International Journal of Scientific Advances
ISSN: 2708-7972
Volume: 2 | Issue: 4 | Jul - Aug 2021 Available Online: www.ijscia.com
DOI: 10.51542/ijscia.v2i4.37

# Study on Structure of Labour Force Divided by Economic Sector: HCM, Vietnam Case

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**ABSTRACT**

Labour force plays a crucial role and it is the strategy of a country. The paper has objective to assess how impact of labour force structure is divided by economic sectors on logistics transport development in Ho Chi Minh (HCM), Vietnam. Author uses Estimating Logistics regression by Maximum Log Likelihood (LRML) and Assessing fit of a Logistics Regression (AFLR) with the time series data between 2005 and 2019. The notable results are cumulative percentage (%) of impact of Labour force on state sector, Labour force on outside state sector and Labour force on foreign investing sector, ranging from 14% to 100%. The lowest level is 10% in 2005. The highest level is 100% in 2019. Cumulative % of logistics transport development impacted was at the lowest level of 7% and the highest level of 100%. The impact level fluctuated upwards between 2006 and 2015. The Cumulative % of impact of Labour force on state sector, Labour force on outside state sector and Labour force on foreign investing sector, and Cumulative % of logistics transport development were impacted at different levels.

***Keywords:*** labour force; logistics; transport; HCM; Ho Chi Minh; Vietnam; logistics regression; likelihood; LRML; AFLR

## INTRODUCTION

Labour force plays a crucial role in a country. In any eras, or any socio-economic form, labour force always plays a decisive role, it directly impacts on the development process of a nation. Labour force is a major factor, it is the source and the main driving force that creates the production force, which is the factor that determines the speed and sustainable development of new production methods in an economy, especially an economy in the context of integration and internationalization. Therefore, it is impossible not to take care of labour force development. Labour force is very important. However, the distribution of labour force by economic sectors is much more important, especially in underdeveloped and developing countries. Each economic sector has its own decisive role in contributing GDP to the state budget. Therefore, the strategy of labour force allocation has much more effect on the economy of a nation. In order to achieve economic growth and have it developed, the country needs to have a harmonious, synchronous, balanced and scientific distribution of labour force for each economic field with its own characteristics.

[1] The reduction of the gap of the gender labour force participation is driven by higher entry of women, especially women who have more education. This results in intrahousehold adjustments in work dynamics, with women entering the labour force to offset the lost income of male partners who left the labour force. The trade liberalization increased female workers' unemployment rate and reliance on part-time jobs (Tibor Besedeš, Seung Hoon Lee, Tongyang Yang, 2021). [2] Tiebei Li, Jago Dodson, Xavier Goldie (2021) supposed that "Understanding the productivity effects of worker commuting burdens is essential for appraisals of urban planning and investment strategies designed to improve urban productivity. It is found that the labour force in areas experiencing high commuting burdens exhibit lower levels of engagement with job markets. This research further reveals important variations in such relationships across diverse industry and occupation groups". [3] In Korea, proportion of aggregate labour force shows a reducing trend while masking the divergence in labour force's share at the industry level. At the industry level, analysis provides evidence that in major capital-intensive industries with high substitutability between capital and labour force like electronics, an increase in the capital-to-labour ratio tends to be associated with a fall in the labour force share. It is given that the rapid growth in value-added, these industries play a key role in the declining proportion of aggregate labour force. Service industries for example finance which has rapid labour-augmenting technological progress and low substitutability, and they have also contributed to the declining aggregate labour share (Eunbi Song, 2021).

The objective of this paper is to assess the impact of labour force structure divided by economic sector on logistics transport development.

## LITERATURE REVIEW

[4] In United Kingdom, the industrial and service sectors already accounted for 40% of the labour force in 1381. There was a substantial further shift of labour out of agriculture that occurred between 1522 and 1700. Agricultural labour productivity led to the basis of increased employment in the industry and service sector from the beginning of seventeenth century.

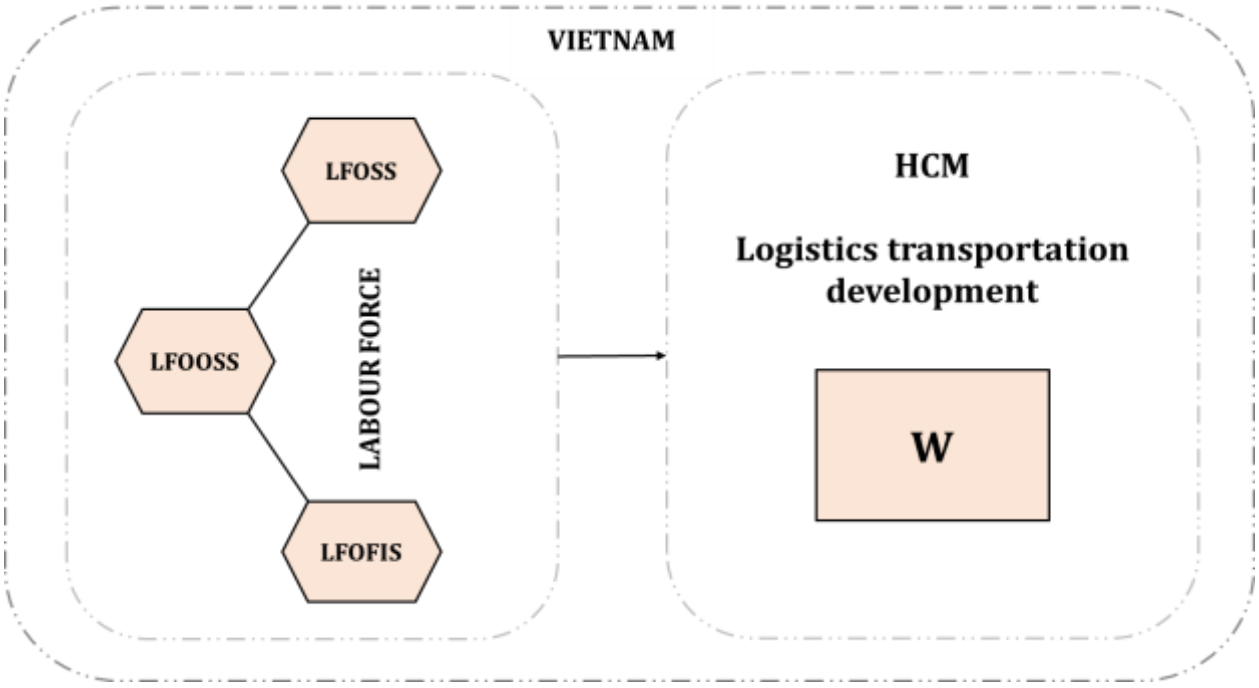
Thereafter, and increased output of industry during the Industrial Revolution owed more to gains in labour productivity consequent upon mechanization than the

expansion of employment (Stephen Broadberry, Bruce M.S.Campbell, Basvan Leeuwen, 2013). [5] Unemployment benefits have an impact on labour force participation decisions and individuals are more likely to participate in the labour force and to actively search for a job (Wolfgang Lechthaler, Patrick Ring, 2021). [6] The smaller the value of the extensive-margin labour force supply elasticity is, the stronger the procyclical values of non-market activities channel is. The wage rigidity helps, due to it mitigates increases in the return to market work during expansions (Isabel Cairó, Shigeru Fujita, Camilo Morales-Jiménez, 2021). [7] In the United State of America, underlying data shows that labour-force participation rate, and duration of unemployment calculations contain numerous internal contradictions, so the considering issue is whether labour-force participation rate and unemployment depend on divide of labour force (Hie Joo Ahn, James D. Hamilton, 2021). [8] The employed population, the distribution of occupations and industries provide a first glance into the way the social norms and market dynamics create gender segregation in specific economic sectors. Salary differs by education, location, age, sector, industry, and occupation. The salary gap and some other issues are also reflected over discrimination in the opportunities that women face to occupy different positions in their companies. Gender discrimination in the labour market is a substantial barrier to the economic development of countries (Gustavo Nicolas Paez, Myat SuTin, 2021). [9] There is an increase in the participation of women at their reproductive ages. The older labour force of adults will be declined in the future compared to more developed economies. Associated with population aging and longer life expectancy is to reduce the ratio between workers and retirees which affect the basic premise of the pay-as-you-go system (BernardoLanza Queiroz, Matheus Lobo Alves Ferreira, 2021). [10] Mobility of women with higher education levels should be considered.

Labour force participation of women increased considerably in the regions which is most affected by the destruction of men which have jobs and with relatively higher labour demand in occupations more likely to employ women. Women with higher levels of education are also more likely to move to regions which has higher labour demand in these occupations. For men, there is an increase of unemployment in response to regional declines in male labour demand (Gregory Verdugo, Guillaume Allègre, 2020). [11] İnsan Tunalı, Murat G.Kırdar, Meltem Dayıoğlu (2021) stated that "The evidence compiled confirms that Turkey has reached the turning point of the U-shaped pattern in female labour force participation observed in countries where agriculture initially accounts for a large fraction of employment. The related interruptions in rural areas and for low-educated women in urban areas. The least-educated women are more likely to participate, contrary to the belief that culture stands in the way". [12] Technological advances raise productivity and growth, but it also likely to reshape labour markets. It is confirmed that labour force worked in fields where careers are easily changed, and it is easy to resign jobs. Encouragingly, the higher spending on active labour force programs and education can reduce negative impact of the participation of technological change (Francesco Grigoli, Zsoka Koczan, PetiaTopalova, 2020). [13] In France, a two-sector economy with endogenous allocation of the labour force between sectors and social networks favour the transmission of job information. Social networks can induce sector concentration even when sectoral productivities and entry costs are perfectly symmetric. Moreover, it is confirmed that social networks can also trap workers in poorly productive sectors (Manon Domingues Dos Santos, Emmanuelle Taugourdeau, 2021). [14] Werner Roeger, Janos Varga, Jan in 'tVeld et al., (2021) found “A general trade-off between an increase in employment for a particular group and the income of the average group member relative to income per capita. Reforms which aim at increasing employment of low- and medium-skilled workers, are associated with a fall in low- and medium-skilled wages relative to income per capita. Capital owners generally benefit from labour market reforms, with an increasing share of profits in total income that can be attributed to limited entry into the final goods production sector”.

## METHODOLOGY

### Study framework



**Variables of study framework**

***• Independent variables***

LFOSS is labour force on state sector in terms of the whole economy of Vietnam, unit is a thousand people.

LFOOSS is labour force on outside state sector in terms of the whole economy of Vietnam, unit is a thousand people.

LFOFIS is labour force on foreign investing sector in terms of the whole economy of Vietnam, unit is a thousand people.

***• Dependent variables:***

W represents five dependent variables below
Goods productivity calculated on labour of logistics transport industry (LTI), unit is a thousand tons over total labour.

Passenger productivity calculated on labour of LTI, unit is a million people over total labour.

Goods productivity calculated on capital of LTI, unit is a thousand tons over total capital.

Passenger productivity calculated on capital of LTI, unit is a million people over total capital.
X is Gross domestic products.

**HYPOTHESIS**

W = 1: W is impacted by LFOSS, LFOOSS, LFOFIS
W = 0: W is not impacted by LFOSS, LFOOSS, LFOFIS

- **Estimating Logistics regression by Maximum Log Likelihood (LRML) and Assessing fit of a Logistics Regression (AFLR)**

***Estimating Logistics regression by Maximum Log Likelihood (LRML)***

Impact = Log $(\frac{W(I)}{1-(W(I)}$)

Log $(\frac{W(I)}{1-(W(I)})$ = $a_0$+ $a_1A_1$(LFOSS) + $a_2A_2$(LFOOSS) + $a_3A_3$(LFOFIS)

Where
W is given as a value to measure the probability of a variable.

I is short writing of impact (I = impact)
n are positive integers which are 1, 2, 3,…, n
$a_0$ is the intersection of the vertical axis and line of regression

$a_1$, $a_2$, $a_3$ are parameters that have been estimated by multivariate regression

$A_1$, $A_2$, $A_3$ are prediction variables that representing LFOSS, LFOOSS, LFOFIS, respectively.

$$(1)\quad P = \frac{e^{-\log(score)}}{1+e^{-\log(score)}}$$

As equation 1 states, Where,

$e^{-\log(score)} = e^{-\log(Log(W))}$

$= e^{-\log(\text{Intercept's Coefficient+sumproduct (coefficient[A1:A3, inputdata] A1:A8)})}$

$1 + e^{-\log(\text{score})} = 1 + e^{-\log(\log(W))}$

$= 1 + e^{-\log(\text{Intercept's Coefficient+sumproduct (Coefficient [A1:A3, inputdata] A1:AE)})}$

Score = log(W) = Intercept's Coefficient + sumproduct (coefficent|$A_1$: $A_3$, inputdata| $A_1$: $A_3$)

Coefficients of $A_1$, $A_2$, $A_3$ are parameters estimated by multivariate regression in which $A_1$, $A_2$, $A_3$ are independent variables, W is dependent variable. They are then estimated by LRML.

Intercept is intersection between vertical axis and regression line which is the paramater estimated by LRML.

Sumproduct is the formula to calculate the scores independent variables $A_1$, $A_2$, $A_3$ based on the actual values in condition with both rows and columns

$$(2)\ \text{W's Probability} = \frac{e^{-\log(score|A1:\,A3)}}{1+e^{-\log(score|A1:\,A3)}}$$

As equation 2 states the Probability of W to happen, where, Likelihood (LLHD):

W = 1 is to show LH = probability of W

$$\text{LLHD} = \frac{e^{-\log(score|A1:\,A3)}}{1+e^{-\log(score|A1:\,A3)}}$$

W = 0 that means LLHD = 1 – W(E)

$$\text{LLHD} = \frac{1-e^{-\log(score|A1:\,A3)}}{1+e^{-\log(score|A1:\,A3)}}$$

Log – Likelihood = Logarit of LLHD

W = 1: Log likelihood = Ln

$$\text{Ln} = \left(\frac{e^{-\log(score|A1:\,A3)}}{1+e^{-\log(score|A1:\,A3)}}\right)$$

W = 0: Log likelihood = Ln

$$\text{Ln} = \left(\frac{1-e^{-\log(score|A1:\,A3)}}{1+e^{-\log(score|A1:\,A3)}}\right)$$

Maximum LLHD = $\sum_3^1 A$ (Likelihood)
Using solver Parameters by:

Setting Objective = $\sum_3^1 A$ (LLHD)

Maximize by changing coefficient of independent variables $A_1$, $A_2$, $A_3$ and coefficient of intercept.
Selected solving method: CRG Nonlinear

***Assessing fit of a Logistics Regression (AFLR)***

Sort Score from Largest to Smallest

W is impacted by three independent variables $[A_1, A_2, A_3]_{im}$

$W_{im(t)}$ = W|1/0

$W_{im(t)+1} = W_{imt} + A/DV_t$

Propensity rankings (PR) by ranking number from $t_0$ to $t_n$ where t is time, 0 and n are numbers in order

Cumulative percentage (%) of impact = $\frac{\text{Wim(t)}}{\text{Wim(n)I}}$

Cumulative % of W be impacted = $\frac{\text{PR(t)}}{\text{PR(n)}}$

Charting scatter

**THEORETICAL BASIS OF LOGISTICS TRANSPORTATION**

[15] There is an existence of a capacity constraint within the public transport mode. The congestion interactions between cars and buses are associated with the transfer of passengers at bus stops. The non-motorised transport is considered that it impacts on optimal public transport pricing policy (David A.Hensher, 2020). [16] S. Bista, I. Debache, B. Chaix (2020) stated that "The physical activity and sedentary behaviours are related to transport activity. Transport policies encourage people to reach daily recommendations of physical activity. In addition to active transport modes, encouraging people to use public transport increases physical activity and reduces sedentary time". [17] Logistics transportation is often considered a mode of transport which is used by train, tram, bus and other vehicles (Long T. Truong, GrahamcCurrie, 2019).

**DATA SOURCE**

Data is time series between 2005 and 2019. All data are from HCM Statistics Department and HCM Statistical Yearbook.

**STUDY RESULTS**

**TABLE 1:** Output Result of Multivariate Regression

| | | | |
|---|---|---|---|
| R square (RS) | | 0.22027038 (22%) | |
| Adjusted R Square (ARS) | | 0.00761685 (0.76%) | |
| Significance F (SF) | | 0.41465157 | |
| Independent variables | Coefficients | Value of Coefficients | P-Value |
| | $a_0$ | 10.75036461 | 0.20884386 |
| $A_1$ | $a_1$ | -0.001604095 | 0.45217152 |
| $A_2$ | $a_2$ | -4.50119E-05 | 0.70810545 |
| $A_3$ | $a_3$ | -0.000223837 | 0.71071053 |

Source: Compiled result by author

With RS = 0.22027038 (22%), ARS = 0.00761685 (0.76%) is to mean that the input data has been explained by the output of multivariate regression model is 0.76%. The model has statistical significance at 0.41465157. The Coefficients of $a_0$, $a_1$, $a_2$, $a_3$ are 10.75036461, -0.001604095, -4.50119E-05, -0.000223837, respectively. The Coefficients of $a_0$, $a_1$, $a_2$, $a_3$ are to be used as parameters to have Maximum Likelihood in the step of Estimating Logistics regression by Maximum Log Likelihood which will presented in table 2.

**TABLE 2:** Estimating Logistics regression by Maximum Log Likelihood

| Parameters after Maximum likelihood | | Intercept | Coefficient of regression output: A1 | Coefficient of regression output: A2 | Coefficient of regression output: A3 | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 50.1483507 | -0.007971851 | -0.000201834 | -0.001143197 | | | Maximum Likelihood | -8.573815688 |
| Year | No | LTD | A1 | A2 | A3 | SCORE | Probability impacts on LTD | Likelihood | Log-Likelihood |
| 2005 | 1 | 1 | 4,967.40 | 36,694.70 | 1,112.80 | 1.870589374 | 0.866526458 | 0.866526458 | -0.143262636 |
| 2006 | 2 | 1 | 4,916.00 | 37,742.30 | 1,322.00 | 1.829744481 | 0.861731284 | 0.861731284 | -0.148811792 |
| 2007 | 3 | 1 | 4,988.40 | 38,657.40 | 1,562.20 | 0.793288331 | 0.688536963 | 0.688536963 | -0.373186277 |
| 2008 | 4 | 0 | 5,059.30 | 39,707.10 | 1,693.60 | -0.133997115 | 0.466550755 | 0.533449245 | -0.628391349 |
| 2009 | 5 | 0 | 5,040.60 | 41,178.40 | 1,524.60 | -0.088681675 | 0.4778441 | 0.5221559 | -0.649789076 |
| 2010 | 6 | 0 | 5,025.20 | 42,370.00 | 1,729.20 | -0.440318604 | 0.391665055 | 0.608334945 | -0.497029652 |
| 2011 | 7 | 1 | 5,024.80 | 43,423.80 | 2,098.60 | -1.072119366 | 0.255000248 | 0.255000248 | -1.36649076 |
| 2012 | 8 | 0 | 5,017.40 | 44,423.30 | 2,249.80 | -1.387712092 | 0.19977326 | 0.80022674 | -0.222860166 |
| 2013 | 9 | 1 | 4,994.90 | 44,994.60 | 2,518.30 | -1.630601496 | 0.163747979 | 0.163747979 | -1.809426746 |
| 2014 | 10 | 0 | 4,893.20 | 45,269.30 | 2,868.10 | -1.275198199 | 0.218368705 | 0.781631295 | -0.246372139 |
| 2015 | 11 | 0 | 4,779.90 | 45,132.80 | 3,166.80 | -0.685909936 | 0.334943545 | 0.665056455 | -0.407883347 |
| 2016 | 12 | 0 | 4,702.30 | 45,052.20 | 3,591.00 | -0.535970449 | 0.369125456 | 0.630874544 | -0.460648256 |
| 2017 | 13 | 1 | 4,595.40 | 44,905.40 | 4,207.80 | -0.359273969 | 0.411135329 | 0.411135329 | -0.888832851 |
| 2018 | 14 | 0 | 4,525.90 | 45,215.40 | 4,541.20 | -0.248940597 | 0.438084272 | 0.561915728 | -0.57640339 |
| 2019 | 15 | 1 | 4,226.20 | 45,664.60 | 4,768.40 | 1.789825086 | 0.85690583 | 0.85690583 | -0.15442725 |

Source: Compiled result by author

Table 2 is presented information of A1, A2, A3 and results of Maximum Log Likelihood that are parameters of regression coefficients of A1, A2, A3 are -0.001604095, -4.50119E-05, -0.000223837, respectively, and intercept is 10.75036461. Coefficients are value after Maximum Log Likelihood of A1 = -0.007971851, A2 = -0.000201834, A3 = -0.001143197 and intercept is 50.1483507, which is to show that the interception between the vertical axis and the regression lines is still over the horizontal axis., however it has been moved up from 10.75036461 to 50.1483507.

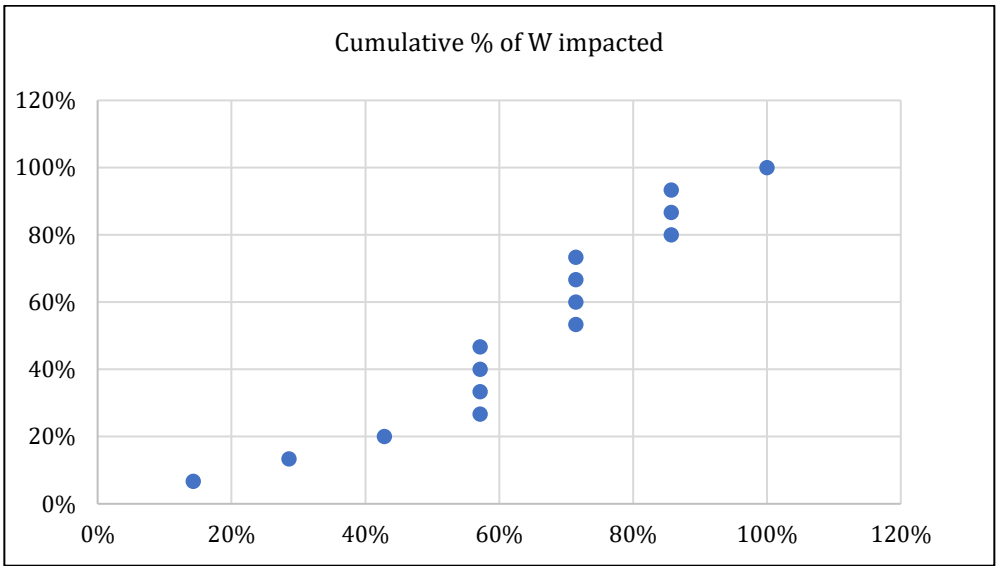
**TABLE 3:** Assessing fit of a Logistics Regression

| Year | No | LTD | SCORE (largest to smallest) | LTD be impacted | Propensity rankings | Cumulative % of impact (A1, A2, A3) | Cumulative % of W impacted |
|---|---|---|---|---|---|---|---|
| 2005 | 1 | 1 | 1.870589374 | 1 | 1 | 14% | 7% |
| 2006 | 2 | 1 | 1.829744481 | 2 | 2 | 29% | 13% |
| 2007 | 15 | 1 | 1.789825086 | 3 | 3 | 43% | 20% |
| 2008 | 3 | 1 | 0.793288331 | 4 | 4 | 57% | 27% |
| 2009 | 5 | 0 | -0.088681675 | 4 | 5 | 57% | 33% |
| 2010 | 4 | 0 | -0.133997115 | 4 | 6 | 57% | 40% |
| 2011 | 14 | 0 | -0.248940597 | 4 | 7 | 57% | 47% |
| 2012 | 13 | 1 | -0.359273969 | 5 | 8 | 71% | 53% |
| 2013 | 6 | 0 | -0.440318604 | 5 | 9 | 71% | 60% |
| 2014 | 12 | 0 | -0.535970449 | 5 | 10 | 71% | 67% |
| 2015 | 11 | 0 | -0.685909936 | 5 | 11 | 71% | 73% |
| 2016 | 7 | 1 | -1.072119366 | 6 | 12 | 86% | 80% |
| 2017 | 10 | 0 | -1.275198199 | 6 | 13 | 86% | 87% |
| 2018 | 8 | 0 | -1.387712092 | 6 | 14 | 86% | 93% |
| 2019 | 9 | 1 | -1.630601496 | 7 | 15 | 100% | 100% |

Source: Compiled result by author

Table 3 gives information result of Assessing fit of a Logistics Regression, the cumulative % of impact $A_1$, $A_2$, $A_3$ on W is from 14% to 100%, namely is years 2005, 2006, 2007 are 14%, 29%, 43%, respectively. 2008-2011 have 57% impacted, 71% impact is between 2012 and 2015, three years have 86% impact i.e. 2016, 2017, and 2018, but only 2019 has 100% impact.

Cumulative % of W was impacted at the lowest percentage (7%) in 2005, while the highest was 100% in 2019. Details from 2006 to 2015 are 13%, 20%, 27%, 33%, 40%, 47%, 53%, 60%, 67%, 73%, respectively. 2016 recorded 80%, while 2017, 2018 and 2019 recorded 87%, 93% and 100%, respectively. The figures in table 3 is to mean that Cumulative % of impact of $A_1$, $A_2$, $A_3$ and Cumulative % of W be impacted are at different levels.




Source: Compiled result by author

**FIGURE 1:** Scatter chart of Cumulative % of $A_1$, $A_2$, $A_3$ and W impacted

The chart (figure 1) defined the scatter between Cumulative % of W impacted and Cumulative % of impact of $A_1$, $A_2$, $A_3$. Cumulative % of W impacted is illustrated by vertical axis, Cumulative % of impact $A_1$, $A_2$, $A_3$ is described by horizontal axis. The scatter chart gives us the picture of single dots under 20% on both of the two axes, and there are four dots under 60% for both of the vertical and horizontal axes, while there are four dots inside 80% of the two axes. Three dots stay under 100%, and finally, only one dot could reach 100% for both vertical and horizontal axes.

**DISCUSSION**

Based on study results presented in table 1, table 2 and figure 1 which show that the multivariate regression model was built suitably to input data at the statistical significance of 0.41465157, the Coefficients parameters of multivariate regression model are acceptable. Coefficients value thereafter had been Maximum Log Likelihood of $A_1$ = -0.007971851, $A_2$ = -0.000201834, $A_3$ = -0.001143197 and intercept is 50.1483507, which means that the interception between the vertical axis and the regression lines is still over the horizontal axis. However, it has been moved up from 10.75036461 to 50.1483507. Result of Assessing fit of a Logistics Regression is Cumulative % of impact $A_1$, $A_2$, $A_3$ are from 14% to 100%, detailing 2005, 2006, and 2007 with 14%, 29%, 43%, respectively. 2008-2011 have 57% impacted, 71% impact is between 2012 and 2015, 86% impact is from 2016 to 2018, while 100% impact was recorded in 2019. Cumulative % of W impacted was lowest at 7% in 2005, and highest at 100% in 2019. Between 2006 and 2015, the impact recorded were 13%, 20%, 27%, 33%, 40%, 47%, 53%, 60%, 67%, 73%, respectively. From 2016 to 2019, they were is 80%, 87%, 93% and 100%, respectively. The figures in table 3 is to tell that Cumulative % of impact of $A_1$, $A_2$, $A_3$ and Cumulative % of W impacted are at different levels. The chart (figure 1) defined the scatter between Cumulative % of W impacted and Cumulative % of impact of $A_1$, $A_2$, $A_3$. Cumulative % of W impacted is illustrated by vertical axis, Cumulative % of impact $A_1$, $A_2$, $A_3$ is described by horizontal axis. The scatter chart gives us the picture of single dots under 20% on both of the two axes, and there are four dots under 60% for both of the vertical and horizontal axes, while there are four dots inside 80% of the two axes. Three dots stay under 100%, and finally, only one dot could reach 100% for both vertical and horizontal axes.

**CONCLUSIONS**

Cumulative % of impact ($A_1$) LFOSS, ($A_2$) LFOOSS, ($A_3$) LFOFIS are from 14% to 100%, the lowest level is 10% in 2005, the highest level is 100% in 2019.

Cumulative % of W impacted has the lowest level as 7% in 2005, the highest as 100% in 2019. The impact level fluctuated upwards between 2006 and 2015 in the likes of 13%, 20%, 27%, 33%, 40%, 47%, 53%, 60%, 67%, and 73%, respectively. The Cumulative % impact of ($A_1$) LFOSS, ($A_2$) LFOOSS, ($A_3$) LFOFIS and Cumulative % of W impacted are at different levels. The scatter chart showed that there is one dot is under 20%, four dots under 60%, four dots inside 80%, three dots under 100% and only one dot reaching 100% levels for both vertical and horizontal axes.

**ACKNOWLEDGEMENT**

This research is funded by University of Economics and Law, Vietnam National University Ho Chi Minh City / VNU-HCM.

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[17] Logistics transportation is often considered a mode transport which is used by train, tram, bus and other vehicles (Long T.Truong, GrahamcCurrie, 2019)