Scientific, Technical and Art Releases – 2026 (ISSN 2786-36389)
Published by: Óbuda University, Rejtő Sándor Faculty of Light Industry and Environmental Engineering, Budapest, Hungary

SOME EXPERIENCES CONCERNING LOWER MISSISSIPPI RIVER VALLEY IN US

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Abstract:
The study focuses on main features of Lower Mississippi River Valley accompanying with some economic and ecological conditions. The study overviews these economic and ecological conditions for the period of 2010 and 2021. From point of view the study analyses annual freshwater resources, nitrous oxide emissions from different sectors, as agriculture, power industry energy, transport energy, foreign direct investment, forest areas, high-technology export in manufactured exports, imports of goods and services in percent of GDP, industry including construction in value added in percent of GDP, inflation, merchandise trade in percent of GDP, population density and urban population growth. The study analyses correlations of different economic and ecological variables based on statistical package for social sciences. The research analyses correlations of annual freshwater withdrawals, which are declared as very strong valued by -82.8% with nitrous oxide emissions from power industry energy, by 89.8% with forest area in km2, by -80.8% with industry including construction in value added in GDP and by 80.1% with population density per km2 of land area. The high-technology export can globally provide more increasing competitiveness for the US economy. Develop more favourable conditions of Lower-Mississippi River – even with Upper Mississippi River – for interest of the American society.

Keywords: Annual freshwater resources, Competitiveness, Correlations, High-technology export, Imports of goods, Nitrous oxide emissions

1. INTRODUCTION

The article overviews the Lower Mississippi River Valley, which comes from the meeting point, where Missouri River goes to the Upper Missouri River and from here the Lower Mississippi River goes to the delta of the Mississippi river in the Mexico-gulf. The Mississippi river collects all of amount of water from the watershed of this river, which is about 3.2 million km2, as the biggest watershed of the world. The study emphasizes importance of the Mississippi river valley in fields of large sized watershed, irrigation system, water supply and inside ship-navigation system at national level. The study focuses on some main features of the Lower Mississippi River Valley as economic and ecological conditions. The study overviews these economic and ecological conditions for the period of 2010 and 2021.
From point of view the study analyses annual freshwater resources, nitrous oxide emissions from different sectors, as agriculture, power industry energy, transport energy, foreign direct investment, forest areas, high-technology export in manufactured exports, imports of goods and services in percent of GDP, industry including construction in value added in percent of GDP, inflation, merchandise trade in percent of GDP, population density and urban population growth. The analyses are based on the database of World Development Indicators, which can obtain data from national resources of the US. *America's Watershed Initiative* (AWI 2015; AWI 2018) aims at sustaining a water use system to support efficient and effective agricultural, industrial and energy productivity. Access to high-quality water in sufficient, reliable quantities is critical for many economic sectors in local, state and national economies. The Mississippi River Watershed's water resources are used in power generation, agricultural irrigation, animal husbandry and industrial production (AWI 2018; USEPA 2022).

Ward (et al 2023) declared that Resist–Accept–Direct (RAD) framework may enhance large-river management by promoting coordinated and deliberate responses to social-ecological trajectories of change. RAD-informed basin-, reach-, and site-scale decisions could: (1) provide cross-spatial scale framing; (2) open the entire decision space of potential management approaches; and (3) enhance coordinated inter-jurisdictional management in response to the trajectory of the Upper Mississippi River hydrograph (Ward et al 2023; see more in Wang et al 2023; Wang-He 2022).

The research emerged some main *hypotheses* concerning main correlations among different economic and ecological variables for the Lower Mississippi River Valley in the US, which are as follows (Table 1-2-3; World Development Indicators 2010 – 2021, US Environmental Protection Agency 2022)

The research analyses correlations of annual freshwater withdrawals (***AnnFreshW1***) by any value ***with*** nitrous oxide (N2O) emissions from power industry energy (NitEPoIn3), forest area in km2 (ForestAre6), industry including construction value added in GDP (IndConGDP9) and population density as people per km2 of land area (PopDens12).

Analyse the correlations of nitrous oxide (N2O) emissions from agriculture in million tons CO2 equivalent (Mt CO2e) (***NitEPoAgr2***) by any values ***with*** high-technology exports in percent of manufactured exports (HTechEx7).

Research correlations of nitrous oxide (N2O) emissions from power industry energy in Mt CO2e (***NitEPoIn3)*** by any values ***with*** nitrous oxide (N2O) emissions from transport energy in Mt CO2e (NitEPoTra4) and high-technology exports in percent of manufactured exports (HTechEx7), imports of goods and services in percent of GDP (Import8) and industry including construction in value added in percent of GDP (IndConGDP9), merchandise trade in percent of GDP (MeTraGDP11) and population density of people per km2 of land area (PopDens12).

The research focuses on correlations of nitrous oxide (N2O) emissions from transport energy in Mt CO2e (***NitEPoTra4***) by any values ***with*** high-technology exports in percent of manufactured exports (HTechEx7), imports of goods and services in percent of GDP (Import8), industry including construction, as value added in percent of GDP (IndConGDP9), merchandise trade in percent of GDP (MeTraGDP11) and population density of people per km2 of land area (PopDens12).

As it is mentioned above, the *first four economic* variables as annual freshwater withdrawals, nitrous oxide (N2O) emissions from agriculture (Mt CO2e), nitrous oxide (N2O) emissions from power industry energy (Mt CO2e) and nitrous oxide (N2O) emissions from transport energy (Mt CO2e) have important role for analysing correlations among the variables. The following chapter analyses researching methods of the study. The study analyses correlations of the different economic and ecological variables based on *the statistical package for social sciences (SPSS),* which provides wide-side possibility for overviews of research for different variables and their connections for the Lower Mississippi River Valley Basen in the US (Field 2020 and Horváth – Mitev 2023). The principal component analysis can be followed in the *Figure 1* where the principal line "X" gets the component-1 and the principal line "Y" get component-2 in the Figure 1.

2. RESULTS AND DISCUSSION

The study overviews the basic correlations among economic and ecological variables based on data of Table 2 and Table 3 concerning the Lower Mississippi River Valley (World Development Indicators 2010 – 2021, US Environmental Protection Agency). The values of variables show the strengthen of correlations among variables. This means if the values are between 0.800 and 1.000 (80% - 100%) the correlations among variables are ***very strong***. But if the values are between 0.500 and 0.800 (50%- 80%) the correlations are only ***strong***. If the values are under 0.500 (50%), which means that the correlations are weak, therefore these correlations are not important for the researching. Naturally the values of correlations among variables can also be written in percentage. There are also the other issues, namely that if the values are negative, this means the correlations are inversely proportional to other positive valued variables, but direct proportional to the same negative valued variables. Naturally the positive valued variables are also direct proportional to other positive valued variables. In this case

of the study the negative or positive valued of variables means opposite changing direction and not more or less values. The positive values of variables are increasing trends, and the negative values of variables are decreasing developing trends (Table 3).
From point of view the very strong correlations mostly are emphasized in this study (Table 3).
The research analyses correlations of annual freshwater withdrawals total in percent of internal resources (***AnnFreshW1***) can be declared as *very strong* valued by -82.8% ***with*** nitrous oxide (N2O) emissions from power industry energy (NitEPoIn3), by 89.8% with forest area in km2 (ForestAre6), by -80.8% with industry including construction value added in percent of GDP (IndConGDP9) and by 80.1% with population density as people per km2 of land area (PopDens12). This hypothesis can be accepted.
In cases of above-mentioned correlations, the correlations of annual freshwater withdrawals total in percent of internal resources are opposite with nitrous oxide (N2O) emissions from power industry energy (NitEPoIn3), because the green policy for protecting natural resources resulted in *decreased pollutions* by considerable decreasing nitrous oxide (N2O) emissions. At the same time freshwater withdrawals use increased.
Correlations of nitrous oxide (N2O) emissions from agriculture in million tons CO2 equivalent (***NitEPoAgr2***) are contradictive *very strong* valued by -85.1% ***with*** high-technology exports in percent of manufactured exports (HTechEx7). In any way the high-technology exports can increase by decreasing trend of nitrous oxide (N2O) emissions from agriculture, because the production process provided by used high-technology can ensure modern technology for agriculture with less nitrous oxide (N2O) emissions from agriculture based on developed *agro-business*.
Also it can be declared that correlations of nitrous oxide (N2O) emissions from power industry energy in Mt CO2e (***NitEPoIn3)*** are *very strong* valued by 97.2% ***with*** nitrous oxide (N2O) emissions from transport energy in Mt CO2e (NitEPoTra4) and by 92.6% with high-technology exports in percent of manufactured exports (HTechEx7), by 88.4% with imports of goods and services in percent of GDP (Import8) and by 95.4% with industry including construction as value added in percent of GDP (IndConGDP9), by 88.3% with merchandise trade in percent of GDP (MeTraGDP11) and by -99.1% with population density of people per km2 of land area (PopDens12). Naturally considerable decreasing nitrous oxide (N2O) emissions from power industry energy in Mt CO2e can make positive effects on the decreasing gas emission of other sectors and some other variables could less decrease as high-technology exports in percent of manufactured exports, imports of goods and services in percent of GDP, merchandise trade in percent of GDP, when population density of people per km2 could increase during the researched period.
It can also be declared that wide-side correlations of nitrous oxide (N2O) emissions from transport energy in Mt CO2e (***NitEPoTra4***) are *very strong* valued by 83.3% ***with*** high-technology exports in percent of manufactured exports (HTechEx7), by 94.2% with imports of goods and services in percent of GDP (Import8), by 99.2% with industry including construction, as value added in percent of GDP (IndConGDP9), by 92.4% with merchandise trade in percent of GDP (MeTraGDP11) and by -95.2% with population density of people per km2 of land area (PopDens12).
According to results of the study correlations of high-technology exports in percent of manufactured exports (***HTechEx7***) are very strong valued by 80.9% ***with*** merchandise trade in percent of GDP (MeTraGDP11) and by -91.2% with population density of people per km2 of land area (PopDens12).
Based on the funds of the study it can be declared that correlations of imports of goods and services in percent of GDP (***Import8***) are *very strong* valued by 93.5% ***with*** industry including construction, as value added in percent of GDP (IndConGDP9), by 99.3% with merchandise trade in percent of GDP (MeTraGDP11) and by -82.1% with population density of people per km2 of land area (PopDens12).
The little decrease of high-technology exports in percent of manufactured exports does not make negative effects on the other economic variables.
The research emphasizes that correlations of industry including construction as value added in percent of GDP (***IndConGDP9***) are *very strong* valued by 90.5 % ***with*** merchandise trade in percent of GDP (MeTraGDP11) and by -93.5% with population density of people per km2 of land area (PopDens12).

The development of industry including construction can affect the increase of merchandise trade in percent of GDP, in spite that both variables have less share of the GDP by more increase of other sectors.
Based on the research it can be stated that correlations of inflation GDP deflator by annual changes in percent (***Inflation10***) are contradictive *very strong* valued by -84.4% ***with*** urban population growth annually in percent (UrbPopG13). The inflation could increase by 4.6% in 2021 because of influences of health crisis in 2020.
In this case-study based on the results of research we can declare that correlations of merchandise trade in percent of GDP (MeTraGDP11) are *very strong* by -81.6% ***with*** population density of people per km2 of land area (PopDens12). *All these correlations are very strong and accepted in cases of the above- mentioned correlations. Correlations among economic variables are based on the features of each year* (Table 2 and Table 3).
In the ***Figure 1*** correlations of componet-1 including MeTraGDP11, Import8, NitEPoTra4, NitEPoIn3, HTechEx7, IndConGDP9, PopDens12 and NitEPoAgr2 comparing with component-2 including UrbPopG13 and Inflation10 (WDI 2010 – 2021; US EPA 2022). This Figure 1 shows that how correlations of component-1 can be comparing with component-2. In *second quarter* of the coordinate system, - *up-left-side* – where the economic features of 2021 and 2019 are at principal line "X" in the negative position, the economic variables of component-1 generally either decrease or little increase; and at principal line "Y" economic variables of component-2 either increase or little decrease in positive position.
The data of Table 2 are relevant of the second quarter of the coordinate system in the Figure 1 in the US. Because in 2010 and 2015 in positive position of *third quarter* in *under-right-side*, the merchandise trade in percent of GDP, imports of goods and services in percent of GDP, nitrous oxide (N2O) emissions from transport energy in Mt CO2e**,** nitrous oxide (N2O) emissions from power industry energy in Mt CO2e, high-technology exports in percent of manufactured exports, industry including construction, value added in percent of GDP, population density in number of people per km2 of land area, and nitrous oxide (N2O) emissions from agriculture in Mt CO2e *considerably increased or little decreased* than these were in 2019 and 2021 in second quarter.
In 2010 and 2015 the increase clearly was higher for example by 21.6% and by 21.0% in merchandise trade in GDP and by 22.6% and by 21.4% in high-technology exports in percent of manufactured exports more than in 2019 and 2021.
The nitrous oxide (N2O) emissions from agriculture (NitEPoAgr2) little increased in 2015 and little decreased in 2010, while in 2019 and 2021 this more increased by 2.4% and by 0.6%.
In 2010 and 2015 the imports of goods and services in percent of GDP increased by 15.9% and by 15.3% more than in period of 2019-2021.
In 2019 and 2021 two sectors namely emissions from power industry energy (NitEPoIn3) achieved considerable decrease by 44% and by 46%; the nitrous oxide (N2O), emissions from transport energy (NitEPoTra4) achieved considerable decrease by 19% and 25%. Naturally the nitrous oxide (N2O) emissions of two sectors are favourable, when this gas emission decreased in these years.
In the *third quarter* of the coordinate system, - *down-right-side* – where the economic features of 2015 and 2010 at principal line "X" in the positive position, the economic variables of component-1 generally increase or little decrease, but at principal line "Y" in the negative position economic variables of component-2 either decrease or little increase.
In the *fourth negative quarter* of the coordinate system, - *down-left-side* – where the economic features of 2020 at principal line "X" and at principal line "Y" in the negative position, the economic variables of component-1 generally decrease or little increase, and in the negative position economic variables of component-2 either decrease or little increase.

Some main features of Lower Mississippi River Valley concerning Mexico Gulf

Formed in 2010, *America's Watershed Initiative (AWI)* is a collaborative organization working with hundreds of businesses, government, academic and civil organizations to find solutions for the challenges of managing the Mississippi River stretching across 31 US states and 2 Canadian provinces, and the more than 250 rivers that flow into it.

The Mississippi River Delta Basin is defined as all the land and shallow estuarine area between the two northernmost passes of the Mississippi River and the Gulf of Mexico. The basin is in Plaquemines Parish, Louisiana, south of the city of Venice. Baptiste Collette Bayou, on the east side of the river, and Red Pass, on the west side, form the basin's northern boundary. This area is also referred to as the Plaquemines-Balize or *"bird's foot" delta*. The Mississippi River has had a profound effect on the landforms of coastal of Louisiana. The entire area is the product of sediment deposition following the latest rise in sea level about 5,000 years ago. This deltaic process has, *over the past 5,000 years, caused the coastline of south Louisiana* to advance gulfward from 15 to 50 miles (24 km to 80 km), forming the present-day coastal plain. Mississippi River Delta Basin comprises approximately 521,000 acres (2108,41 km2) of land and shallow estuarine water area in the active Mississippi River delta. Approximately 83 percent of this area, or 420,000 acres (1700 km2), is open water. The 101,100 acres (410 km2) of land in the basin are characterized by low relief, with the most prominent features being natural channel banks and dredged material disposal areas along the Mississippi River, its passes, and man-made channels. Coastal marshes make up approximately 61,650 acres (250 km2) or about 61 percent of the total land area in the Mississippi River Delta Basin. Eighty-one percent of this marsh is fresh, 17 percent is intermediate, and 2 percent is brackish saline (AWI 2018).

Originally in *Iowa* in Upper Mississippi River Valley, where it is estimated that over 1 billion pounds of ***nitrogen*** (cc. 0.45 million tons= cc. half million tons) has been delivered to the Mississippi River and its tributaries in two of the last four years, resulting in a *doubling of the nitrogen* load leaving the state for the last 20 years. Crop production, even on well-managed fields, invariably results in nutrient losses through surface runoff and tile drainage.

According to the *United States Geological Survey (USGS) within AWI*, which reports that *annually* about *half million tons of nitrogen* are delivered to Upper Mississippi River Valley and then originally from all of Mississippi River Valley Watershed *1.5 million tons of nitrogen* goes to the *Mississippi River Delta* and then to *Mexico-Gulf*, of which a large proportion is from agriculture. This natural damage caused ***dead zone***, which has annually become averaged 5,408 square miles (14,000 square km) for the last 5 years based on the Hypoxia Task on the coast of the *Luisiana* seacoast in Gulf of Mexico. From point of view of *highly level of nitrogen* coming from wastewater as fertilizer and livestock manure, which needs for creating water treatment because of causing growth of *harmful algae* that eventually reduces dissolved oxygen in the *dead zone* in Gulf of Mexico. These efforts have restored over 10,000 acres (40 km2) of wetlands between *Venice* and the *Gulf of Mexico* since 2009 and have been vital in rebuilding coastal Louisiana. As part of the ongoing beneficial use of dredged material program, the *US Army Corps of Engineers* (USACE) also recycles dredged material from the Mississippi River to build small islands that create obstacle against further additional deposition of sediment and mitigate erosion. Some efforts, such as Gunn Island, have been intentionally designed to provide habitat for migratory and nesting birds (America's Watershed Initiative Steering Committee 2015; America's Watershed Initiative 2018).

Long-term suspended sediment loads in the river average 436,000 tons per day; they have ranged from an average of 1,576,000 tons per day in 1951 to a still considerable average of 219,000 tons per day in 1988. Between 1974 and 1990 the *land loss* rate in the Mississippi River Delta Basin averaged 1,072 acres (4 km2) per year, or 1.69 percent of existing land area (Dunbar et al 1992; Kendall et al 2021; Slocum et al 2005). This loss is the result of compaction, subsidence, hurricanes, tidal erosion, sea level rise, and human activities. The total land area lost in this basin over the last 60 years has been approximately 113,300 acres (458 km2). *In recent decades, the delta front has been building laterally into the Gulf of Mexico at a rate of 300 to 400 feet/year (122 m). Currently, the delta front is located at the edge of Mexico-Gulf's continental shelf. As a result, large volumes of sediment are now being lost to the continental slope or ocean floor, where water depths are up to 1,000 feet (304 m) and, therefore, not conducive for land-building* (AWI 2018; AWI 2015; AWI2 20015; Guo 2023).

The other difficulty concerning the Mississippi River Valley is that for the last decades the exceed ***flood discharge thresholds*** have been increasing from result of changes in precipitation and landscape conditions. Therefore, extreme flooding occurred in the watershed in 5 of the last 10 years. The opening of the spillway *reduces flood risk* in New Orleans, but also has ecological consequences, namely the massive influx of fresh water into *Lake Pontchartrain* not only affects the fish and shellfish there but also brings *high doses of nutrients* into the lake, that can cause certain types of *algae to grow*, which can be toxic.

The Mississippi River Watershed is vital to economic development of the US. It provides drinking water for population of the country, water for agriculture and industry, and the ***world's largest inland navigation system***. These ports are vital to US exports and imports, and maintaining access for deep draft shipping is critically important. The watershed is a recreational and environmental treasure. It is also facing growing challenges. Therefore, the vital to the Lower Mississippi *deep draft navigation* has substantially increased since 2015. Therefore, the maintenance and operations of the ship channel in Mississippi River are needed, because average age of transportation infrastructure along the Mississippi River is far beyond their designed life expectancy of 50 years.

According to the natural issues the national economy needs for more investment for supporting and financing economic prosperity in direction to diversity structure. From point of view this development trends, the employment has relatively remained at highly level compared to other regions and states of the US, owing in part to the regions' incredible economic diversity, which includes agriculture, energy, industry, transportation, and recreation, among many other sectors. However, as important as the Mississippi River Watershed is to the national economy, national investment to support that the watershed has not kept pace (AWI 2018; Abramson 2024).

Fields of economic prosperity, which are follows:

INVEST**:** $2 Billion in annual funding through private and government sources to address critical needs in inland navigation, regenerative agriculture, ecosystem function, and flood and water management.

LEARN**:** Establish a science agenda, improve data information systems, and report progress against goals to inform decisions and ensure wise use of funds.

EDUCATE**:** An informed citizenry—coupled with transparent and data-informed decision-making by basin leaders—will facilitate progress toward goals.

ACT**:** Greater collaboration among complementary and competing interests will improve ability to manage in a way that values all uses of this tremendous resource.

This 2020 Mississippi River Watershed Report Card describes *progress toward achieving the goals established in the 2015,* highlights some of the important work that partners across the watershed are doing to make positive change, and documents the additional work that remains.

The *Mississippi River Valley Watershed provides some main economic favourable conditions:*

$50 billion in agricultural products, flood mitigation and resilience, habitat for diverse and important living resources, recreational opportunities and public land access and 25% of America's total hydropower. *Additionally, to the favourable conditions, there are some facts which are threatened:*

more frequent and extreme floods and droughts, lagging habitat and coastal restoration funding, continued urbanization and agricultural intensification and persistent nutrient and chemical pollution.

Nutrient runoff that contributes to the "Dead Zone" in the Gulf of Mexico.

The *outdoor recreational activities* are valued at $4 billion per year, supporting 420,000 jobs. Likewise, the Mississippi River Delta, with its unique assemblage of species, is known for fishing and hunting.

The Mississippi River Watershed provides *energy from hydropower* (25% of the nation's hydropower is produced in the Mississippi River Watershed) and renewable sources like wind, solar, and biofuel, and there is capacity for more (AWI 2018; Allan-Palmer 2006).

Restored *networks of floodplains*, wetlands, and uplands that work together to provide benefits such as flood damage reduction, water storage, and habitat conservation. The floodplains can be "reconnected" to river channels, so that rivers can safely expand beyond their banks as floodwaters rise.
Providing *critical habitat for aquatic and bird species*, combating land loss caused by subsidence and erosion, and reducing nutrient load.
Along the coast, wetlands provide critical storm surge protection to vulnerable communities during hurricanes and tropical storms. The floodwater storage to minimize flood damage to infrastructure and property and prevent overall loss of critical wetland habitat (America's Watershed Initiative Steering Committee 2015; America's Watershed Initiative 2018).
The lack of growth in the Mississippi River delta, on a large scale, is as much a coast-wide problem as a basin problem. This source of ample fresh water and sediment, which shaped the Louisiana coast as we know it, is no longer producing a net gain in coastal wetlands, placing the entire Louisiana coast at risk. To achieve the goal of maintaining the current level of wetland functions and offset the high rates of wetland loss, measures which net large gains in coastal wetlands must be pursued. *Any major reduction in the flow of the Mississippi River will result in a reduction of the naturally maintained channel. This would in turn result in increased dredging requirements* (AWI2 2015; AWI 2018).

The correlations of economic and ecological variables show considerable *decreasing trends* of the *nitrous oxide (N2O)* emissions in million-ton CO2 equivalent first from power industry energy and then transport energy in 2019 and 2021. But *in 2020* two sector more decreased their nitrous oxide (N2O) emissions based on their less intensive activities, which can be resulted by corona virus caused health crisis. There is also a difficulty for economy of the US, that the nitrous oxide (N2O) emissions in million-ton CO2 equivalent *from agriculture* has been *continuously only little increasing* for the period of 2010-2021. But in 2020 the nitrous oxide (N2O) emissions of agricultural sector have been at top increase by 2.4% since 2010. Also, the agricultural sector *should decrease pollutions into the Mississippi river* to defence natural environment even at seacoast of Louisiana state accompanying with decreasing high risk of nitrogen contamination in the river. The high-technology exports have had considerable share in percent of manufactured exports for researching period, but only a little decrease was in 2019 and 2020, which was partly accused by corona virus difficulty in 2020. The high-technology export can globally provide more increasing competitiveness for US economy. The wide-side national cooperation should be increasing to develop more favourable conditions of Mississippi River.

3. FIGURES, TABLES AND EQUATIONS

The tables, figures and maps of this chapter can show the correlations of economic and ecological variables with each-others. Also, these can help to understand more trends of changes of the variables.

Table 1. *Means of economic variables for researched period of 2010-2021*

Economic variables	Means of economic variables	Years	Source
AnnFreshW1	Annual freshwater withdrawals, total (% of internal resources)	2010-2021	World Development Indicators
NitEPoAgr2	Nitrous oxide (N2O) emissions from Agriculture (Mt CO2e)	2010-2021	World Development Indicators
NitEPoIn3	Nitrous oxide (N2O) emissions from Power Industry (Energy) (Mt CO2e)	2010-2021	World Development Indicators
NitEPoTra4	Nitrous oxide (N2O) emissions from Transport (Energy) (Mt CO2e)	2010-2021	World Development Indicators
FDINetIf5	Foreign direct investment, net inflows (BoP, current US$)	2010-2021	World Development Indicators
ForestAre6	Forest area (sq. km)	2010-2021	World Development Indicators
HTechEx7	High-technology exports (% of manufactured exports)	2010-2021	World Development Indicators
Import8	Imports of goods and services (% of GDP)	2010-2021	World Development Indicators
IndCoGDP9	Industry (including construction), value added (% of GDP)	2010-2021	World Development Indicators
Inflation10	Inflation, GDP deflator (annual %)	2010-2021	World Development Indicators
MeTraGDP11	Merchandise trade (% of GDP)	2010-2021	World Development Indicators
PopDens12	Population density (people per sq. km of land area)	2010-2021	World Development Indicators
UrbPopG13	Urban population growth (annual %)	2010-2021	World Development Indicators

Source: World Development Indicators, 2023

***Table 2**. Main economic indicators of the US between 2010-2021 in percent*

Economic variables	2010	2015	2019	2020	2021
Component-1, Principal line "X"					
MeTraGDP11	21.6	21.0	19.6	18.0	20.0
Import8	15.9	15.3	14.5	13.0	14.5
NitEPoTra4	0.1	-10	-19	-31	-25
NitEPoIn3	0.1	-23	-44	-52	-46
HTechEx7	22.6	21.4	18.7	19.5	20.0
IndConGDP9	19.3	18.5	18.2	17.3	17.7
PopDens12 (Number of people)	33.8	35	36	36.2	36.3
NitEPoAgr2	0.1	-0.1	2.4	1.0	0.6
Component-2, Principal line "Y"					
UrbPopG13	1.0	0.9	0.7	1.2	0.4
Inflation10	1.2	1.0	1.7	1.3	4.6
Component-3, Principal line "Y"					
ForestAre6	0.1	0.5	0.3	0.4	0.3
AnnFreshW1	14.8	15.8	15.7	15.9	15.6
FDINetIf5	0.1	94.0	19.7	-48	55

Source: World Development Indicators 2010 – 2021, US Environmental Protection Agency

***Table 3**. Correlation Matrix[a] among main economic indicators of the US between 2010-2021*

		AnnFresW1	NitEPoAgr2	NitEPoIn3	NitEPoTra4	FDINetIf5	ForestAre6	HTechEx7	Import8	IndConGDP9	Inflation10	MeTraGDP11	PopDens12	UrbPopG13
Correlation	**AnnFresW1**	1.000	.344	**-.828**	-.771	.117	**.898**	-.728	-.722	**-.808**	.073	-.702	**.810**	-.041
	NitEPoAgr2		1.000	-.598	-.464	-.344	-.034	**-.851**	-.462	-.367	.054	-.555	.574	-.190
	NitEPoIn3			1.000	**.972**	.199	-.512	**.926**	**.884**	**.954**	-.417	**.883**	**-.991**	.241
	NitEPoTra4				1.000	.320	-.469	**.833**	**.942**	**.992**	-.422	**.924**	**-.952**	.128
	FDINetIf5					1.000	.361	.230	.555	.266	.252	.592	-.096	-.586
	ForestAre6						1.000	-.362	-.439	-.549	-.119	-.393	.498	.088
	HTechEx7							1.000	.767	.780	-.284	**.809**	**-.912**	.264
	Import8								1.000	**.935**	-.129	**.993**	**-.821**	-.202
	IndConGDP9									1.000	-.402	**.905**	**-.935**	.096
	Inflation10										1.000	-.090	.517	**-.844**
	MeTraGDP11											1.000	**-.816**	-.205
	PopDens12												1.000	-.364
	UrbPopG13													1.000

a. This matrix is not positive definite.

Source: World Development Indicators 2010 – 2021, US Environmental Protection Agency

Based on the SPSS analyse

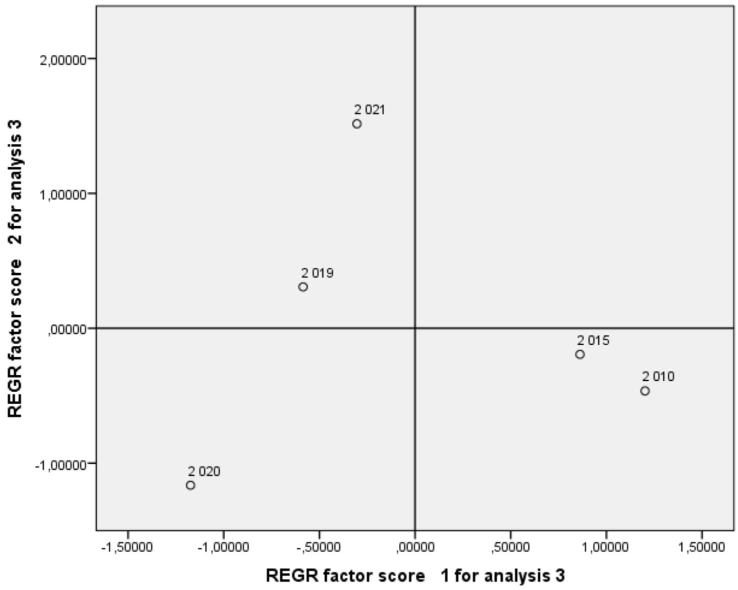

Figure 1.
Source: World Development Indicators 2010 – 2021, US Environmental Protection Agency
Based on the SPSS analyse
Correlations of componet-1 including MeTraGDP11, Import8, NitEPoTra4, NitEPoIn3, HTechEx7, IndConGDP9, PopDens12 and NitEPoAgr2 at the principal line "X" with component-2 including UrbPopG13 and Inflation10 at the principal line "Y"

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