

Travelling, retail activities, trade openness and COVID-19 incidence in Vietnam

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Abstract:

Coronavirus disease 2019 (COVID-19) was first detected in Wuhan, China at the end of 2019; and then quickly spread to become a global pandemic. Vietnam, a country located in Southeast Asia, is also affected by the pandemic. The first case of COVID-19 infection was recorded in the country on 23 January 2020; and by the end of this year, the country reported a total of 1465 confirmed cases of COVID-19. Nevertheless, the disease infection incidence is different among provinces in Vietnam. In this research, we explore the effects of travel, retail activities, and trade openness on the disparities in the spread incidence of COVID-19 among Vietnam's 63 provinces in 2020, utilising cross-sectional provincial-level data. Empirical findings in this research indicate that travel activities and trade openness are likely to exert positive and significant impacts on COVID-19 incidence. In contrast, retail activities appear not to significantly affect the variance in COVID-19 incidence among the Vietnamese provinces in 2020.

Keywords: COVID-19 incidence, retail activities, trade openness, travelling activities, Vietnam.

Classification number: 2.1

1. Introduction

Coronavirus disease 2019 (COVID-19) was first identified in Wuhan, China, towards the end of 2019, swiftly escalating to a global pandemic. Numerous studies have found associations between socioeconomic factors and the spread of COVID-19 [1-6]. However, these studies often utilise cross-national data or focus on data from the United States, China, Europe, or South America.

Vietnam, a Southeast Asian country, has been impacted by the COVID-19 pandemic, albeit to a lesser extent. The first case of COVID-19 was recorded in Vietnam on 23 January 2020, with a total of 1,465 confirmed cases reported by the year's end. Yet, the incidence of COVID-19 varied among the provinces. This paper aims to examine whether travel, retail activities, and trade openness influence the variation in COVID-19 incidence across the provinces, drawing on aggregate data from all 63 provinces for 2020.

Travel and retail activities, which relate to local and tourist mobility and contact, may impact the spread

of the virus, as evidenced in research conducted in Chile and China [4, 7]. Additionally, trade openness could facilitate the spread of COVID-19 through import and export-related activities and international transportation, as suggested by cross-country studies [8, 9]. Consequently, these factors could potentially influence the variance in COVID-19 spread among Vietnamese provinces. To the best of our knowledge, there is scant empirical research on this topic concerning Vietnam, thus our investigation seeks to contribute to the existing literature.

The remainder of the paper is structured as follows: Section two describes the data and methodology, section three presents the results, and section four offers the conclusion.

2. Data and method

Employing Vietnamese provincial aggregate data for 2020, this paper investigates the relationship between economic activities, trade openness, and COVID-19 incidence using the following cross-sectional model:

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$$Y_i = \alpha + \beta_1 \text{Travelling}_i + \beta_2 \text{Retail}_i + \beta_3 \text{Openness}_i + \beta_4 \text{Control}_i + \varepsilon_i$$

where i signifies provinces in Vietnam. The dependent variable, Y , represents COVID-19 incidence. Travelling and retail symbolise travel and retail activities in the provinces, respectively. Openness refers to trade openness, while control represents variables encompassing socioeconomic, health, and climate factors potentially affecting COVID-19 incidence. ε denotes the error term.

In this study, the infection rate, computed as the number of confirmed COVID-19 cases per million people, serves as a proxy for COVID-19 incidence. Furthermore, we attempt to use the infection ratio, calculated as the number of confirmed COVID-19 cases in each province relative to the total number of confirmed cases in Vietnam, as an alternate measure of provincial COVID-19 spread disparity.

The Ministry of Health of Vietnam (MOH) provides the data on confirmed COVID-19 cases.

It is essential to note the challenges posed by missing or inconsistent data across Vietnam's 63 provincial-level administrative units, particularly for 2020. These constraints limit our choice of proxy measures for provincial travel and retail activities, as well as socioeconomic factors.

Owing to the unavailability of provincial tourist data, we use a proxy for the travelling variable, calculated as local travel turnover per capita. The retail variable is measured by local retail sales of goods and services per capita, while openness is gauged by the sum of exports and imports as a proportion of each province's GDP.

Control variables encompass socioeconomic factors related to COVID-19 contagion, selected based on previous studies [1-7] and the availability

Table 1. Description and data sources of variables.

Variables	Description	Sources
<i>Infection rate</i>	Number of confirmed COVID-19 cases of each province/1 million people	MOH
<i>Infection ratio</i>	Number of confirmed COVID-19 cases of each province/total number of confirmed COVID-19 cases of Vietnam	MOH
<i>Retail</i>	Local retail sales of goods and services/Population	General Statistics Office, Ministry Planning and Investment of Vietnam (GSO-MPIV) and Statistics Office of Vietnamese Provinces (SOVP)
<i>Travelling</i>	Local turnover of travelling/Population	GSO-MPIV and SOVP
<i>Openness</i>	(Import + export)/GDP	Data on provinces' Import and Export are collected from General Department of Vietnam Customs (GDVC). Data on provinces' GDP are collected from SOVP and Reports on the socio-economic situation in 2020 of local governments
<i>Population density</i>	Number of people per square kilometre of each province	GSO-MPIV
<i>In-migration rate</i>	Number of people from different provinces in-migrates to a province per 1,000 population of in-migration province.	GSO-MPIV
<i>Labor rate</i>	Percentage of employed population at 15 years of age and above as compared to population.	GSO-MPIV
<i>Income per capita</i>	Monthly average income per capita	GSO-MPIV
<i>Difference in per capita income</i>	Difference between the highest income quintile and the lowest income quintile on monthly average living expenditure per capita	GSO-MPIV
<i>Mortality rate</i>	Infant mortality rate	GSO-MPIV
<i>Hospital beds</i>	Number of hospital beds per 1,000 people	GSO-MPIV
<i>Doctors</i>	Number of doctors per 1,000 people	GSO-MPIV
<i>PAPI</i>	Vietnam Provincial Governance and Public Administration Performance Index (PAPI)	Centre for Community Support Development Studies (CECODES), United Nations Development Programme (UNDP) and Vietnam Fatherland Front (VFF)
<i>Temperature</i>	Average temperature (°C)	Climate-data.org (based on European Centre for Medium-Range Weather Forecasts Data)
<i>Humidity</i>	Average humidity (%)	Climate-data.org (based on European Centre for Medium-Range Weather Forecasts Data)

Table 2. Descriptive statistics.

Variables	Mean	Standard deviation	Minimum	Maximum
Infection rate	14.93929	46.17038	0	354.853
Retail	42.23264	20.59118	11.00702	112.6303
Travelling	0.0621159	0.1529627	0.0000274	0.866607
Openness	11.14961	79.51587	0.021645	632.1544
Population density	521	684.1637	52	4476
In-migration rate	4.755556	9.638511	0.2	62.7
Labor rate	56.06508	4.028373	45.7	64.9
Income per capita	3634.746	1133.592	1737	7034
Difference in per capita income	6.655556	1.973639	3.48	12.66
Mortality rate	15.28889	6.687111	7.6	36.2
Hospital beds	3.553942	1.062711	1.906968	6.400269
Doctors	0.9830839	0.2948754	0.43482	1.894822
PAPI	45.45538	2.138296	40.096	53.29576
Temperature	24.56495	2.136618	19.7	27.41667
Humidity	0.7969577	0.0203085	0.723333	0.835833

Source: Authors' calculation.

of Vietnamese provincial data. These variables include population density, in-migration rate, labour rate, income per capita, and difference in per capita income.

PAPI serves as an additional control variable to account for potential variations in local authorities'

response to the spread of COVID-19. Variables relevant to the health system, including mortality rate, hospital beds, and doctors, are also integrated into the model. Lastly, temperature and humidity variables are included to control for potential effects of local climate on COVID-19 incidence.

This research employs 2020 data for all variables, with the exception of the 'doctors' variable. As 2020 data pertaining to the number of doctors in Vietnamese provinces are unavailable (at the time of writing), 2019 data have been utilised instead. Detailed descriptions and data sources for these variables are presented in Table 1. Additionally, descriptive statistics and a correlation matrix for the variables are offered in Tables 2 and 3, respectively.

The correlation matrix in Table 3 reveals that the correlation amongst the independent variables is moderate, thus eliminating the potential for multicollinearity in the regression analysis. The Ordinary Least Squares (OLS) regression method, with robust standard errors, is employed to estimate model (1) in this research.

Table 3. Correlation matrix of coefficients among variables.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Infection rate (1)	1														
Retail (2)	0.246	1													
Travelling (3)	0.3946	0.5822	1												
Openness (4)	0.9423	0.19	0.3513	1											
Population density (5)	0.1229	0.4979	0.6978	0.0792	1										
In-migration rate (6)	0.1186	0.3889	0.1871	0.1277	0.4461	1									
Labor rate (7)	-0.4023	-0.5776	-0.5199	-0.3308	-0.3926	-0.0245	1								
Income per capita (8)	0.2403	0.6848	0.5061	0.195	0.709	0.6483	-0.443	1							
Difference in per capita income (9)	-0.177	-0.41	-0.1959	-0.0942	-0.5046	-0.3114	0.3717	-0.668	1						
Mortality rate (10)	-0.2143	-0.5372	-0.2394	-0.1449	-0.4569	-0.2979	0.3079	-0.7411	0.6093	1					
Hospital beds (11)	0.304	-0.0196	0.1459	0.3412	-0.1207	-0.1689	-0.0788	-0.1271	0.1034	0.1578	1				
Doctors (12)	0.3119	-0.0023	0.2354	0.3378	0.177	0.0219	0.0661	-0.0163	0.1484	0.0768	0.5667	1			
PAPI (13)	-0.0672	-0.0221	0.0286	-0.064	-0.059	-0.095	-0.047	0.0154	0.0125	-0.1087	0.3311	0.0809	1		
Temperature (14)	-0.0666	-0.0427	0.0082	-0.0824	-0.052	-0.1413	0.0465	-0.1158	-0.0397	0.1068	-0.0198	-0.1416	0.1013	1	
Humidity (15)	-0.01	-0.0602	-0.1019	0.0603	-0.0987	-0.0292	0.0683	-0.1647	0.2478	0.1979	0.1277	0.1953	-0.1435	-0.0762	1

Source: Authors' calculation.

3. Results

Table 4 delivers the research's estimation results. In regression (I) of Table 4, 'infection rate' is used as a proxy for COVID-19 incidence, and it is found that the coefficients for the variables of openness to trade and travelling activities are positive and significant at one and ten percent levels respectively. This suggests that both travelling activities and trade openness exert a significant and positive impact on the infection rate in Vietnamese provinces in 2020. Estimation results in regression (I) further demonstrate that retail activities are not significantly correlated with the infection rate. Similarly, other variables of socioeconomic factors and variables of health system and climate appear to have insignificant effects on the disparities in infection rates across Vietnamese provinces in 2020.

In regression (II) of Table 4, 'infection ratio' is employed as an alternative measure of COVID-19 incidence variance amongst provinces in Vietnam in 2020. Estimation results from regression (II) also signify that the coefficients for the two variables of trade openness and travelling activities are positive and significant at the one percent level. This reiterates that travelling activities and trade openness have a significant and positive effect on the spread of COVID-19 among Vietnamese provinces. The coefficients on the variable of retail activities and on other variables in the estimation results are found to be insignificant. This implies that variables relating to socioeconomic factors, the health system, and climate within the model are likely not to have a substantial effect on the disparities in the COVID-19 infection ratio across Vietnamese provinces in 2020.

In summary, the estimation results demonstrate that trade openness and travelling activities have a positive and significant impact on the spread of COVID-19. Conversely, retail activities are

Table 4. The estimation results of effects of travelling, retail activities and trade openness on COVID-19 incidence of Vietnamese provinces in 2020.

	(I)	(II)
Retail	-0.09266 (0.17183)	-0.000254 (0.000188)
Travelling	43.7896* (25.0215)	0.122755*** (0.036229)
Openness	0.49515*** (0.02868)	0.000339*** (3.22e-05)
Population density	-0.00891 (0.00645)	4.82e-07 (7.83e-06)
In-migration rate	0.28935 (0.27277)	-7.50e-05 (0.000337)
Labor rate	-1.24221 (0.77093)	-0.000606 (0.000716)
Income per capita	-0.00522 (0.00535)	6.97e-07 (5.63e-06)
Difference in per capita income	-2.43921 (1.81933)	-0.001321 (0.00167)
Mortality rate	-0.80011 (0.53576)	-0.000400 (0.000524)
Hospital beds	-1.51218 (2.35988)	-0.00331 (0.00257)
Doctors	11.4105 (9.6131)	0.011596 (0.008653)
PAPI	-0.76172 (1.22006)	-0.001601 (0.001306)
Temperature	0.23954 (0.89464)	-0.000813 (0.00107)
Humidity	-89.2650 (171.451)	-0.155107 (0.171146)
Observations	63	63
R-squared	0.912	0.900

Source: Authors' calculation.

Note: robust standard errors in parentheses; ***: denotes significance at the one percent level; *: denotes significance at the ten percent level. Regression (I) employs the 'infection rate' as a measure of COVID-19 incidence, whilst regression (II) utilises 'infection ratio' as an alternative measure. The dependent variables in regression (I) and (II) are calculated from the number of confirmed COVID-19 cases documented in Vietnamese provinces from 23 January 2020 (when the first case of COVID-19 was detected in Vietnam) to 31 December 2020.

surprisingly found to have an insignificant impact on the transmission of COVID-19 amongst Vietnam's provinces in 2020. The significant effect of travelling activities on COVID-19, as discovered in this paper, is in agreement with findings that human mobility has a strong correlation with COVID-19 outcomes, such as those found in studies in Chile and China [4, 7]. Moreover, evidence that trade openness impacts the spread rate of COVID-19 in this investigation aligns with the findings in [8, 9], where countries' levels of globalisation or openness are found to influence the transmission speed of the coronavirus.

4. Conclusions and policy recommendations

This study utilises aggregate data from 63 provinces to scrutinise the effect of travelling, retail activities, and trade openness on COVID-19 incidence in Vietnamese provinces in 2020. To the best of our knowledge, no prior empirical research has been conducted on this subject in Vietnam, which suggests that this research could contribute to scientific knowledge.

Cross-sectional estimation results from our study indicate that travelling activities and provinces' trade openness do have positive and significant impacts on the variation in COVID-19 incidence amongst Vietnamese provinces in 2020. Conversely, retail activities are found to be unlikely to exert a significant effect on COVID-19 incidence variation in these provinces for 2020. The results relating to the significant effects of travel and openness on the spread of COVID-19 suggest that intensive control policies, encompassing early travel restrictions, border and entry control measures, community isolation, and social distancing, should be implemented promptly to curtail the spread of COVID-19 at the initial stage of an outbreak. These policies are particularly beneficial in densely populated nations like Vietnam, which have strong international social and economic

ties, in order to minimise case increases in future outbreaks of COVID-19-like pandemics, particularly when no vaccine is yet available [5, 7-12].

Additionally, the negligible impact of retail activities on the spread of COVID-19 in Vietnamese provinces, as discovered in this research, may suggest that Vietnamese authorities propagated and implemented effective control measures to prevent COVID-19 spread in retail and service activities within local communities. This has, to some extent, led to Vietnam's success in controlling the epidemic outbreak in localities in 2020 [11-15].

This research has certain limitations. Firstly, the empirical estimations could provide more insight if the research were to use panel data (e.g., utilising 12 monthly datasets from 63 Vietnamese provinces in 2020) for empirical analysis, as opposed to solely using cross-sectional aggregate data. Regrettably, monthly (and daily) provincial data for almost all variables in the research model are unavailable in Vietnam. Secondly, it would be interesting for the research to further investigate the effect of travelling, retail activities, and trade openness on the spread of COVID-19 in Vietnamese provinces in 2021. However, data on the total number of confirmed COVID-19 cases for each province in Vietnam for 2021 are currently unavailable. Future studies may undertake this subject for 2021 when the data become accessible.

CRedit author statement

Duong Nguyen Minh Huy: Methodology (data and method), Formal analysis, Writing, Editing; Do Anh Duc: Data collection, Writing.

COMPETING INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this article.

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