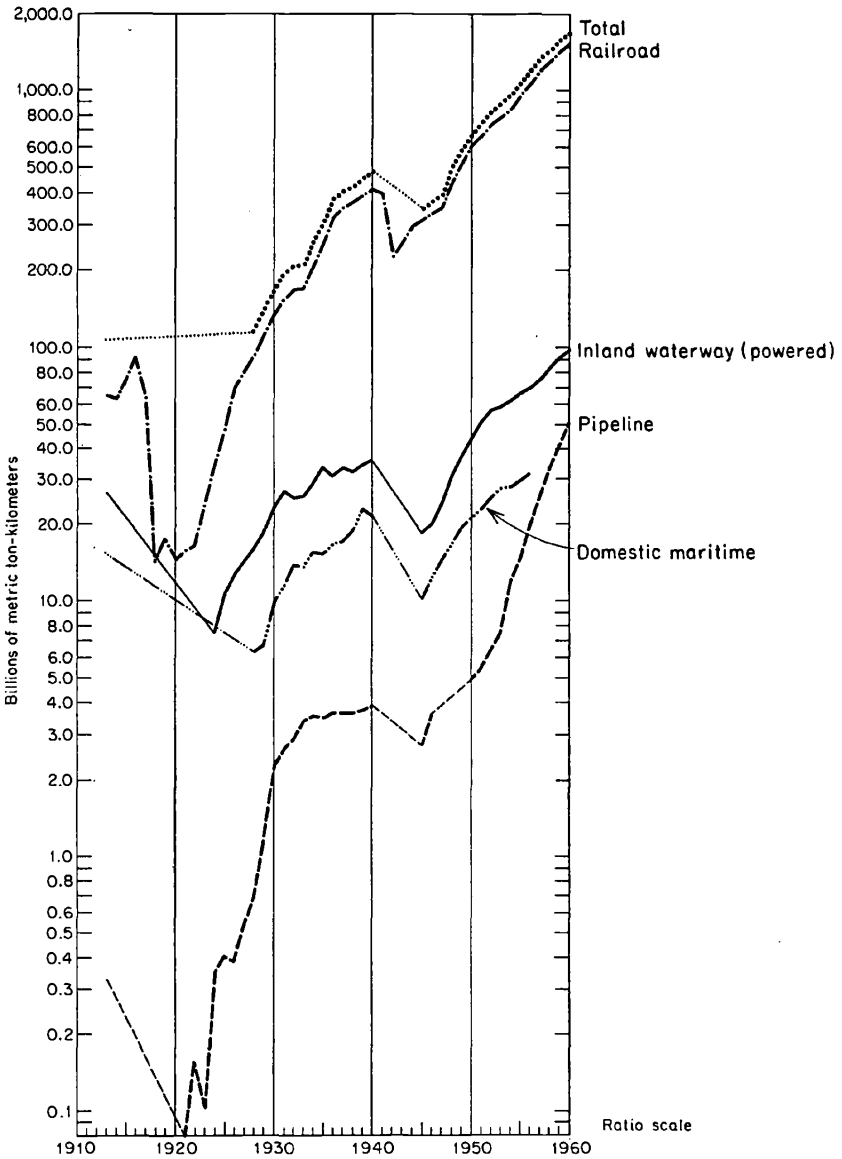
g Converted from ton-kilometers at 0.685 ton-miles per metric ton-kilometer.

h Assumed to enable a total to be estimated.

NOTE: Changes in concept, of which some have come to our attention and others may not have, deprive these series of complete homogeneity. The rail tariff ton-kilometers, in particular, have been subjected to a change in the postwar period that inflates them somewhat by comparison with the earlier data. This change is discussed in Chapter 2.

CHART 1

Soviet Freight Traffic, Selected Years, 1913-60



Source: See sources to Table 1.

The probable accuracy of the rail series will be discussed at some length in Chapter 2. Suffice it to say that it is believed to overstate actual performance somewhat. While Table 1 probably reasonably reflects the relative movement of traffic by various types of transport from year to year, it should be borne in mind that the data in all likelihood err on the high side. Much more is known about the nature and causes of error in the rail series than in the others. Not enough is known, however, to permit any conclusion on whether the series for one type of transport is more seriously overstated than those for others. Only a qualitative comment is possible on the direction of error.

It will be observed that all intercity freight transportation quadrupled between 1928 and 1940, that the prewar level was attained in 1948, and that by 1954 it had been doubled. Since 1945 a remarkable stability has prevailed in the relationship of rail to other forms of transportation. Even the sharp growth in pipeline volume after 1953 has not greatly disturbed this relationship.

It should be noted that some of the postwar growth in traffic can be traced to expansion of Soviet territory. For years up to 1940, the data in Table 1 are given for the interwar territory; for 1940 on, for the postwar territory. The acquired territories brought about an increase of approximately 7 per cent in railway mileage but they probably had a traffic density somewhat lower than that of the Soviet system in the interwar territory.

Transportation in the United States

Although rail transportation is representative of Soviet transportation today, the same is not true in the United States. Comparisons of the two countries using freight traffic growth as representative of economic growth must be made from aggregates of intercity transportation by all forms of transport (except air which is too negligible for inclusion). A first step is, therefore, to develop the aggregate ton-mile output in the United States in a fashion as nearly comparable with the Soviet coverage as possible. This is difficult because, for some forms of transportation, our statistics are hardly in a better state than those of the Soviet Union and may easily contain biases of as great a magnitude as those that are believed to characterize the Soviet data; nor is the bias likely to be always in a single direction.[24] Moreover, certain of the data have been shifting in coverage over the period we would like to compare and we are unable here to go into all of the qualifications

[24] Only the data on railroads can properly be referred to as statistics.

which surround the estimates for every form of transport except rail, although we shall call attention to them and cite available discussions. Because of the infirmities of estimates for years before 1939, emphasis will be placed upon the period from 1940 to the present, although some much less reliable estimates will be employed for selected years before 1940 because of the great interest of contemporaneous developments in the Soviet Union.

From Table 2 (and Chart 2) on intercity freight traffic in the United States, it appears that, whereas in the 1920's railroads were accustomed to handle well over 60 per cent of the total volume, their share declined rapidly during the 1930's until America's entry into the second war.

TABLE 2

UNITED STATES INTERCITY FREIGHT TRAFFIC, SELECTED YEARS, 1890-1959
(billion short ton-miles)

Year	Rail[a]	Inland Waterways[b]	Coastwise and Intercoastal[c]	Motor Truck[d]	Pipeline[e]	Total	Rail as Per Cent of Total
1890	84.0	19.2	16.6			119.8	70.1
1920	456.2	78.0	59.0		7.0	600.2	76.0
1926	490.8	93.0	158.0	5.0	19.0	765.8	64.1
1928	479.1	86.0	163.0	8.0	26.0	762.1	62.9
1930	423.2	78.0	160.0	12.0	33.0	706.2	59.9
1932	258.0	28.0	131.0	15.0	34.0	466.0	55.4
1936	375.3	86.0	192.0	28.0	40.2	721.5	52.0
1937	398.6	103.0	219.0	35.0	45.0	800.6	49.8
1938	320.2	60.0	202.0	40.0	42.5	664.7	48.2
1939	370.2	96.2	234.7	52.8	55.6	809.5	45.7
1940	411.8	118.1	243.4	62.0	59.3	894.6	46.0
1945	736.2	142.7	117.2	66.6	126.5	1,189.2	61.9
1946	642.7	124.0	229.7	81.7	95.1	1,173.2	54.7
1947	706.7	146.7	206.7	101.7	105.2	1,267.0	55.8
1948	688.7	161.8	210.5	115.5	119.6	1,296.1	53.1
1949	567.3	139.4	214.3	124.9	114.9	1,160.8	48.9
1950	628.5	163.3	233.0	170.2	129.2	1,324.2	47.5
1951	686.4	182.2	251.1	182.5	152.1	1,454.3	47.2
1952	651.4	168.4	248.1	184.1	157.5	1,409.5	46.2
1953	641.8	202.4	264.4	217.2	169.9	1,495.7	42.9
1954	577.5	173.7	270.2	214.6	179.2	1,415.2	40.8
1955	654.8	216.5	278.7	226.2	203.2	1,579.4	41.5
1956	670.2	220.0	274.4	253.8	230.0	1,648.4	40.6
1957	649.4	231.8	268.4	244.9[f]	222.7	1,617.2	40.0
1958	574.8	189.0	n.a.	255.5	211.3	1,500.6[g]	38.3
1959	604.0	196.6	n.a.	288.5	227.0	1,586.1[g]	38.1

NOTES TO TABLE 2

a Revenue ton-miles of Class I, II, and III line-haul railways, electric railways, express and mail, plus nonrevenue ton-miles of Class I steam railroads. Nonrevenue ton-miles of other railroads are not available but are negligible. For 1889, from Barger, *Transportation Industries,* p. 184, adjusted as for 1940. For 1920, 1926, 1928, 1930, 1932, and 1936-38, derived from tons carried one mile by Class I, II, and III railroads as those compared in 1940 with the 1940 datum shown here. Tons carried one mile are from *Statistics of Railways in the United States,* Interstate Commerce Commission, Washington, 1940, Table 155. For 1939-52, from *Intercity Ton Miles, 1939-1952,* I.C.C. Statement No. 544, File No. 10-D-7. For 1953-59, revenue ton-miles (from *Transport Economics,* October 1955, p. 5; *70th Annual Report of the Interstate Commerce Commission,* Washington, 1957, p. 43; *73rd Annual Report of the I.C.C.,* Washington, 1959, p. 11; *74th Annual Report of the I.C.C.,* Washington, 1961, p. 10; and *Intercity Ton Miles, 1939-1959,* I.C.C. Statement No. 6103, File No. 10-D-7) adjusted to the broader concept for 1953 by the relationship which prevailed in 1952, for 1954 and 1955 by the addition of nonrevenue ton-miles reported in *70th Annual Report of the I.C.C.,* p. 43 (source note 1), and for 1956-59 by the relationship which prevailed in 1955.

b Includes the Great Lakes and the intercoastal waterways. For 1889, 1920, 1926, 1928, 1930, 1932, and 1936-38, estimates from Barger, *Transportation Industries,* Table H-1, p. 254. Expansion of the coverage of Corps of Engineers data employed for estimation account for lack of homogeneity between earlier and later years. For 1939-52, from *Intercity Ton Miles, 1939-1952,* Table 2. The data include certain international operations conducted in the United States inland waters. For 1953-59, from *Transport Economics,* October 1955, p. 5; *70th Annual Report of the I.C.C.,* p. 43; *73rd Annual Report of the I.C.C.,* p. 11; and *Intercity Ton Miles, 1939-1959.*

c For 1889, 1920, 1926, 1928, 1930, 1932, and 1936-38, from Barger, *Transportation Industries,* p. 254. Barger's method is substantially similar to that of the Maritime Commission (see Barger, pp. 255-259). For 1939-50, I.C.C. estimates derived from computations of the U.S. Maritime Commission. For 1951-54, estimates of our own made by substantially the same methods, employing data from U.S. Army, Board of Engineers for Rivers and Harbors, *Waterborne Commerce of the United States,* Washington, 1951-54, together with representative distances from U.S. Navy, Hydrographic Office, Table of Maritime Distances. The basic data of the Corps of Engineers present many difficulties of concept, coverage, and overlap. For an analysis of these difficulties, reference may be made to Wytze Gorter and George H. Hildebrand, *The Pacific Coast Maritime Shipping Industry, 1930-1948,* Berkeley, 1952, Vol. I, pp. 71-81. For 1955-57, estimated in *73rd Annual Report of the I.C.C.,* p. 11.

d These data follow the 1952 revision by the Interstate Commerce Commission in which an effort was made to exclude rural-to-rural movement as well as local and suburban delivery by truck. See *Intercity Ton Miles, 1939-1952,* pp. 1-3, for an explanation of the methods used in estimation. Prior to 1939, taken from Barger, *Transportation Industries,* Table F-4, p. 242. Since 1952, from *70th Annual Report of the I.C.C.,* p. 43; *73rd Annual Report of the I.C.C.,* p. 11; *74th Annual Report of the I.C.C.,* p. 10; and *Intercity Ton Miles, 1939-1959.* The surveys on which estimates of the Bureau of Public Roads are based, from which these estimates are derived, are discussed in *Public Roads* (December 1956, pp. 97-98, 102-103), as are statistical methods for choosing and expanding the samples (*ibid.,* pp. 110-117).

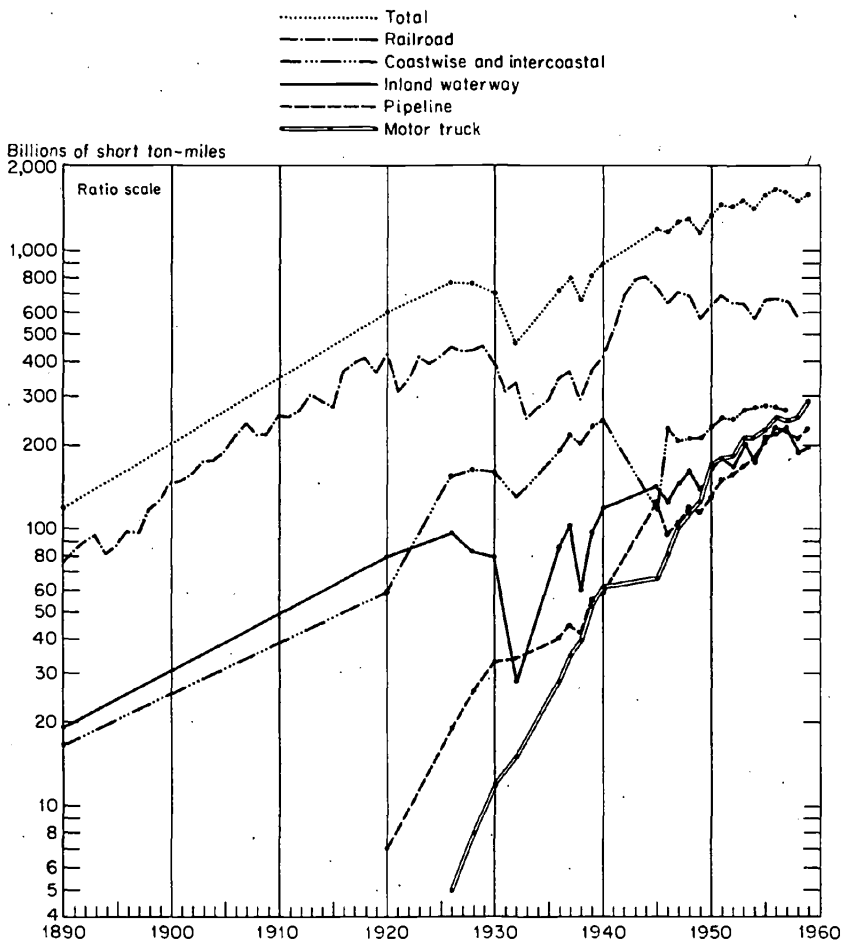
e For 1920, 1926, 1928, 1930, 1932, and 1936-38, from Barger, *Transportation Industries,* Table G-1, p. 251. For later years, from the same I.C.C. sources as cited for motor truck transportation. The estimates by Barger include only pipelines reporting to the I.C.C., hence are less complete than the data shown for later years. The disparity between Barger's estimate for 1940 and the figure here shown is 13.9 billion ton-miles.

f Not comparable with data for other years.

g In order to show a total, coastwise and intercoastal traffic has been included arbitrarily at 270 billion in each year.

CHART 2

U.S. Intercity Freight Traffic, Selected Years, 1890-1959



Source: Table 2, except for railroad freight traffic for 1890-1938, which is from Barger, **Transportation Industries,** Table B-1, pp. 184-185. Those early data have not been adjusted here to include nonrevenue ton-miles, as those in Table 2 were, but the total freight traffic shown here is nevertheless taken from Table 2. The data for 1890-1915 are for years ending June 30, thereafter for calendar years.

By 1940 they handled only 46 per cent of the total. During the war, however, their share increased rapidly and at the end of the war stood at nearly 62 per cent. Since that time there has been an almost uninterrupted decline to a share of less than 40 per cent in the late 1950's.

The rail data employed here are approximately the net ton-miles of all American railroads, for they include nonrevenue ton-miles of Class I carriers. In Chapter 2 we shall have occasion to discuss the proposition that the available Soviet series corresponds most closely to net ton-miles for U.S. roads. However, the Soviet data are tariff, rather than actual, ton-kilometers, a difficulty which will also be discussed in Chapter 2. As there is good reason to believe, from the analysis in the next chapter, that these tariff ton-kilometers are overstated, we have made no adjustment here to place the U.S. data on short-line distances. While the relationship to reported actual ton-kilometers is known approximately, the extent of overstatement is not known for either series although it is believed to be large enough to be of significance. These two differences oppose and at least partially offset one another—perhaps completely in some years. It is likely, however, that the Soviet series overstates in most years the ton-kilometers which are properly comparable with the U.S. series.

It is customary to leave coastwise and intercoastal transportation out of the reckoning in presenting statistics of U.S. transportation. To do so, however, ignores important traffic flows which are of great significance to our domestic economy and which compete with other types of transport; for other resource and movement arrangements would be essential in the absence of these flows, and a large portion, at least, would turn up in other forms of transport. The largest single element of our domestic petroleum transportation is embraced within these data, for nearly the whole coastwise tonnage in recent years is made up by the Gulf-Atlantic petroleum movement. While the hauls in some of these trades are long by comparison with overland routes, the principal trades show only a modest degree of circuity, hence no adjustment has been considered. All the estimates of water transportation volume are subject to a considerable margin of error since no ton-mile data are collected and the Corps of Engineers tonnage data leave much to be desired.[25]

The data on motor truck transportation are estimated, and the estimates have gone through several revisions in recent years. They are designed to show all ton-miles carried by motor vehicles between cities and also between rural and urban areas. They are designed to exclude rural-to-rural movements, city deliveries, and city movements to contiguous suburbs. Estimates by the Bureau of Public Roads

[25] The difficulties with the statistical sources are discussed at length elsewhere and need not be recounted here. See particularly Gorter and Hildebrand, *Pacific Coast Maritime Shipping*, pp. 71-81.

have been adjusted by the Interstate Commerce Commission in an effort to secure this desired coverage of "intercity" traffic.[26] It should be noted that the Bureau of Public Roads estimate is derived from information gathered at test points maintained by the Bureau in order to obtain information on the use made of highways. The representativeness of these estimates has long been a matter of controversy, but they are the only available estimates with any substantial underpinnings of evidence. It will also be observed that these data exclude virtually all motor truck movements of the type which occur in the Soviet Union even though the notion "intercity" sometimes includes movements between political entities which form parts of a metropolitan region in an economic sense. The terminal district concept as administered by the I.C.C. does, however, avoid this difficulty in many of the large urban areas, even bistate ones.

As pointed out in the notes to Table 2, the pipeline data for the years before 1940 are not as inclusive as those after that date. It should be understood that in both periods the ton-miles are estimates based upon barrels moved, estimated weights, and estimated lengths of haul. They are compiled from reports to the I.C.C. of carriers under Commission regulation and from data developed by the Bureau of Mines for nonregulated pipelines. They exclude natural gas lines, but include both crude and products trunk lines and the gathering line system. The growing importance of this method of transportation will be obvious.

The data, when presented in this form, indicate the sharp change in American transportation which has occurred since the 1920's. As the rail share has declined, the representativeness of rail data has also declined. Attention should be focused upon the character of traffic by the various modes of transportation because it has a distinct bearing upon the extent to which rail transport now reflects the aggregate composition of intercity traffic. Unfortunately, data on the composition of truck traffic by commodity and by size of shipment is not available. In 1926, all the water transportation shown was primarily bulk carriage of low-grade commodities, with the exception of a limited tonnage of general cargo handled in the coastwise and intercoastal trades and a very small volume of package freight. The pipeline movement was, of course, bulk. The high-grade traffic moved by truck was a very minor item. It is not likely that traffic in manufactures and miscellaneous categories exceeded 30 per cent of total ton-miles

[26] These adjustments are described in *Intercity Ton Miles, 1939-1952*, pp. 1 ff.

and virtually all of this moved by rail.[27] At the high traffic level of 1953, the situation was in marked contrast to the earlier year. Less-than-carload traffic originated by rail had declined from some 40 million tons in 1926 to a mere 8,255,000 tons in 1953. Manufactures and miscellaneous tonnage originated by rail in 1953 was only 14 per cent higher than in 1926 and its ratio to the total showed very little change. In the interval, however, truck transportation had built up from virtually nothing to 217 billion ton-miles and, while nothing is known directly of the composition of this traffic, what we do know about the character, organization, and regulatory status of truck operators leads us to suppose that more than 70 per cent of this traffic is less-than-carload and manufactures and miscellaneous categories. Water transportation has remained primarily bulk carriage of raw materials, fuels, and staples, changes in the general cargo and package traffic among trades having probably offset one another in large degree. A growing portion of pipeline traffic has, however, been in refined products which has brought it into the manufactured category. It would appear likely, although no satisfactory proof can be afforded, that the proportion of aggregate ton-miles represented by manufactured products, including petroleum, in 1953 was significantly larger than it had been in 1926 and probably represented between 35 and 40 per cent of the total.

When measurement is changed from ton-miles to revenues, the significance of the growth of motor transportation becomes more readily apparent. Revenues of motor common carriers per ton-mile have consistently been more than three times the average ton-mile revenues of railroads, reflecting both the higher quality and shorter average haul of truck freight.[28] Water and pipeline carriers, of course, obtain ton-mile revenues substantially lower than those of railroads. Barger has worked out the freight revenues of the various forms of transportation for 1939:[29]

[27] Rail carloadings were 35.96 per cent in the manufactures and miscellaneous category to which may be added the less-than-carload tonnage. Ton-miles are not available by class of traffic, but tons originated in these two categories represented 28 per cent of total rail tonnage originated, and, as the average haul is longer for these than for other groups, rail ton-miles in these categories may be supposed to have exceeded 30 per cent of total rail ton-miles.

[28] However, average truck hauls for Class I regulated carriers have approximated 200 miles in recent years.

[29] Barger, *Transportation Industries*, pp. 15, 128.

Electric and steam railroads	$3,317,000,000
Intercity for-hire trucking	887,000,000
Pipelines	188,000,000
Waterways	463,000,000
Total	$4,855,000,000

Charles Taff has developed estimates for 1951 and 1955 which cover passenger and freight transportation combined, but from which we may extract certain approximations of intercity freight transportation:[30]

	1951	1955
	(million dollars)	
Steam and electric railroads	8,860	8,790
Common and contract truck	4,169	
Total, intercity truck		12,900
Pipeline (petroleum)	655	846
Water carrier	1,930	2,659
Total	15,614	25,195

Thus it appears that rail freight revenues have declined from 69 per cent of the total in 1939 to 56 per cent in 1951. But this is far from a complete picture, for the truck revenues shown here represent approximately 37 per cent of the intercity movement covered by our ton-mile estimates while they include certain local operations excluded from those data. As Class I motor carriers of property reporting to the Commission in 1951 already had average ton-mile revenues exceeding five cents, it is reasonable to use a figure of four cents a ton-mile for the entire intercity truck traffic. If this is done, we obtain $7,300 million of truck revenues and a total for all transportation of $18,745 million. By 1953 truck revenues should have passed rail freight revenues and should have accounted for approximately 43 to 46 per cent of all intercity freight revenues. This situation is emphasized by Taff's 1955 estimates which attempt to reflect all intercity truck transportation. Upon this basis, rail freight revenues were less than 35 per cent of all freight revenues. These value data demonstrate the extent to which the United States has become dependent upon the truck for its high-quality transportation—predominantly the movement of small-lot consignments and of finished and semi-finished manufac-

[30] Charles A. Taff, *Traffic Management: Principles and Practices*, rev. ed., Homewood, Ill., 1959, p. 3.

tured items, although the substantial truck movement of perishables and other agricultural commodities in exempt transportation should not be forgotten.

Comparisons of Soviet and United States Traffic

To compare Soviet and United States aggregate freight traffic, it is necessary to convert the data to a common unit of measure. Because the short ton-mile is a measure more congenial to American ways of thinking than the metric ton-kilometer, we have converted Soviet data into short ton-miles. The results are presented in Table 3 and Chart 3.

TABLE 3

UNITED STATES AND SOVIET TOTAL FREIGHT TRAFFIC, SELECTED YEARS, 1890-1959
(billion short ton-miles)

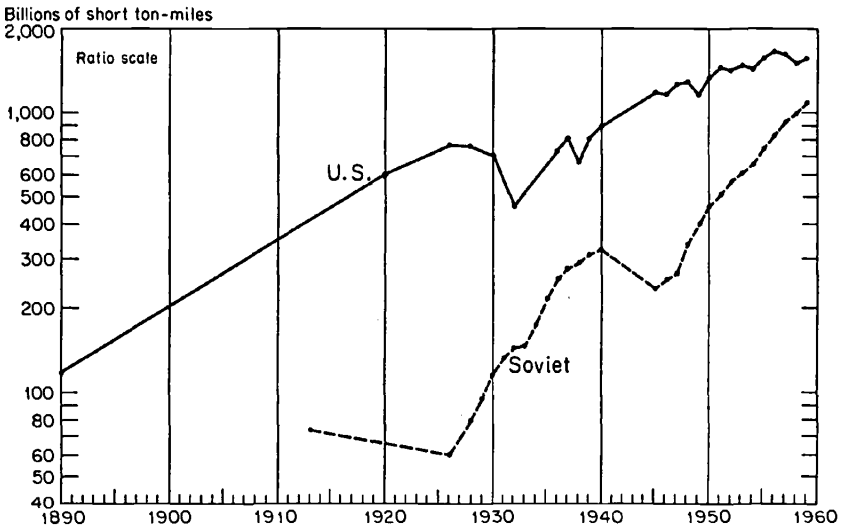
Year	U.S. Traffic	Soviet Traffic	U.S. as a Multiple of Soviet Traffic	Excess of U.S. over Soviet Traffic
1890	119.8	n.a.		
1913	n.a.	73.5		
1920	600.2	n.a.		
1926	765.8	60.4a	12.7	705.4
1928	762.1	79.6	9.6	682.5
1930	706.2	115.8	6.1	590.4
1932	466.0	144.7	3.2	321.3
1936	721.5	256.7	2.8	464.8
1937	800.6	279.7	2.8	520.9
1938	664.7	291.1	2.3	373.6
1939	809.5	310.3	2.6	499.2
1940	894.6	326.2	2.7	568.4
1945	1,189.2	236.4	5.0	952.8
1946	1,173.2	254.1	4.6	919.1
1947	1,267.0	269.6	4.7	997.4
1948	1,296.1	342.2	3.8	953.9
1949	1,160.8	400.4	2.9	760.4
1950	1,324.2	461.6	2.9	862.6
1951	1,454.3	518.3	2.8	936.0
1952	1,409.5	569.0	2.5	840.5
1953	1,495.7	611.1	2.4	884.6
1954	1,415.2	655.5	2.2	759.7
1955	1,579.4	741.1	2.1	838.3
1956	1,648.4	822.6	2.0	826.4
1957	1,617.2	922.6	1.8	694.6
1958	1,500.6	994.8	1.5	501.8
1959	1,586.1	1,093.0	1.5	493.1

SOURCE: Tables 1 and 2.

a For 1925/26. For purposes of this comparison, maritime traffic is assumed to have been 6 billion ton-kilometers in 1925/26.

CHART 3

Comparison of U.S. and Soviet Total Freight Traffic, Selected Years, 1890-1959



Source: For U.S., Table 3; for Soviet Union, derived from sources given in Table 1 and converted into short ton-miles (at 0.685 ton-miles per metric ton-kilometer).

It will appear from Table 3 that while transportation in the United States more than doubled between its pre-World War II peak in 1926 and its peak to date in 1956, Soviet transportation increased twelve times in the equivalent period. Yet in 1956 the United States was still transporting more than twice as many ton-miles of freight as the Soviet Union, without even taking account of the fact that the United States product is probably understated,[31] and the Soviet product overstated, a matter that will be discussed in the following chapter. During this period, moreover, U.S. traffic grew by 820.3 billion ton-miles while Soviet traffic grew only 762.1 billion. Soviet transportation was nearly 30 per cent below the 1940 level in 1945, but by 1954 had attained slightly more than double the 1940 volume. The United States, however, which experienced a growth during the war, had by 1953 moved up to 166 per cent of the 1940 level, and then experienced a

[31] This applies particularly to intercity truck transportation, since it is believed that a portion of the vehicles escapes Bureau of Public Roads stations under the misapprehension that they are state weighing stations. It may apply also to certain elements of water transportation because the ton-miles are estimated from what are believed to be representative distances which may well understate distances over the routes of movement, especially where outports are served.

modest decline. This decline was more than made up for in 1955 and a further increase occurred in 1956. Since then, the volume has decreased, although a resumption of traffic growth now appears to be in progress.

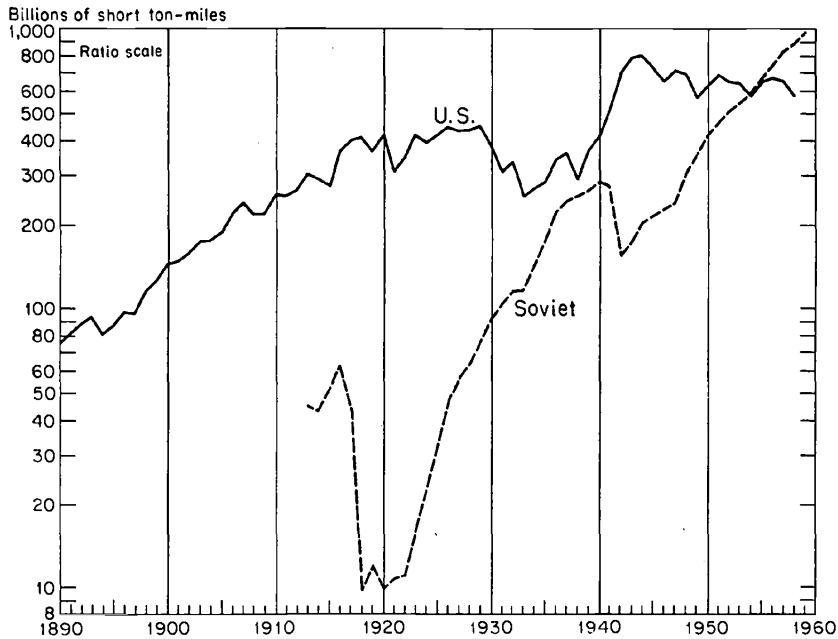
Over the decades covered in Table 3, it was never necessary for U.S. freight traffic to grow as rapidly as Soviet freight traffic has, except for the brief acceleration to the wartime peak. It is worth noting, however, that the American rail plant, without increase of mileage and with a shrinkage of total available trackage, without significant increase of its freight car fleet, and with only limited additions to its motive power, was able to handle by 1944 more than two and a third times the volume of 1938. With substantially less plant and equipment than in 1926, the 1944 performance was one and a half times the previous peak volume of 1926. In no small measure the ability of the American rail system to accomplish so large an increase in ton-miles in such a short space of time is the result of the transition from peacetime to wartime conditions, which makes possible changes in operation conducive to more intensive utilization. "Normal" Soviet conditions, as will be observed later, are more akin to wartime than to peacetime conditions in the United States. But in considerable part the wartime experience also reflects the fact that the American railway system has, over the years, carried a good deal of excess capacity in its main running lines and terminals.

The effect of the depression of the 1930's, reflected in the decline of U.S. traffic while Soviet traffic continued to grow, is apparent in Table 3. The rapid wartime expansion in the U.S. and the contemporaneous contraction in the USSR resulted in U.S. excesses over USSR freight volume approaching a trillion ton-miles in each of the first four postwar years. Only a modest reduction in this excess occurred until after 1956 when the U.S. experienced a decline in traffic volume.

The brief discussion so far has compared Soviet and American developments over concurrent periods. This involves comparing growth in the relatively large American industry with growth in the relatively small Soviet industry. Rapid rates of growth characterized transportation in the United States at earlier periods in its history. Since extensive data are not available for total transportation during those earlier periods, recourse must be had to railroad data alone as a means of appraising relative rates of growth. As an approach to these comparisons, we may recast Soviet railroad ton-kilometers and compute index numbers using various base years to compare rates of growth

CHART 4

U.S. and Soviet Railroad Freight Traffic, Selected Years, 1890-1959



Source: For Soviet Union, series C-1 in Appendix C converted into short ton-miles. For U.S., see Chart 2.

TABLE 4

SOVIET RAILWAYS, INDEX NUMBERS, SELECTED YEARS, 1913-54

	1913 Base	1926 Base	1940 Base	1948 Base[a]
1913[b]	100			
1925/26	105	100		
1930	204	194		
1935	393	375		
1940	632	602	100	
1948	679		107	100
1950	917		145	135
1952	1,128		179	166
1954	1,304		206	192

SOURCE: Table 1; 1935 from series C-1 in Appendix C.

NOTE: It should be observed that moderate territorial expansion, for which we have been unable to adjust, entered at several points (see Chapter 2). There is also reason to suppose that the overstatement of ton-kilometers may have increased as a percentage of the whole, particularly in the 1930's, which would exaggerate the rate of growth. The evidence is, however, far from conclusive; hence it is undesirable to make any assumptions on this point. The ton-kilometer series, as observed above, is not entirely homogeneous because of several changes of concept.

a This is of interest as a base year since it represents the first postwar year in which the 1940 volume of freight traffic in ton-kilometers was surpassed.

b Interwar territory.

with those during various periods in American railroad history (Table 4; see also Chart 4). Thus, from the level achieved in 1913 before the revolution, Russian rail freight traffic multiplied thirteen times over the forty-one years through 1954. Soviet rail traffic first exceeded U.S. rail volume in that year and it has remained ahead in all subsequent years. By comparison, United States traffic multiplied 11.4 times from 1882 through 1923; 10.2 times from 1885 through the 1926 peak; five times from 1889 through 1930, which was a year of depressed traffic; and 3.8 times from 1904 through the all-time peak of 1945. Data for all United States railroads are not available before 1882.

Comparisons of the Soviet 1926-40 experience may be made with traffic growth in ton-miles on United States railroads at five-year intervals for various periods of rapid growth as follows:[32]

	U.S.					
Soviet 1925/26 Base	1890 Base	1893 Base	1894 Base	1895 Base	1898 Base	1903 Base
100	100	100	100	100	100	100
194	112	122	154	166	152	126
375	186	185	217	219	191	174
602	245	233	272	299	264	236

Thus it appears that the most rapid growth over a fifteen-year period in the recorded history of American railroads was from 1895 to 1910 when the volume nearly tripled.[33] However, it appears from the Babson estimates of ton-miles, which antedate the Interstate Commerce Commission statistics, that in the period 1877-81 American railroad ton-miles more than doubled in the space of four years.[34] Between 1885 and 1888 the increase was by approximately one-half. Both of these periods represent increases from the low points of depressions and both were accompanied by a rapid increase of line mileage—indeed they were two of the most vigorous periods of railroad building and of westward expansion in American railway history. The rates then achieved were not sustained over long periods. Nor can the Babson estimates be meshed with the I.C.C. figures to enable us to span the periods before and after 1889 with confidence. However, it may be observed that the growth beween 1890 and 1920 was not quite sixfold. After 1918 growth was at a considerably slower rate than in the period from 1890 up to that year.

[32] All U.S. data for the period before 1940 are for Class I, II, and III railroads, revenue ton-miles only, as reported by the I.C.C.

[33] The Interstate Commerce Commission statistics begin with the year 1889.

[34] See Thor Hultgren, *American Transportation in Prosperity and Depression*, New York, NBER, 1948, p. 24.

Soviet postwar traffic growth, since the re-establishment of the prewar level, has been slower than during the prewar period. It has had no parallel in recent American history, for either rail alone or transportation of all types (Table 5). Hence some indexes of railroad

TABLE 5

UNITED STATES AND SOVIET POSTWAR GROWTH OF FREIGHT TRAFFIC, INDEX NUMBERS

	Soviet Rail		*U.S. Rail*		*U.S. All Transportation*	
	1940 Base	1948 Base	1940 Base	1948 Base	1940 Base	1948 Base
1940	100		100		100	
1948	107	100	167	100	145	100
1950	145	135	152	91	148	102
1952	179	166	158	95	158	109
1954	206	192	140	84	155	107[a]

SOURCE: Tables 4 and 2.

a 1954 was a year of depressed truck and rail traffic. For 1955, the ratio on the 1948 base was 118, while for 1953 it stood at 114.

growth at earlier periods of U.S. history are also offered at two-year intervals for comparison with the span in Soviet development from 1948 to 1954 (Table 6). Again it is necessary to return to the period before 1889 to find growth rates in short periods on American railroads which duplicate the Soviet postwar period.

TABLE 6

SOVIET POSTWAR GROWTH OF RAIL TRAFFIC
COMPARED WITH OTHER PERIODS IN THE UNITED STATES, INDEX NUMBERS
(two-year intervals)

	U.S.			
Soviet 1948 Base	1894 Base	1898 Base	1908 Base	1921 Base
100	100	100	100	100
135	119	125	117	134
166	142	138	121	135
192	176	154	132	139

SOURCE: Table 4 and footnote 32.

As will be elaborated in later chapters, the Soviet growth is a real one, even though our indexes may overstate it to some degree. It represents, moreover, a very solid accomplishment. Except for a brief period in the middle 1930's, no substantial evidence has come to light which suggests that Soviet transportation inadequacies have in any material way limited the growth of other segments of the economy, although it is clear that Soviet industry labors under the burden of adjusting its operations to limited transportation capacity in ways unknown in the Western world. Four decades of intensive development of a limited rail network with a highly intensive use of the physical plant appear not to have diminished the capabilities of transport in relation to the economy as a whole. The period has been one of struggle to keep abreast of traffic, however. There has not been significant concentration on service improvement. The emphasis now appears to be shifting toward modernization of plant and equipment which, however, Soviet writers concede will be a slow process as theirs is a rapidly expanding railroad economy. That there are but limited reserves in the transportation system is very probably correct, yet if this should also be true of the Soviet manufacturing industry, then the risk may be a limited one. Nevertheless, the recent literature suggests growing concern lest the postwar transportation expansion not keep pace with the demands of the economy and lest this failure again obstruct growth in other sectors. Hence the emphasis is on further expansion, but with an economy of investment to be made possible by large-scale electrification and dieselization.

The rationale behind such proposals as embraced in the Sixth Five Year Plan was made clear by Blackman in his study of locomotive technology,[35] and the same policies appear to be reflected in the current Seven Year Plan for the years to 1965. Essentially they represent a logical continuance of earlier policy for, by shifting to diesel power, it will be possible to handle heavier trainloads at greater speeds over existing lines, thus increasing the output of which these lines are capable. Although passing sidings and receiving and departure yard trackage may require lengthening, the light axle loadings of diesel power will avoid the necessity for large-scale replacement of rail with heavier section as well as the necessity for extensive bridge strengthening or replacement. Both these types of rebuilding would be required were more intensive working sought through the use of heavier steam power. Hence although the Soviet calculations promise

[35] James H. Blackman, *Transport Development and Locomotive Technology in the Soviet Union,* Columbia, S. C., 1957.

operating economies analogous to those realized in this country, primary interest appears to be focused on the saving in capital investment associated with a given increase in capacity. This gives dieselization a dimension which was rarely of significance in the U.S.[36]

[36] Difference in the quality of transport output might, of course, be reflected by comparisons in value terms rather than in ton-miles. Since the Soviet output is virtually all performed by rail, water, and pipeline transport, and since the principal change over the years has been the increase in the rail share to nearly 90 per cent, a properly constructed index of values ought to show a growth not very different from that in ton-miles. In the United States, despite great changes in the participation of various types of transport, the discrepancy between output measured in value and that measured in ton-miles appears to be less than might be expected. For while the 1955 volume was slightly over twice the 1929 volume, estimated freight revenues were less than two and a half times the 1929 level. Yet U.S. performance compared with USSR performance would probably appear somewhat stronger in value terms than in tons or ton-miles, as used here.