СОЦИАЛЬНО-ЭКОНОМИЧЕСКОЕ РАЗВИТИЕ

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India-Vietnam Bilateral Trade and Investment Relations: An Empirical Analysis

Abstract. The relations between India and Vietnam have been strengthening in both social and economic aspects. The bilateral trade and investment relations between the two countries are on an upward trend. In this context, the present paper analyzes the trade intensity between India and Vietnam and provides an overview of the investment relations. The study also examines the impact of the host country's GDP and exchange rate on the home country's export level for both India and Vietnam using the Multilayer Perceptron Neural Network technique of Artificial Neural Network. The main findings of the study show that before 2017, India's exports are more intensive than imports with Vietnam and Vietnam's imports are more intensive than exports with India. However, since 2017, this trend is slightly reversed and Vietnam's exports are more intense than imports with India. Furthermore, it is found that the host country's GDP and exchange rate have a significant impact on India and Vietnam's bilateral exports.

Keywords: India, Vietnam, trade, FDI, Trade Intensity Index, Multilayer Perceptron Network

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Индийско-вьетнамские торговые и инвестиционные отношения: эмпирический анализ

Аннотация. Отношения между Индией и Вьетнамом укрепляются как в социальном, так и в экономическом аспектах. На подъёме находятся и двусторонние торговые и инвестиционные отношения. В настоящей статье анализируется интенсивность торговли между Индией и Вьетнамом и дается обзор инвестиционных отношений. В исследовании также с использованием метода многослойного перцептрона искусственной нейронной сети изучается влияние ВВП и обменно-

го курса принимающей страны на уровень экспорта страны происхождения как для Индии, так и для Вьетнама. Основные результаты исследования показывают, что до 2017 г. экспорт Индии во Вьетнам был более интенсивным, чем импорт из Вьетнама, затем эта тенденция изменилась, и экспорт Вьетнама в Индию стал превосходить импорт из неё. Кроме того, обнаружено, что ВВП и обменный курс принимающей страны оказывают значительное влияние на двусторонний экспорт.

Ключевые слова: Индия, Вьетнам, торговля, ПИИ, Индекс интенсивности торговли, многослойный перцептрон.

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Introduction

Trade and foreign investment have driven strong growth in both developed and developing economies. Developing countries' exports and investments have consistently grown faster than those of developed countries. Faster growth, higher income levels, improved productivity, increased employment and greater opportunity are some of the many benefits an economy receives when it is open to international trade and investment [The World Bank 2018]. Lower-income households also benefit from trade and investment, as consumers have more affordable options for goods and services [Erixon 2018]. The strategic relationship between two countries is strengthened by economic ties in the form of trade and investment. This has therefore stimulated the growth of export and investment earnings for the economies of India and Vietnam. Similarly, the institutional mechanism and the bilateral treaties provide the framework for a gradually strong relationship in the case of both countries [Kumar 2008].

India-Vietnam relationship is traditional, friendly and strengthened throughout its history. Bilateral relations between India and Vietnam have grown stronger since 1972, when the two countries established diplomatic relations, and have been nurtured over the past 50 years by a great deal of effort on both sides [Lê Thị Hằng Nga 2022]. The economic reforms in India (Liberalization, Privatization, and Globalization) and Vietnam (Doi Moi) put forward various new opportunities for both the economies in the areas such as infrastructure development and capacity building [Nayyar 2019]. The bilateral cooperation between India and Vietnam is a time-tested relationship that has been upgraded from Comprehensive Partnership in 2003, to Strategic Partnership in 2007, to Comprehensive Strategic Partnership in 2016 in various fields including agriculture, manufacturing, economic, defense and political. While Vietnam's relations

with other countries go up and down, cooperation between Vietnam and India is always strengthened and developed by the continuous bilateral visits of the leaders of the host countries [Nguyễn Thị Hồng Mai 2021]. Economic and trade relations between India and Vietnam are growing steadily as Vietnam is an important regional partner for India under its "Look East" policy. In addition, both economies cooperate in various regional fora such as the World Trade Organization, the United Nations, the East Asia Summit, ASEAN, the Asia-Europe Meeting and the Mekong-Ganga Cooperation [Pradhan 2020].

Therefore, the objectives of the present study are to discuss the bilateral trade and investment relationship between India and Vietnam. The study further examines the impact of the host country's GDP and exchange rate on the home country's export level for both countries using the Multilayer Perceptron Neural Network technique of Artificial Neural Network.

Literature Review

In today's globalized world, bilateral trade and investment play an important role in the economic development of all countries, and India-Vietnam is no exception [World Trade Organization 2021].

Mehta [2005] examined the composition, level and growth of merchandise trade between India and Vietnam. The study found that if a duty-free regime is agreed between the two countries, there are a number of sectors in which India has export potential such as edible fruits and nuts, textiles and apparel, fruits and vegetables, and transport vehicles. Jha [2008] shows that India-Vietnam relations are mostly driven by their mutual concerns and common experiences based on history, for example, they have good relations with the former Soviet Union while facing aggression from China. Kumar [2008] examines the economic relations between New Delhi and Hanoi. The study identified the potential sectors for investment opportunities such as knowledge-based industries, steel, oil, gas, and transportation. Mishra [2014] found that bilateral economic cooperation between the to countries is mostly in the form of loans and development assistance from India to Vietnam. Mullen and Prasad [2014] show that Vietnam's strategic and economic importance to India has increased over the past decade due to India's rapid economic growth and subsequent desire for open trade through the South China Sea, development partnership with Southeast Asia, and energy security.

Khan [2017] highlights some of the challenges facing the India-Vietnam relationship, such as the border dispute with China and Beijing's misinterpretation of the India-Vietnam ties. Van [2019] has found that Vietnam and India have explored areas such as economy, politics, security and defense, science, education, and culture to build their bilateral relations.

Bragina [2019] studied the bilateral trade between Vietnam and India by focusing only on main products for the bilateral cooperation and introduced the driving force behind the development of this trade tie in 21st century. This article also introduced briefly the reasons why both countries have mutual interests for extending and diversifying

trade tie and showed the priority of China and the USA policies for the commercial cooperation with Vietnam. Uyanaev [2022] traces the history and stages of bilateral relations, mutual interests and their limiters. The conclusion of the study is a favorable prospect of relations between the two countries, which meets the interests of Russia.

India-Vietnam Relations: An Overview of Trade and Investment

Since gaining independence, both India and Vietnam have experienced significant socio-economic growth (Table 1).

Table 1. **Size of the economies (India and Vietnam), 2023**

	Population, million people	Area, sq.km (2021)	Gross National Income, PPP*, million current international $	Per capita income, PPP, current international $
India	1428.63	2,973,190.0	14,324,038.08	10,030
Vietnam	98. 86	313,429.0	1,423,576.25	14,400

Note: * PPP: Purchasing Power Parity.
Source: World Bank Database.

Figure 1 shows the growth of the bilateral trade relations over a period of time (2000—2019). Both exports and imports have shown a significant increase.

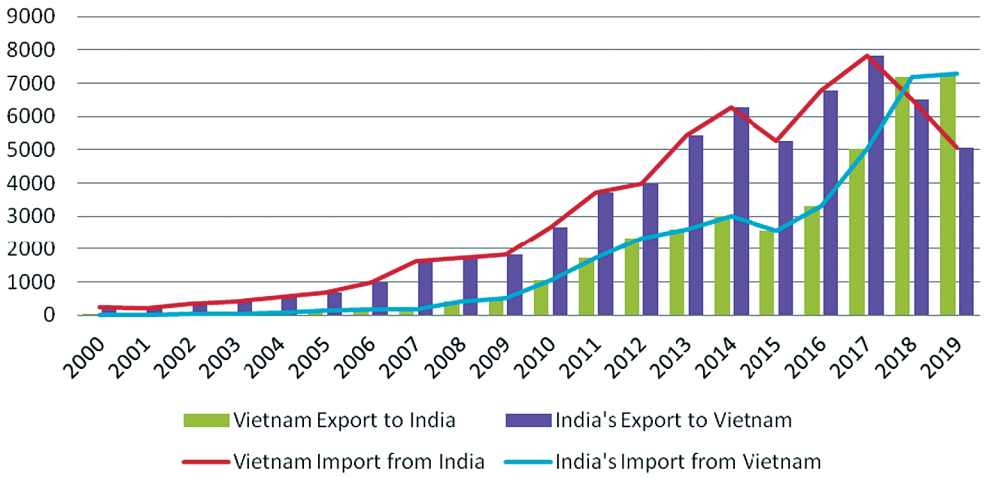

Fig. 1. Bilateral trade between India and Vietnam (2000—2019). *Source:* IMF Database.

Sectors such as computers and electronic hardware, chemicals and coffee, mobile phones and components, and machinery for India were the top sectors of imports from Vietnam in 2019—2020. Meanwhile, the top exports from India were pharmaceuticals, corn, steel, cotton, machinery, meat, and fishery products [Embassy of India 2020].

The trade cooperation between Vietnam and India during 1991—2020 can be divided into two phases: before the establishment of the Comprehensive Strategic

Partnership (1991—2016) and after the establishment of the Comprehensive Strategic Partnership (2016—2020). During the period from 1991 to 2016, the trade balance is toward India because Vietnam has imported more goods [Nguyễn Đức Hoàng Thọ, Nguyễn Trọng Quyền 2022]. The trade surplus toward India during this period is due to the similarity of the two countries' export goods [Ngô Xuân Bình, Lê Thị Hằng Nga 2017]. However, due to the variety of goods exported to India and the fact that only "machinery and electrical equipment" is the main item imported from India to Vietnam, the trade balance between 2017 and 2020 is in favor of Vietnam with a surplus of $5,109,337. It is the achievement of Vietnam's economy thanks to the support of the leaders of both countries [Nguyễn Đức Hoàng Thọ, Nguyễn Trọng Quyền 2022]. The following table shows the bilateral trade features of Vietnam and India in some periods of 1991—2020 continuum.

Table 2. **Vietnam-India bilateral trade in 1991—2020 (Thousand USD)**

Year	Total trade value	Export to India from Vietnam	Import from India to Vietnam	Trade balance
1991—1994	127,200	57,900	69,300	-11,400
1995—1997	5,828,983	732,833	5,095,950	-4,358.417
2008—2016	36,547,575	15,158,643	21,388,932	-6,230,289
2017—2020	39.310,845	22,210,091	17,100,754	5,109,337
1991—2020	81,814,603	38,159,467	43,654,936	-5,490,769

Sources: General Department of Customs of Vietnam, International Trade Center (ITC).

The trend of Vietnam exporting more to India than India importing more to Vietnam has been stable since 2017. According to the database of the International Trade Center (Trademap.org), in 2018, Vietnam's exports to India reached USD7.2 billion, while imports from India to Vietnam reached USD6.7 billion [ITC 2021]. According to India's statistics for the fiscal year 2021—2022, bilateral trade between Vietnam and India has grown by 27 % and got USD14.14 billion. For India, Vietnam was the 23rd trading partner in the world and the 4th among ASEAN countries [Phương Anh 2022]. Export value from Vietnam to India reached USD7.96 billion, growing by 26.8 % in comparison with USD6.28 billion in 2021, while total import value from India to Vietnam in 2022 reached USD7.09 billion, growing by 1.8 % in comparison with USD6.96 billion in 2021 [Trade Affairs Agency of Vietnam in India 2023].

According to experts, the signing of the Asean-India Free Trade Agreement (AIFTA) will boost exports from Vietnam to India and vice versa [Quan hệ hữu nghị... 21.03.2023].

Trade Intensity Index of India-Vietnam trade relations

To get a deeper insight into the India-Vietnam relationship, trade intensity index has been calculated for both economies in the form of export intensity index and import intensity index using quarterly data from 2000 to 2019. The data for the selected variables have been extracted from the International Monetary Fund database.

The formula for the calculation is:

$$\text{“}T_{ij} = (X_{ij}/ X_{it}) / (X_{wj}/ X_{wt}),$$

Where,

$X_{ij}$and $X_{wt}$are the values of country's i's exports and of world exports to country j;

Xit and Xwt are country i's total exports and total world exports respectively”.

An index greater than one indicates that bilateral trade flows are larger than expected given the importance of the partner country in world trade. The trade intensity index is further divided into the export intensity index (EXI) and the import intensity index (IMI) [Kojima 1964; Drysdale 1969].

Table 3 shows that India's export intensity with Vietnam is above one for all quarters of the selected years. However, the import intensity index is below one before 2019 and above one for the first three quarters of 2019.

Table 3. **Trade Intensity Index (Export and Import) of India-Vietnam bilateral trade**

Year/Quarters	Export Intensity Index India	Import Intensity Index India	Export Intensity Index Vietnam	Import Intensity Index Vietnam
2001Q1	2.23	0.13	0.45	1.79
2001Q2	1.86	0.19	0.37	2.09
2001Q3	2.01	0.13	0.33	2.02
2001Q4	1.79	0.17	0.39	2.18
2005Q1	1.99	0.29	0.23	1.56
2005Q2	1.78	0.28	0.22	1.79
2005Q3	1.89	0.25	0.22	1.74
2005Q4	2.05	0.28	0.24	1.87
2009Q1	2.46	0.26	0.35	1.77
2009Q2	1.53	0.30	0.31	1.81
2009Q3	1.43	0.38	0.37	1.73
2009Q4	2.15	0.45	0.40	1.69
2013Q1	2.51	0.92	0.63	1.13
2013Q2	1.69	0.99	0.70	1.40
2013Q3	2.19	0.82	0.79	1.31
2013Q4	3.12	0.75	0.81	1.42
2017Q1	2.17	0.69	0.61	0.83
2017Q2	1.65	0.71	0.62	0.98
2017Q3	2.15	0.87	0.75	1.05
2017Q4	2.38	0.75	0.78	1.18
2019Q1	1.37	1.04	0.97	1.01
2019Q2	1.07	1.26	1.14	0.95
2019Q3	1.26	1.22	1.09	0.94
2019Q4	1.36	0.89	0.82	1.25

India-Vietnam investment relations

India's FDI growth rate is very stable over the years, while Vietnam's growth is exemplary, as FDI in Vietnam reached US$38.2 billion in 2019, an increase of 7.2 % compared to the same period in 2018 (Table 4).

Table 4. **Foreign Direct Investment in India and Vietnam**

Year	2001	2003	2005	2007	2009	2011	2013	2015	2017	2019
FDI as a percentage of GDP (India)	1.05	0.61	0.89	2.07	2.65	2.00	1.52	2.09	1.51	1.76
FDI as a percentage of GDP (Vietnam)	3.98	3.67	3.39	8.65	7.17	5.48	5.19	6.11	6.30	6.15

Source: World Bank Database.

Bilateral investment relations promote economic cooperation between the to countries through the transfer of technology, the sharing of skills, research and development, the creation of jobs, a wider reach in the global market, and the use of exclusively available natural resources and raw materials of the home economy.

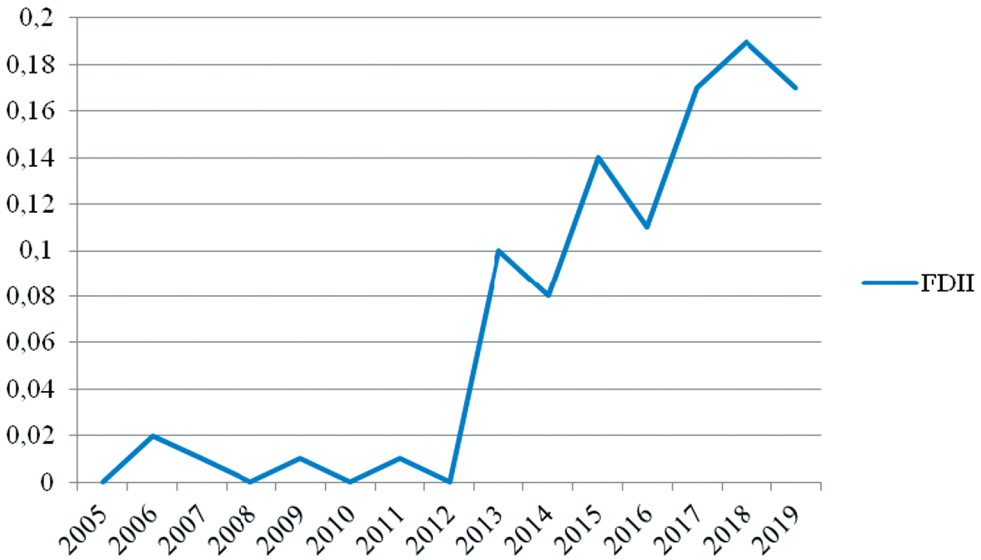

Fig. 2. FDI Equity inflows from Vietnam to India (2005 to 2019), USD billions.
Source: Department of Promotion of Industry and Internal Trade (India).

In the past, India has been reluctant to invest in Vietnam. However, there has been a change over the years (Fig. 2) as Indian companies have started to cooperate with Vietnamese companies in various sectors such as infrastructure construction, IT, and steel production [Jha 2008].

Research Methodology

In the present study, the artificial neural network (Multilayer Perceptron Neural Network) technique has been applied to predict the impact of India's GDP and Vietnam's exchange rate on the level of Vietnam's export to India and the impact of Vietnam's GDP and India's exchange rate on the level of India's export to Vietnam.

Artificial neural network is a machine learning method, which has evolved and developed from the scheme of imitating the human brain (Fig. 3). Artificial neural network technique can help in building the relationship, handling parallel data processing, nonlinear mapping of odd data and learn or adapt from environment [Khan, Ahmed and Prasad 2015; Paswan et al. 2018]. A multilayer perception is one of the techniques of artificial neural network based on the supervised procedure in terms of data with known outputs. It consists of three layers i.e. input, hidden and output with nonlinear computational elements known as neurons and processing units. The information flows from the input layers to the output layers through the hidden layers. In the input layer, the number of independent variables in the model determines the number of neurons, and in the output layer, the dependent variables determine the number of neurons.

The error between the computed values from the model and the desired target values is minimized in the multilayer perceptron network, and the data set is taken from the real data for both input and output. The training set is used to train the network, while the test

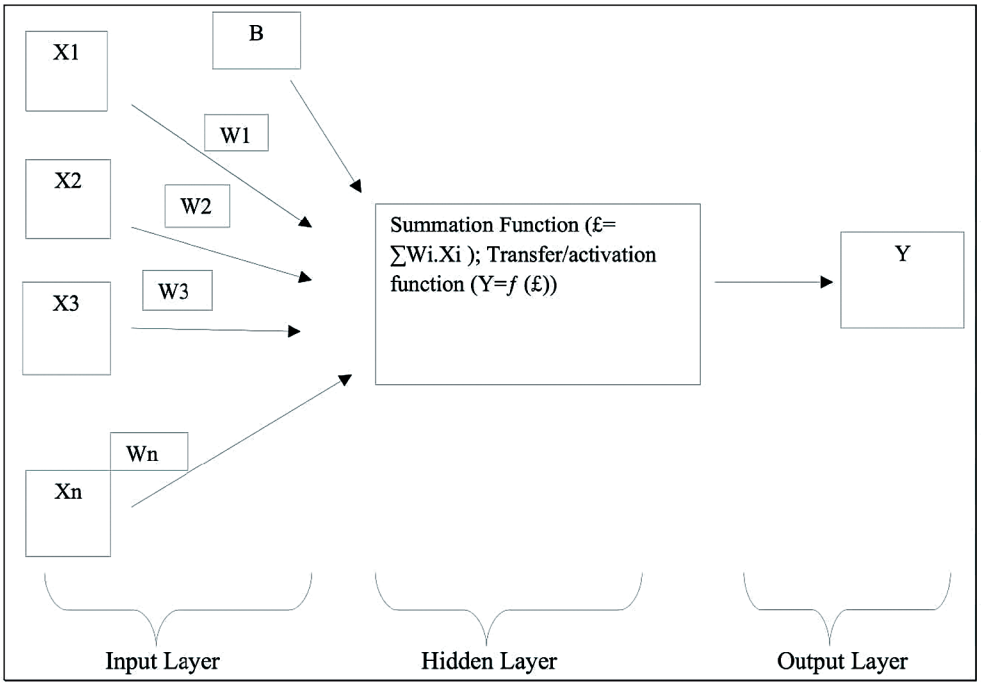

Fig. 3. Artificial Neural Network Model.
Source: [Alaloul and Qureshi 2020].

set is used to analyze the performance of the network. First, the learning phase of the model is applied followed by the testing phase to determine the properties and performance of the model. During the test phase, after input data is fed into the network, the desired target values are compared with the calculated network values. The performance of the model is evaluated by the agreement or disagreement of these two sets.

$$S_j = \sum_{i=1}^{n} X_i W_{ij};$$

$$O_j = \frac{1}{1+e^{S_j}}.$$

Where, S_j = sum of weighted input; O_j = output activation function.

The above equations show that the net sum of the weighted input values entering node j and the output activation function that converts the neuron's weighted input to its output activation (the most commonly used is the sigmoid function) in an Artificial Neural Network. In addition, to reduce the error, the error function belonging to the weights must be improved [Bekesiene, Smaliukiene and Vaicaitiene 2021].

The methodology of the Artificial Neural Network differs from that of the ordinary least square regression method in that the latter estimates the parameters of a given model by minimizing the residual sum of squares and it gives the best results when certain assumptions related to linearity, multicollinearity, autocorrelation and homoscedasticity are satisfied [Lin et.al. 2012]. However, in reality, the data do not satisfy all the assumptions of the least squares regression [Kahane 2008]. On the other hand, the artificial neural network model complex nonlinear relationships between the predictor variables and the response with great flexibility by defining input neurons — nodes — which are the predictor variables, a hidden layer with a number of nodes connected to each of the input nodes, and finally an output layer with one or more nodes [IBM Cloud Education 2020]. In other words, the relationship between the variables does not need to be specified in advance, as the neural network establishes the relationship through a learning process from the data used in its training process. The ANNs also do not require any assumptions about the underlying population distribution. Various studies have shown that the Artificial Neural Network model achieved a better fit and forecast than the Ordinary Least Square Regression model because it has the least root mean square error [Ramirez, MCV et.al. 2005; Soukayna and Jan 2015; Bertolaccini et al. 2017; Ebiendele and Ebiendele 2018]. Therefore, this study used artificial neural network to predict model.

The data used in the study are quarterly from 2000 to 2019. The variables used to test the model are GDP of India, GDP of Vietnam, exchange rate of India and Vietnam, export of India to Vietnam and export of Vietnam to India. The data are extracted from the IMF (International Monetary Fund) database.

Results and interpretation

IBM SPSS was used to construct the neural network models and check their accuracy. A Multilayer Perceptron has input and output layers, and one or more **hidden layers** with many neurons stacked together [Bento 2021]. The neuron must have an

activation function that imposes a threshold, like Rectified Linear Unit, sigmoid, neurons in a Multilayer Perceptron and can use any arbitrary activation function in the Perceptron. It is a neural network in which the mapping between inputs and outputs is nonlinear [Brownlee 2019]. In the neural network models, the randomly assigned values to the data set are 60 % training, 20 % testing, and 20 % holdout. While training the model, the testing data is used to prevent overtraining and find errors, while the holdout data is used to validate the model.

In this section, the multilayer perceptron neural network is applied to predict Vietnam's export to India based on the GDP of the concerned economy, i.e., India and the exchange rate of Vietnam (Model 1), and to predict India's export to Vietnam based on the GDP of the concerned economy, i.e., Vietnam and the exchange rate of India (Model 2). In developing the neural network, it is important to develop an acceptable structure with the appropriate number of hidden layers and neurons, because too few neurons may be insufficient for data processing, and too many neurons may lead to overfitting. Table 5 shows the dataset information analyzed in the study. Different partitioning rates of the datasets were randomly assigned for training, testing, and holdout as 63.7 %, 16.3 %, and 20 % for Model 1 and 51.2 %, 26.3 %, and 22.5 % for Model 2.

Table 5. **Case Processing Summary**

Model 1		**N**	**Percent**
Sample	Training	51	63.7
	Testing	13	16.3
	Holdout	16	20.0
Valid		80	100.0
Excluded		0	
Total		80	
Model 2			
Sample	Training	41	51.2
	Testing	21	26.3
	Holdout		18
Valid		80	100.0
Excluded		0	
Total		80	

Source: SPSS Output.

Table 6 shows the network information of both models, it shows the number of neurons present in each layer and two independent variables. The hyperbolic tangent is the activation function for the hidden layer and the identity is the activation function for the output layer. The sum of squares is the error function. The covariates are 1 and 2 for the input layer variables with 1 hidden layer and 5 units in the hidden layer 1 for Model 1,

while the covariates are 1 and 2 for the input layer variables and 1 hidden layer with 3 units in the hidden layer 1. Annex 1 and Annex 2 show the network diagram built-in SPSS used to predict the course outcome with three input nodes, three hidden nodes, and one output node representing the export of Vietnam to India.

Table 6. **Network Information of the Models**

Model 1			
Input Layer	Covariates	1	Vietnam Exchange Rate
		2	India GDP
	Number of Units[a]		2
	Rescaling Method for Covariates		Standardized
Hidden Layer(s)	Number of Hidden Layers		1
	Number of Units in Hidden Layer 1[a]		5
	Activation Function		Hyperbolic tangent
Output Layer	Dependent Variables	1	Vietnam export to India
	Number of Units		1
	Rescaling Method for Scale Dependents		Standardized
	Activation Function		Identity
	Error Function		Sum of Squares
Model 2			
Input Layer	Covariates		1
			2
	Number of Units[a]		2
	Rescaling Method for Covariates		Standardized
Hidden Layer(s)	Number of Hidden Layers		1
	Number of Units in Hidden Layer 1[a]		3
	Activation Function		Hyperbolic tangent
Output Layer	Dependent Variables		1
	Number of Units		1
	Rescaling Method for Scale Dependents		Standardized
	Activation Function		Identity
	Error Function		Sum of Squares

a. Excluding the bias unit.
Source: SPSS Output.

The model summary shown in Table 7 presents the results of the training (and testing) sample and the holdout sample. A sum of squares error is reported for both the training and testing samples. The small value of the sum of squares error of 1.36 (model 1)

and 4.06 (model 2) indicates the power of the model to predict the outcome. The relative error of the holdout is smaller than the errors of the training and test data sets, indicating that the network model has not been overfitted to the training data and has learned to generalize from the trend.

Table 7. **Model Summary**

Model 1		
Training	Sum of Squares Error	1.363
	Relative Error	.055
	Stopping Rule Used	1 consecutive step(s) with no decrease in error[a]
Testing	Sum of Squares Error	.057
	Relative Error	.031
Holdout	Relative Error	.115
Model 2		
Training	Sum of Squares Error 4.063 Relative Error .203 Stopping Rule Used 1 consecutive step(s) with no decrease in error[a]	
Testing	Sum of Squares Error 1.980 Relative Error .245	
Holdout	Relative Error .319	

Dependent Variable: Vietnam export to India
a. Error computations are based on the testing sample.
Source: SPSS Output.

The percentage of incorrect prediction shown by the relative error is very low, i.e., 0.05 percent (training), 0.03 percent (testing), and 0.11 percent (holdout) for model 1 and for model 2 the percentage of incorrect prediction shown by the relative error is also very low, i.e., 0.20 percent (training), 0.24 percent (testing), and 0.31 percent (holdout). Tables 8 and 9 show the parameter estimates for the input and output layers for Model 1 and Model 2.

Table 8. **Parameter Estimates of the Model 1**

Predictor		Predicted					
		Hidden Layer 1					Output Layer
		H(1:1)	H(1:2)	H(1:3)	H(1:4)	H(1:5)	Vietnam export to India
Input Layer	(Bias)	-.350	-3.607	-.031	.239	-.271	
	Vietnam Exchange Rate	.618	2.269	.204	-.403	-.476	
	India GDP	-.018	-.254	-.291	-.055	.119	

End of Table 8

Predictor		Predicted					
		Hidden Layer 1					Output Layer
		H(1:1)	H(1:2)	H(1:3)	H(1:4)	H(1:5)	Vietnam export to India
Hidden Layer 1	(Bias)						2.045
	H(1:1)						.716
	H(1:2)						2.103
	H(1:3)						.052
	H(1:4)						-.232
	H(1:5)						.075

Source: SPSS Output.

Annexes 3 and 4 show the comparison of the predicted values and the original values of Vietnam's export to India and India's export to Vietnam, which indicates the robustness of the results. The Multilayer Perceptron model justifies the result of the original values based on the predictive capabilities of the independent variables, i.e., exchange rate of Vietnam and GDP of India for model 1 and exchange rate of India and GDP of Vietnam for model 2.

Table 9. **Parameter Estimates of the Model 2**

Predictor		Predicted			
		Hidden Layer 1			Output Layer
		H(1:1)	H(1:2)	H(1:3)	India Export to Vietnam
Input Layer	(Bias)	.134	.352	.167	
	India Exchange Rate	-.332	1.552	-.198	
	Vietnam GDP	-.604	-.983	.226	
Hidden Layer 1	(Bias)				-.026
	H(1:1)				-.782
	H(1:2)				.970
	H(1:3)				-.091

Source: SPSS Output.

Table 10 shows the importance of the independent variables of both models with an importance value of 0.83 for the exchange rate of Vietnam and a value of 0.16 for the GDP of India, along with having normalized importance of 100 % and 19.8 % respectively for Model 1. In the case of Model 2, an importance value of 0.69 for the exchange rate of Vietnam and a value of 0.30 for the GDP of India, along with having normalized importance of 100 % and 43.8 % respectively.

Table 10. **Independent Variables Importance of the Model**

	Importance	Normalized Importance
Vietnam Exchange Rate	.834	100.0 %
India GDP	.166	19.8 %
India Exchange Rate	.695	100.0 %
Vietnam GDP	.305	43.8 %

Source: SPSS Output.

Conclusion

In recent years, the bilateral relationship between India and Vietnam has grown significantly with a common focus on trade, investment and security issues. This paper examines the India-Vietnam bilateral relationship from the perspective of trade intensity, investment, and the impact of exchange rate and host country GDP on bilateral export levels. The findings based on trade intensity index analysis show that India's exports are more intense than imports with Vietnam during 1991—2016, and Vietnam's exports are more intense than imports with India since 2017. Moreover, using the Multilayer Perceptron Network, the study explores that the host country's GDP and exchange rate have a significant impact on the bilateral exports of both India and Vietnam. The findings provide policy insights from the perspective of trade relations to address trade balance issues, along with achieving economic growth by using exchange rate as a policy variable.

In terms of investment, FDI inflows from Vietnam to India and from India to Vietnam have increased sharply over the years, and sectors such as mineral exploration, sugar, energy, agro-processing, agro-chemicals, coffee production, auto components, and IT are being explored. Measures such as a post-investment monitoring system, reduction in the duration of ease of doing business, promotion of local linkages, and easy understanding of policies related to legal and environmental aspects will take bilateral relations to the next level. For further growth and development of trade and investment, both economies should explore the potential opportunities of their prospective markets along with a coordinated and comprehensive policy approach.

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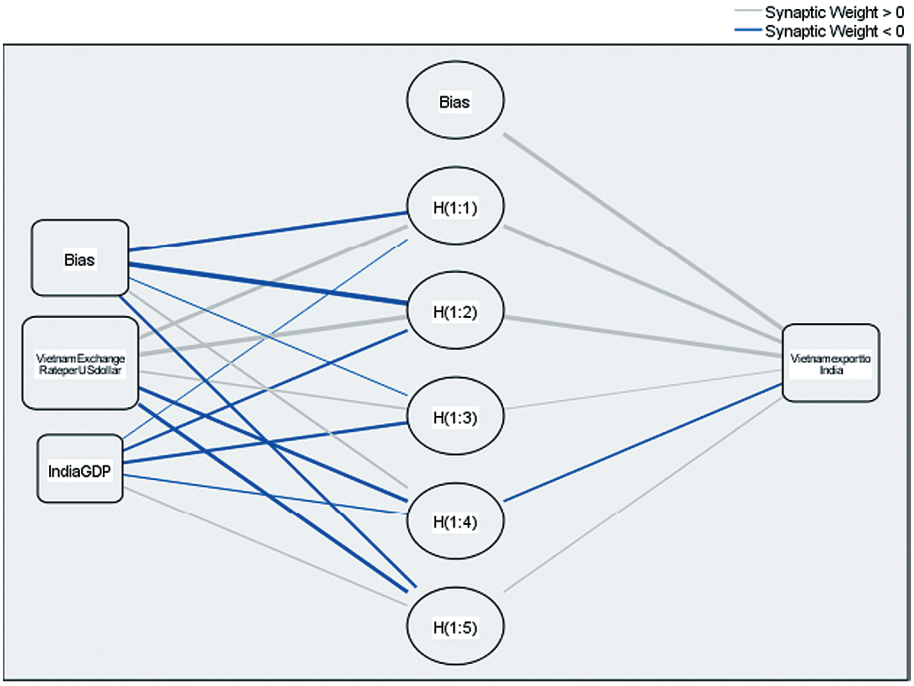
Annexes

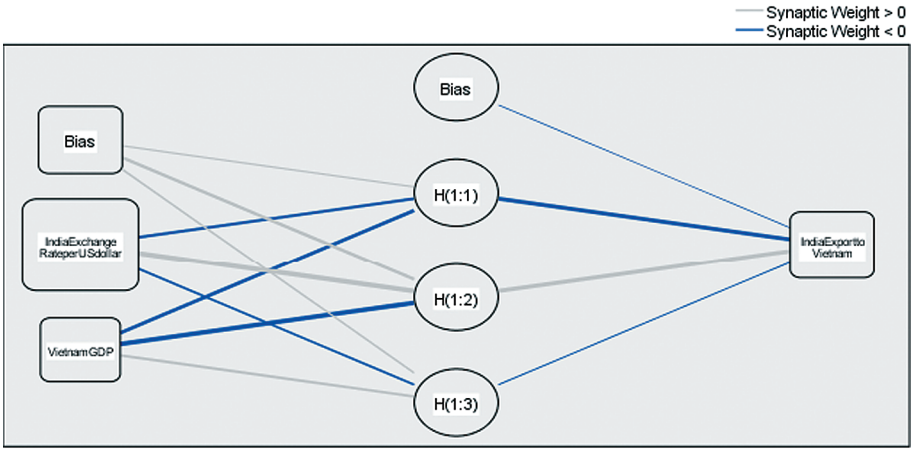
1) Network Diagram of the Model 1



Hidden layer activation function: Hyperbolic tangent
Output layer activation function: Identity

Source: SPSS Output.

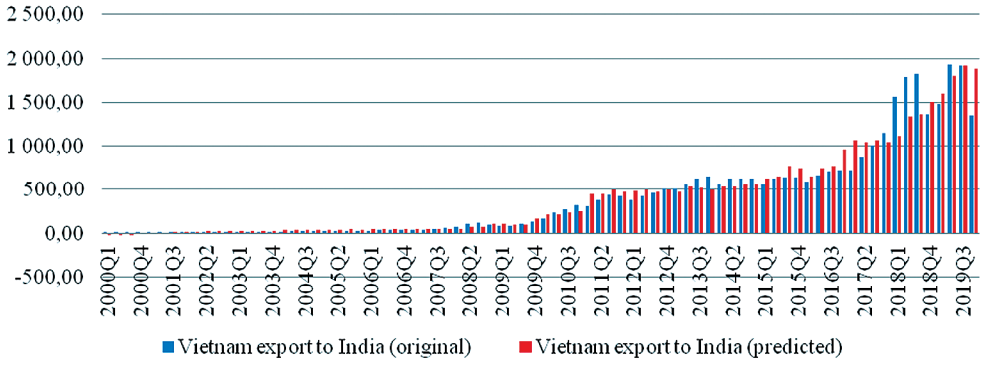
2) Network Diagram of the Model 2



Hidden layer activation function: Hyperbolic tangent
Output layer activation function: Identity

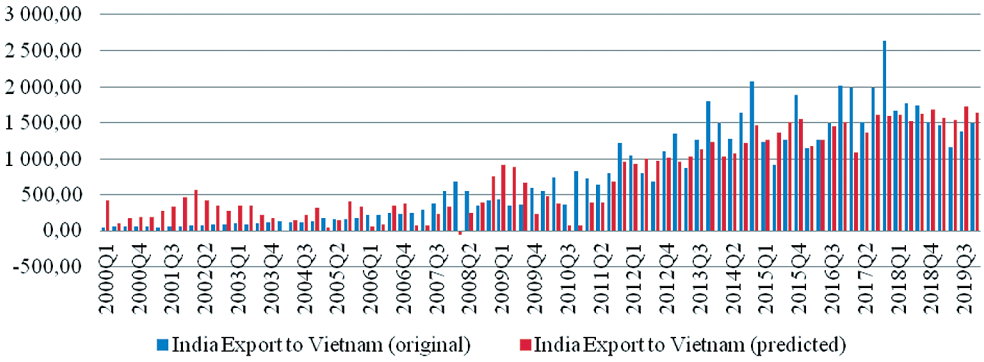
Source: SPSS Output.

3) Comparison of Original and Predicted Value of Vietnamese Export to India



Source: SPSS Output.

4) Comparison of the Original and Predicted values of India's Export to Vietnam



Source: SPSS Output.

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