

DETERMINANTS OF FREIGHT TRAFFIC IN THE FEDERAL
REPUBLIC OF GERMANY THROUGH THE YEAR 2000

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Outline

- A) Determinants of Freight Traffic as Factors Governing Future Transport Demand

- B) Determinants of Freight Traffic
 - 1. Economic
 - 2. Socioeconomic
 - 3. Sociocultural
 - 4. Regional
 - 5. Transportational
 - 6. Politico-administrative

- C) Determinants as Factors Governing Transport Volume, Transport Service, Choice of Transportation and Regional Distribution of Transport

- D) Freight Transport Trends in the Federal Republic of Germany

A) Determinants of Freight Traffic as Factors Governing
Future Transport Demand

Freight transport patterns (fig. 1):

- kind and quantity of the goods to be transported,
- the different transport modes' share of total transport
and
- the geographical distribution of transport links

are determined - in the Federal Republic of Germany,
too - by a variety of operative factors which are called
determinants in the broadest sense in this paper.

These determinants include factors from a number of dif-
ferent sectors of the economic, technological, political,
social and cultural environment.

For the whole bundle of determinants I propose a subdivi-
sion (fig. 2) which differentiates according to the

- economic
- socioeconomic
- sociocultural
- regional
- transportational and
- politico-administrative

environments of freight transport.

It should constantly be kept in mind that, on the one
hand, the determinants are embedded in a hierarchy of
action and, on the other, a comprehensive network of
interdependencies exists between the individual determi-
nants within and between the designated environments.

Here it will only be possible to look at these relationships in detail in isolated cases.

B) Economic Determinants of Freight Traffic

Included in the economic factors here are

- the macroeconomic growth trend
- the change in the structure of the economy and individual industries
- the supply of energy and resources and
- international economic integration.

That the growth of freight transport is primarily determined by macroeconomic growth requires no special proof. However, available figures permit the conclusion (fig. 3) that total freight traffic has been growing at a slower rate than the gross national product since the mid-seventies, and the gap will probably increase in future¹⁾.

Long-term forecasts are always in danger of being influenced by momentarily prevailing optimistic or pessimistic moods. It is almost a matter of good taste today not to proffer a long-term growth rate any higher than 2% per annum, knowing full well that such a modest level of

1) cf.: Die voraussichtliche Entwicklung des Güterverkehrs in der Bundesrepublik Deutschland bis zum Jahre 2000; Deutsches Institut für Wirtschaftsforschung, Weekly Report 22/82, prepared by Peter Lünsdorf, Berlin 1982

growth is inadequate to cope with present structural problems.

The spread given in the base data for the energy forecast¹⁾ for the 3rd projection²⁾ appears more realistic: a real annual growth rate of 2.2 to 3.4% into the nineties, depending on forecast variant. We find this interval on a similiar scale again in scenario calculations from other sources.

Compared with the average growth of the GNP of almost 4% annually in the period from the beginning of the sixties to the mid-seventies, these projections signify a slowing of the growth rate through the end of this century.

To these diminished overall growth expectations is added a significant change in the pattern of the contributions of individual industries to the GNP. The growing importance (fig. 4) of the service sector, at the expense of the goods-producing sector, commerce and transportation, and particularly agriculture, should continue as a tendency in the future.

But within the processing industries, too, the current trend should continue: further declining importance of bulk goods production and growing emphasis on the manufacture of capital and consumer goods as well as of higher-grade chemical products.

1) DIW, EWI, RWI: Der Energieverbrauch in der Bundesrepublik Deutschland und seine Deckung bis zum Jahre 1995, Essen 1981

2) Federal Economics Ministry: Energy Programme of the Federal Government - Third Projection, dated November 11, 1981

The raw material and energy sector has a twofold significance for future transportation trends. On the one hand, the raw material supply of the German economy influences production patterns and the quantitative makeup of transports. On the other hand, the efficient transport industry indispensable to a highly technologized economic system requires a secure and efficient energy supply with energy prices adjusted to scarcity conditions.

The preferred source of energy in the transport industry will likely continue to be petroleum in the future. Other sources will play only complementary, not alternative roles. In all probability there should be no market-caused bottlenecks for petroleum products, from a long-term viewpoint, as oil continues to be substituted in the heating market. However, we must expect the real crude oil price to continue rising in the long run.

Finally, as far as the numerous raw material and semi-finished product markets are concerned, in future the conditions of the sixties and early seventies will no longer persist (falling relative prices, and in instances even declining absolute prices, and the reduction or stultification of technical progress that went with it). The opportunities for substitution made possible by changed price relations will change the makeup of freight at the expense of the traditional bulk goods. This applies both to the raw material purchases of heavy industry and to the energy transport market. The stagnation of the transport volume of crude oil and mineral oil products at levels of the mid-seventies, or even a decline below that, cannot be offset even by a slightly rising volume of coal transports.

In the past twenty years, the volume of world trade has grown two and one half times. Imports to the Federal Republic of Germany - at constant prices - have risen by 90% since 1970, exports by almost 100%. Exports account for a third of GNP. This involvement in foreign trade, and in foreign trade the exchange of goods within the European Community, will continue to grow in future and, in conjunction with the accelerated transfer of mass production to low-wage countries, will result in changes in the structure of freight traffic, too.

B2) Socioeconomic factors

Socioeconomic influence factors such as

- population growth
- family structures
- personal income trends
- individual consumption patterns

play an important role not only in passenger transport but also in the development of freight transport.

Model calculations for the Federal Republic of Germany indicate a decline in resident population through the year 2000 with a slight rise in the number of households, the consumption unit which ultimately determines the home market for consumer goods.

The trend of disposable income of households is closely coupled with the assumptions on the run of the long-term overall growth curve.

Growth estimates for private consumption over the next fifteen years¹⁾ range from 1.6 to 2.7% per annum (fig. 5). Of prime importance to freight transport will be the shift in the pattern of expenditures of households in the domestic market which has been observed in the past and is highly likely to continue in future: further growth of the share of expenditure categories involving few transport requirements.

B3) Sociocultural determinants

Influence factors such as

- the system of social values
- settlement patterns and home types
- the value placed on the environment

also affect the freight industry.

Transport requirements in the eyes of society in general are determined also by attitudes, opinions, conceptions und resultant behaviour patterns, in addition to economic, geographic and demographic influences.

A glance at the literature shows that the talk of changing values is not mere sloganeering. However, the question yet to be answered is whether the observable different basic attitudes of various groups in West German society will lead to lasting changes in behaviour. Alternative life styles with divergent consumption, housing and business forms would not be without influence on goods

1) DIW, EWI, RWI, op. cit.

transport, particularly within cities and towns.

The existing areal distribution of residences in the Federal Republic of Germany, with distribution needs primarily served by the road vehicle, is irreversible on a large scale. It may be assumed that the spreading of housing areas in concentric rings around the great agglomerations and also the medium-size cities will progress further. If we follow the discussion on the theory of increasing concentration and deconcentration¹⁾ we gain the impression that a slight tendency towards geographical deconcentration for both the industrial and service sector is emerging, which should basically favour means of transportation which can serve large areas, in goods transport also.

In a paper entitled "Spekulationen über Siedlungsstruktur und Verkehr der Zukunft" (Reflections on housing patterns and transportation of the future), Albers²⁾ comes to the conclusion that "no unprecedented prospects for radical changes in the current system of housing and transportation are in evidence.... At the moment there appear to be more factors favouring an evolutionary change in this area."

1) cf. J. Heinz Müller/Bertram Schaeffer: Wider die unspezifizierte These von der wachsenden räumlichen Konzentration, in: Raumforschung und Raumordnung, Vol. 39, Cologne/Berlin/Bonn/Munich 1981, p. 263 ff., and Wolfgang Istel: "Wider die unspezifizierte These von der wachsenden räumlichen Konzentration?" Eine Entgegnung und Spezifizierung, in: Raumforschung und Raumordnung, vol. 40, Cologne/Berlin/Bonn/Munich 1982, p. 243 ff. as well as the reference literature mentioned in both papers.

2) Gerd Albers, Spekulationen über Siedlungsstruktur und Verkehr in der Zukunft, in: Perspektiven 1/83, a series published by Daimler-Benz AG, Düsseldorf 1983, in printing

The issue of environmental sensitivity has significance for freight transport when the extension or improvement of the traffic infrastructure is seen as ecologically destructive or when necessary transport processes impinge on society's tolerance for noise and air pollution.

What will count in future is that the possible conflicts arising from the antinomial relationship between the provision of productive infrastructure and the preservation of the quality of the environment are not solved without taking the necessary level of regional and national prosperity into account.

In this connection, the serious observer will not overlook the fact that precisely an environment-protecting traffic system requires adequate space. Over the past years, decision-making has doubtlessly become more difficult for a number of reasons. Despite these inconveniences, planners should also in future concentrate their efforts on avoiding inequitable decisions that disadvantage the transport of goods for consumers and producers, indispensable for a country's economy.

B4) Regional determinants

Regional influence factors such as

- location
- distribution and consumption patterns
- traffic infrastructure

do not so much affect the volume of transport as the

spatial distribution of transports as well as the modal split, the share of the different transport modes.

Site selection by economic enterprises can be furthered or initiated by government but ultimately remains the decision of the individual company, not anticipatable by outsiders and therefore difficult or not possible at all to forecast. This applies analogously to future distribution and consumption patterns in the economy as a whole.

The differentiation of freight observable in the past with regard to geographical concentration should continue in future. Bulk products such as crude oil, iron ore, coal, mineral oil products, non-ferrous ores and scrap are moved chiefly in relatively few concentrated streams of traffic. In the main, transports of food-stuffs and feed, and capital and consumer goods are dispersed over very wide areas. Between these two extremes, chemicals, fertilizers, iron, steel and non-ferrous metals occupy an intermediate position along with non-metallic mineral products.

As for short-haul road transport, shipping and receiving in metropolitan areas and on their periphery should grow more than in other areas in the future. Slight shifts in geographical pattern in long-distance haulage could result from the planned opening of new waterways (Rhine-Main-Danube canal, canalization of the Saar river) and from changes in the makeup of output and sales in the refinery industry.

In a country with an already well developed traffic

infrastructure the forging of new traffic links - whether rail, water or road - generally can not be expected to generate a significant amount of previously non-existent traffic¹⁾. Of greater relevance for forecasting is the extent to which it affects the future division of transport. It must be assumed that

- extensions or improvements of the federal long-distance highway system - as of the rest of the road network - will result in only marginal enlargement of the share of transport accounted for by long-haul road transport, since, on the one hand, a quantitatively and qualitatively sophisticated road system already exists now and, on the other hand, consignor preferences (for example speed, availability, accessibility) have a far greater impact on the decision for long-distance road haulage as the means of transport than improvement or enlargement of the road system;

- new projects and extension plans for the railway system do not so much affect transport infrastructure as help the Federal Railways achieve the new service image it strives for and thus potentially increase the attractiveness of rail transport;

1) The Federal Republic of Germany had the following transport channels at its disposal in 1980: 480,000 km of public highways, a 28,500 km railway network, 4,400 km of waterways (navigable length), and 1,600 km of long-distance pipeline for crude oil.

- the opening of new canals will raise inland shipping's share of transport - mainly at the cost of rail transport - particularly for the hauling of coal, iron ore and chemical products.

B5) Transportational determinants

Future freight traffic indeed will doubtlessly be determined by transportational factors too, such as

- transport services offered
- structure of rates and costs
- transport technology and organization as well as
- transport affinities and consignor preferences.

In estimating future transport services - the characteristics of which derive from the organizational process of operation of the conveyances, vehicle technology and traffic systems design - criteria such as availability, speed, safety, punctuality, adaptability to specific products, reliability and directness play a decisive part.

Since road haulage has acquired a dominant position among today's transport modes, it can be concluded that it meets the spectrum of requirements for the majority of transport purposes in the eyes of the consignors.

This should not change substantially in future, even considering that the efficiency of the railways will increase due to enlargements and improvements of the

rail network and further growth of combined transport and that new routes will possibly be opened to inland shipping.

The rates of the individual transportation systems are only a factor if fundamental changes in the rate system must be presumed in the long term.

If we look at the change in freight revenues per ton-kilometre for the freight transport modes¹⁾ over the past twenty years and index them on the basis of 1960 = 100, the German Federal Railways were able to increase their freight revenue an average of just under 50%, but road haulage and inland shipping each by more than 100%. Over the same period, however, the amount of transport²⁾ (expressed in tkm) accounted for by the railways dropped from 44.2 to 30.3% and from 33.6 to 24.4% for inland shipping, while long-distance road haulage raised its share from 19.7 to 39.1%. Therefore, even if long-distance road haulage rates should rise further relative to other transport systems, a negative effect on its share of transport need not be expected, especially as there is no prospect of fundamental changes in rate patterns.

It is generally agreed today that if the development of transport continues undisturbed, for the medium

1) Verkehr in Zahlen 1982, published by the Federal Transport Minister, prepared by Heinz Enderlein, Berlin 1982

2) Not counting short-haul road transport

term - that would mean through the year 2000 - the appearance of new freight transport technologies which have not already indicated their feasibility today is not to be expected.

Based even on optimistic estimates, combined transport (fig. 6) will not account for more than 10% of the railways' waggon traffic in the year 2000 and thus will not reach any decisive proportions.

However, improvements in the organization of the transport systems owing to increased use of computer-assisted control methods, particularly in the area of logistics, would seem to be important for the future. The growing necessity of offering full-service, integrated transport to consignors opens the prospect of greater cooperation within and between transport systems.

Of great importance for the future division of transport are the preferences of the consigning industries and the transport affinities of individual product groups (fig. 7) reflecting them. The trend, which, if we leave aside the classic bulk goods, has basically favoured road transport in the past, will continue to favour truck transport, particularly as the structure of goods shifts to higher-grade freight, as is foreseeable.

B6) Politico-administrative determinants

In estimating future transport trends, a status quo is almost always assumed with respect to the politico-

administrative determinants

- regulative policy
- structural policy
- energy policy and
- environmental policy

and their repercussions on transport policy. This premise is not without pitfalls.. Other country's experiences (progressive deregulation in the U.S. and U.K.) show that a strong influence on supply and demand in the transport markets must be reckoned with at least as a potential alternative. A policy is also conceivable that aims at increasing the cost of transport services by raising levies and consciously constricting the infrastructure.

Numerous public statements on transport policy in the Federal Republic of Germany do not justify such concerns as last stated for the immediate future. Rather it can be expected that the main goals of transport policy¹⁾

- maintaining mobility for citizens and industry
- provision of an adequate transport infrastructure for the further growing economy, and
- free choice of the means of transportation in a controllable system for regulating competition

1) For example: Erwin Gleissner, Johannes Stoch, Rudolf Gabler: Aufgaben und Probleme der Verkehrspolitik and der Verkehrswirtschaft im Rahmen der Energiepolitik, in: Internationales Verkehrswesen, vol. 34, Darmstadt 1982, p. 18 ff.

will continue to be endorsed. The Federal Transport Minister's economic advisory council went even further, declaring it "an important task to examine the existing regulative setup also with an eye to whether greater reliance on the impelling and controlling forces of the free market might lead to better solutions"¹⁾.

C) Determinants as Factors Governing Transport Volume, Transport Service, Choice of Transportation and Regional Distribution of Transport

The groups of determinants introduced thus far influence the forms and individual features of freight transport to differing degrees (fig. 8). In all its elements, freight transport is first influenced by economic factors, particularly the growth of the overall economy. While the modal split is influenced by all determinants, socio-cultural and regional factors chiefly determine the regional distribution of transport.

In practical forecasting it is impossible to include all factors as explanative variables, and thus as determinants in a narrower sense, in the forecasting model. A large part of all the possible influence factors are defined as parameters which - formulated as premises - assume the role of quasi-constants in the forecasting model, in the sense of *ceteris paribus*

1) Economic Advisory Council of the Federal Transport Minister: Überlegungen zur langfristigen Verkehrsentwicklung, in: Zeitschrift für Verkehrswissenschaft, vol. 52, Düsseldorf 1981, p. 151

restrictions. For a freight transport forecast, the problem with parameters is basically that

- they are related to a number of determinants
- they frequently elude quantitative analysis
- their relegation to a more or less unspecified *ceteris paribus* sphere in capitulation to the unsolvable complexity problem is ultimately unavoidable.

The tendency in freight transport forecasting is to include among the determinants phenomena which have previously been defined as parameters and incorporate them in the forecasting process as independent variables. But the question is, if we do that won't we have to formulate new parameters which again take on the status of unspecified *ceteris paribus* clauses, since - to quote Hayek - the chief difficulty in the social sciences consists in "actually establishing all data which determine an individual manifestation of the phenomenon in question"¹⁾.

D) Freight Transport Trends in the Federal Republic of Germany

On the basis of the following parameters

- free choice of transportation
- adequate energy supply and realization of the 3rd projection of the federal government's energy programme

1) F.A. von Hayek: Die Theorie komplexer Systeme, Tübingen 1972, p. 14

- no new administrative measures to influence competition between transport systems
- no drastic changes in the relation of rates and costs between transport systems
- no employment of new transport systems
- no extension of the present long-distance pipeline system for transporting crude oil and mineral oil products
- opening of the Saar canal and the Rhine-Main-Danube canal
- qualitative and quantitative enlargement of the federal long-distance highway system so that the smooth flow of traffic is ensured in future in spite of a continuously and clearly growing car population
- accomplishment of planned improvements of and additions to the rail network
- no shrinking of the German Federal Railways system or abandoning of lines beyond the extent made known in the past
- furtherance of combined transport in compliance with the federal government's cabinet order of June 16, 1978, and calculated efforts of the Federal Railways to obtain a larger share of transport in a number of product categories by improvements in service

and assuming just slightly slower economic growth and a decrease in resident population to approximately 56 million in the year 2000¹⁾, growth of freight traffic²⁾ can be expected to slacken considerably in future, the reasons being the more moderate growth expectations expressed in the output and sales estimates of the

1) cf.: Die voraussichtliche Entwicklung des Güterverkehrs in der Bundesrepublik Deutschland bis zum Jahre 2000, loc.cit.

2) The term "freight traffic" includes all transport of goods by rail, inland shipping, road or long-distance pipeline.

different industries as well as changes in the pattern of production and sales, along with the declining resident population (with the labour force remaining almost the same and the number of households presumably even rising slightly).

In the past, freight volume in tons always grew a little faster than the gross domestic product, but this trend was broken for the first time in 1974. The tendency of freight volume since then to grow at a proportionally slower rate will accelerate in future.

The reasons behind this trend are, in particular:

- changes in the pattern of goods production favouring higher-grade, processed products with lower freight weight
- the increasing use of new and lighter materials
- more efficient organization of transport¹⁾ as a consequence of increasing cost pressure, and
- the change in the composition of freight traffic by products.

The increasing concentration of freight traffic on main arteries with a tendency to longer hauls should make the average transport distance by rail rise to 190 km by the year 2000. The enlargement of the waterway system permits us to assume an average transport distance of 215 km for inland shipping. Long-distance road haulage will increase its average transport distance to 246 km. For long-dis-

1) Avoiding the transfer of a product to other carriers results in a statistically smaller transport volume overall.

tance pipelines, on the other hand, we can reckon with a drop in the average transport distance by 3.5% to about 170 km in view of expected changes in the pattern of use of the existing pipeline system. In short-haul road transport the average transport distance of 18 to 19 km will remain unchanged. (fig. 9)

By the year 2000, total transport volume, computed on the basis of 1980, will have increased by about 28% to 320 billion tkm. The shares of rail and inland shipping will not change much, the share of long-distance pipelines will decline to 4% due to the expected decline of crude oil imports.

Long-distance road haulage is the only form of transport that will be able to increase its share of transport, but the amount of traffic it carries will rise appreciably slower than in the past. Increases can be expected particularly in the product categories "foodstuffs and feed", "iron, steel and non-ferrous metals", "non-metallic minerals", "chemical products" as well as for the carriage of capital and consumer goods.

If short-haul road transport is included in the discussion, in the year 2000 more than half of overall transport in the Federal Republic of Germany will be taking place on roads. The railways will account for a quarter, inland shipping for a fifth of total transport volume.

The long-range estimates of population and economic growth on which this freight transport forecast is based were worked out for the most part in 1978. Since then, important basic conditions have changed. Based on today's

knowledge, a relatively lower growth rate than could possibly have been assumed for the overall economy in 1978 must be expected in future. Against this background, the freight transport forecast 2000 summarized here has the character of an optimistic variant of the possible scenarios of freight transport. A rough calculation on the basis of an annual rate of growth of the gross domestic product of only 2.1% through the year 2000 - a rate anticipated by the German Institute for Economic Research DIW in a report completed at the end of 1981 - arrives at a 30 to 40 billion tkm lower transport volume for the year 2000.

1) cf. Herwig Birg and others: Auswirkungen der Bevölkerungsentwicklung auf Struktur und Niveau der Gesamtnachfrage. DIW study on behalf of the Federal Minister of Economics, Berlin 1981 (reproduced as manuscript).

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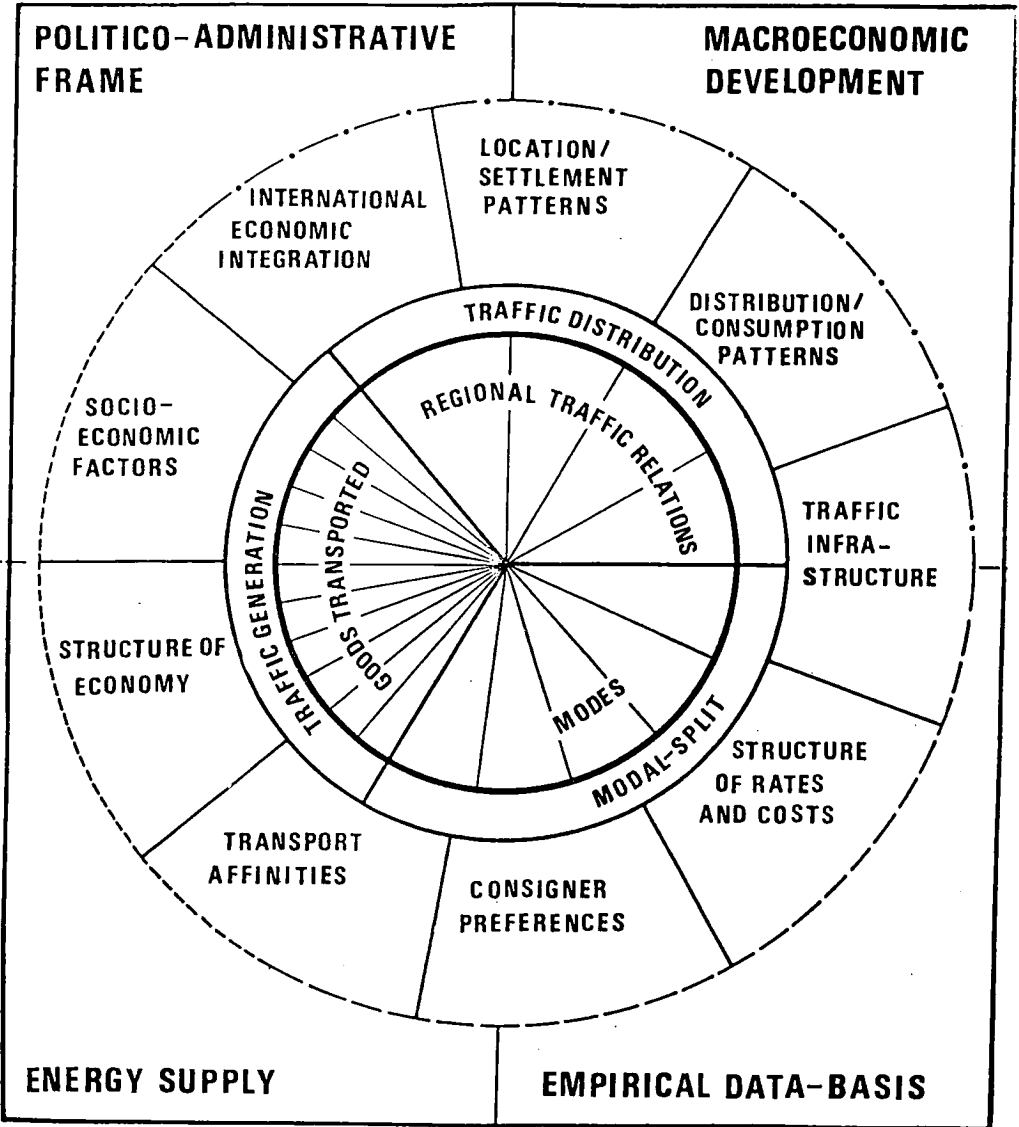
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List of Figures

- Figure 1: Structure of Determinants
of Freight Traffic
- Figure 2: Factors influencing Freight Traffic
- Figure 3: Development of Goods Transport and
Gross Domestic Product at constant Prices
(1970) in the Federal Republic of Germany
1960 until 2000
- Figure 4: Contributions of individual Industries
to the GDP of the Federal Republic of Germany
1950 and 1981
- Figure 5: Structure of Households' Expenditure 1960
and 1980 in the Federal Republic of Germany
- Figure 6: Development of Combined Traffic and Goods
Transport by Rail in the Federal Republic
of Germany 1960 until 2000
- Figure 7: Changes in Transport Affinities of Product
Categories in the Federal Republic of Germany
- Figure 8: Factors influencing alternative Aspects
of Goods Transport
- Figure 9: Development of Goods Transport in tkm by
Transport Mode in the Federal Republic of
Germany 1960 until 2000

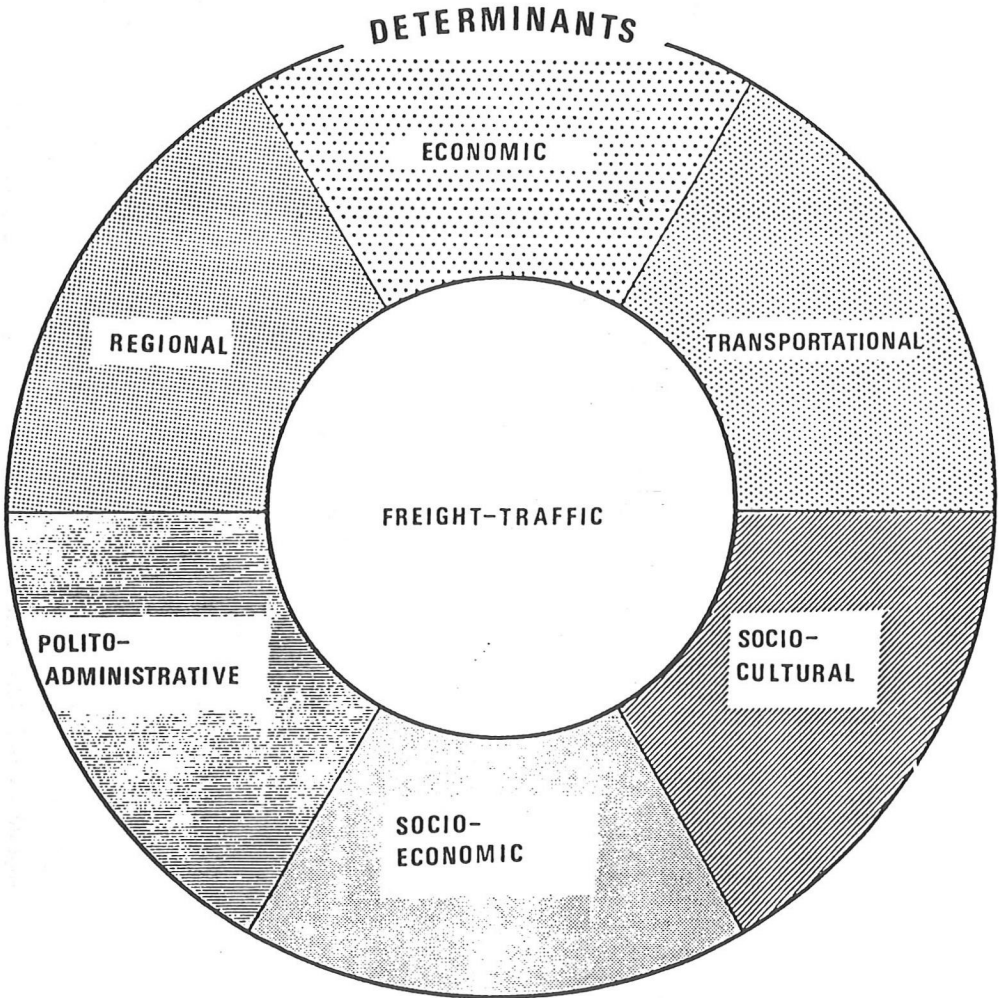


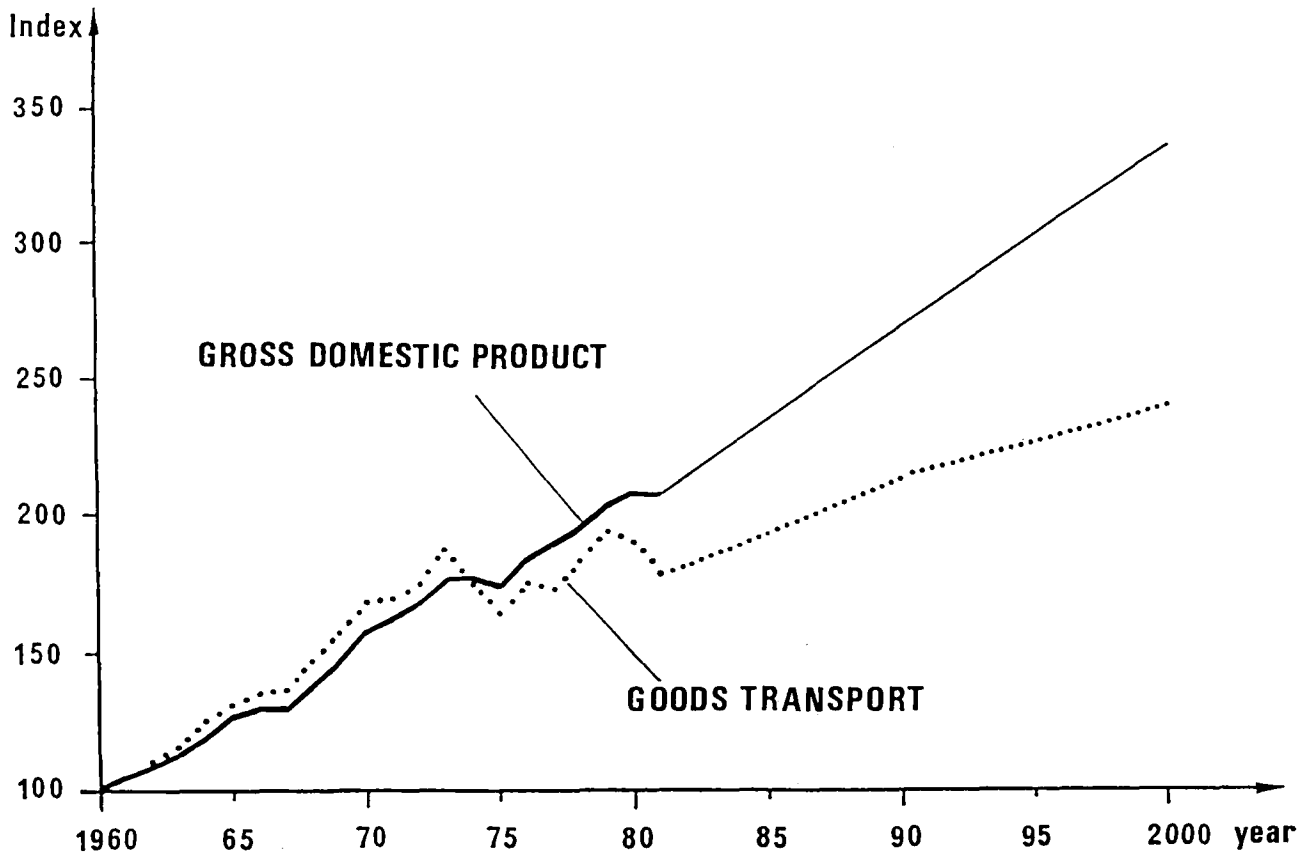
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STRUCTURE OF DETERMINANTS OF FREIGHT TRAFFIC

Forschung und Entwicklung
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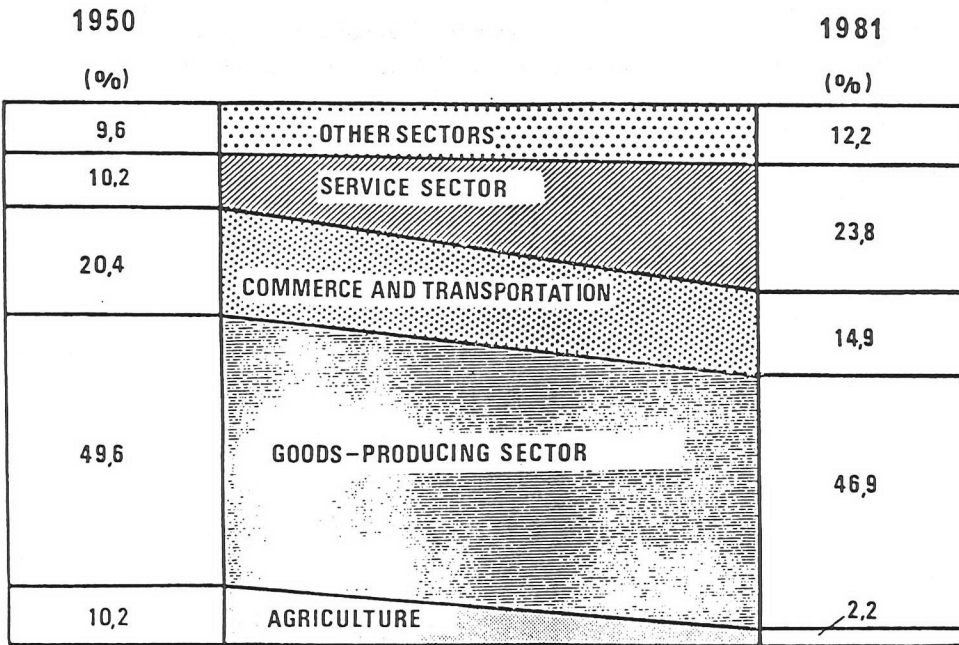
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Determinants of Freight Traffic by P. Lünsdorf
1303



DEVELOPMENT OF GOODS TRANSPORT AND GROSS DOMESTIC
PRODUKT AT CONSTANT PRICES (1970) IN THE FEDERAL
REPUBLIC OF GERMANY 1960 UNTIL 2000

Forschung und
Entwicklung
E6Z 83 03 49



Determinants of Freight Traffic by P. Linsdorf
1304



CONTRIBUTIONS OF INDIVIDUAL INDUSTRIES TO THE GDP
OF THE FEDERAL REPUBLIC OF GERMANY 1950 AND 1981
SOURCE: STATISTICAL BUREAU

Forschung und
Entwicklung
E6Z 83 03 48

1960

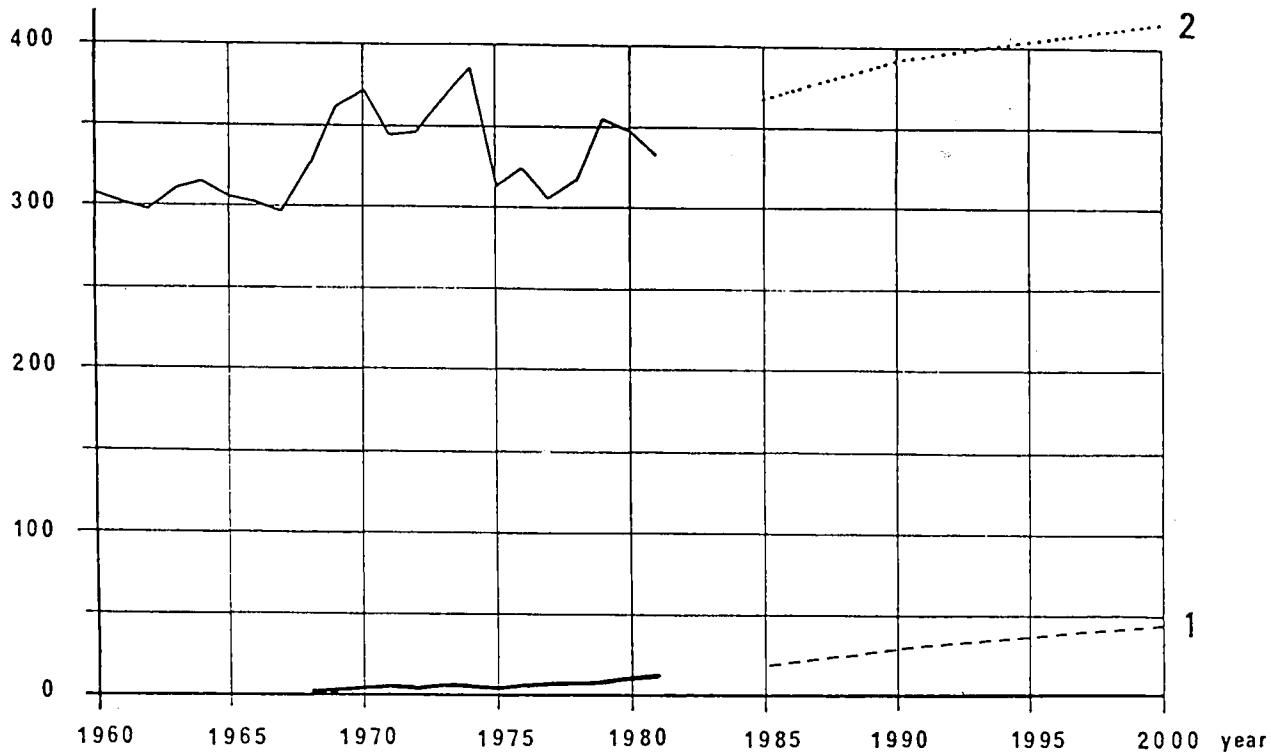
(%)

1980

(%)

26	OTHER EXPENDITURE	24
9	TRANSPORT AND VEHICLES	16
10	HOUSING, FUEL AND LIGHT	18
17	CLOTHING	15
38	FOOD AND DRINK	27



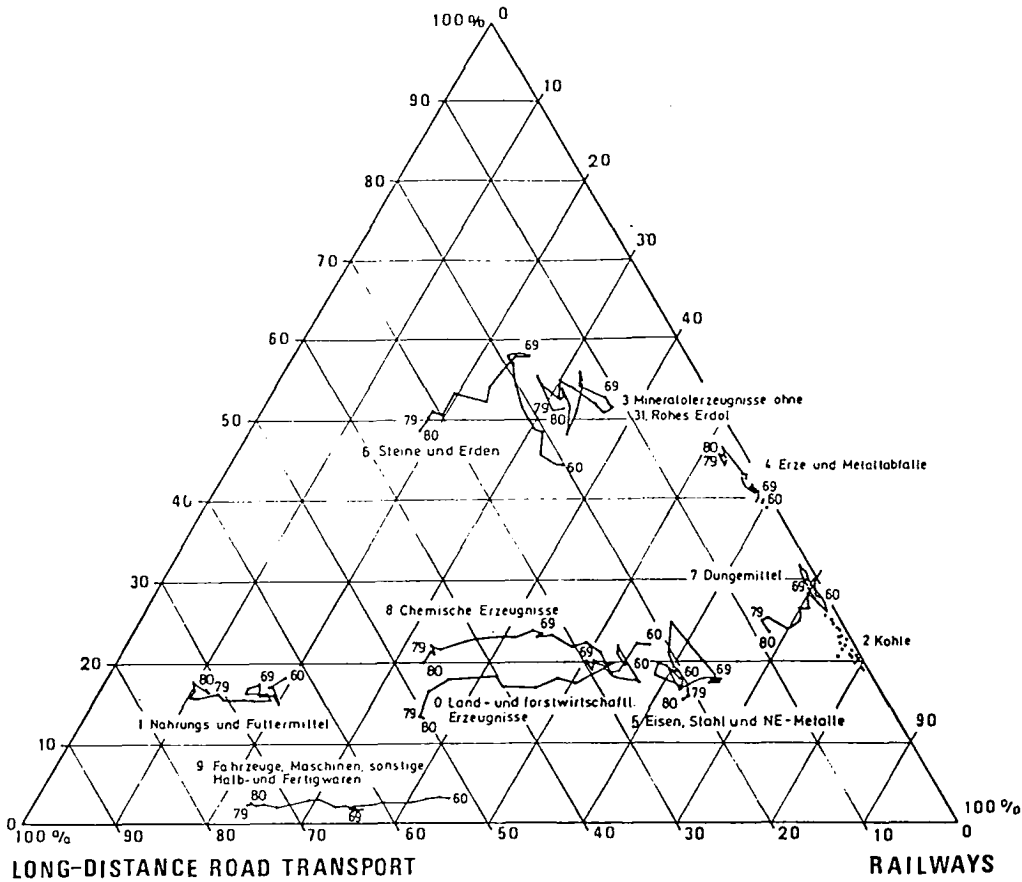


Determinants of Freight Traffic 1306 by P. Lünsdorf



DEVELOPMENT OF COMBINED TRAFFIC (1)
 AND GOODS TRANSPORT BY RAIL (2)
 IN THE FEDERAL REPUBLIC OF
 GERMANY 1960 UNTIL 2000
 SOURCES: DIW, INFRAEST/BVU, DB

**Forschung und
 Entwicklung**
 EZ 82 09 172

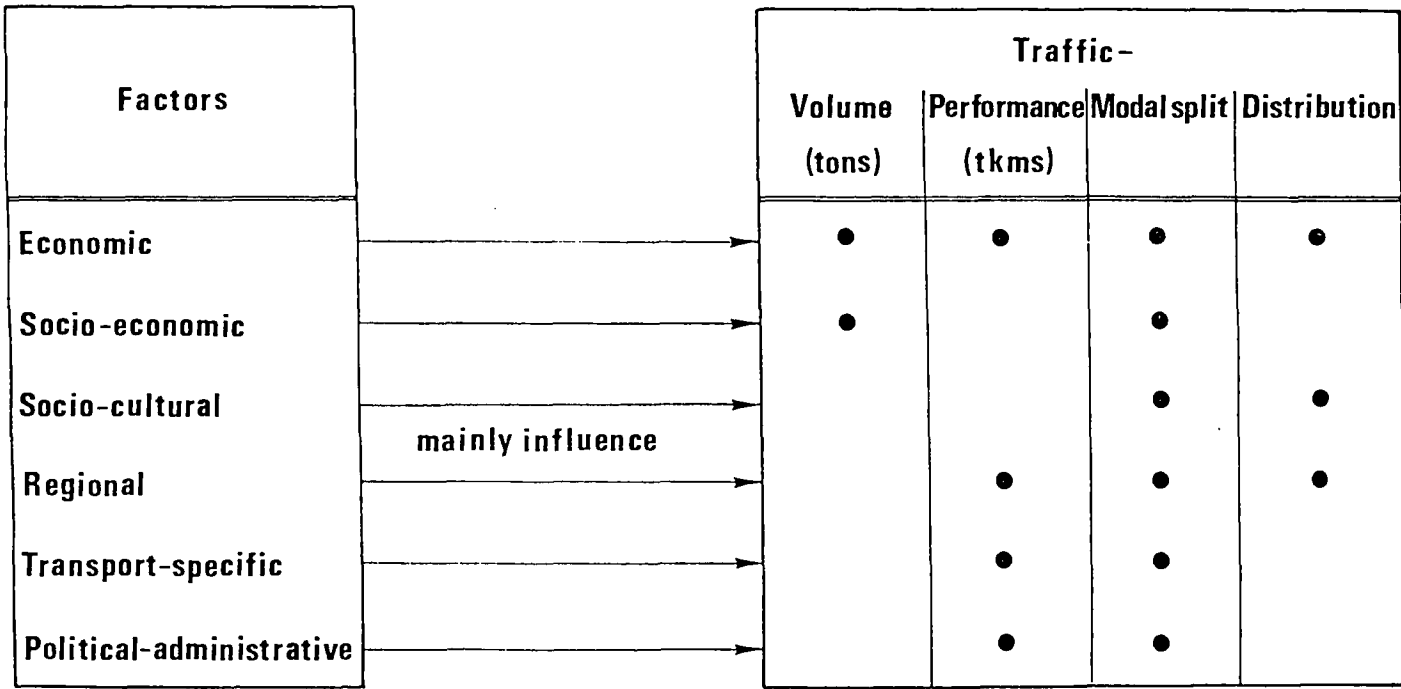


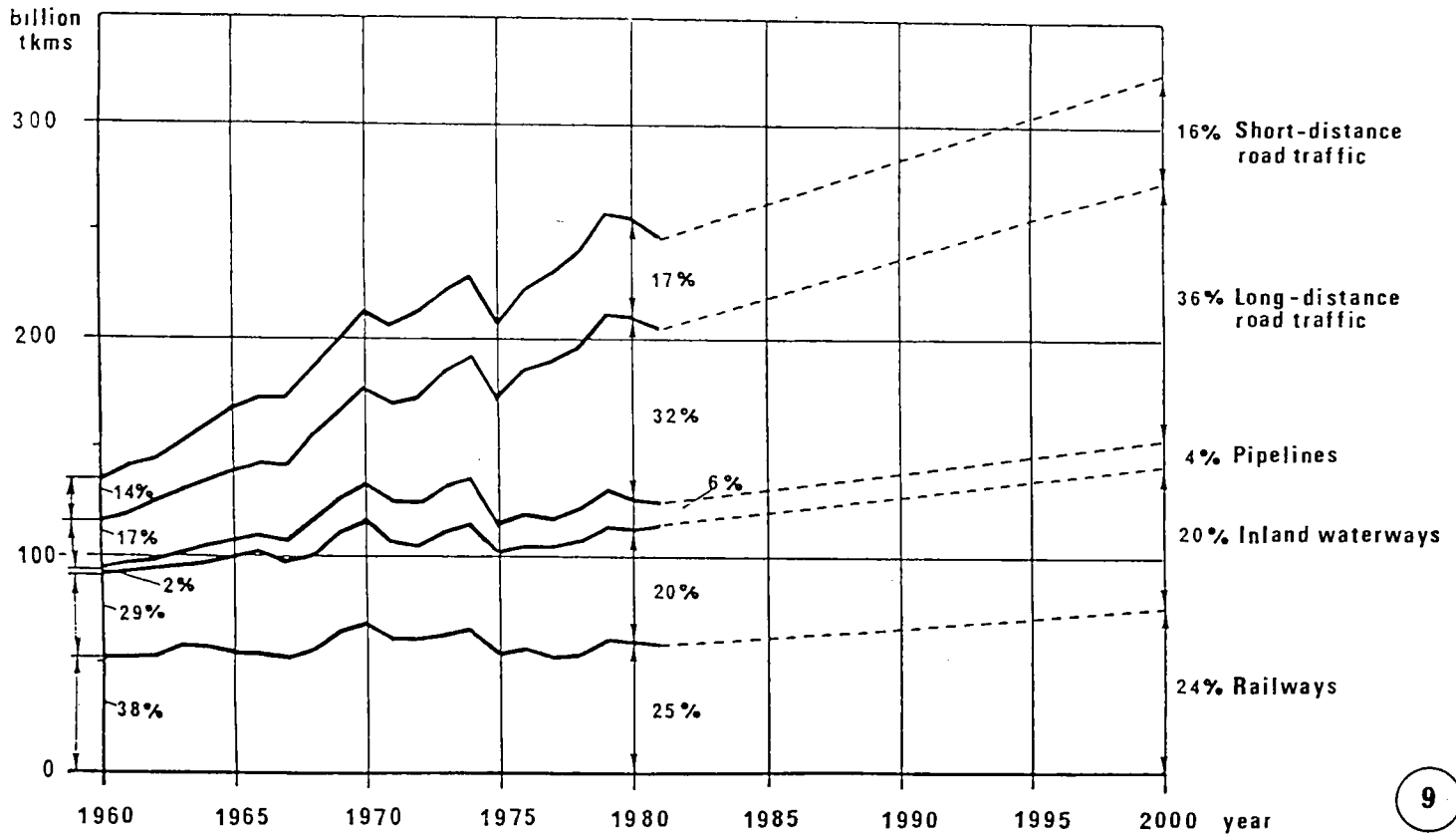
- | | |
|---------------------------|--|
| 0 = FARM PRODUCTS | 5 = IRON, STEEL AND NON-FERROUS METALS |
| 1 = FOODSTUFFS AND FEED | 6 = BUILDING MATERIAL, SAND, GRAVEL |
| 2 = COAL | 7 = FERTILIZERS |
| 3 = MINERAL OIL PRODUCTS | 8 = CHEMICAL PRODUCTS |
| 4 = IRON ORE, SCRAP METAL | 9 = CAPITAL AND CONSUMER GOODS |



CHANGES IN TRANSPORT AFFINITIES
 OF PRODUCT CATEGORIES IN THE
 FEDERAL REPUBLIC OF GERMANY
 SOURCE: STATISTICAL BUREAU

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DEVELOPMENT OF GOODS TRANSPORT IN TONS-KILOMETRES
 BY TRANSPORT MODE IN THE FEDERAL REPUBLIC
 OF GERMANY 1960 UNTIL 2000
 SOURCE: DIW

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