ERAI
Eurasian Rail Alliance Index

Information and analytical digest

ITALY'S EXPORTS TO CHINA: STRUCTURE AND MODAL SHIFT PROSPECTS

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INTRODUCTION. SPECIFICS OF CARGO FLOW FROM ITALY TO CHINA

China is one of the European Union's key partners. In 2020 it became the main trading partner thereof. At the same time, one of China's key partners among the Union is Italy. In 2020, bilateral trade between these countries exceeded EUR 45 billion, of which nearly EUR 13 billion came from Italian exports to China. Similarly to other EU countries, Italy has a negative balance in trade with China: in 2020 it was about EUR 19.4 billion, and in January-October 2021 — EUR 18.5 billion (EUR 17 billion in the same period last year). The current balance of Italian exports/imports demonstrates challenges for the transport industry, and makes it relevant to consider Italy's exports as well as prospects for its modal shift.

Due to the COVID-crisis, which hit the country hardest, Italy's GDP fell by almost 9% in 2020. At the end of 2021, GDP is projected to recover by 6.3%. The EU Recovery Fund, of which Italy will be the main beneficiary, will also contribute to resilience of its economy. Thus, we should expect an accelerated rate of economic growth in 2022, and, consequently, of exports. The current situation could be an additional incentive to accelerate the modal shift in favor of railroads.

Specific feature of Italy is the imbalance between the economic powerhouse, Northern regions, and the predominantly agrarian South. However, it is the north of the country that is characterized by a greater availability of rail infrastructure, which is also a factor in favor of modal shift. The country's main railway "exits" are from Verona to the north, towards Munich via Austria, and to the north-east: towards Vienna and Maribor (Slovenia). The main container terminals are located near Milan and Verona. Thus, such regions as Lombardy (the main exporter to China), Emilia-Romagna, Piedmont, and Veneto can be identified as the freight base for expanding Italy's exports to China by rail. To a lesser extent, Tuscany and Lazio.

Italy is a country of small and medium-sized businesses actively entering foreign markets. In contrast to the models of capitalism dominated by large industrial capital, such as in Germany, the Italian model, as well as Italian exports, is represented by a significant number of medium-sized companies.

Rail transport accounts for about 14% of ground freight traffic in Italy, less than in Germany (18%), Austria (32%) and Switzerland (35%), but more than in France (10%). Italy, like other EU countries, has adopted the goal of switching 30% of freight traffic over 300 km by 2030, and 50% by 2050. The main competitor of railroads is the extensive network of ports in Italy, including the ports of Genoa, La Spezia and Naples, which attract a significant number of shippers. In addition, development of multimodal transport with access to the country's ports (Terzo Valico) occupies a special place within the development strategy of Italian railways (FS Group) and its subsidiary Mercitalia as the country's main freight operator.

However, advantages of speed and cost of rail delivery contribute to modal shift. According to ERAI, the number of freights from Italy to China, transported via Belarus, Russia and Kazakhstan along the Eurasian rail route in 2021, had already exceeded the previous year's figures by November, but in absolute terms remains small, which leaves room for growth.

Finally, another reason for optimism is Italy's interest in switching the freight flow to trans-Eurasian rails. Italy was one of the first EU countries to support China's One Belt, One Road initiative, given the associated investments in infrastructure and transport connections between China and Europe.

This review looks in detail at Italy's bilateral trade with China, especially exports thereto, as well as the current nomenclature of goods, including those transported by rail, and categories of goods with the potential to be switched to rail.

GENERAL OVERVIEW OF ITALIAN EXPORTS TO CHINA

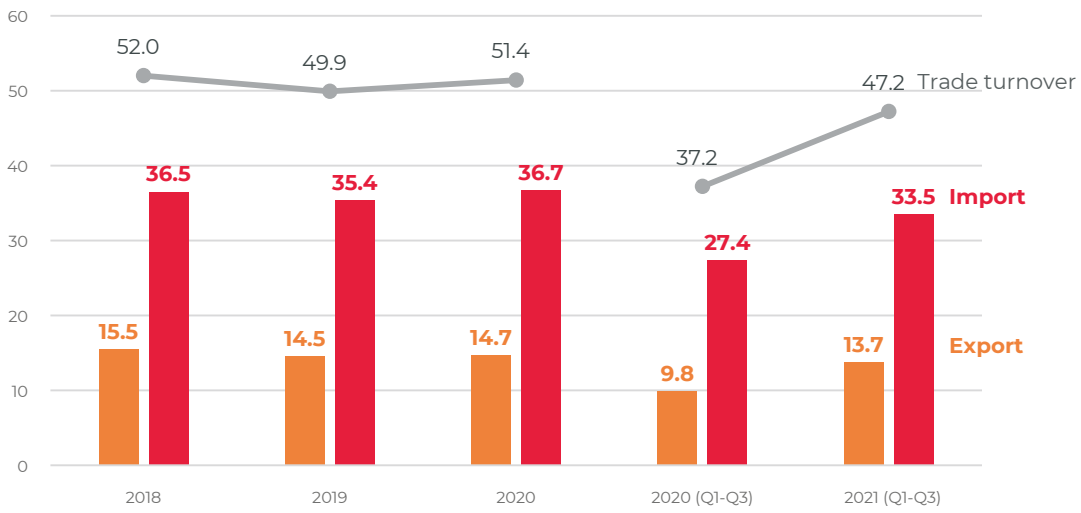
Bilateral ties between Italy and China are stable, as evidenced by indicators of mutual trade between these countries in recent years. Italy's economic recovery in 2021 ensured a positive dynamics of exports to China. The basis of exports are mechanical equipment, as well as products of the automotive industry, pharmaceuticals, consumer goods (including leather). Such and other products are the largest export items in value terms. In physical terms, a significant part of exports is made up of mid- and high-value-added products: goods of the chemical sector, non-ferrous metallurgy, and food industry, which can be containerized. Italy is a supplier of high-quality and often niche products.

Bilateral Trade Turnover Between Italy and China

Over the past few years, trade between Italy and China has remained fairly stable, with imports from China traditionally more than doubling over exports in Europe. The COVID-crisis had no negative impact on total exports/imports, indicating the sustainability of trade relations between these countries. For 9 month of 2021, Italy's exports to China showed a 40% year-over-year increase, while imports were up 22%, due to recovery in trade in certain sectors. The 2021 totals are likely to surpass 2020, both in exports and imports.

Figure 1.

TRADE TURNOVER BETWEEN ITALY AND CHINA, USD BILLION.



Source: Authors' calculations based on UN Comtrade.

Exports are supported by the recovery growth of Italian GDP. After Italy's GDP fell by 9% in 2020 (to 1998 levels at current prices), the country's economy is expected to return to 2019 levels in 2021. According to Italian regulators' forecasts, the economy will grow at a rate of 6.3% in 2021 and decline to 4.7% in 2022. However, it should be noted that the main driver of economic growth will be the growth of consumption within Italy, which will also support imports from China.

Structure of Italian Exports to China

The structure of Italy's exports to China is represented by traditional goods of the Italian economy, and is also quite stable. The main export category in recent years has been mechanical equipment: in 2020, total shipments to China reached USD 4.4 billion, representing 30% of exports in value terms. The dominance of this group remains in 2021 — 29% of exports for 9 months. As for the mechanical equipment exports, main Harmonized System (HS) Codes of four digits are as follows,

- Stop valves (code 8481): exports in 2020 — In the first 9 months of 2021 — USD 549 million, in the first 9 months of 2021 — USD 549 million.
- Washing, filling, or packing equipment (code 8422): exports in 2020. — USD 331 million, for 9 months of 2021 — USD 265 million.
- Other special mechanical equipment (code 8479): exports in 2020 — USD 331 million, for 9 months of 2021 — USD 206 million.
- Liquid pumps (code 8413): exports in 2020 — USD 261 million, for 9 months of 2021 — USD 205 million.
- As well as gas turbines (USD 323 million in 2021), air pumps (USD 279 million in 2021) and thermal equipment (USD 138 million in 2021).

Thus, the export of mechanical equipment to China is represented by goods of the country's industry specialization: sanitary equipment, equipment for metallurgy, food, and light industry, etc.

An important export item to China is pharmaceutical products, represented primarily by prepackaged medicines (code 3004) — USD 968 million in 2020 and USD 730 million in the first nine months of 2021. At six digits, other prepackaged medicines (300490) and insulin preparations (300431) account for the lion's share in this category. The most prominent representatives of this industry are such companies as Menarini, Artsana, Angelini ACRAF, as well as multinational companies with production facilities in Italy.

Exports of motor vehicles and their components (USD 726 million in 2020, USD 839 million in the first 9 months of 2021) are mainly represented by passenger cars (USD 496 million in 2020) — cars with gasoline engines from 3,000 cm3 (code 870324) and with engines 1,500-3,000 cm3 (code 870323). Also an important export category in this group are auto parts (USD 150 million in 2020): other auto parts (870899), brakes and parts thereof (870830). The center of the Italian car industry is Piedmont (FIAT and Alfa Romeo brands), to a lesser extent Emilia-Romagna.

Italian electronics exports to China are also steady and on an upward trend: USD 699 million in 2020, USD 742 million exports in the first nine months of 2021. This group includes the following products:

- Low-voltage electrical switchgear (code 8536): USD 112 million in 2020, USD 121 million for 9 months of 2021.
- Electric motors and generators (8501): USD 66 million in 2020, USD 74 million for 9 months of 2021.
- Semiconductors (8541), cables (8544), telephones, and communications equipment (8517): about USD 50 million for each group in 2020.

This category reflects the country's specialization in production of high-quality electrical equipment, including for the consumer segment. Notable here is Candy, a producer of home appliances (subsidiary of China's Haier), Indesit, and a number of smaller companies.

Italy is a traditional manufacturer of clothing and footwear, especially in the premium segment. In the first nine months of 2021, the country shipped USD 696 million worth of apparel to China, including such items as:

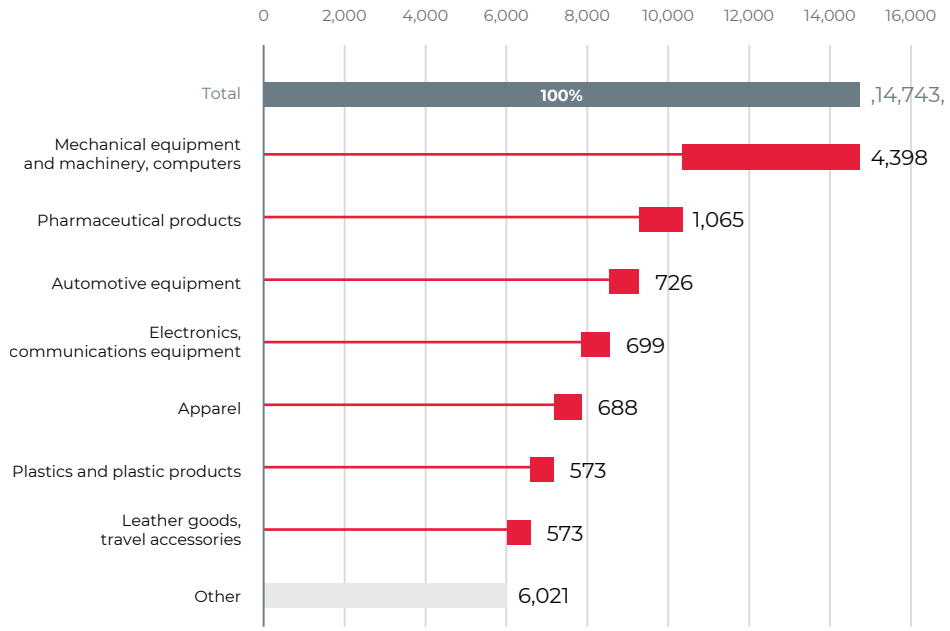
- Women's apparel — outerwear (code 6202): USD 168 million in 2020, USD 184 million for 9 months of 2021,
- Women's apparel — dresses, jackets, skirts, pants, shorts (6204): USD 169 million in 2020, USD 183 million in 9 months of 2021.
- Men's apparel — outerwear (6201): USD 120 million in 2020, USD 120 million in 9 months of 2021.

The most famous Italian brands in this segment are Gucci, Prada, D&G, Armani, Versace, Valentino, Ferragamo and others.

Related to clothing is the category Leather Goods, Travel Accessories, whose exports to China in the first nine months of 2021 amounted to USD 556 million, higher than in 2020. The lion's share of this category is carry-and-store articles (code 4202), with ladies' and men's leather face bags (420221) as well as other leather accessories being the main commodity. While Italy exported USD 501million worth of carry-and-store articles to China in 2020, it has already exported USD 523million in the first nine months of 2021.

Figure 2.

STRUCTURE OF EXPORTS TO CHINA IN 2020, USD MILLION.

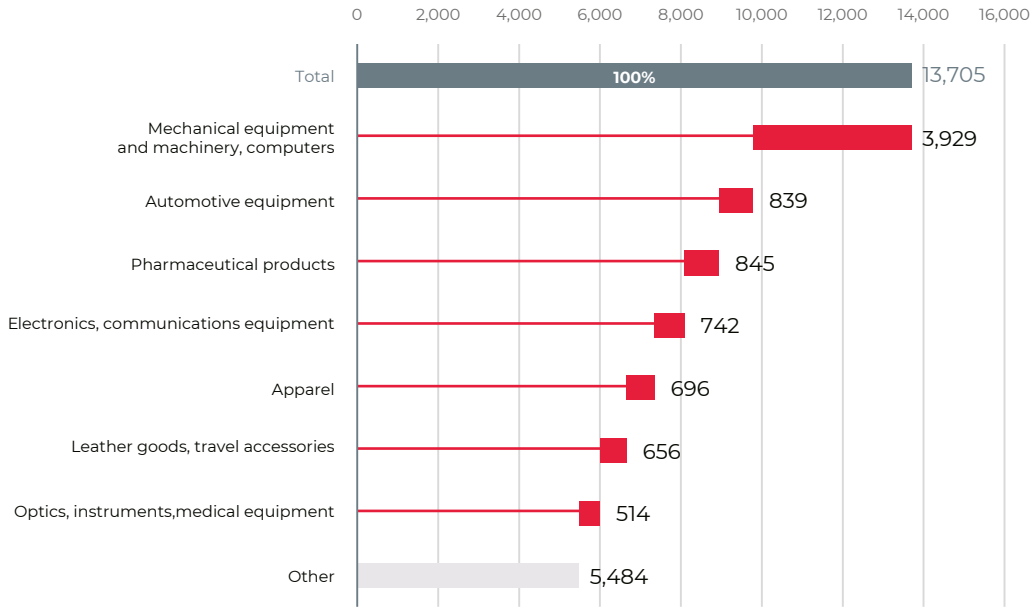


Source: Authors' calculations based on UN Comtrade.

A number of other categories of Italian exports to China should also be noted. For example, exports of plastics, which mainly consist of polyacetals, polyethers, polycarbonates (code 3907) — USD 90 million for 9 months 2021 and other plastic products (3926) — USD 61 million for 9 months of 2021. In addition, Italy actively exports furniture to China — USD 490 million for 9 months 2021 and medical equipment — USD 514 million.

Figure 3.

STRUCTURE OF EXPORTS TO CHINA IN Q1-Q3 2021, USD MILLION.



Source: Authors' calculations based on UN Comtrade.

Sectoral structure of Italian exports to China

The analysis of Italian exports to China in physical terms (tons) considers the industry structure, according to the adopted classification, using the available statistics for the last full year. In 2020, Italy's exports to China amounted to about 2 million tons. The leader in absolute terms was the export of non-metallic raw materials — 369 thousand tons. The basis of this category is marble (code 2515) — 347 thousand tons.

Plastics accounted for a significant part of exports — 178 thousand tons. These include: polyethylene (3901) - 63 thousand tons, which showed an increase of more than 2 times compared to 2019; polyacetals, polyethers, polycarbonates (3907) — 20 thousand tons; laminated and porous polymer films and sheets (3921) — 19 thousand tons.

Non-ferrous metals are also an important export item for Italy to China — 138 thousand tons in 2020. In this group, we can note, first of all, aluminum and its alloys (7601), which showed an increase by 64 thousand tons in 2020, reaching the mark of 72 thousand tons. This is followed by copper waste and scrap (7404) — 33 thousand tons, and refined copper (7403) — 21 thousand tons. All commodities in the base metals category showed record growth in 2020.

Significant tonnage was the export of uncoated paper and paperboard (4805) — 75 thousand tons, as well as coated paper and paperboard (4810) — 23 thousand tons.

Given the developed chemical industry in Italy, a significant place is taken by finished chemical products (120 thousand tons), as well as chemicals and materials (105 thousand tons). The following items are important to consider:

- Detergents and surfactants (3402) — 26 thousand tons.
- Additives to petroleum products (3811) — 16 thousand tons
- Pneumatic tires (4011) — 7 thousand tons.
- Lubricants (3403) — 10 thousand tons.
- Synthetic rubber (4002) — 8 thousand tons.

Export goods such as air pumps (8414) — 10 thousand tons, liquid pumps (8413) — 11 thousand tons, stop valves (8481) - 17 thousand tons, transmission equipment (8483) — 11 thousand tons should be mentioned among the universal equipment. It is important to note the special industry equipment: other equipment for agriculture and forestry (8436) — 11 thousand tons; other special mechanical equipment (8479) — 11 thousand tons.

Exports of light industry products are substantial in value terms, but in physical terms are broken down into many product groups. In 2020 Italy exported 72,000 tons of textile materials and products to China. Within this category, the main tonnage came from tanned leather of cattle and horses (4104) — 55 thousand tons.

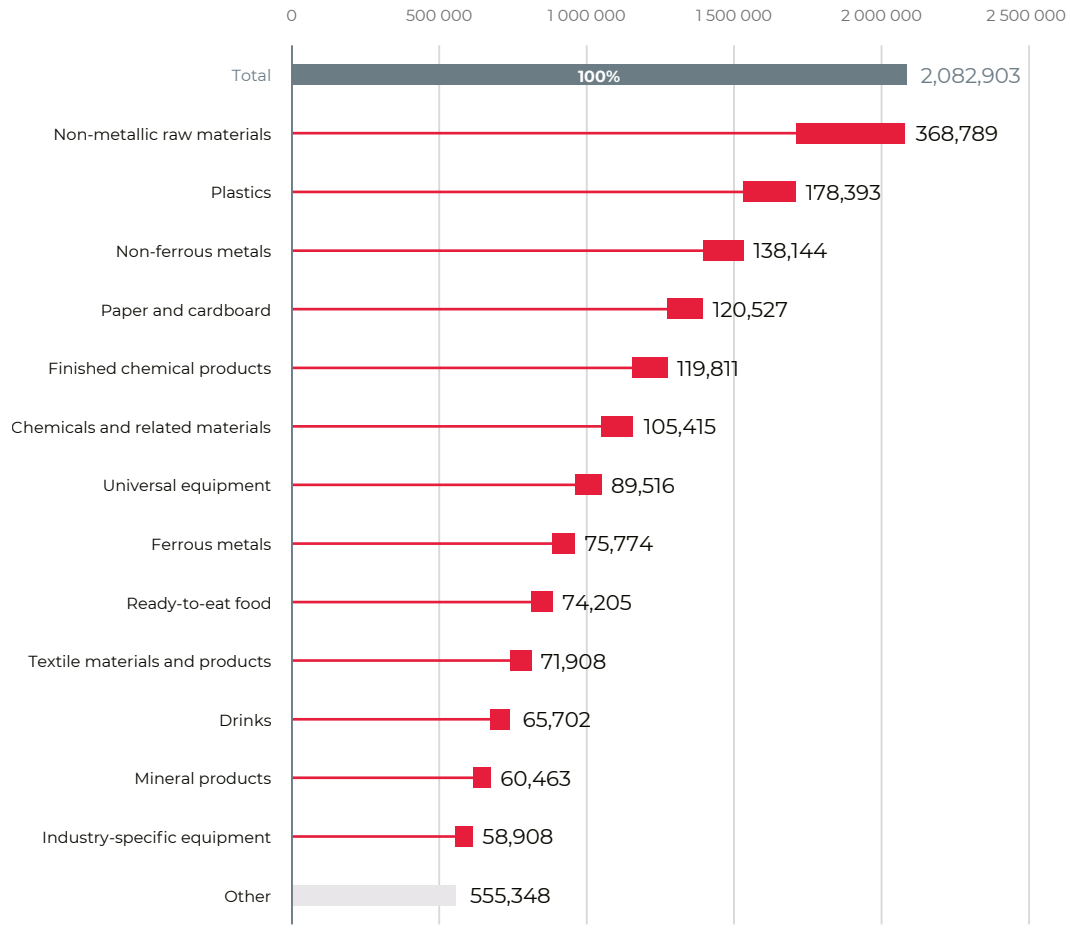
Italy's specialization in the export of high-quality food products is significant. In 2020, 74,000 tons of prepared food and 66,000 tons of beverages were exported. Among them are:

- Pasta, dumplings and similar products (1902) — 37 thousand tons.
- Canned tomatoes (2002) — 8 thousand tons.
- Cheese and cottage cheese (0406) — 5 thousand tons.
- Water (2201) — 25 thousand tons.
- Wine grapes (2204) — 25 thousand tons.

Export of ferrous metals is not a specialty of Italy, but in this category should be noted seamless steel pipes (7304) —16 thousand tons, unalloyed cold-rolled sheets (7209) — 12 thousand tons.

Figure 4.

ITALY'S EXPORTS TO CHINA IN 2020 BY SECTOR, TONS.



Source: Authors' calculations based on UN Comtrade.

The above list of goods gives an idea of the nature of Italian exports to China in physical terms, reflects a fairly high degree of redistribution of the country's exports, as well as the presence of niche, specialized products, which is associated with the peculiarities of the country's economy. In addition, it should be noted notable export volumes of tiles (45 thousand tons), pork (21 thousand tons), auto parts (13 thousand tons), ready-made animal feed (8 thousand tons) — since the export of these goods can be redirected to railroads.

POTENTIAL FOR SWITCHING ITALY'S EXPORTS TO CHINA TO RAILROADS

The following assessment of the modal shift potential in favor of railways is based on the author's approach to analyzing and comparing various statistical data from publicly available sources of information, the Eurostat database and in-depth statistics of ERAI.

The structure of Italy's exports to China by rail is characterized by a significant share of finished industrial goods, as well as clearly defined specialization goods that can be switched to railroads. At the same time, at present less than 1% of Italy's exports to China go by rail, lower than the share of rail in EU-China freight traffic, which, according to expert estimates, is 6-7% by TEU. However, a number of goods already account for up to a quarter of the export flow from Italy to China (tires, safes, carbon black) in physical terms.

In order to determine how much of the freight flow from Italy to China could be transferred to rail and how much rail capacity would be required, two basic approaches to estimating potential freight flow were developed, as well as a method to convert freight flow weight values into volume ones (TEU).

Current Goods Traffic by Rail

At the end of 2020 the volume of goods exported from Italy to China by rail was 15.6 thousand tons, which is 0.72% of the total physical volume of exports by all modes of transport. These are 188 commodity items, the largest of which are such goods as furniture, tires, additives for rubber and plastics, etc. In general, goods of such categories as universal equipment, various industrial goods, metal products, chemicals and materials, plastics, ferrous metals, ceramics, etc. are transported most by rail. The entire nomenclature of goods exported from Italy to China (all modes of transport) is 1,121 commodity items.

The specific nature of rail freight transported in containers is responsible for the absence of cheap and bulky commodities, and close to them in the structure of Italy's rail-mediated exports to China. Such industry groups as non-metallic materials, plastics, paper and cardboard, chemicals and materials are absent (or have a smaller presence) in the total mass of the cargo flow by rail. Thus, the basis of Italian rail shipments to China consists of finished products.

In the group of finished chemical products — 2,951 tons (19% of exports by rail) the first place is taken by pneumatic tires (code 4011), rail exports of which amounted to about 1,800 tons in 2020. Interestingly, the world-famous Italian tire manufacturer Pirelli is owned by Chinese chemical giant Irina National Chemical Corp. (ChemChina), which may also influence the company's choice of modal composition. Chemical products such as detergents, soaps, shower gels, and finishing products, which account for a significant share of this category's total exports to China, are almost never transported by rail.

In the miscellaneous industrial goods group — 2,235 tons (14% of exports by rail) the most important commodity is non seating furniture (code 9491) — almost 2,000 tons in 2020. Such figures are related to the specific economic specialization of Italy, which traditionally supplies quality fittings to other countries. At the same time, seating furniture goes by rail to a much lesser extent.

Also an important industry group is universal equipment — 2,066 tons (13%), where a significant part is represented by stop valves (8481) — 644 tons, transmission equipment (8483) - 394 tons, air pumps (8414) — 347 tons. Liquid pumps go by rail to the lesser extent.

Significant share is taken by special-purpose industry equipment, power equipment, and machine tools — about 10% in total. These groups include the following goods: mineral processing equipment (166 tons), cables (117 tons), non-electric motors (101 tons). In contrast to general exports, other agricultural/special mechanical equipment hardly ever come by rail.

In the group of metal products, ferrous and nonferrous metals, we should mention other ferrous metal products (288 tons by rail in 2020), ferrous metal fittings (238 tons), bars and shaped stainless steel (464 tons), aluminum wire (384 tons). At the same time, aluminum and its alloys (code 7601), the main group in the structure of total exports in four digits, is only singularly represented in the railway freight traffic.

Due to the commodity characteristics and specifics of containerization, chemical substances and materials, as well as plastics are less represented in the railway freight flow. These categories include carbon black (486 tons by rail in 2020), saturated acyclic monocarboxylic acids and their derivatives (324 tons), polyacetals, polyethers, polycarbonates (238 tons). However, the railroad does not represent or almost does not represent significant goods in total Italian exports to China: acyclic hydrocarbons (27 thousand tons), lubricants (10 thousand tons), polyethylene (63 thousand tons).

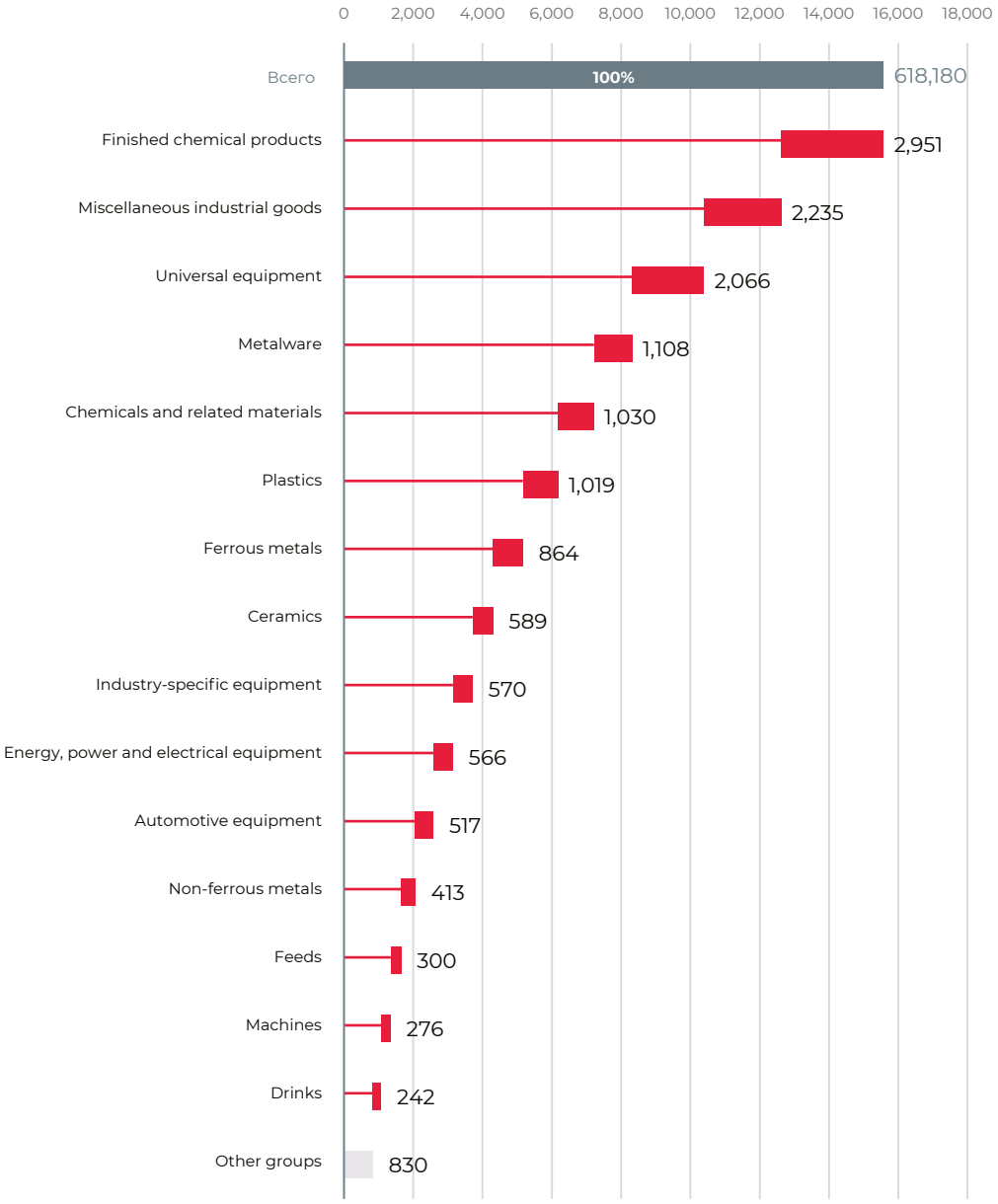
Finally, when analyzing the structure of Italy's exports to China by rail, a number of groups of goods that tend to be transported by rail in containers, but are still under-represented in the flow of goods by rail, stand out. The main export commodity in the ceramic group is facing tiles and similar products: 45,000 tons in total, of which only 588 tons are exported by rail. Italian finished animal feed has a stable niche in the global market, but only 4% of exports of this product go by rail (300 tons).

Due to the counter-sanctions regime in Russia, the transit of European food products via the Eurasian route is currently hindered, except for containers going with navigation seals as part of pilot shipments. At the same time, it is foodstuffs that have significant prospects for increasing the flow of goods by rail. Water (164 tons) and grape wines (59 tons), traditional export products for Italy, are already transported by rail. However, in both cases the share of railways is no more than 1% with the combined total exports of both groups of 50,000 tons.

In the case of ready-to-eat foodstuffs, pasta, dumplings and similar products (37 thousand tons in total export), canned tomatoes (8 thousand tons), flour products (4 thousand tons), cheese and cottage cheese (5 thousand tons) could have a significant potential for eastward shipment.

Figure 5.

STRUCTURE OF ITALY'S EXPORTS TO CHINA BY RAIL IN 2020, TONS.



Source: authors' calculations based on Eurostat.

While Italy's total exports to China in physical terms in 2020 showed a decrease of 3.5% compared with the previous year, the volume of exports transported by rail showed a significant increase — by 125% or 8.6 thousand tons. This is due to the growth of the largest (of the rail freight) commodity groups. This is due to the growth of the biggest (of those supplied by rail) commodity groups: pneumatic ties (25% of deliveries by rail) — an increase of 21%, carbon black (share of rail — 24%) — an increase of 154%, safes (share of rail — 24%) — an increase of 52%, aluminum wire (share of rail — 18%) — an increase of 20%, rubber and plastics additives (share of rail — 15%) — an increase of 46%. In quantitative terms, non-seating furniture shipments by rail are also significant (1,985 tons, 6%) — this commodity showed the largest absolute increase in rail freight traffic in 2020.

Assessment of Modal Shift Potential

Modal shift potential refers to the difference between the potential volume of freight traffic and the current volume, i.e. it is a forecast of the increase in the volume of freight delivered due to the shift of some exports from other modes of transport to rail. The following data is used to determine how much of Italy's exports to China could be shifted to rail via trans-Eurasian routes:

- Italy's export statistics to China according to UN Comtrade (International Trade Center, ITC).
- Statistics on Italy's exports to China by mode of transport according to Eurostat.
- ERAI freight statistics.

Export statistics contain data on physical volumes of shipments by commodity classification of the harmonized system (HS Codes) and export destination countries. Physical volume means "net weight" — the weight of goods in tons without packaging (in the case of Italian statistics).

Eurostat statistics by mode of transport determines the active vehicles (air, road, rail, sea), by which goods leave the statistical territory of EU states, as well as their volumes in physical terms. Data are presented by HS commodity classification and by country of final destination. The physical volume refers to the "net mass".

ERAI statistics contain data on actually committed container rail shipments along the Eurasian route between cities in Europe and China by country of departure/destination of cargo, cargo volumes in tons and number of TEU, as well as the nomenclature of transported goods in the HS classification. The database is a list of completed rail shipments (one shipment - one record), each of which contains information about the weight of freight and type of container - TEU (20-foot equivalent or FEU (40-foot). In this case, a container may not be filled completely or contain goods of different product lines.

According to Eurostat, the range of goods shipped by rail from Italy to China is not yet extensive. As mentioned above, it was represented by 188 items in 2020. Their total export (by all modes of transport) is 903 thousand tons, and only 15.5 thousand tons of them (1.7%) are accounted for by rail. Taking into account the current trend to increase the share of rail in transcontinental transport between Europe and Asia, the rail share in Italy's exports to China will also increase. This is possible

by expanding the range of goods transported and/or by using rail to a greater extent for those goods that are already transported by rail to some extent. This study considers the second case — the potential to increase the flow of goods already being transported by rail. It is a question of assessing the extent to which their rail freight traffic can increase on the basis of current market dynamics (demand from China is key here), as well as assessing whether the role of rail freight in exports of individual goods can be increased to an "optimal" level (the EU as a whole may be the benchmark here).

In this regard, two approaches are proposed to estimate the potential for modal shift:

- Approach 1: Estimation based on total demand from China for selected Italian goods
- Approach 2: Benchmarking based on the European average for the share of rail freight in selected European goods

Based on the two calculations presented below, projected (potential) values for the annual volume of rail shipments and its growth in tons were determined. In order to estimate these volumes in TEU, information on specific weights of different commodities (weight/volume ratio) was needed, for which ERAI data were used to calculate. The detailed ERAI database is a list of records of all container shipments made during a given period of time, specifying the commodity code, the total weight of the shipment and the number of TEUs involved (1 or 2). To determine the specific weights of goods transported by rail in 2020, the ratio of weight to container volume (1 or 2 TEU) was calculated for each shipment of goods, which were then aggregated to the 4-digit HS Codes. Container shipments of mixed freights were excluded from the 2020 data set, as in this case it is not possible to determine the specific weight of a single commodity. As a result, specific weights could be established for 866 commodity items out of the existing 1,253 in the HS Codes, some of which are presented below.

AVERAGE SPECIFIC WEIGHTS OF GOODS BASED ON FREIGHT DATA IN ERAI

	HS	Goods	Specific weight (tons/TEU)
		Average value of specific weight (all goods)	6.6
1	3,907	Polyacetals, polyethers, polycarbonates	13.36
2	7,226	Rolled sheet, alloy, narrow	12.92
3	4,404	Poles, stakes, and other rough-hewn wood	12.84
4	2,923	Quaternary ammonium salts and hydroxides	12.77
5	2,917	Polycarboxylic acids and derivatives thereof	12.67
6	4,801	Newsprint	12.32
7	4,702	Soluble cellulose	12.32
8	4,403	Roundwood	12.16
9	3,820	Antifreeze	12.03
10	2,804	Other nonmetals	12.02
11	6,904	Bricks and similar ceramic products	12.00
12	2,519	Magnesia raw materials	11.97
13	7,403	Refined copper	11.95
14	3,504	Proteins, other	11.87
15	1,510	Residual olive oil	11.76
16	3,102	Nitrogen fertilizers	11.73
17	6,901	Ceramics of diatomite and similar rocks	11.52
18	7,406	Copper powders	11.50
19	2,525	Mica	11.48
20	4,410	Particle boards	11.47
21	1,508	Peanut butter	11.47
22	9,604	Hand sieves	11.45
...		....	
860	9,704	Cancelled postage stamps	1.05
861	4,906	Plans and drawings	1.04
862	2,001	Canned fruits and vegetables with vinegar	0.83
863	8,802	Avionics	0.80
864	9,703	Original sculptures and statuettes	0.63
865	8,606	Freight cars	0.45
866	8,609	Containers	0

Source: Authors' calculations based on ERAI.

According to the calculations, polyacetals, polyethers, polycarbonates, various timber and metal products have the highest average specific weight, and the lowest (less than a ton) — various finished industrial goods, which, including packaging, take up a considerable amount of space during transportation (for example, sculptures and statues. The average value of the specific weight for all commodity items was 6.6 tons.

Based on the available types of products exported from Italy to China by rail, their volumes and average specific weights, the corresponding export volume in TEU was calculated. For those commodities for which data were not available in ERAI or were not applicable due to the sign of mixed shipments, an average of 6.6 tons/TEU

was used as the specific weight of commodities based on freight data in the ERAI database in 2020. Thus, to transport 15,576 tons of goods delivered from Italy to China by rail in 2020, about 2,546 TEU were used (taking into account the structure of exports).

ESTIMATION BASED ON CHINESE DEMAND FOR ITALIAN GOODS

Under the first approach, China's demand for goods is indicated by the overall trend in exports from Italy to China (by all modes of transport). In this context, for each of the 188 commodity lines of Italian rail exports to China, the relative increase in total exports (in tonnes, in 2020 relative to 2019) was calculated.

Having applied the growth rate of total exports of goods (both positive and negative) to the volume of their transportation by rail (in tons) in 2020, a forecast value of the volume of their transportation by rail was calculated for each commodity. Thus, the freight flow forecast is based on the dynamics of demand for goods in the current year. The total volume of forecast values of railway exports for 188 goods was 19 thousand tons. Consequently, the volume of exports transported from Italy to China by rail can be increased by 3.4 thousand tons per year (from the current level of 15.5 thousand tons).

If we exclude the cases of negative dynamics of total exports from the assessment, the projected volume will be about 20 thousand tons. Thus, the volume of railway exports from Italy to China can be increased by 4.4 thousand tons per year.

To assess the potential for modal shift in TEU, the forecast values of annual volumes and increments of rail deliveries of goods (in tons) were divided by the average specific weights of the corresponding goods (tons/TEU); thus, the annual forecast volumes of exports and its increment in TEU were obtained. According to calculations, the growth of rail exports in TEU could range from 449 (taking into account both positive and negative dynamics of demand), to 618 TEU (taking into account only the positive dynamics of total demand for goods). The largest increases can be expected for such commodities as carbon black, finished animal feed and pneumatic tires.

POTENTIAL FOR GROWTH IN RAIL FREIGHT TRAFFIC (TEU) BASED ON POSITIVE DYNAMICS OF TOTAL EXPORTS, 2019-2020.

No.	Code	Goods	Total exports	Rail export											
			Dynamics 2020/2019	Volume		Growth	Volume	Potential (+ and - dynamics)				Potential (only + dynamics)			
				2019	2020	2020/2019	2020	Volume		Growth		Volume		Growth	
			%	tons	tons	tons	TEU	tons	TEU	tons	TEU	tons	TEU	tons	TEU
Total			-3%	7,773	15,576	7,803	2,546	19,007	2,994	3,431	449	20,048	3,164	4,472	618
1	2,803	Carbon black	154%	16	486	470	67.7	1,236	172	750	104.4	1,236	172.1	750	104.4
2	4,011	Pneumatic tires	21%	834	1,795	961	433.2	2,168	523	373	90.0	2,168	523.2	373	90.0
3	2,309	Finished animal feed	242%	0	300	300	28.6	1,026	98	726	69.2	1,026	97.9	726	69.2
4	7,307	Ferrous metal fittings	166%	97	238	141	29.7	633	79	395	49.3	633	79.0	395	49.3
5	3,812	Additives for rubber and plastics	46%	0	654	654	63.7	956	93	302	29.4	956	93.1	302	29.4
6	7,305	Large diameter pipes	718%	0	26	26	3.8	213	31	187	27.5	213	31.3	187	27.5
7	3,921	Layered and porous polymer films and sheets	62%	188	174	-14	34.5	281	56	107	21.3	281	55.8	107	21.3
8	7,306	Steel pipes, except large diameter and seamless ones	128%	10	128	118	16.5	292	38	164	21.1	292	37.7	164	21.1
9	8,481	Stop valves	17%	41	644	603	93.6	756	110	112	16.2	756	109.9	112	16.2
10	8,303	Safes and similar products	52%	0	220	220	29.2	334	44	114	15.1	334	44.3	114	15.1
11	7,601	Aluminum and its alloys	900%	0	19	19	1.7	190	17	171	15.1	190	16.7	171	15.1
12	2,915	Saturated acyclic monocarboxylic acids and derivatives thereof	32%	20	324	304	44.5	429	59	105	14.4	429	58.9	105	14.4
13	8,474	Mineral processing equipment	31%	131	166	35	26.5	217	35	51	8.1	217	34.6	51	8.1
14	8,414	Air pumps	15%	108	347	239	52.5	399	60	52	7.8	399	60.4	52	7.8

No.	Code	Goods	Total exports	Rail export											
			Dynamics 2020/2019	Volume		Growth	Volume	Potential (+ and - dynamics)				Potential (only + dynamics)			
				2019	2020	2020/2019	2020	Volume		Growth		Volume		Growth	
			%	tons	tons	tons	TEU	tons	TEU	tons	TEU	tons	TEU	tons	TEU
15	7,605	Aluminum wire	20%	36	384	348	36.3	459	43	75	7.1	459	43.4	75	7.1
16		Diesel engines	239%	19	20	1	2.9	68	10	48	7.0	68	9.9	48	7.0
17	8,418	Refrigeration equipment	27%	8	88	80	23.2	112	29	24	6.3	112	29.5	24	6.3
18	3,911	Other polymers	167%	0	34	34	3.7	91	10	57	6.2	91	9.9	57	6.2
19	8,302	Metal mountings and fittings	31%	10	154	144	19.0	201	25	47	5.9	201	24.9	47	5.9
20	4,016	Rubber products, other	37%	20	79	59	15.7	108	22	29	5.8	108	21.5	29	5.8
...	...	...													
188	7,616	Other aluminum products	-45%	1.0	1.0	0.00	0.08	0.55	0.05	-0.45	-0.04	1.0	0.1	0.00	0.00

ESTIMATION BASED ON AVERAGE EUROPEAN SHARE OF RAIL FREIGHT IN EXPORTS

The second approach to assessing the potential for modal shift is based on the hypothesis that the share of rail deliveries in Europe-wide foreign exports for each individual commodity can act as a benchmark for the “optimal” level, in particular, for the flow of goods from Italy to China.

The calculation of the "European average" share of rail shipments was based on statistics of EU exports to all foreign countries by commodity (at the 4-digit level) and mode of transport in 2020. Comparing them with similar indicators of Italy's exports to China, it can be noted that for most commodity groups the "average European" share of rail transport does not exceed the corresponding indicators of Italy, which is due to the specific structure of Italian exports. For 63 of the 188 commodities, this excess occurred; in particular, European exports of unalloyed steel wire are nearly 29% supplied by rail, while in the Italy-China traffic rail represents no more than 2%.

ITALIAN EXPORTS TO CHINA WITH A SHARE OF RAIL FREIGHT LOWER THAN THE EU AVERAGE

No.	FEACN	Goods	Share of rail freight in export	
			EU to all countries	Italy to China
1	7,217	Non-alloy steel wire	28.92%	1.9%
2	2,202	Soft drinks	16.33%	0.8%
3	7,601	Aluminum and its alloys	13.11%	0.0%
4	8,703	Passenger cars	12.93%	0.1%
5	7,606	Aluminum plates and sheets	12.14%	0.9%
6	3,909	Aldehyde resins and polyurethanes	8.58%	0.5%
7	3,907	Polyacetals, polyethers, polycarbonates	5.68%	1.2%
8	8,455	Rolling mills and rolls	5.67%	2.4%
9	8,482	Ball and roller bearings	4.01%	1.0%
10	3,904	Polyvinyl chloride	3.95%	1.2%
11	2,201	Water	3.94%	0.7%
12	8,708	Automotive parts	3.89%	3.8%
13	4,810	Coated paper and cardboard	3.63%	0.0%
14	2,508	Clays, other than kaolin ones	3.23%	1.9%
15	8,428	Other lifting and handling equipment	3.18%	0.6%
16	8,451	Machines for processing textile materials and products	3.15%	0.1%
17	8,508	Vacuum cleaners	3.07%	0.8%
18	6,810	Cement and artificial stone products	2.39%	0.2%
19	5,603	Nonwovens	2.31%	1.2%
20	8,439	Equipment for the pulp and paper industry	2.22%	0.2%
21	8,479	Other special-purpose mechanical equipment	2.16%	0.9%
22	7,019	Fiberglass and products thereof	2.04%	0.9%
23	3,901	Polyethylene	1.92%	0.1%
24	8,505	Magnets and magnetic devices	1.79%	1.4%
25	7,607	Aluminum foil	1.74%	0.9%
26	7,318	Ferrous metal fasteners	1.68%	0.5%
27	3,811	Additives to petroleum products	1.61%	0.2%
28	3,403	Lubricants	1.59%	0.0%
29	8,413	Liquid pumps	1.53%	1.2%
30	4,410	Particle boards	1.51%	0.2%
...				
63	6,403	Shoes with leather uppers	0.16%	0.1%

Source: authors' calculations based on Eurostat.

To calculate the potential rail freight flow for each of the 188 goods, the maximum (of two) share of rail transport was determined, which was then multiplied by the total volume of Italian exports to China by commodity (all modes of transport) in tons. The increase in rail freight for each commodity was calculated as the difference between the potential and current volume of rail exports.

The calculation resulted in a total potential volume of rail exports of nearly 35,000 tons per year and a potential increase of 19,300 tons per year, representing 4,852 and 2,306 TEU, respectively. In this case, the greatest potential has such commodity items as aluminum and its alloys, passenger cars, aldehyde resins and polyurethanes

POTENTIAL FOR GROWTH IN RAIL FREIGHT TRAFFIC (TEU) BASED ON THE AVERAGE EUROPEAN SHARE OF RAIL TRANSPORT IN EXPORTS OF GOODS, 2020.

No.	Code	Goods	EU exports	Italy's exports to China							
			Share of Railway	Volume	Rail export		Share of Railway	Max share	Railway export potential		
								Volume		Growth	
				tons	tons	TEU	%	%	tons	TEU	tons	TEU
Total					15,576	2,546			34,883	4,852	19,307	2,306
1	7,601	Aluminum and its alloys	13.1%	71,616	19	1.7	0.0%	13.1%	9,386	826.7	9,367	825.0
2	8,703	Passenger cars	12.9%	11,962	6	2.0	0.1%	12.9%	1,547	503.7	1,541	501.7
3	3,909	Aldehyde resins and polyurethanes	8.6%	12,753	58	6.7	0.5%	8.6%	1,095	126.0	1,037	119.3
4	3,901	Polyethylene	1.9%	63,185	35	3.2	0.1%	1.9%	1,211	110.7	1,176	107.5
5	6,810	Cement and artificial stone products	2.4%	23,280	57	11.1	0.2%	2.4%	556	107.9	499	96.8
6	4,810	Coated paper and cardboard	3.6%	23,480	4	0.4	0.0%	3.6%	853	90.4	849	90.0
7	2,201	Water	3.9%	24,837	164	17.2	0.7%	3.9%	978	102.6	814	85.4
8	3,907	Polyacetals, polyethers, polycarbonates	5.7%	19,830	238	17.8	1.2%	5.7%	1,127	84.3	889	66.5
9	2,202	Soft drinks	16.3%	2,438	19	2.0	0.8%	16.3%	398	41.3	379	39.3
10	1,902	Pasta, dumplings and similar products	0.6%	36,938	20	3.4	0.1%	0.6%	239	41.1	219	37.7
11	3,402	Detergents and surfactants	1.2%	25,848	37	4.2	0.1%	1.2%	301	34.3	264	30.1
12	8,479	Other special-purpose mechanical equipment	2.2%	10,597	94	18.4	0.9%	2.2%	229	44.8	135	26.4
13	8,451	Machines for processing textile materials and products	3.1%	3,138	3	0.7	0.1%	3.1%	99	23.9	96	23.2
14	3,811	Additives to petroleum products	1.6%	16,394	27	2.5	0.2%	1.6%	264	24.4	237	21.9
15	8,455	Rolling mills and rolls	5.7%	4,660	111	15.6	2.4%	5.7%	264	37.2	153	21.6
16	6,802	Worked stone (except slate)	0.6%	33,374	1	0.1	0.0%	0.6%	206	21.5	205	21.4
17	3,403	Lubricants	1.6%	10,237	1	0.1	0.0%	1.6%	163	19.8	162	19.7
18	2,204	Grape wines	0.9%	24,747	59	6.3	0.2%	0.9%	212	22.5	153	16.2
19	4,410	Particle boards	1.5%	14,479	35	3.1	0.2%	1.5%	218	19.0	183	16.0
20	8,428	Other lifting and handling equipment	3.2%	2,317	15	3.7	0.6%	3.2%	74	18.3	59	14.6
...												
188	7,007	Safety glass	0.4%	150	1	0.1	0.7%	0.7%	1	0.1	-	-

This estimate seems conservative and takes into account the evolutionary scenario of the development of rail freight traffic from Italy to China. At the same time, there are a number of other approaches to estimating freight flow potential, each of which cannot have absolute predictive power due to a number of factors that are difficult to assess: economic and geographic gravitation to a particular mode of transport, the nature of organization of transport and logistics chains, product container suitability, political uncertainties, limited access to data. At the same time, the increase in freight traffic by rail seems to be a logical and irreversible process for several years to come.

Thus, the evaluation of the modal shift potential is based on two approaches that solve the problem from different angles. Although the final quantitative results of the estimate of potential growth have some scatter — 618 TEU and 2,306 TEU, both values fall within a fairly realistic range, not exceeding a twofold increase in rail freight traffic. An estimate based on China's demand dynamics has a closer "horizon" because factors that determine demand spikes are often short-term. The assessment based on the average European level of "popularity" of rail transport in the export of certain goods implies the transition of exporters from other modes of transport to rail within the current volumes of goods traffic, which are stable in the long term. In all likelihood, the actual freight flow will be determined by a combination of these factors, in one ratio or another.

APPENDICES

APPENDIX 1. ITALY'S EXPORTS TO CHINA IN PHYSICAL TERMS BY COMMODITY SECTOR AND THE SHARE OF RAIL TRANSPORT.

Commodity sector	Italy's exports to China in 2020.	Commodity flow by rail (% of total exports)
Non-metallic raw materials	368,789	0.02
Plastics)	178,393	0.15
Non-ferrous metals	138,144	0.21
Paper and cardboard	120,527	0.01
Finished chemical products	119,811	0.57
Chemicals and related materials	105,415	1.01
Universal equipment	89,516	0.55
Ferrous metals	75,774	0.68
Ready-to-eat food	74,205	0.06
Textile materials and products	71,908	0.49
Drinks	65,702	0.02
Mineral products	60,463	0.18
Industry-specific equipment	58,908	0.30
Recycled fuel	54,821	-
Miscellaneous industrial goods	48,198	0.58
Ceramics	46,945	0.02
Livestock products	41,521	-
Wood raw material	36,861	-
Metalware	36,325	1.99
Energy, power and electrical equipment	35,316	0.33
Woodworking	35,284	0.19
Cellulose	32,667	-
Agri supplies	29,339	0.21
Automotive equipment	27,316	0.05
Railway machinery	23,027	-
Machines	16,683	0.29
Glass	16,675	0.02
Feeds	14,336	0.04
Fertilizers	10,797	-
Fat and oil products	10,310	-
Fruit and vegetable products	9,942	-
Pharmacy	7,082	0.02
Instruments	4,004	0.30
Grain and milling products	3,497	-
Clothing	3,202	0.06
Household appliances	2,490	0.23

Commodity sector	Italy's exports to China in 2020.	Commodity flow by rail (% of total exports)
Shoes	2,323	0.00
Farm machinery	2,107	0.01
Other equipment and devices	1,788	0.03
Animals and plants	760	-
Telecommunications equipment	726	0.04
Electronics	558	
Armaments	179	
Ships and watercraft	115	
Ores and concentrates	61	
Articles of precious metals and stones	51	
Fish and seafood	24	
Precious metals and stones	10	
Avionics	8	
Primary fuel	-	
Total	2,082,903	0.72

Source: Authors' calculations based on data from UN Comtrade and Eurostat.

APPENDIX 2. GOODS LEADING IN ABSOLUTE GROWTH OF EXPORTS BY RAIL.

No.	HS	Goods	2019	2020	Abs. growth	in total item exports
			tons	tons	tons	%
		Italy's exports to China, Total	2,268,646	2,188,871	-79,775	
		Including export by rail:	6,931	15,576	8,645	
1	9,403	Non seating furniture	741	1,985	1,244	6%
2	4,011	Pneumatic tires	834	1,795	961	25%
3	3,812	Additives for rubber and plastics	0	654	654	15%
4	8,481	Stop valves	41	644	603	4%
5	2,803	Carbon black	16	486	470	24%
6	7,222	Stainless steel bars and shapes	72	464	392	8%
7	7,605	Aluminum wire	36	384	348	18%
8	8,483	Transmission equipment	67	394	327	4%
9	2,915	Saturated acyclic monocarboxylic acids and derivatives thereof	20	324	304	14%
10	2,309	Finished animal feed	0	300	300	4%
11	7,326	Other products of ferrous metals	43	288	245	3%
12	8,414	Air pumps	108	347	239	3%
13	3,907	Polyacetals, polyethers, polycarbonates	0	238	238	1%
14	8,303	Safes and similar products	0	220	220	24%
15	3,920	Single-layer polymer films and sheets	0	165	165	2%

16	2,201	Water	0	164	164	1%
17	8,422	Equipment for washing, filling or packing	24	173	149	3%
18	8,302	Metal mountings and fittings	10	154	144	5%
19	9,401	Seating furniture	21	164	143	3%
20	7,307	Ferrous metal fittings	97	238	141	3%
		Other	4,801	5,995	1,194	

Source: Authors' calculations based on data from UN Comtrade and Eurostat.