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The expansion of population size has also greatly contributed to an increase in carbon emissions. The expansion of population size will directly lead to an increase in energy demand, an increase in urban traffic pressure and an increase in population mobility, which will further increase traffic CO<sub>2</sub> emissions. Based on national and regional studies, population growth contributes greatly to the growth of carbon emissions from transportation. Wang et al.(2011) <sup>[22]</sup> pointed out that, by adding a resident population, the number of day trips to Beijing would increase by 2.64. With the acceleration of urbanization, the increase of Beijing's permanent population has put great pressure on the city's traffic and contributed to the increase of carbon emissions.

The impact of energy prices on transportation carbon emissions is second only to per capita GDP and population size. For every 1% increase in energy prices, Beijing's transportation carbon emissions will be reduced by 2.895%, which has a significant inhibitory effect. If the energy price changes, it means that the price of the factors invested in production will also change. The rise in energy prices will lead to an increase in the production cost per unit of production, and some of the increased costs will be passed on to consumers, thereby curbing demand and reducing the total energy consumption to achieve less carbon emissions; It will be reflected in energy consumers, affecting consumer demand to a certain extent, and then promoting energy-intensive enterprises to accelerate technological innovation. In the transportation field, it can stimulate the use of new energy and reduce energy by means of electricity instead of oil. The consumption has thus reached the goal of reducing emissions.

The empirical results show that there is a positive correlation between urbanization level and total carbon emissions. When the urbanization level increases by 1%, the traffic carbon emission of Beijing increases by 0.65%, and the VIP value is 1.062. The importance of all research factors ranks fourth, second only to economic, demographic and price factors. With the acceleration of urbanization, Beijing's population is highly concentrated, and people's pursuit of quality of life is gradually increasing. Private car ownership has increased year by year, leading to a decline in the proportion of people taking public green transport. Longer travel distances lead to an increase in energy consumption, which further contributes to the increase in carbon emissions from transport.

The increase in passenger and freight turnover will contribute the increase of traffic carbon emissions. When the passenger turnover increases by 1%, the corresponding Beijing traffic carbon emissions increase by 0.67%. When the freight turnover increases by 1%, the corresponding the carbon emissions of transportation increased by 0.93%, both of which are related to the level of economic development. From the perspective of the variance expansion factor of the two, the VIP value of the passenger turnover is 1.04, which is greater than the freight turnover of 0.99. Therefore, the effect of passenger turnover is more obvious than the impact of freight turnover. For one thing, passenger transport mainly relies on road, air and rail transport, while freight transport is more dependent on rail and water transport, which are more

energy efficient than road and air transport. On the other hand, urbanization and accelerated economic development have resulted in a significant increase in passenger traffic in Beijing.

Beijing's energy intensity has a VIP value of 0.61, which has less impact on the factors studied, but the results show that its reduction will lead to an increase in traffic carbon emissions. When energy intensity drops by 1%, Beijing's traffic carbon emissions will increase. 0.32%, this conclusion is inconsistent with the improvement of technology will promote the efficiency of energy use. The increase in carbon emissions for an industry in a city is not caused by a single factor. First, both economic and demographic changes have an impact on them and play a key role in counteracting the positive effects of technological development. Secondly, we use the entire energy intensity of Beijing instead of the simple energy intensity of transportation, which may have a certain impact on the results. Finally, because of the rebound effect, technological development and innovation reduce energy consumption due to its efficiency, but it will increase the development and utilization of new energy. The two are used together for carbon emissions, and finally present technological development and innovation for Beijing traffic. Carbon emissions have had a positive effect. However, in any case, the reduction of energy intensity has always been an important means of saving energy and reducing carbon emissions. With the development and progress of society, there is still great potential for technological innovation.

## **V. CONCLUSIONS AND POLICY IMPLICATIONS**

The article mainly studies the influencing factors of Beijing's traffic carbon emissions. Through analysis, economic development, population expansion, urbanization level, and passenger and freight turnover increase have all contributed to the increase of traffic carbon emissions. The increase in energy prices has significantly inhibited CO<sub>2</sub> emissions, and the increase in energy intensity has a negative impact on carbon emissions, but the impact is small.

Accordingly, in order to reduce carbon emissions and build a low-carbon city, Beijing should vigorously develop low-carbon transportation, optimize its industrial structure, and promote the development of high-tech industries and high-end services. In addition, in the process of economic development, we should control the size of the population and give consideration to the quality and quality of the population. Secondly, fuel and energy prices can be appropriately raised to improve energy efficiency, promote new energy vehicles, and advocate green travel for residents. Finally, improve the level of urban infrastructure, optimize the structure of urban transportation network, speed up the development of rail transit, expand the carrying capacity of existing public facilities, improve the network of medium and long distance and suburban lines, and reduce the turnover rate of passenger and cargo transportation. At the same time, through accurate information services, promote the development of intelligent transportation, so as to reduce Beijing's traffic carbon emissions.

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## REFERENCES

- [1] Yang YY, Zhao T, Wang YN, et al. Research on impacts of population-related factors on carbon emissions in Beijing from 1984 to 2012. *Environmental Impact Assessment Review*, 2015, 55: 45–53
- [2] IEA. CO<sub>2</sub> Emissions From Fuel Combustion. Paris: Inter National
- [3] González R M, Marrero G A. The effect of dieselization in passenger cars emissions for Spanish regions: 1998–2006. *Energy Policy*, 2012, 51:213-222.
- [4] Ruiling Han, Lingling Li et al. Spatial-temporal Evolution Characteristics and Decoupling Analysis of Influencing Factors of China's Aviation Carbon Emissions. *Chinese Geographical Science*, 2022(32): 218-236.
- [5] C.H. Liao, C.S. Lu, P.H. Tseng. Carbon dioxide emissions and inland container transport in Taiwan. *Journal of Transport Geography*, 2011, 19(4): 722-728.
- [6] Mazzarino M. The economics of the greenhouse effect: evaluating the climate change impact due to the transport sector in Italy. *Energy Policy*, 2000, 28(13): 957-966.
- [7] Md. Afzal Hossain, Songsheng Chen & Abdul Gaffar Khan. Decomposition study of energy-related CO<sub>2</sub> emissions from Bangladesh's transport sector development. *Environmental Science and Pollution Research*, 2021(28): 4690.
- [8] Lian Lian, Jingyan Lin et al. The CO<sub>2</sub> emission changes in China's transportation sector during 1992-2015: a structural decomposition analysis. *Environmental Science and Pollution Research*, 2020(27): 9085–9098
- [9] Graham D J, Crotte A, Anderson R J. A dynamic panel analysis of urban metro demand. *Transportation Research Part E Logistics & Transportation Review*, 2009, 45(5): 787-794.
- [10] Rentziou A, Gkritza K, Souleyrette R R. VMT, energy consumption, and GHG emissions forecasting for passenger transportation. *Transportation Research Part A Policy & Practice*, 2012, 46(3): 487-500.
- [11] Yong Jiang, Zhongbao Zhou, Cenjie Liu. The impact of public transportation on carbon emissions: a panel analysis based on Chinese provincial data. *Environmental Science and Pollution Research*, 2019(26): 4000–4012
- [12] Xu Wang, Yingming Wang, Yixin Lan. Centralized carbon emission abatement (CEA) allocation based on non-separation using data envelopment analysis: an observation of regional highway transportation systems in China. *Environmental Science and Pollution Research*, 2022
- [13] Yanmei Li, Tingting Li, Shuangshuang Lu. Forecast of urban traffic carbon emission and analysis of influencing factors. *Energy Efficiency*, 2021. 11(84).
- [14] Tangyang Jiang, Yang Yu, Bo Yang. Understanding the carbon emissions status and emissions reduction effect of China's transportation industry: dual perspectives of the early and late stages of the economic "new normal". *Environmental Science and Pollution Research*, 2022. 06
- [15] Liddle B. The systemic, long-run relation among gasoline demand, gasoline price, income, and vehicle ownership in OECD countries: Evidence from panel cointegration and causality modeling. *Mpra Paper*, 2012, 17(4): 327-
- [16] B&B J, Lin S J, Lewis C. Decomposition and decoupling effects of carbon dioxide emission from highway transportation in Taiwan, Germany, Japan and South Korea. *Energy Policy*, 2007, 35(6):3226-3235.
- [17] Andreoni V, Galmarini S. European CO<sub>2</sub>, emission trends: A decomposition analysis for water and aviation transport sectors. *Energy*, 2012, 45(1): 595-602.
- [18] Kwon T H. Decomposition of factors determining the trend of CO<sub>2</sub>, emissions from car travel in Great Britain (1970-2000). *Ecological Economics*, 2005, 53(2): 261-275.

- [19]Huaping Sun, Lingxiang Hu et al. Uncovering impact factors of carbon emissions from transportation sector: evidence from China's Yangtze River Delta Area. *Mitigation and Adaptation Strategies for Global Change*, 2020(25): 1423–1437
- [20]Dietz T, Rosa E A. Rethinking the environmental impacts of population, affluence, and technology. *Human Ecology Review*, 1994(1): 277-300.
- [21]Jia JS, Deng HB, Duan J, et al. Analysis of the Major drivers of the ecological footprint using the STIRPAT model and the PLS method-A case study in Henan Province, China. *Ecol Econ* 2009, 68: 2818-2824.
- [22] Wang, S.G., Duan, T.T., Cun, X.B., et al, 2011a. Research on traffic congestion in Beijing from the perspective of economics. *Foreign Investment China* 253, 186-187 (in Chinese).