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STUDY OF THE LINKS BETWEEN THE DEVELOPMENT OF THE WORLD ECONOMY AND TRANSPORT IN 1995–2015¹

Abstract

The article provides a synthetic analysis of the interrelationships between economic development, the primary economic measure of which is the size of Gross Domestic Product, and the volume of transport work measured in tkm and pkm. The study was conducted over a 30-year time series based on the polynomial curves of the most-developed economies (the United States, Japan, China and EU-28) and Russia, the largest area of the world, with large natural resources and significant military industry, and constantly increasing since 2004 GDP. The research shows that GDP in the whole period (1995–2015) in the United States, Japan and the European Union is growing rapidly, significantly ahead of the tkm and pkm transport indicators. In China and Russia, GDP growth has been increasing since 2003, while the dynamic growth of transport (in billion tkm) in 1995–2015 is well ahead of economic growth (GDP). In Poland, trends in the development of the GDP measurement and transport indicators (tkm and pkm) are similar to those of Russia and China.

Keywords: The USA, Japan, EU-28, China, Russia, Poland, economy, transport

Introduction

The article presents research showing how the economy and transport changed over the years 1995–2015. The development and needs of the economy determine the size and mode of transport. The importance of transport (its functions and links with other sectors of the economy) to economic development, as well as the interdependence between transport and the economy, have also been analyzed.

The study has included the most advanced economies, which have been the world's leading economies for the past few decades, forming the bulk of world

¹ The article was based on: Mindur (2010).

GDP and setting the trend for the modern world – the United States of America, Japan and the European Union. There are also two countries with enormous potential, the largest area, significant natural and military resources, rapidly developing in recent years – Russia and China (the world's most populous country, developing continuously for more than thirty years, according to some reports, contributing more to global GDP than Japan).

The article also presents Poland. Its economy (in terms of size) cannot be compared with any of the economies of the countries concerned, therefore the analysis of the economic situation has been compared to macroeconomic size comparisons but to the development of economic processes. The polynomial curves were used for the study.

1. The United States of America

Figure 1 shows the development of the economy between 1995 and 2014 and the carriage of cargo and passengers between 1995 and 2015 in the United States of America².

Macroeconomic variables and transport measures are characterized by steady growth, with the largest increase being the polynomial curve describing GDP, followed by the passenger transport curve and at the lowest level there is a trend showing the freight movement. The pace of GDP changes compared to the measures presenting transport during the period under review steadily increased (a decline occurred in 2009, which quickly disappeared), indicating a faster growth of the economy than transport, and a decrease in the share of transport in GDP in the US economy.

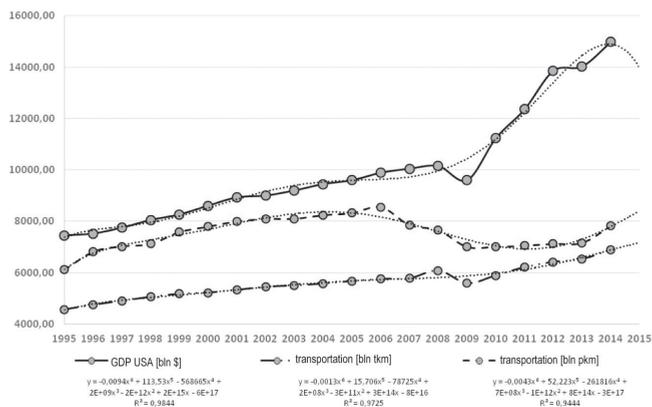


Figure 1. Economic macroeconomic indicators (GDP) and transportation measures (tkm and pkm) in the United States of America

Source: (own elaboration based on: Mindur, 2010)

² The variables in the drawing were developed in real data based on the polynomial curve. As the R2 indicators indicate, polynomial curves well describe the real development of the economy and transport.

2. The European Union (EU-28)

The polynomial curve representing the basic variables that characterize the economy and the transport measures in the EU-28 was developed in the same way as for the United States. All three variables in the European Union have a growing trend. The highest growth rate was the curve of GDP polynomial. In the next place there were curves describing passenger transport and cargo handling in the transport of cargo.

The differences between Figures 1 and 2 presenting the basic economic macroeconomic variable and transportation metrics (tkm and pkm) in the United States of America and the EU consisted in the spread between the GDP curve and the indicators characterizing transport. The spread in the EU was much higher, and the baseline levels (1995, 1998) and the course throughout the period under review were considerably lower. This means that the GDP level in the EU-28 compared to the US GDP was lower³.

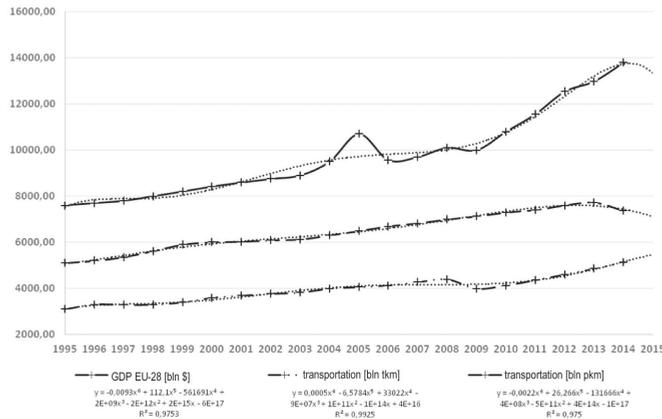


Figure 2. Economic macroeconomic indicators (GDP) and transport measures (tkm and pkm) in EU-28

Source: (own elaboration based on: Mindur, 2010)

³ Using the GDP meter and comparing its level in the USA and the EU-28, in 2014 it was 54 thousand USD and 36 thousand. USD per capita – the conclusion is that the level of economic development in Europe was as high as in America 15 years earlier (then US GDP was \$ 36.000), and now US per capita GDP is almost 50% higher. Although this reflects an increase in the level of income and the rate of change, it does not mean that this gap in the level of economic growth in the USA and in the EU was due to better labor productivity and productivity in the United States, as both sides of the Atlantic increased at a comparable pace – It was rather a result of a different approach to sharing efficiency gains. In Europe, a significant portion of this has been devoted to shortening working hours, while Americans have chosen to “divert” labor productivity growth to higher incomes. The difference between the US and the EU is therefore the result of societal preferences rather than economic efficiency, yet such a significant difference in GDP levels does not translate into such a large difference in the standard of living of the population. More in: Kolodko (2008, p. 222 et seq.).

Likewise, transports in pkm and tkm (respectively, the curves started at a lower level and did not have such a high rate of growth). The EU-28 recorded high R2 compliance curves for polynomials with real execution.

3. Japan

The polynomial curve representing the GDP trend in Japan in 1995–2015, deviating from the whole of the analyzed period, showed a slight increase (Figure 3). Its high initial level indicates that the Japanese economy achieved a high degree of development as early as 1995 (Compare: Mindur, 2012, p. 437 et seq.).

The variables representing the overall volume of mass transit in billion pkm (1995–2015) and the tkm (1995–2015) transport volume were mostly straight lines at a lower level than the GDP curve. In recent years there has been an increase in the passenger transport curve and a slight decrease in the freight curve. This means that, despite systematic small economic growth, there was no increase in cargo traffic in tkm, and economic development took place with a constant share of the volume of transport services. On the other hand, the relatively stable and increasing level of the polynomial curve describing the trend of passenger transport may indicate the almost complete attainment of public transport capacity in Japan by the means of transport necessary to meet the needs.

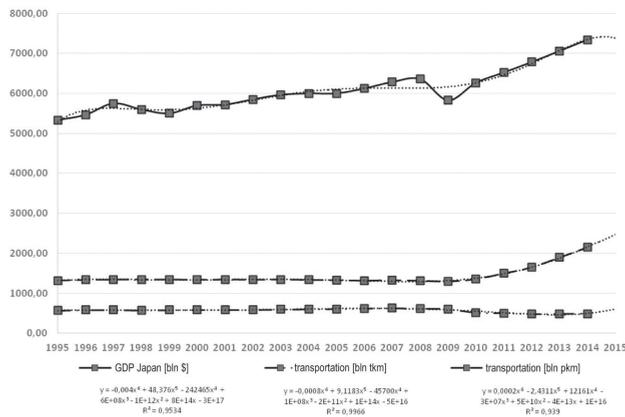


Figure 3. Economic macroeconomic indicators (GDP) and transportation measures (tkm and pkm) in Japan

Source: (own elaboration based on: Mindur, 2010)

4. China

The variable representing GDP growth and the cargo and passenger traffic measures showed an upward trend in the period under study (Figure 4). The highest growth was achieved by the polynomial curve of transport in billion pkm. The real compliance with the polynomial curve was $R^2 = 0.9874$. In another

place, the dynamic tendency of growth and consistency of the actual execution with the polynomial curve $R^2 = 0.9963$ was GDP. At the lowest level with a tendency to slight deviations of the actual performance from the curve estimated on the basis of the polynomial and a clear increase since 2013, the work of transporting loads in tens of millennium was formed.

The distribution of these last two discussed curves proves that consistent and dynamic economic development was taking place regardless of the volume of transport capacity involved. This may be due to the gradual change in the structure of the economy – from industrial production to the emerging service sector.

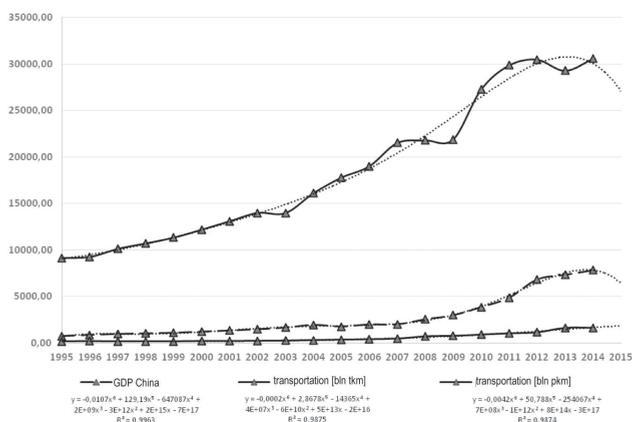


Figure 4. Economic macroeconomic indicators (GDP) and transport measures (tkm and pkm) in China

Source: (own elaboration based on: Mindur, 2010)

5. Russia

Long-term analysis (1995–2015) of the distribution of variables characterizing economy and transport in Russia (Figure 5) indicates the largest increase in cargo traffic (tkm) with a significant drop in 2008–2010, which was triggered by the economic crisis. The increase in the polynomial curve representing the trend of cargo traffic in Russia was due to the raw material nature of the economy and to the favourable situation on these raw materials on the fuel market. The significant share of oil and petroleum products in the development of the Russian economy is driving increased transport. This is also confirmed by the dominant role of pipeline transport in this country (Mindur, 2012, p. 319 et seq.). At the lower level – with the decline in the years 1999–2001 and 2008–2010, and with a slight upward trend – the polynomial curve shows the course of changes in GDP, i.e. the development of the Russian economy. On the other hand, the polynomial curve representing the trend of passenger transport during the period under review was systematically decreasing. This indicates a decrease in these transports – what (as previously mentioned) could have an impact on the development of individual transport.

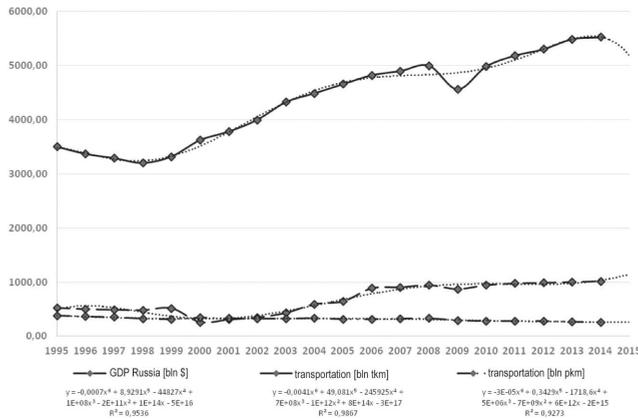


Figure 5. Economic macroeconomic indicators (GDP) and transport measures (tkm and pkm) in Russia

Source: (own elaboration based on: Mindur, 2010)

6. Poland

In Poland during the period considered, the polynomial curves representing the cargo movement (with significant deviations) were subject to a spike in growth (Poland's accession to the EU and to the Schengen area was significant). The polynomial curve representing GDP growth was growing (despite the decline in 2008–2011), indicating a systematic development of the economy. The cargo handling work also clearly increased. However, the polynomial curve representing the collective passenger carriage ran at a relatively even level – showing a slight upward trend in recent years. This could have been due to the involvement in the development of passenger transport and, at the same time, the increased capacity of individual transport.

The analysis of basic macroeconomic variables indicates that in the USA, Japan and the EU-28, the pace of economic growth is greater than the rate of growth of freight – both cargo and passengers. In China, also economic development is greater than the development of transport of goods, and less than the development of passenger transport. The situation is different in Russia, where by 2002 the pace of development of tkm and pkm transport was higher than the pace of economic development, and from that point onwards the level of economic development was higher than that of passenger transport – but still lower than the transport of cargo. There were quite different tendencies in Poland, where high rates of development showed freight transport, the economy was lower (but its growth was growing dynamically), and passenger transport showed a constant trend.

The above facts may indicate that the economic growth of the transport sector has slowed down in the three most economically developed countries in the world (USA, Japan and China) and in the EU-28.

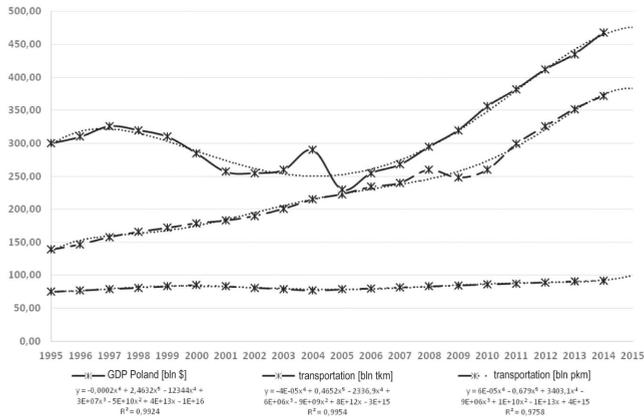


Figure 6. Economic macroeconomic indicators (GDP) and transport measures (tkm and pkm) in Poland
Source: (own elaboration based on: Mindur, 2010)

Conclusions

The volume of world shipping (as the basis for the growth of US, EU and China transport growth, and consistent in Japan), as well as the world economy, is showing an upward trend. This confirms the close link between economy and transport. Transport is an important production division of any economy, an important factor in technical and economic progress and a primary production tool. Securing the right – to meet the needs of the economy – capacity needs a smooth freight subsystem. This subsystem should be systematically improved through the use of modern transport and handling technologies, telematics and IT systems, management methods etc. Logistics centres and a wide range of logistics solutions are very important in rationalizing freight traffic. The most important importance (in the efficient service of the transport economy) is the adaptation of transport activities to the structure and specificity of the economy and the nature of its production, e.g. the modern economy of the United States and the need to secure its transport needs have made transport of the USA regarded as the most modern, environmentally friendly and human. In general, the US plays a dominant role in rail transport, i.e. the most environmentally friendly. According to the research conducted (Mindur, 2010), intermodal transport and bulk use of containers are the highest in US transport. On the other hand, the development of Russia's economy, which is based mainly on the extraction and export of raw materials fuels, has made transport of pipelines the most important. China's economic growth, based mainly on the export of industrial goods, has had an impact on the strong development of maritime transport in containers. This is confirmed by the fact that among the fifteen largest container ports in the world, six (including three

of the largest container transshipments) are Chinese ports. Land transport in China is dominated by inland waterway transport, which results from the favourable natural conditions and the expansion and improvement of the water network by the government of this country.

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