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Study on how impact of emission factor on logistics transport development: Ho Chi Minh case

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Abstract: Our global is being warmed is a concerned matter. In which greenhouse gases is main reason that directly affects. Particularly, consisting of CO_2, methane and other emission factors cause air pollution. The objective of paper is to assess how impact ofthese factors on logistics transport development by using Multivariate regression (MR). The main findings are CO_2, methane and other emission factors cause air pollution impact on Labour goods productivity. Methane impacts on Labour passenger productivity. CO_2, Methaneimpact on Gross domestic products.

Key words: emission factors, CO_2, methane, logistics, transport, development, HCM, Ho Chi Minh City, Vietnam.

I. Introduction

We are facing the biggest environmental problems that is global warming, greenhouse gases are reason that directly affects global is warming. Carbon dioxide emissions are the most substantial, as a result of which the earth's temperature has risen by almost 1 degree Celsius over the last 100 years. Road transport is an economic sector that is growing on a global scale in most indicators, which is creating and growing the associated negative effects on the environment and the health of the population (Martina Kovacikova, Patricia Janoskova, Kristina Kovacikova, 2021).Carbon emission from the transport sector will continue to grow steadily because the high people demand to transport is growing. The cheap availability of fuel and affordable car costs that give the limited public transport, will persist as driving factors of the ongoing rise in carbon emission from transportation. Therefore, phasing out the fuel subsidies system, developing a reliable public transport system, planning for the electrification of road transportation, and using rail for freight transportation is needed in order to curb emission from the Omani transportation system should take place in the socio-economic context of the country (Y. Charabi, N. Al Nasiri, T. Al Awadhi et al., 2020). Economic growth plays an important role in improving production technology and increasing people's demands for the environment, thereby contributing to the sustainable development goals (IV Filimonova, IV Provornaya, AV Komarova and associates 2020). According to Ángel S. Marrero, Gustavo A. Marrero, Rosa Marina González et al., (2021) said that "In Europe, the transport sector accounts for more than 27% of total CO2 emissions and, within this sector, road transport is by far the largest polluter. This fact has placed road transport emissions abatement firmly on the agenda of global alliances. The European transport policy should reduce the differences in structural factor endowments among countries to enable the absolute convergence towards a lower level of emissions in a reasonable period of time".

With the objective to measure which emission factors and how they impact on logistics transport development. Paper assess three independent variables are CO_2, methane and other emission factors cause air pollution, five dependent variables are Labour goods productivity, Labour passenger productivity, Capital goods productivity, Capital passenger productivity and Z is Gross domestic products. Paper has eight sections are introduction (section 1), literature review (section 2), methodology (section 3), theoretical basis (section 4), data source (section 5), study results (section 6), discussion (section 7) and conclusion (section 8).

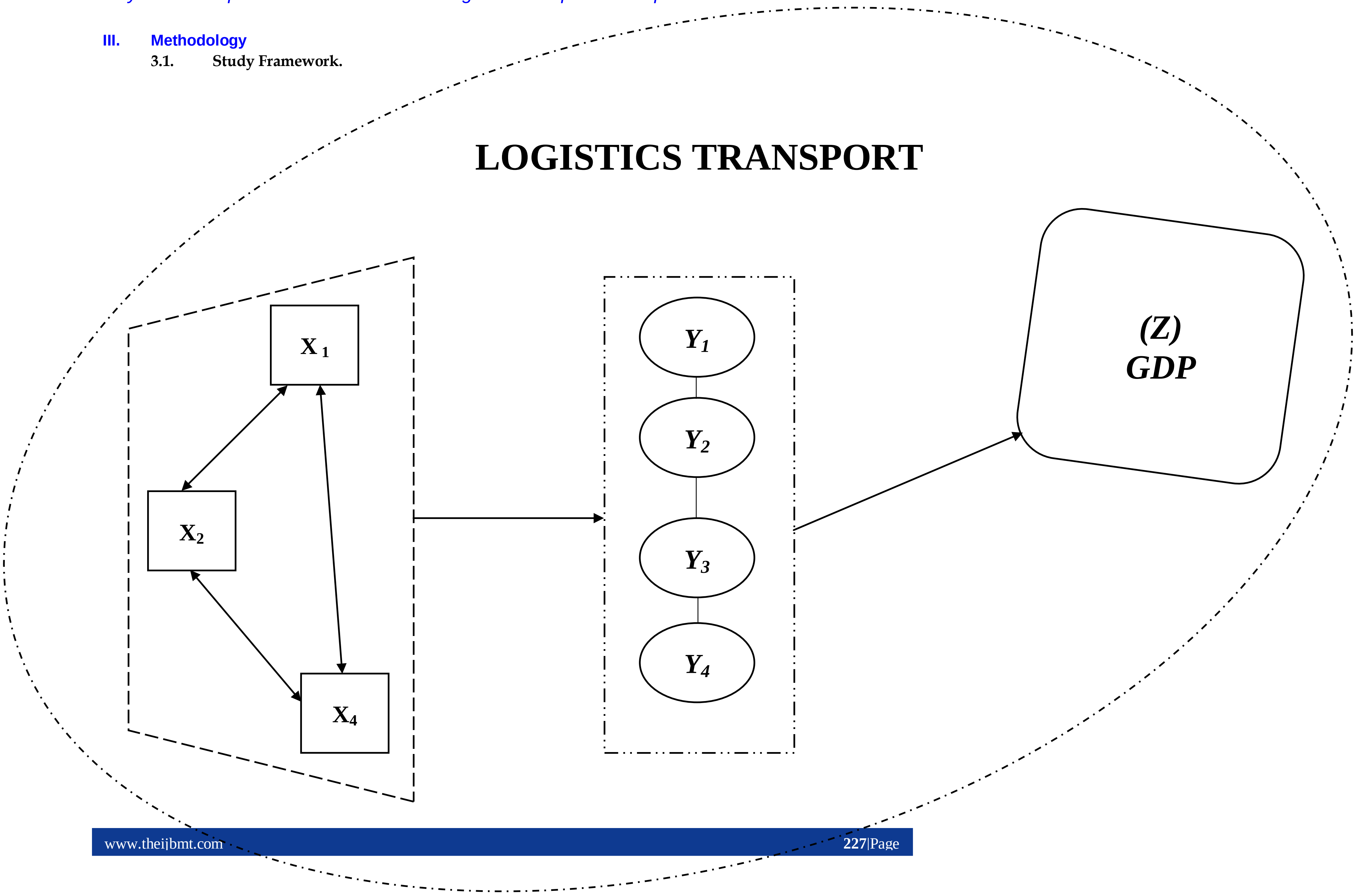
II. Literature review

Study of Dequn Zhou, Fei Huang, Qunwei Wang et al., (2021) shows that "In China, the waterway transport structure change performed as a negative driver for reducing CO2 emissions. However, transport structure changes would facilitate reductions in CO2 emissions from the waterway transport sector. Industrial development was the greatest driver for CO2 emission increase, while energy intensity change was an important driver for mitigating CO2 emissions. Regional disparities on the effect of waterway transport structure change and industrial development indicated the necessity of collaboration among 17 provincial regions on waterway transport management to mitigate CO2 emissions". The costs incurred and the amount of pollutant emitted are nearly equal to the economic regulation value and the corresponding emission regulation value compared to the economic regulation solution based on the price

- penalty factor and according to the distribution program (Bishwajit Dey, BiplabBhattacharyy, Fausto Pedro García Ma´rquez, 2021). The driving factors of water environmental stress indicate that population size and urbanization are the main factors affecting wastewater discharge. The direction and scale of industrial structures are influenced by policies and markets. Subsequently, economic growth, fixed asset investment and commercial opening have had a positive impact on wastewater discharge. Technological advancement and environmental management are important factors in wastewater discharge control. However, their current impact on wastewater discharge is not ideal (Yuying Zhang, Meiying Sun, Rongjin Yang et al. 2021). The new induction heating asphalt pavement can increase the waterproofing efficiency by 81.80% compared to the normal induction hot asphalt pavement. Meanwhile, the recycled waste materials in the new induction hot asphalt pavement can bring economic benefits, save energy and reduce emissions significantly (Kai Liu, Peixin Xu, Fang Wang et al., 2020). The socio-economic system tends to increase while the ecological environment tends to decrease. The impact of average GDP per capital on haze pollution confirmed the relationship of the "inverted U" (environmental Kuznets curve (EKC)). At the same time, urbanization has limited haze pollution, which is evidence of the existence of an "inverted U" shaped EKC between GDP per capita and haze pollution. (Wenqi Wu, Wenwen Wang, Ming Zhang, 2020). Environmental regulations may support or may not encourage a reduction in carbon emissions. China's transport infrastructure between 2001 and 2017 has reduced its carbon emissions by 10.15% (Jingxiao Zhang, WeixingJin, Simon P. Philbin et al., 2021).As Research byTao Shi, Shenyan Yang, Wei Zhang et al (2020) indicates that "There is a significant spatial heterogeneity between economic development and ecological environment, Economic development and ecological environment are at the intermediate stage of coordination and coupling, relatively many regions are economically lagging, ecological laggards are mainly located in the developed regions in the East. While the type of economic lag is mainly in the Central and Western regions, the spatial relationship and the cumulative impact of economic development both tend to be positive, and the spatial relationship of ecological environment also tends to be positive. The interaction relationship between economic development and ecological environment tends to converge. The negative interaction effects of economic development and the ecological environment tend to be concentrated in the developing central and eastern regions, while the positive interactions tend to be concentrated in the central region, the centre and the developing West". The growing trend of emissions from transport, it must be necessary to increase reduction efforts, either by adopting new additional measures or by implementing existing measures. In particular to Carbon dioxide may include measures for the introduction of low-emission zones in municipalities, including charging for entry into these zones and the calming of traffic in settlements. There are many decarbonization measures in the transport sector as possible can be financed by EU and Slovakia, including the reduction of administrative burdens for project submission such as reducing emissions from aviation, reducing the carbon footprint of urban public transport with available technologies (Martina Kovacikova, Patricia Janoskova, Kristina Kovacikova, 2021). There is dynamic relationship between carbon emissions and the eco-environment in China has not reachech the balance level. the carbon emission evaluation value has a positive effect on promoting to increase in the coordination degree, the eco-environment evaluation value determines the trend of coordinated regional development. The priorities of government policymakers have a substantial impact on coordinated development. However, these impacts gradually diminish as the differences in evaluation values decrease (Jiandong Chen, Zhiwen Li, Yizhe Dong et al., 2020). In China, the study in 325 cities at the period between 2005 and 2015 indicated that a 1% increase in built-up areas' size, compactness, and isolation is associated with increases of 0.35%, −0.14%, and 0.13%, respectively, in adjacent traffic CO2 emissions. The main reason is the spatial configurations of built environment which is not only systemically affect the probability, frequency, speed, and distance of intracity motorised travels, but also have impacts on the intercity transboundary mobility of motor vehicles. In addition, the built-up areas' compactness effect has an antagonistic relation with the per capita GDP effect (Weize Song, Xiaoling Zhang, Kangxin An et al., 2021). The regional transport of vehicular emissions plays a role which is significantly increasing in contributing toward air pollution on haze days. The contribution of non-local vehicular emissions to atmospheric PM2.5 and NO3− from non-haze to haze days increased by 38% and 27%, respectively. Studies provide new knowledge for understanding the environmental impact of vehicular emissions and also providing a scientific basis for formulating effective regional coordination control strategies for air pollution (Jianlei Lang, Xiaoyu Liang, Shengyue Li et al., 2021). The decreasing greenhouse gases emissions from fuel share and emission factors revealed the success of biofuel promotion in the road transport. Energy efficiency and CO2 mitigation are suggested in Thailand that should continue promotion of energy efficiency improvement, public transport, biofuels and electric vehicles (Piti Pita, PornphimolWinyuchakrit, BunditLimmeechokchai, 2020). As by study of Lukas Byrne, Vanessa Bach, Matthias Finkbeiner (2021) that "The shift of car traffic to public transport and cycling in conjunction with the use of alternative propulsion systems limits the increase in the demand for critical resources to a factor of 20–23 while at the same utilizing the potentials for reducing pollutant emissions". According to SedatAlata (2021) that "A growing number of studies empirically investigate the nexus between CO2 emissions and technological progress. The findings reveal that environmental technologies have a statistically insignificant positive effect on CO_2 emissions from the transport sector. Moreover, while economic growth and energy consumption lead to more pollution, the effect of urbanization on emissions is not statistically significant. It is recommended that the policymakers of EU15 countries should pay special attention to the transport sector for becoming a carbon-neutral economy by 2050".

III. Methodology

3.1. Study Framework.



3.2. Variables of study framework.

Independent variables.

X_1 is CO_2, unit is million tons.

X_2 is methane, unit is KT CO2 equivalent.

X_3 isother emission factors cause air pollution, unit is PM2.5 (Micrograms per Cubicm).

Dependent variables:

Y_1 is Labour goods productivity

$Y_2$is Labour passenger productivity

Y_3Capital goods productivity

Y_4Capital passenger productivity

Z is Gross domestic products.

Base on definition of International Monetary Fund that "GDP measures the monetary value of final goods and services—that is, those that are bought by the final user—produced in a country in a given period of time (say a quarter or a year). It counts all of the output generated within the borders of a country. GDP is composed of goods and services produced for sale in the market and also includes some nonmarket production, such as defence or education services provided by the government. Analternative concept, gross national product, counts all the output of the residents of a country. So, if a German-owned company has a factory in the United States, the output of this factory would be included in U.S. GDP, but in German GNP."

According to definition of World bank that "GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources".

3.3. Productivity calculation formula and Multivariate regression model.

$$Y_1 = \frac{\textit{Total volume of goods} \text{ which } \textit{have been transported} \text{ of logistics transport industry}}{\textit{Total number of human resource} \text{ of logistics transport industry}}$$

$Y_1 = x_0 + x_1X_1 + x_2X_2 + x_3X_3 + e$ (1)

$$Y_2 = \frac{\text{Total number of passenger have been transported of logistics transport industry}}{\text{Total number of human resource of logistics transport industry}}$$

$Y_2 = x_0 + x_1X_1 + x_2X_2 + x_3X_3 + e$ (2)

$$Y_3 = \frac{\text{Total volume of goods that have been transported of of logistics transport industry}}{\text{Total captal of of logistics transport industry}}$$

$Y_3 = x_0 + x_1X_1 + x_2X_2 + x_3X_3 + e$ (3)

$$Y_4 = \frac{\text{Total number of passenger have been transported of logistics transport industry}}{\text{Total capital of logistics transport industry}}$$

$Y_4 = x_0 + x_1X_1 + x_2X_2 + x_3X_3 + e$ (4)

$Z = x_0 + x_1X_1 + x_2X_2 + x_3X_3 + e$ (5)

Where

x_o is the intersection of vertical axis and lines of regression.

e is other variablesthat beyondX_1, X_2, X_3, it is skipped by this paper.

According to Keshab Bhattarai (2015, p. 55) and Jeffrey M. Wooldridge (2020, p. 126), where.

$x_o + x_1 + x_2 + x_3 = 0$ is to mean that (1), (2), (3), (4) and (5)are not built suitably to the input data and they do not have statistics significance.

$x_o + x_1 + x_2 + x_3 \neq 0$ is to mean (1), (2), (3), (4) and (5) are built suitably to the input data andthey have statistics significance.

$x_o + x_1 + x_2 + x_3 > 0$ means X_1, X_2, X_3 impact on Y_1, Y_2, Y_3, Y_4, Z, respectively and separately.

$x_o + x_1 + x_2 + x_3 <= 0$ means X_1, X_2, X_3do not impact on Y_1, Y_2, Y_3, Y_4, Z, respectively and separately.

IV. Theoretical basis

4.1. Logistics transportation.

The transport logistics industry has evolved and gone through many anecdotes over time. It evolves with the history of the transportation system. It has certain impacts on the economy, society and daily life. An increase use of the transport system on all modes can be changed to better suit each social context and each time needed. There is no transport systems are alike in terms of cost and efficiency, the logistics of a transportation system must be considered thoroughly in order to fully understand its efficiency and quality to meet requirements of society (MD Sarder, 2020). Transport logistics is one of the most important sectors of the economy, its proportion is increasing every year which is determined by the process of globalization. In the European Union, the transport and storage sector employ about 11 million people, accounting for more than 5% of total employment and almost 5% of GDP (EgilsGinters, VytautasPaulauskas, Mario Arturo Ruiz Estrada, 2019). Transport logistics is a major part in supply chain systems in order to reduce costs and improve services (MD Sarder, 2020).

4.2. Emission factor.

It is found that if ridesharing services is supported by substantial policy, CO2 emissions from passenger transport in 2050 will be on average 6.3% lower than their reference level. However, it is shown that this finding differs widely between cities (LoannisTikoudis, Luis Martinez, Katherine Farrow et al., 2021). The emission intensity, transport distance and meteorological factors at burn sites are three factors that can support in prediction and effective polluted environment control measures (Xiaoyang Li, Tianhai Cheng, Shuaiyi Shi et al., 2021). Transportation contributes significantly to greenhouse gas emissions and air pollution. However, new technologies are emerged, existing technologies are being further improved. German is able to have emission reduction target in 2030 for the transport sector will be met. And it is demonstrated that only a joint de-carbonization of both transport and electricity systems lead to a significant reduction of emissions (Simone Ehrenberger, Stefan Seum, Thomas Pregger et al., 2021).

V. Data source

Data of Y_1, Y_2, Y_3, Y_4, Z are from HCM Statistics Department and HCM Statistical Yearbook.
Data of X_1, X_2, $X_3$are from world bank.

VI. Study results

Table 1: MR results of models (1), (2) and (3)

$Y_1= x_0 + x_1X_1+ x_2X_2+ x_3X_3$ (1)				$Y_2= x_0 + x_1X_1+ x_2X_2+ x_3X_3$ (2)				$Y_3= x_0 + x_1X_1+ x_2X_2+ x_3X_3$ (3)			
R square (RS)		0.73112219 (73%)		R square (RS)		0.74256825 (74%)		R square (RS)		0.27723086 (28%)	
Adjusted R Square (ARS)		0.61588885 (62%)		Adjusted R Square (ARS)		0.63224036 (63%)		Adjusted R Square (ARS)		-0.0325273 (-3.25%)	
Significance F (SF)		0.02086054		Significance F (SF)		0.01801569		Significance F (SF)		0.48961835	
Independent variables	Coefficients	Value of Coefficients (VC)	P-Value (PV)	Independent variables	Coefficients	Value of Coefficients (VC)	P-Value (PV)	Independent variables	Coefficients	Value of Coefficients (VC)	P-Value (PV)
	x_0	-2.7422346	0.75107534		x_0	-0.0296852	0.97652253		x_0	7.4106608	0.5165038
X_1	x_1	0.00022368	0.90526635	X_1	x_1	-6.101E-05	0.78216195	X_1	x_1	0.00076298	0.75655239
X_2	x_2	2.7764E-05	0.643466	X_2	x_2	1.8319E-06	0.79317783	X_2	x_2	-4.577E-05	0.56076004
X_3	x_3	0.00122589	0.98220868	X_3	x_3	-0.0023762	0.71349951	X_3	x_3	-0.0501942	0.49207506

$Y_1 = x_0 + x_1X_1 + x_2X_2 + x_3X_3$ (1).
The model of Y_1 was built with RS = 0.73112219 (73%), ARS = 0.61588885 (62%) is meant input data was explained by output at 62%. $x_o + x_1 + x_2 + x_3 = -2.740757274 \neq 0$ is the evidence that MR model issuitableto input data and it has statistics significance at 0.02086054.
Independent variables which have VC > 0 including all three variables are x_1 = 0.00022368, x_2= 2.7764E-05, x_3 = 0.00122589, that shows X_1, X_2, X_3 all impact on Y_1
$Y_2 = x_0 + x_1X_1 + x_2X_2 + x_3X_3$ (2).
The model of Y_2 was built with RS = 0.74256825 (74%), ARS = 0.63224036 (63%) is meant input data was explained by output at 63%. $x_o + x_1 + x_2 + x_3 = -0.032120617 \neq 0$ is the evidence that MR model is suitable to input data and it has statistics significance at 0.01801569.
Independent variables which have VC > 0 including x_2=1.8319E-06, that shows X_2impacts on Y_2
Independent variables which have VC < 0 including x_1 = -6.101E-05, x_3 = - 0.0023762, that shows X_1 and X_3do not impact on Y_2
($Y_3 = x_0 + x_1X_1 + x_2X_2 + x_3X_3$ (3).
The model of Y_3 was built with RS = 0.27723086 (28%), ARS = -0.0325273 (-3.25%) is meant input data has not been able to be explained by output result and the MR model was built is not suitable to input data, conclusion is the MR model does not have statistical significance.

Table 2: MR results of models (4) and (5)

$Y_4 = x_0 + x_1X_1 + x_2X_2 + x_3X_3$ (4)				$Z = x_0 + x_1X_1 + x_2X_2 + x_3X_3$ (5)			
R square (RS)		0.27415931 (27%)		R square (RS)		0.99398328 (99%)	
Adjusted R Square (ARS)		-0.0369153 (-3.69%)		Adjusted R Square (ARS)		0.99140468 (99%)	
Significance F (SF)		0.49548602		Significance F (SF)		3.92431E-08 (0.000000039)	
Independent variables	Coefficients	Value of Coefficients (VC)	P-Value (PV)	Independent variables	Coefficients	Value of Coefficients (VC)	P-Value (PV)
	x_0	1.4385184	0.24005047		x_0	-473200.08	0.13381824
X_1	x_1	9.7704E-06	0.96922914	X_1	x_1	175.413695	0.0236118
X_2	x_2	-8.843E-06	0.29090664	X_2	x_2	4.68758131	0.04536109
X_3	x_3	-0.0096532	0.2191482	X_3	x_3	-922.92661	0.62041318

$Y_4 = x_0 + x_1X_1 + x_2X_2 + x_3X_3$ (4).
The model of Y_4 was built with RS = 0.27415931 (27%), ARS = -0.0369153 (-3.69%) is meant input data has not been able to be explained by output result and the MR model was built is not suitable to input data, conclusion is the MR model does not have statistical significance.
$Z = x_0 + x_1X_1 + x_2X_2 + x_3X_3$ (5).
The model of Y_5 was built with RS = 0.99398328 (99%), ARS = 0.99140468 (99%) is meant input data was explained by output at 99%. $x_o + x_1 + x_2 + x_3 = -473942.9023 \neq 0$ is the evidence that MR model is suitable to input data and it has statistics significance at 3.92431E-08 (0.000000039).
Independent variables which have VC > 0 including x_1 = 175.413695, x_2 = 4.68758131, that shows x_1 and X_2 impact on Z
Independent variables which have VC < 0 including x_3 = -922.92661, that shows X_3does not impact on Z

VII. Discussion.

According to table 1 and table 2 are described in section 6 that MR model Y_1 has statistics significance with SF is at 0.02086054. MR model Y_2has statistics significance with SF is at 0.01801569and MR model Y_5 has statistics significance with SF is at 3.92431E-08 (0.000000039). MR model $Y_3$and MR model Y_4do not have statistical significance. Whereby, (X_1) x_1 = 0.00022368, (X_2) x_2= 2.7764E-05 and (X_3) x_3 = 0.00122589 impact on Y_1. (X_2) x_2= 1.8319E-06 impacts on Y_2.(X_1) x_1= 175.413695 and (X_2) x_2 = 4.68758131 impact on Y_5

VIII. Conclusion

Based on study results are presented in section 6 and discussion is shown in section 7. The conclusion is below:

Firstly, MR model $Y_3$and MR model Y_4do not have statistical significance is to mean that Capital goods productivity and Capital passenger productivity have not been assessed which independent variables impact on and how they impact on.

Secondly, (X_1) CO_2 that unit is million tons, (X_2) methane which unit is KT CO2 equivalent and (X_3) other emission factors cause air pollution has unit is PM2.5 (Micrograms per Cubicm) impact on Y_1(Labour goods productivity). (X_2) methane which unit is KT CO2 equivalent impacts on Y_2(Labour passenger productivity). (X_1) CO_2 that unit is million tons and (X_2) methane which unit is KT CO2 equivalent impact on (Z) Gross domestic products.

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