# The Correlation between COVID-19 Confirmed and Recovered Cases in China: Simple Regression Linear Model Evidence

by

**Nuhu A Sansa**

Guangxi University, Economics Department, Nanning, China

Email: nuhusansa09@gmail.com

Ph: +86 135 1781 7904

## Abstract

The number of cases of the COVID - 19 being reported on a daily basis in China is stabilising however there is no studies have been undertaken to evaluate the correlation between the COVID - 19 Confirmed cases and Recovered cases in China. The contemporary study is undertaken to analyse the correlation between the COVID - 19 Confirmed and Recovered Cases from the period dated 20 January 2020 to 23 February 2020 in China. With that concern the present study employed the Simple regression linear model to evaluate the correlation between the COVID - 19 Confirmed Cases and Recovered cases during the period from dated 20 January to 23 February 2020 in China. Time series data from China daily statistics daily reported cases were used by the study to analyse the significant correlation between the two important variables of the study from dated 20 January to 23 February 2020 for China. To assess the correlation between the COVID - 19 Confirmed and recovered cases the study assumes the COVID - 19 Confirmed cases to be independent variable and the COVID - 19 recovered cases to be a dependent variable of the study. The findings of the study were really interesting. The study findings revealed that there is a significant positive correlation between the COVID - 19 Confirmed cases and Recovered cases during the period from dated 20 January 2020 to 23 February 2020 in China.

**Key Words**: COVID -19 confirmed cases, covid - 19 recovered cases, and Simple linear regression model.

## Introduction:

What is COVID – 19? The 2019 novel coronavirus is now named severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) while the disease associated with it is referred to as COVID-19. SARS-CoV-2, was identified in China at the end of 2019 and is a new strain of coronavirus that has not been previously identified in humans.

During the month of December in the year of 2019 (Wuhan City Health Committee, 2019. pg. 1) briefing on the current COVID - 19 stated that some institutions found that many of the pneumonia cases received were related to south china seafood city. From that report the Municipal Health and Health Commission quickly initiating the search regarding South China seafood city where by twenty-seven cases were found, of which seven were in serious condition while the remaining cases found stable and controllable (Wuhan City Health Committee, 2019.

pg. 1). On 9 January 2020, The China Government officially reported the outbreak of COVID - 19 to the public where the initial cases were found at the Wuhan City ( ECDC, 2020, pg. 1 ) reported that, "On 9 January 2020, China CDC reported that a novel coronavirus (SARS-CoV-2) had been detected as the causative agent for 15 of the 59 pneumonia cases. On 10 January 2020, the first novel coronavirus genome sequence was made publicly available. The sequence was deposited in the GenBank database (accession number MN908947) and was uploaded to the Global Initiative on Sharing all Influenza Data (GISAID). Preliminary analysis showed that the novel coronavirus (SARS-CoV-2) clusters with the SARS-related CoV clade and differs from the core genome of known bat CoVs (ECDC, 2020, pg. 1).

As dated 23 February 2020, it has been reported that the confirmed COVID 19 is 77,048, suspected number is 4,148, recovery number is 23, 138 and the death number amounted to 2,445.

The China Government has taken several seriously measures to fight against the COVID 19  spreading including ban for the public gathering, building the big hospital at Wuhan City particularly for the COVID - 19 infected patients, Providing necessary medical materials such as marks, temperature thermometers, providing free medical for the COVID - 19 patient, collecting physical money cash from the areas which having high level of infections for special treatment and ban its circulation to safe areas,  and recently the China authority provide the subsidies for the workers who are particularly serving the hospitals areas.

Despite the fact that the number of cases of the Covid - 19 being reported on a daily basis in China is stabilising there is no studies have been undertaken to evaluate the correlation between the Covid - 19 Confirmed cases and Recovered cases in China. The contemporary study is undertaken to analyze the correlation between the Covid - 19 Confirmed and Recovered Cases from the period dated 20 January 2020 to 23 February 2020 in China. The implication of the study will be to the Medical health study, economics study and most important to the China Government.

**Motivation and Objective of the Study:**

The number of cases of the COVID - 19 being reported on a daily basis in China is stabilising however there is no studies have been undertaken to evaluate the correlation between the COVID - 19 Confirmed cases and Recovered cases in China.

As dated 23 February China's newly recovered coronavirus patients outnumber new infections for 5th consecutive day while 18 new infections on mainland regions outside Hubei with 21 province level regions recording zero new infections (Guangxi University Report 2020).

New coronavirus cases in China appear to have stabilized in recent days, but world health officials cautioned the public against reading too much into those numbers. The outbreak could still get worse, World Health Organization officials said Wednesday. "The outbreak could still go in any direction," Tedros Adhanom Ghebreyesus, director-general of WHO, warned at a news conference at the agency's headquarters in Geneva. The slowing number of new cases "must be interpreted with extreme caution." (Lovelace, 2020).

Despite the fact that the number of cases of the COVID - 19 being reported on a daily basis in China is stabilising there is no studies have been undertaken to evaluate the correlation between the COVID - 19 Confirmed cases and Recovered cases in China. The contemporary study is undertaken to analyse the correlation between the COVID - 19 Confirmed and Recovered Cases from the period dated 20 January 2020 to 23 February 2020 in China. The implication of the study will be to the Medical health study, economics study and most important to the China Government.

**Objective of the Study:**

The contemporary study is undertaken to analyse the correlation between the COVID - 19 Confirmed and Recovered Cases from the period dated 20 January 2020 to 23 February 2020 in China.

**Literature review:**

**How COVID - 19 Spread**:

Literature evidence shows that the original source of the COVID - 19 is from the animal and recently the virus is spreading from human to human transmission. Recently there are no reasonable facts to identify how easily   viruses are transmitted from person to person. However the virus basically transmitted through respiratory droplets that human beings sneeze, cough, or exhale.

The incubation period for COVID-19 (i.e. the time between exposure to the virus and onset of symptoms) is currently estimated at between two and 14 days. At this stage, we know that the virus can be transmitted when those infected show (flu-like) symptoms.

**Symptoms of COVID – 19:**

The recent evidence shows that the fundamental symptoms of the COVID - 19 is where the virus can cause mild, flu - like symptoms such as fever, cough, difficulty breathing, pain in the muscles and the tiredness.

More serious cases develop severe pneumonia, acute respiratory distress syndrome, sepsis and septic shock that can lead to the death of the patient. People with existing chronic conditions seem to be more vulnerable to severe illness.

**How to Protect from COVID – 19:**

From the present fact that the virus is spread among human beings, medical experts recommend wearing a mask for every day movements particularly the moment you move outside from your home place where your heading you will necessarily meet other people.

Due to the fact that the virus is spread human to human particularly from the infected person to another, it is advisable to avoid the physical contact with the persons with cough symptoms.

Since the evidence shows that the origin of the virus is from the animals it is advisable to escape visiting places where animals are kept avoiding physical contact with any kind of animal, their excretions or droppings.

In addition to that it is recommended to follow and obey the general rules regarding hand hygiene and food hygiene. That means wash your hands with soap and water OR use an alcohol-based disinfectant solution before eating, after using the toilet and after any contact with animals.

**Facts about the vaccine against the COVID – 19:**

There are currently no vaccines against coronaviruses, including SARS-CoV-2. This is why it is very important to prevent infection or contain further spread of an infection.

The development of vaccines takes time. Several pharmaceutical companies are working on vaccine candidates. It will, however, take months before any vaccine can be widely used as it needs to undergo extensive testing to determine its safety and efficacy (ECDC, 2020, pg. 1).

## The Impact of the COVID - 19 to the Petrol Price in China:

Recent evidence in China shows that the oil price trend tends to decline since the outbreak of the COVID - 19 in particular the oil price from December to January.

Gasoline Prices in China decreased to 0.72 USD/**Litre** in January from 0.73 USD/**Litre** in December of 2019 (Trading Economic 2020).

## China Government Actions to Fight against the COVID – 19:

The China Government has taken several seriously measures to fight against the COVID 19 spreading including ban for the public gathering, building the big hospital at Wuhan City particularly for the COVID - 19 infected patients, Providing necessary medical materials such as marks, temperature thermometers, providing free medical for the COVID - 19 patient, collecting physical money cash from the areas which having high level of infections for special treatment and ban its circulation to safe areas, and recently the china authority provide the subsidies for the workers who are particularly serving the hospitals areas.

## Current Status for COVID - 19 in China:

As dated 23 February 2020, it has been reported that the confirmed COVID 19 is 77,048, suspected number is 4,148, recovery number is 23, 138 and the death number amounted to 2,445.

## Research Methodology:

The contemporary study is undertaken to analyse the correlation between the COVID - 19 Confirmed and Recovered Cases from the period dated 20 January 2020 to 23 February 2020 in China. The study applied the Simple Regression in Double Log and Semi Log Linear Models to analyse the correlation between the COVID - 19 Confirmed and Recovered cases during the period from dated 20 January 2020 to 23 February 2020. Time series data from China Daily Statistics COVID -19 for Confirmed cases and Recovered cases were used by the study from the period dated 20 January 2020 to 23 February for China.

To analyse the correlation between the COVID - 19 Confirmed and Recovered Cases during the period from dated 20 January 2020 to 23 February 2020 in China the study used the following equation:

$\ln Y_t = \alpha_0 + \beta_1\, CNF/C_t + e_{1t}$ …………………….……………….(1) Where, $\ln Y$ is the natural log of Dependent Variable, CNF/C is Covid 19 Confirmed cases . The $\alpha_0$ is constant, and $\beta_1$, is the coefficient parameter.

The correlation between the Covid - 19 Confirmed cases and Recovered Cases is evaluated by the following equation:

R/Ct   = α0 + β1 CNF/Ct + e2t ……………………………………….(2) Where R/Ct is the natural log of the Covid - 19 Recovered cases.

**Empirical Results and Discussion:**

The contemporary study employed the descriptive and analytical quantitative techniques to evaluate the correlation between the COVID - 19 Confirmed and Recovered cases during the period from dated 20 January 2020 to 23 February 2020 in China.

**The Correlation Between COVID - 19 Confirmed and Recovered Cases from the Period Dated 20 January 2020 to 23 February 2020 In China:**

The contemporary study is undertaken to analyse the correlation between the COVID - 19 Confirmed and Recovered Cases from the period dated 20 January 2020 to 23 February 2020 in China

To find the correlation between the COVID - 19 Confirmed and Recovered cases the study assumes the COVID - 19 Confirmed cases to be the independent variable while the COVID - 19 assume to be the dependent variable of the study.

The study regression results revealed that there is a significant positive correlation between the COVID - 19 Confirmed cases and Recovered cases during the period from dated 20 January 2020 to 23 February 2020 in China. The coefficient for the COVID - 19 Confirmed cases is 0.3206% which means that for each additional for the COVID - 19 Confirmed cases the COVID - 19 Recovered cases increases by 0.3206% cases as well (Table 1).

**TABLE 1: Regression Results Between the COVID - 19 Confirmed Cases and Recovered cases during the period from dated 20 January 2020 to 23 February 2020 in China[1]**

Dependent Variable : COVID - 19  Recovered Cases

| V | C | STD | T | P |
|---|---|---|---|---|
| | | | | |
| RC (b) | 0.3206 | 6.1 | 0.0526 | 0 |
| CN | 282.7 | | | 0 |
| R-S | 0.9 | | | |
| A.R.S | 0.8970 | | | |
| S.E.O | 460.5 | | | |
| NOB =35 | | | | |

Where V is Variable, RC(b) is Recovered cases, C is the coefficient, STD is the Standard deviation, T is the T-statistic, P is the probability, CN is constant, RS is the R Square, A.R.S is the Adjusted R - Square, S.E.O is the standard error of estimation, and NOB is the number of observation.

[1] Origin : Appendix 2

**Appendix 1: The following table shows the COVID - 19 confirmed cases, recovered cases, and the death cases from the period dated 20 January 2020 to 23 February 2020 in China[2]**

| DATE | CONF CASES | REC CASES | D/CASES[3] |
|---|---|---|---|
| 20 Jan 2020 | 291 | | |
| 21 Jan 2020 | 440 | | 6 |
| 22 Jan 2020 | 571 | | 17 |
| 23 Jan 2020 | 830 | 34 | 25 |
| 24 Jan 2020 | 1287 | 38 | 41 |
| 25 Jan 2020 | 1975 | 49 | 56 |
| 26 Jan 2020 | 2744 | 51 | 80 |
| 27 Jan 2020 | 4515 | 60 | 106 |
| 28 Jan 2020 | 5974 | 103 | 132 |
| 29 Jan 2020 | 7711 | 124 | 170 |
| 30 Jan 2020 | 9692 | 171 | 213 |
| 31 Jan 2020 | 11791 | 243 | 259 |
| 1 Feb 2020 | 14380 | 328 | 304 |
| 2 Feb 2020 | 17205 | 475 | 361 |
| 3 Feb 2020 | 20438 | 632 | 425 |
| 4 Feb 2020 | 24324 | 892 | 490 |
| 5 Feb 2020 | 28018 | 1153 | 563 |
| 6 Feb 2020 | 31161 | 1540 | 636 |
| 7 Feb 2020 | 34546 | 2050 | 722 |
| 8 Feb 2020 | 37198 | 2649 | 811 |
| 9 Feb 2020 | 40171 | 3281 | 908 |
| 10 Feb 2020 | 42638 | 3996 | 1016 |
| 11 Feb 2020 | 44653 | 4740 | 1113 |
| 12 Feb 2020 | 52526 | 5911 | 1367 |
| 13 Feb 2020 | 63851 | 6723 | 1380 |
| 14 Feb 2020 | 66492 | 8096 | 1523 |
| 15 Feb 2020 | 68500 | 9419 | 1665 |
| 16 Feb 2020 | 70548 | 10844 | 1770 |
| 17 Feb 2020 | 72436 | 12556 | 1868 |
| 18 Feb 2020 | 74185 | 14376 | 2004 |
| 19 Feb 2020 | 74576 | 16155 | 2118 |
| 20 Feb 2020 | 75465 | 18264 | 2236 |

[2] Source: China Daily Statistics COVID - 19
[3] Where CONF CASES is the COVID - 19 Confirmed cases, and D/CASES is the death cases

| | | | |
|---|---|---|---|
| 21 Feb 2020 | 76288 | 20659 | 2345 |
| 22 Feb 2020 | 76936 | 22888 | 2442 |
| 23 Feb 2020 | 77150 | 24734 | 2592 |
| | | | |
| **TOTAL** | **77150** | **24734** | **2592** |

**Appendix 2: From appendix 1 the following table shows the regression calculations for the regression between The COVID - 19 Confirmed cases and the COVID-19 recovered cases during the period from dated 20 January 2020 to 23 February 2020 in China[4]**

| DATE[5] | C/C | R/C | X² | Y² | XY |
|---|---|---|---|---|---|
| 20 Jan 2020 | 291 | | 84681 | 0 | 0 |
| 21 Jan 2020 | 440 | | 193600 | 0 | 0 |
| 22 Jan 2020 | 571 | | 326041 | 0 | 0 |
| 23 Jan 2020 | 830 | 34 | 688900 | 1156 | 28220 |
| 24 Jan 2020 | 1287 | 38 | 1656369 | 1444 | 48906 |
| 25 Jan 2020 | 1975 | 49 | 3900625 | 2401 | 96775 |
| 26 Jan 2020 | 2744 | 51 | 7529536 | 2601 | 139944 |
| 27 Jan 2020 | 4515 | 60 | 20385225 | 3600 | 270900 |
| 28 Jan 2020 | 5974 | 103 | 35688676 | 10609 | 615322 |
| 29 Jan 2020 | 7711 | 124 | 59459521 | 15376 | 956164 |
| 30 Jan 2020 | 9692 | 171 | 93934864 | 29241 | 1657332 |
| 31 Jan 2020 | 11791 | 243 | 139027681 | 59049 | 2865213 |
| 1 Feb 2020 | 14380 | 328 | 206784400 | 107584 | 4716640 |
| 2 Feb 2020 | 17205 | 475 | 296012025 | 225625 | 8172375 |
| 3 Feb 2020 | 20438 | 632 | 417711844 | 399424 | 12916816 |
| 4 Feb 2020 | 24324 | 892 | 591656976 | 795664 | 21697008 |
| 5 Feb 2020 | 28018 | 1153 | 785008324 | 1329409 | 32304754 |
| 6 Feb 2020 | 31161 | 1540 | 971007921 | 2371600 | 47987940 |
| 7 Feb 2020 | 34546 | 2050 | 1193426116 | 4202500 | 70819300 |
| 8 Feb 2020 | 37198 | 2649 | 1383691204 | 7017201 | 98537502 |
| 9 Feb 2020 | 40171 | 3281 | 1613709241 | 10764961 | 131801051 |
| 10 Feb 2020 | 42638 | 3996 | 1817999044 | 15968016 | 170381448 |
| 11 Feb 2020 | 44653 | 4740 | 1993890409 | 22467600 | 211655220 |
| 12 Feb 2020 | 52526 | 5911 | 2758980676 | 34939921 | 310481186 |
| 13 Feb 2020 | 63851 | 6723 | 4076950201 | 45198729 | 429270273 |
| 14 Feb 2020 | 66492 | 8096 | 4421186064 | 65545216 | 538319232 |

---

[4] Source: Appendix 1
[5] Where by C/C is COVID - 19 Confirmed cases and RC is the COVID -19 Recovered cases in China.

| 15 Feb 2020 | 68500 | 9419 | 4692250000 | 88717561 | 645201500 |
|---|---|---|---|---|---|
| 16 Feb 2020 | 70548 | 10844 | 4977020304 | 117592336 | 765022512 |
| 17 Feb 2020 | 72436 | 12556 | 5246974096 | 157653136 | 909506416 |
| 18 Feb 2020 | 74185 | 14376 | 5503414225 | 206669376 | 1066483560 |
| 19 Feb 2020 | 74576 | 16155 | 5561579776 | 260984025 | 1204775280 |
| 20 Feb 2020 | 75465 | 18264 | 5694966225 | 333573696 | 1378292760 |
| 21 Feb 2020 | 76288 | 20659 | 5819858944 | 426794281 | 1576033792 |
| 22 Feb 2020 | 76936 | 22888 | 5919148096 | 523860544 | 1760911168 |
| 23 Feb 2020 | 77150 | 24734 | 5952122500 | 611770756 | 1908228100 |
|  |  |  |  |  |  |
| **TOTAL** | **77150** | **24734** | **5952122500** | **611770756** | **1908228100** |

**Summary of Findings:**

The study regression results revealed that there is a significant positive correlation between the COVID - 19 Confirmed cases and Recovered cases during the period from dated 20 January 2020 to 23 February 2020 in China. The coefficient for the COVID - 19 Confirmed cases is 0.3206% which means that for each additional for the COVID - 19 Confirmed cases the COVID - 19 Recovered cases increases by 0.3206% cases as well.

**Limitation of The Study:**

Since the China Government publicly announced the outbreak of the COVID - 19 dated 9 January 2020, the study efforts to find the data for COVID - 19 Confirmed, Recovered and Death Cases specifically for the interval period between 9 January 2020 to 19 January 2020 were fruitless.

**Conclusion:**

The contemporary study is undertaken to analyse the correlation between the COVID - 19 Confirmed and Recovered Cases from the period dated 20 January 2020 to 23 February 2020 in China.
The study regression results revealed that there is a significant positive correlation between the COVID - 19 Confirmed cases and Recovered cases during the period from dated 20 January 2020 to 23 February 2020 in China.

**Acknowledgement**

**References**

China Daily Reports (2020). Daily Reports statistics COVID - 19.

European Centre for Disease Prevention and Control (2020). Risk assessment: Outbreak of acute respiratory syndrome associated with a novel coronavirus, Wuhan, China; first update

2020 [updated 22 January 2020]. Available from: https://www.ecdc.europa.eu/en/publications-data/risk-assessment-outbreck.

Guangxi University Report (2020). Daily Report of COVID - 19 dated 23 February 2020 - China.

Holmes E. (2020). Initial genome release of novel coronavirus 2020 [14 January 2020]. Available from: http://virological.org/t/initial-genome-release-of-novel-coronavirus/319.

Lovelace. B, (2020). CNBC Report. (World Health Organisation - Coronavirus in China have stabilized but warms that could change).

News. X. E. (2020). Claim that a new coronavirus is identified in Wuhan 2020 [14 January 2020]. Available from: http://www.xinhuanet.com/2020-01/09/c_1125438971.htm.

Singh, J. (2020). COVID -19 and its impact on society. Electronic Research Journal of Social Sciences and Humanities. Volume 2, Issue I. pp. 102-105

Trading Economics (2020). China Gasoline Prices 1995 - 2020 data. National Bureau of Statistics of China.

World Health Organization (2020). Coronavirus Disease 2019 (COVID - 19) - Situation Report - 29.

Wuhan City Health Committee (2019). Wuhan Municipal Health and Health Commission's briefing on the current pneumonia epidemic situation in our city 2019 [updated 31 December 201914 January 2020]. Available from: http://wjw.wuhan.gov.cn/front/web/showDetail/2019123108989.