Freight Transport in the United States and Chosen European and Asian Countries[1]

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The article consists of three parts. First part focuses on the development of goods conveyance (along with the consideration of particular transport branches) between 1980 and 2010 in the United States. Second part describes the development of commodity conveyance by means of transport of particular branches in the European Union in the same year, in Japan (1985-2008) and China (1980-2008). Last part is an attempt to indicate the differences in the structure of transport development in the United States and the European Union.
Keywords: Freight transport, The United States, Europe, Asia

1. INTRODUCTION

Technical advancement and introduction of new technologies made production easier and goods more available. It was also a stimulus for some structural changes which resulted in the fact that service sector became larger and more significant. A tendency for extreme specialization and scale effect advantages (which were not possible without transport) were of great importance for the economic development.

Along with these processes, exchange trading had grown to the extent that had not been observed before. International trade was significantly developing in the European Union, but also in the countries of southern and eastern Asia.

As a result of the introduction of new management and production concepts (transferring them to Asia, among others), the supply chain extended. Even though, the role of industry in the national production had gone down, the amount of goods supplied (cars, computer, toothbrushes, jumpers, trousers) was growing and so was the demand for transport. [10]

The growth of the demand for transport is connected with economic development.

2. FREIGHT TRANSPORT IN THE UNITED STATES

In the States most of the Goods are conveyed in containers which makes uploading and unloading less complicated and allows the usage of modern transport technologies.

In the USA, in past 25 years a dynamic development of road, rail and air transport was observed. And in case of road transport, its share tripled (table 1 and 2).

Road transport grew much faster than rail transport. However, it is the latter that leads in terms of the amount of conveyed goods.

The development of the air transport is also characteristic since it is one of the most dynamic among the biggest countries. [8]

[1] The article was written on the basis of a book by Maciej Mindura *Transport w erze globalizacji gospodarki*. ITE-PIB Warszawa-Radom 2010

Table 1: Transport volume performed by varied means and branches of transport (b tkm)

	TRANSPORT						
	OVERALL	**rail**	**road**	**inland waterways**	**marine**	**air**	**pipeline**
1980	-	1 352	790	600	-	10	-
1985	-	1 440	981	615	-	12	-
1990	5 301	1 558	1 242	430	790	15	1 226
1995	6 007	1 928	1 514	450	732	19	1 365
2000	6 336	2 263	1 746	445	500	23	1 358
2005	6 642	2 538	1 893	404	461	23	1 323
2010	6 636	2 601	1 964	384	333	20	1 333

Source: study based on: North America Transportation Statistics Database 2010/stastisticsdatabase9927u.

Table2: The structure of transport volume in the USA

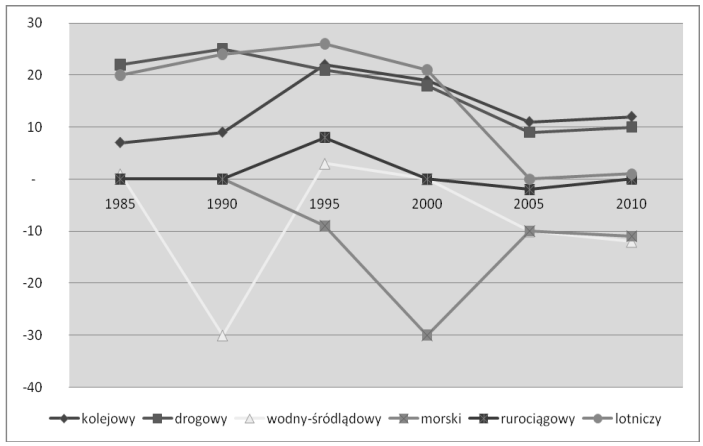
	TRANSPORT					
	OVERALL	**rail**	**road**	**inland waterways**	**marine**	**pipeline**
1985	100	47,00	32,00	21,00	-	-
1990	100	30,00	24,00	8,00	15,00	23,00
1995	100	32,00	25,00	8,00	12,00	23,00
2000	100	36,00	28,00	7,00	8,00	21,00
2005	100	38,00	29,00	6,00	7,00	20,00
2010	100	39,00	30,00	6,00	5,00	20,00

Source: study based on : North America Transportation Statistics Database 2010/databasestatiscics9972freight.

It is different with marine and inland waterways transports. Both branches limited their shares in the conveyance in comparison to the other means of transport. The number of conveyance was reduced by 1/3.

However, there is a chance that it is going to change because new locks are to be built on Panama Canal until 2015. Is is assumed that more ships between Asia and West Coast will reach the ports of Baltimore, Hampton Road and Wilmington.

The conveyance by varied means of transport in the USA is illustrated on drawing no 1.

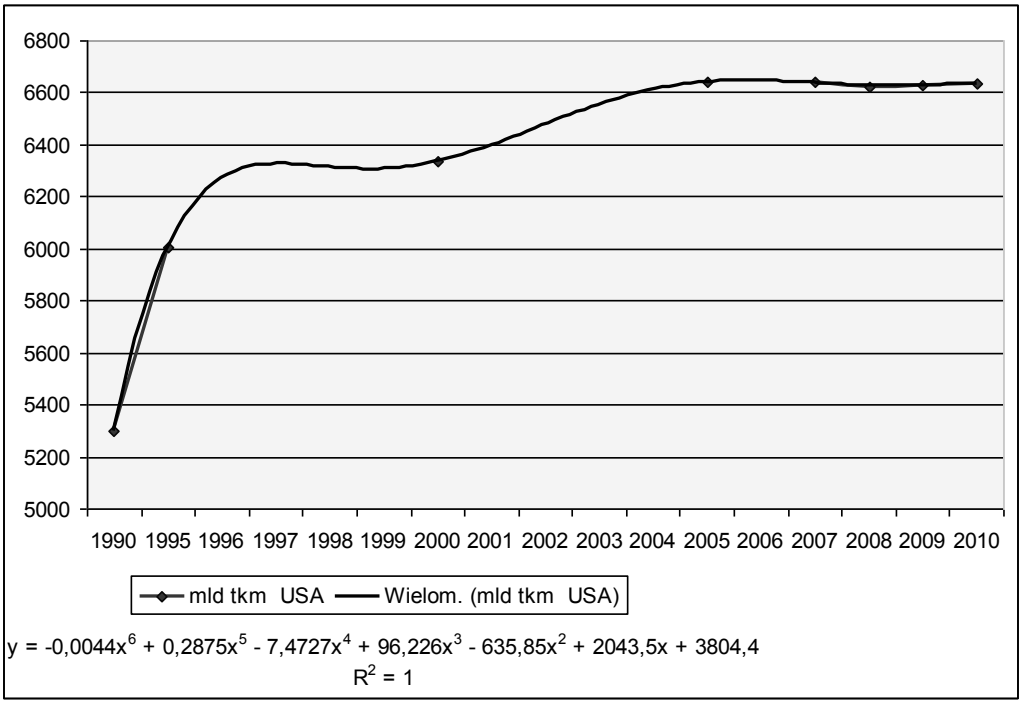


Drawing 1 Transport volume carried by means of transport of varied transport branches in the USA
Source: study based on: North America Transportation Statistics Database 2010/statisticsdatabase8871.

New American administration with President Obama at the front assures they are interested in transport and ecology. For that reason a coalition was appointed which is to promote pro-ecological transport policy. The coalition includes: *The American Public Transportation Association*, *The American Short Line and Regional Railroad Association*, *Amtrak*, *Association of American Railroads*, *Building America's Future*, *National Association of Railroad Passengers*, *The Natural Resources Defense Council*, *The Railway Supply* Institute, The States for Passenger Rail Coalition and The Surface Transportation Policy Partnership.

According to its creators the rail is able to solve a lot of transport problems both ecological and economic.[5]

The overall anticipated transport volume (measured in tkm) for the last decade in the USA illustrates a polynomial curve (drawing 2).



Drawing 2: Overall transport volume in the USA between 1990 and 2010.

Source: Self-study based on North American Transportation Statistics Database 2010.

Polynomial curve is quite a precise reflection of business processes. [7]

In the first phase of the analyzed period (1990-1997) production growth caused an increase of transport, and as follows economic slow-down between 1998 and 2001 resulted in a decrease of transport. This downward trend lasted until 2001. Between 2002 and 2006 economic development resulted in the growth of transport volume.

Between 2006 and 2010 the polynomial curve, which illustrates transport in billion tkm, is equalized with slight deviations. The results of the comparative analysis of GDP and transport volume in the USA are a classic ex ample of transport and economy dependencies.[7]

3. TRANSPORT IN THE EUROPEAN UNION

W przewozach towarowych w Unii Europejskiej widoczne są następujące tendencje:

- road transport increase,
- marine transport increase,
- relatively small decrease of inland water-ways transport,
- decrease of railway transport (table 3).

Table 3: Transport volume carried out by varied means of transport in the UE (b tkm)

	TRANSPORT					
	OVERALL	**railway**	**road**	**inland water-ways**	**marine**	**pipeline**
1980	1 982	290	720	106	781	85
1990	2 332	255	976	107	923	70
1995	2 632	221	1 144	114	1 070	82
2000	3 108	250	1 378	125	1 270	85
2005	3 410	263	1 489	126	1 442	90
2010	3 988	292	1 878	130	1 600	88

Source: self study based on Energy &Transport In Figures, Statistics Pocket book 2010, European Comminion Directorate- General for Energy and Transport.

The conclusions regarding commodity transport trends are the result of a comparison of the transport volume, but not the share of each transport branch in the overall number of conveyance.

Proportionate situation is even less favourable (table 4).

In *White Paper* published in 2001 European Commission alarmed about the scale of road transport. It has been eleven years since then and present results cannot be considered satisfying because the share of road transport is still increasing.

In case of goods conveyance on the continent, inland navigation and railway may be competitive to road transport. However, inland transport is very much restricted by the natural conditions. Therefore, the rail should unburden road transport.

Table 4: The stucture of transport volume in the UE

	TRANSPORT					
	OVERALL	**railway**	**road**	**inland water-ways**	**marine**	**pipeline**
1980	100	14,6	36,3	5,4	39,4	4,3
1990	100	10,9	41,9	4,8	39,5	3,0
1995	100	8,4	43,5	4,3	40,7	3,1
2000	100	8,1	44,3	4,0	40,9	2,7
2005	100	7,7	43,7	3,7	42,3	2,6
2010	100	8,0	47,0	3,0	40,0	2,0

Source: self study based on Energy &Transport In Figures, Statistics Pocket book 2010, European Comminion Directorate- General for Energy and Transport/statiscticdatabase166.

The comparison of share of road and rail transport in the USA and the European Union provides interesting facts. In the European Union the share of road transport is about 47%, and 8% in case of rail. [3] In the USA in the same year railway transport comes to 39%, and road transport comes to 30%.

It is so due to the circumstances described in point 3. Apart from this, there is a common opinion that the American railway`s services are more effective. In 2002 a team under the supervision of Werner Kulpe prepared a report entitled *Rail Road Union* where it is said that a half of 20 000 controlled freight trains in Europe was punctual [4] (this may be the reason why road transport is preferred).

The American rail transport is more sufficient than the European, however, the American one conveys mainly freights and the European rail transport focuses on people (Polish State Railways, for instance, carry 20 000 more passengers than the American ones.

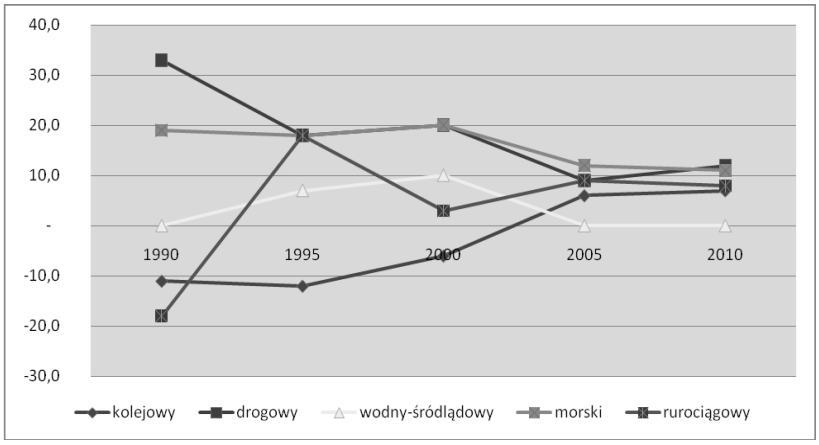
European governments, especially the French one, used to put pressure on rail transport to force it to carry people not freights. Therefore,

the governments are to blame for the lack of balance between road and railway transport. [4] However, we need to take into consideration that road transport had definitely smaller share in freights transport (44%) in comparison to carrying people (79%).

The above attitude of the governments explains the fact that they want to avoid congestions. Trains are therefore an alternative to cars and planes (since 2000 the share of air transport has been increasing (drawing 3).

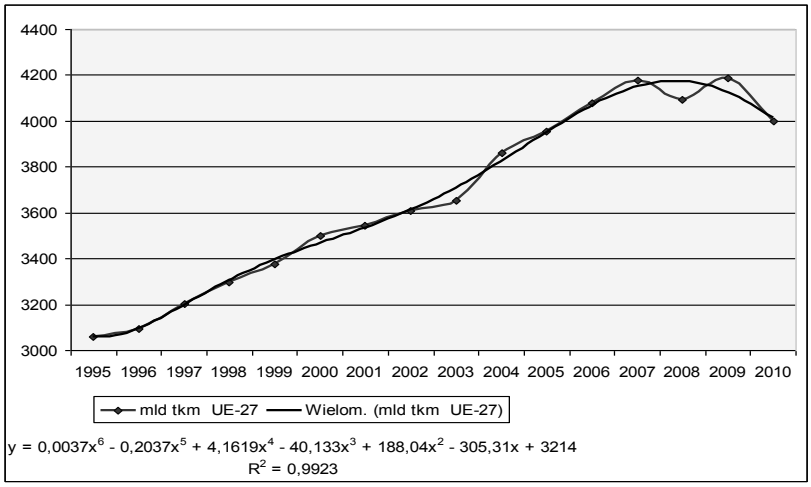
In the upcoming period one of the most important aims of the European Commission is the limitation of road transport. Paradoxically, well-developed system of roads may be an obstacle. Germany, for instance, is a very attractive country in terms of road transport due to its motorways. [6]

The overall freight transport in the EU between 1995 and 2010 is illustrated by the polynomial curve (b tkm) indicating a systematic, stable and dynamic growth transport. The increase was observed until 2008. In 2009 and 2010 there was a reduction of conveyance, which was probably caused by the economic slow-down.



Drawing 3. The dynamics of transport volume carried out by various means and branches of transport in the EU

Source: a self study based on Źródło: Energy &Transport In Figures, Statistics Pocket book 2010, European Comminion Directorate- General for Energy and Transport.



Drawing 4. Overall transport volume in the UE-27 between 1995 and 2010

Source: a self study based on North American Transportation Statistics Database 2010.

The deviations of substantial performance from the trend curve are slight, and coefficient of convergence R^2 is very high (0,9966).

4. TRANSPORT IN CHOSEN ASIAN COUNTRIES

4.1. FREIGHT TRANSPORT IN JAPAN.

Freight transport in Japan has considerbly increased since 1980.

The greatest share belongs to road transport (well-developed dense road system is favorable as well as short distances). The country for long years aspired to be the world leading car producer in terms of quality and quantity. In order to do so special loan policy was introduced providing loans for steel production.

Road transport was the only one that in the analyzed period systematically increased transport volume (table 5) and the share in the overall structure of transport (it comes to about 60% and is greater than its share in the transport of the European Union).

Contrary to the USA, in Japan small cars are used to transport goods. It is caused by the lack of large areas. Most of freight transport is carried out on the Tokio-Osaka route.

Marine transport is most common due to the fact that Japan lies on islands.

Table 6 shows that transport volume in the analyzed period was fluctuating. In the 80s` there was a decrease of transport. In the 90s` there was a raise and another decrease after the year of 2000. In 2005 there were fewer freights carried than in 1980. When we compare the share of marine transport and other branches in the overall transport the decrease is significant (table 6).

Table 5: Transport volume carried out by means of transport of various branches (b tkm)

	Overall	Transport			
		road	railway	marine	air
1985	434,5	206	22	206	0,5
1990	546,8	274	27	245	0,8
1995	558,9	295	25	238	0,9
2000	578,1	313	22	242	1,1
2005	571,1	335	23	212	1,1
2006	579,1	347	23	208	1,1
2007	582,1	355	23	203	1,1
2008	557,1	346	22	188	1,1

Source: http://www.stat.go.jp/english/data/nenkan/1431-12.htm

Table 6: The structure of transport volume in Japan

	Overall	Transport			
		road	railway	marine	air
1985	100	47,41	5,06	47,41	0,12
1990	100	50,11	4,94	44,81	0,15
1995	100	52,78	4,47	42,58	0,16
2000	100	54,14	3,81	41,86	0,19
2005	100	58,66	4,03	37,12	0,19
2006	100	59,92	3,97	35,92	0,19
2007	100	60,99	3,95	34,87	0,19
2008	100	62,11	3,95	33,75	0,20

Source: http://www.stat.go.jp/english/data/nenkan/1431-12.htm

The share of railway transport decreased twice in the analyzed 25 years. Air transport proved to be most dynamic since freight conveyance raised by 266% between 1980 and

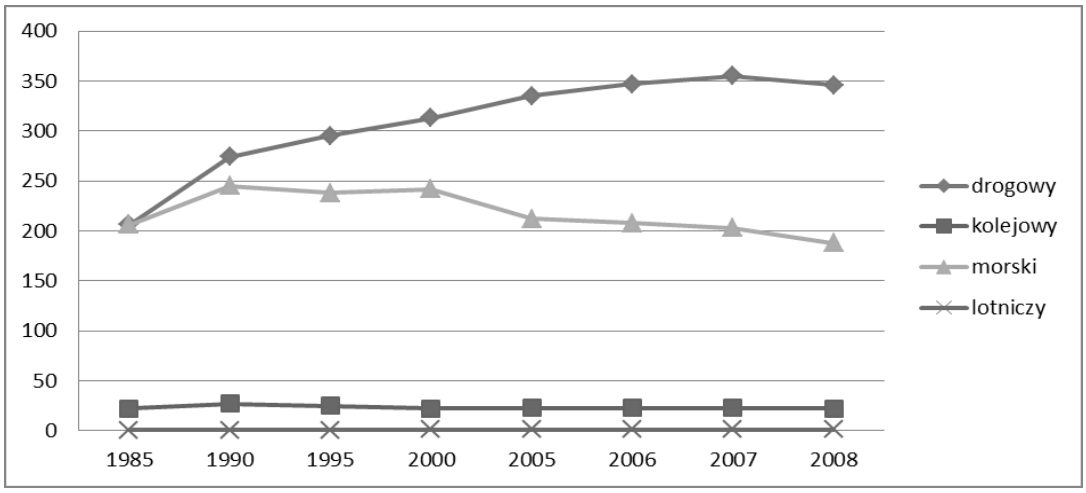
2005. However, the share of this branch in the structure of volume transport decreased twice.

The dynamics of transport volume is illustrated in drawing no 5.

Overall transport volume (measured in tkm) between 1995 and 2008 is illustrated by a sextic polynominal curve (drawing no 6).

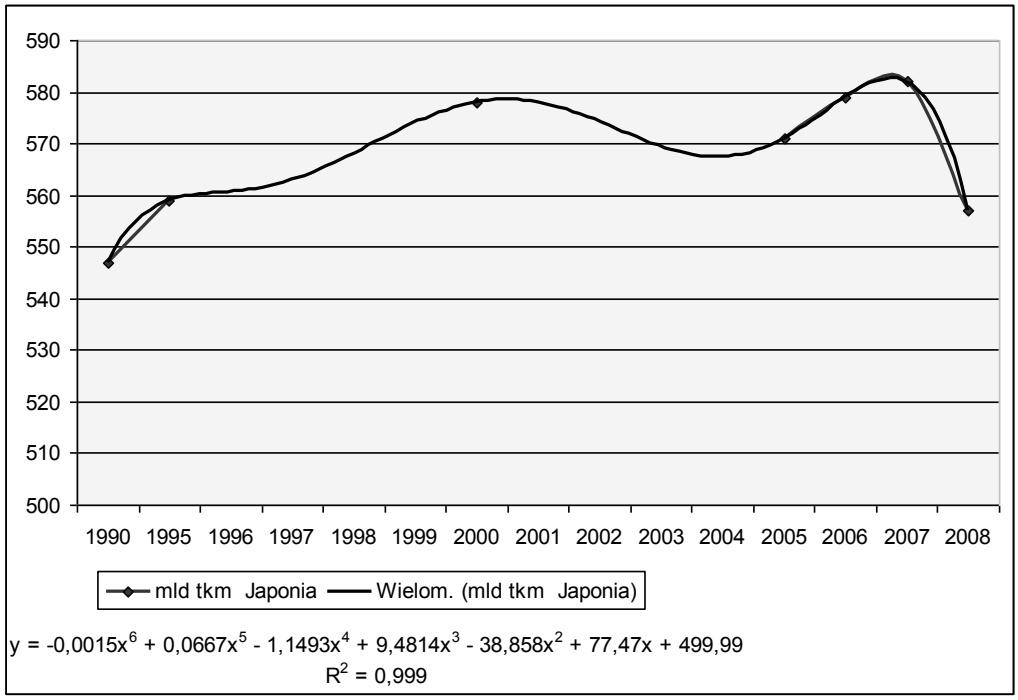
The curve indicates that the overall transport fluctuated, however, was on the increase.

It proves that the conveyances were carried out on the equalized level.



Drawing 5. Dynamics of transport volume in Japan.

Source: http://www.stat.go.jp/english/data/nenkan/1431-12.htm



Drawing 6. The overall transport volume in Japan between 1990 and 2008

Source: self study based on http://www.stat.go.jp

Low transport rate between 1990 and 1998 was a result of economic recession. However, when it comes to 2002 transport decrease could have been caused by domestic demand and investments as well as low export and import rates (in 2003 too). The polynomial curve picks up from 2005 to 2006, which is a result of an overall increased demand (between 2004 and 2005), a larger number of investments (especially between 2005 and 2006), and the growth of export and import, starting from 2004. Between 2005 and 2006 import was still high in spite of some decrease. Since 2007 the curve goes down which seems to be caused by the economic slowdown.

4.2. FREIGHT TRANSPORT IN CHINA

Starting from 1980 transport in China had been significantly developing, and within five doubled (table 7).

The greatest share in transport belongs to inland waterways transport, which outgrows the total number of freight conveyance performed by other branches summed up together. No other country has this kind of division.

It so due to the fact that natural conditions are favorable, tradition and China`s government investments leading to an extension of water routes (the Yangtze is the main water route joining the East and the West, and the ship sailing are of 1000 DWT displacement capacity). Even though inland waterways transport had a share of 52% in the overall transport, the government makes a lot of efforts to improve the router. It necessary to point out that in the analyzed 25 years marine transport increased by 11 times.

The Three Gorges Dam is the most significant investment. The water routes in the provinces of Gudanong and Guangxi are modernized as well.

Table 7: Transport volume carried out by varied means and branches of transport in China (100m tkm).

	Overall	Transport				
		railway	road	water	air	pipeline
1980	12 026	5 717	764	5 053	1	491
1985	18 365	8 126	1 903	7 729	4,0	603
1990	26 207	10 622	3 358	11 592	8,0	627
1995	35 909	13 050	4 695	17 552	22,0	590
2000	44 320	13 771	6 129	23 734	50,0	636
2005	80 258	20 726	8 693	49 672	79,0	1 088
2008	105 517	25 118	12 998	65 218	119,0	2 064

Source: http://www.stats.gov.cn/english/newsandcomingevents/t20090226_402540784.htm

Table 8: The structure of transport volume in China

	Overall	Transport				
		rail	road	water	air	pipeline
1980	100	47,5	6,4	42,0	0,0	4,1
1985	100	44,2	10,4	42,1	0,0	3,3
1990	100	40,5	12,8	44,2	0,0	2,4
1995	100	36,3	13,1	48,9	0,1	1,6
2000	100	31,1	13,8	53,6	0,1	1,4
2005	100	25,8	10,8	61,9	0,1	1,4
2008	100	23,8	12,3	61,8	0,1	2,0

Source: http://www.stats.gov.cn/english/newsandcomingevents/t20090226_402540784.htm

Railway transport is second most popular branch. ¼ of freights is carried by means of it.

Both infrastructure and rail vehicles demand capital (nowadys rail is developing mainly in the western part of the country). Between 1996 and 2000, 30 b USD w allocated for it (between 2001 and 2005 it was 42,3 b USD). Owing to this 21.500 km of bouble track rail and electrify 14 600 km (untill 2020 it is to be 100 000 km of tracks. A half of it is planned to be double-track and electrified. Another 13 000 km will be high-speed rail). The investements caused that the puncuality of freight trains increased up to 96,8% and commercial speed is 39,5 km/h.[7]

In 2009 Chinese authorities allocated 88 b for the development of rail. It ia a worldwide record since any other country has never invested this amount of money in the rail. Thirty-five connections of high-speed rail between the cities of more than 200 000 inhabitants are to be created (300km/h) until 2015. The most important are Pekin- Shanghai and Pekin - Guangzhou routes (trains will drive at the speed of 350 km/h), and East – West routes between Suzhou and Lanzhou as well as Shanghai and Kunming.[12]

In the northern part of the country a rail connection between China and Mongolia based on magnetic technology is to be developed. The investment will guarantee coal transport form the mines of Mongolia.[13] It will be the first case of magnetic technology application in freight transport, which may be a proof that China wants to be a forerunner in the field.

A great share in Chinese conveyance has marine transport. Harbor cities used to develop the quickest which proves the significance of this branch of transport. Marine transport in China is not only based on export and import, but also cabotage. China stands out in comparison to other countries since nearly 90% of conveyance falls on water, and rail transports (the structure is much more pro-ecological than in the remaining countries (table 8).

Road transport is not as important as it is in the European Union or Japan. Its share is 2,5 times smaller than the rail`s and 5 times smaller than the inland waterways`.

It is hard to predict how it is going to develop , however, the amount of conveyance will not differ from the present situation.

Most likely in several years China will have a well-developed road network. If the pace of economic growth do not slow down, China will enter into its postindustrial phase and may become the biggest car producer in the world. However, it depends on the politics of the country whether road transport stars to dominate.

In past ten years pipeline transport doubled because of the development of Chinese economy and the demand for natural resources. The agreements executed with the Russians for oil delivery will increase the importance of pipeline transport.

The growth of air transport is the most dynamic. Every five years we can observe the multiplexing of transported freights. In spite of such a huge increase, this branch of transport is still the last one.

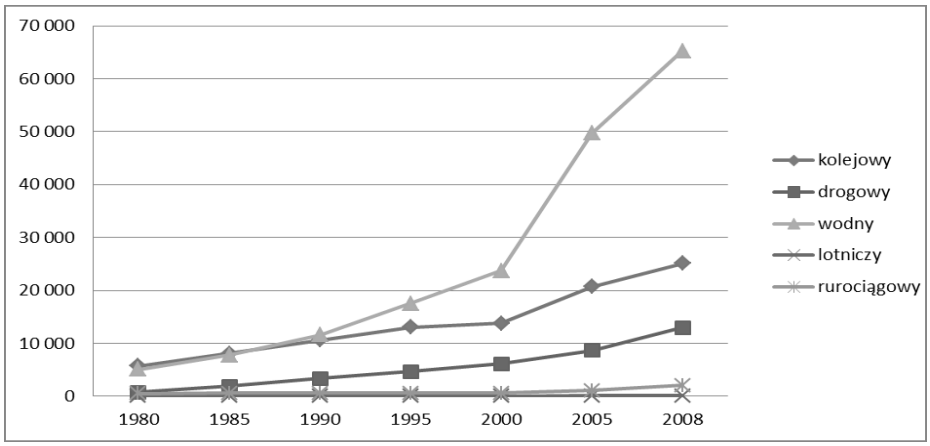
The Dynamics of transport volume in China illustrates drawing no 7.

Transport in China similarly to economy develops in a planned way, and economic growth is preceded by the development of connections. Infrastructure investments create the basis for a balanced functioning of transport system.

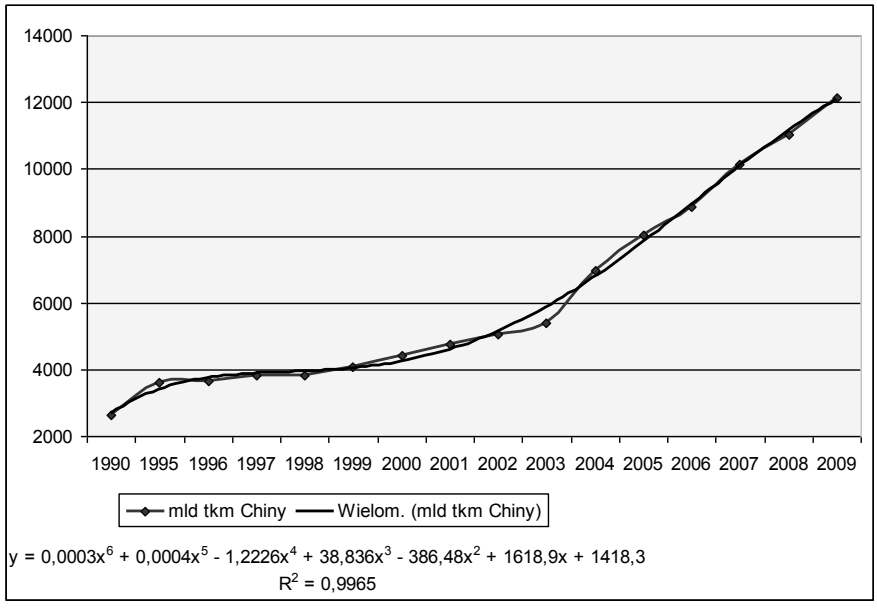
The following polynominal curve illustrates freight conveyance in China (measured in tkm) in past decade.

The deviation between the actual transport volume (between 1990 and 2009) and the draft is the result of the creation of economic processes. From 1996 to 2003 the structure of good production in Chinese economy had been changing. Light industry became important along with electronic one (especially microcomponents, portale computers, flat screen televions and microprocessors), as well as telecommunication appliances.[7] These changes influenced the decrease of transport volume since highly processed products do not need big transport capacity.

Between 2004 and 2009 China`s GDP outgrew annual raises of 10%, which indicates to the acceleration of its development. Export and import rates were high resulting in the growth of marine, rail and road transports. It was very clear in 2004 when the actual transport volume flew over the projections (trend curve).



Drawing 7. The dynamics of transport volume carried out by means and branches of transport in China
Source: http://www.stats.gov.cn/english/newsandcomingevents/t20090226_402540784.htm



Drawing 8. Overall transport volume in China between 1990 and 2009
Source: self study based on China Statistical Yearbook 2009, National Bureau of Statistical of China, China Statistics Press

5. REASONS FOR DIFFERENCES IN THE DEVELOPMENT IN THE UNITED STATES AND EUROPEAN UNION

The greatest share in freight transport in the USA belongs to rail industry – 39% in 2010 (in the American market there are few large operators and several hundred of small ones). Not only does rail have the greatest share but also it increases inversely than in the European Union (table 1, 2, 3 and 4). Railway connection network was formed in the USA in 19th century so the conditions were completely different than those in Europe. The network was prepared for long distance journeys since it was to connect East and West Costs.

While in Europe railway tracks were built to connect cities, which location was determined by water transport network, in the USA cities were created by the train routes. The trucks were laid in the open and uninhabited land owing to which more solutions than in the EU may be used (containers, for instance, are carried in piles consisting from three levels which reduces the costs of a carried freight).

Even though the American rail infrastructure is well-developed, it is still extending. In May 2008 a project of creating National Gateway connecting the middle part of the Atlantic Coast with the middle part of the West Coast was presented.

Cambridge Systematics Inc., a consulting company, published an analysis according to which the cost of road maintenance will decrease within five years after the Gateway is opened since 2m cars will be withdrew. Co2 emission will go down by 4m tons and fuel usage will be decreased by 500m gallons. Sailing costs will go down by more than 2 b USD. Moreover, rail transport is safer than road transport which will reduce the cost by 250m USD. [11]

In the USA there are 580 transport companies.

Transport technological solutions applied in the USA are very specific. Some trains are as long as 2-2,5 km and drawn by two engines. Road trains are common as well. These are tractors and a few trailers. Wide roads and vast open areas enable to carry many more freights at the same time (the cars usually have the power of 500 kM).

6. FORMATION OF TRANSPORT PROCESSES IN THE CHOSEN AREAS - COMPARISON

Polynomial curve presenting transport volume in the most developed countries in the world is illustrated in drawing 9. Transport volume is closely connected with economic development (measured in GDP) [8] Diverse economic development and production type finds a reflection in the amount of freights transported. (measured tkm):

- In the USA, freight transport and GDP are the highest in the world. It is necessary to point out that rail transport was crucial. Between 1995 and 2010 more than 20% of world`s rail transport was carried out there.
- Overall transport is constantly growing in the UE-2 (road transport is the most important since 80% of overall conveyance is carried out by it).
- Transport in Japan was equalized (judging by the polynominal curie). Similarly to the EU, road transport was most significant.
- Polynominal curie illustrating transport volume in China indicates its slight growth and equal-ized level, which may confirm diverse devel-opment of Chinese economy [8].

7. CONCLUSION

As a result of an introduction of new management and production concepts (transferring a part of it to Asia), the supply chain extended, the amount of goods increased in spite of a decrease of industry share in domestic production.

Significantly growing transport demand is connected with economic development as well.

Researches show that road transport dominates in many countries (the growth of this kind of transport was observed in all discussed countries) [8]. In Japan 4% of freights are carried by trains, and in China, which is the quickest developing country, only 26% of freights are carried by means of rail transport. The government, however, allocated a record sum for the development of rail. On a worldwide scale this branch is dominating.

Contrary to declarations regarding balanced development of transport in the EU, road transport reaches 70-80%, which indicates that the European policy is not effective.

Even though road transport in the USA is very effective due to vehicles` road capacity, it placed itself in second position (after the rail). The greatest share (60%) of this transport branch is observed in Japan. It is, however, caused by the country size and mountainous area.

In China, road transport places ifself in third position, and 10% of overall conveyance is performed by it.

Road transport dominates due to the fact that car industry is very innovative. Product`s short life causes that new solutions, for instance, in the field of security and convenience are immediately implemented. Ships and trains are able to operate longer so those branches are not as progressive as car industry. Road transport is very flexible as well.

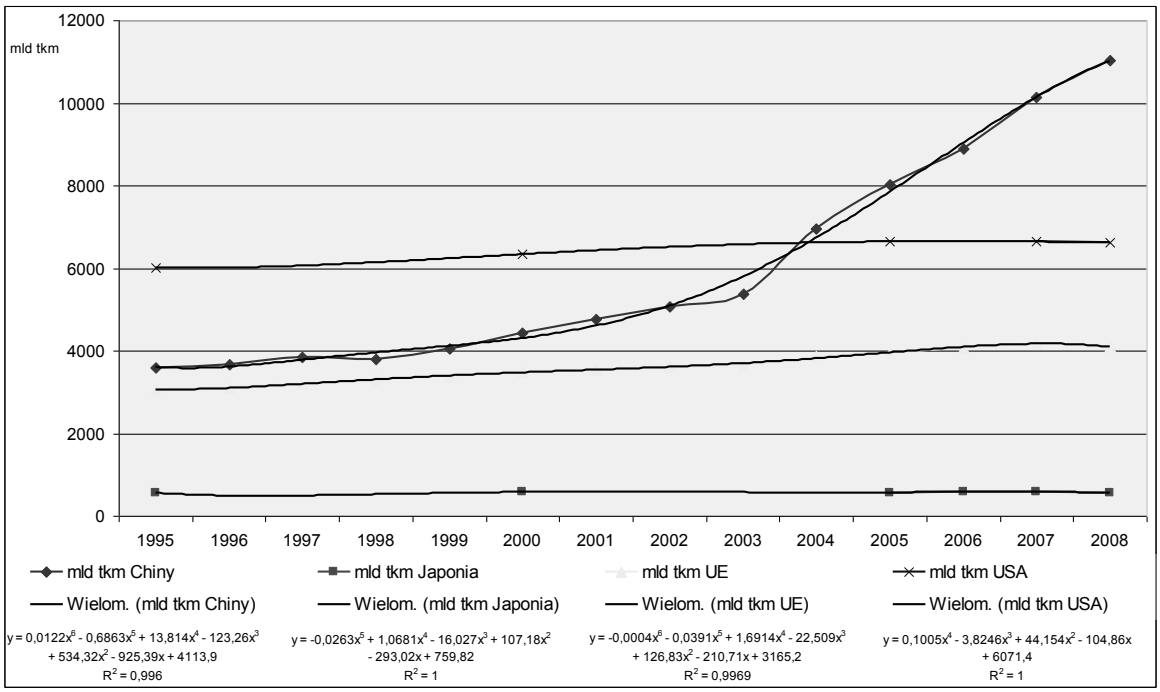
In the discussed countries road transport is the most developed. However, in the USA, which is the most advanced economy in the world, rail transport is dominating and growing. 42% of freights are carried by trains.

In the EU rail transport dropped by 7% in the analyzed period and is the lowest in the discussed countries[8].

Transport volume of the remaining branches depends on the production type, geographical location and natural resources. Therefore, in the

USA due to oil and gas, pipeline transport had a significant share. In the EU water transport consists 45% of overall transport, which is caused by international trade and convenient water routes network.

Therefore, economic development had a great influence on the growth of demand for freight transport. [8]



Drawing 9. Formation of transport processes in chosen countries (b tkm)

Source: a self study based on: EU energy and transport In figures part:3 transport, Statistical Pocketbook 2010, European Union 2010, s. 118.125; Historical Statistics of Japan [40] *Japan Statistical Yearbook 2011,* Statistical Research and Training Institute, MIC;[41] China Statistical Yearbook 2009, Naitional Bureau of Statistical of China, China Statistics Press;[42] Russian Federation, Federal State Statistics Serwis;[43] Rocznik Statystyczny RP, GUS, Warszawa 1997,2000,2004; Mały Rocznik Statystyczny RP,GUS, Warszawa 2010

LITERATURE

[1] *China Statistical Yearbook* 2009, National Bureau of Statistical of China, China Statistics Press.

[2] *Energy &Transport In Figures*, Statistics Pocket book 2010, European Comminion Directorate- General for Energy and Transport.

[3] *Europejska polityka transportowa 2010: czas na podjęcie decyzji*, „Biała Księga", Komisja Wspólnot Europejskich, Wydawnictwo Naukowe Uniwersytetu Szczecińskiego, Szczecin 2002.

[4] Hawlena J., *Determinanty kształtowania cen usług transportowych*, Wydawnictwo Akademii Ekonomicznej, Katowice 2004.

[5] *Internationales Verkehrswesen* 2008.

[6] Lesiak P., *Przystąpienie Polski do Unii Europejskiej a transport samochodowy*, Biblioteka Wiedzy Europejskiej, Zeszyt 17, SGH, Warszawa 2000.

[7] *Logistyka. Infrastruktura techniczna na świecie. Zarys teorii i praktyki*, pod red. Macieja Mindura. Wydawnictwo: Instytut Technologii Eksploatacji – PIB, Warszawa-Radom 2008.

[8] Mindur M., *Transport w erze globalizacji gospodarki*. ITE-PIB Warszawa-Radom 2010.

[9] *North America Transportation Statistics Database* 2010.

[10] Sadowski Z., *W poszukiwaniu drogi rozwoju*, Warszawska Drukarnia Naukowa PAN, Warszawa 2006.

[11] Stagl J., *Double down .Progresseve Railroading.* Nr 1 2009, s.16-25 za Biuletyn Informacyjny Ministerstwa Transportu nr 2/2009.

[12] http://logistyka.wnp.pl

[13] http://górnictwo.wnp.pl/

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