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## CONTENTS

Sr. No.	TITLE & NAME OF THE AUTHOR (S)	Page No.
1.	VAR ANALYSIS OF EXPORTS, IMPORTS AND THE ECONOMIC GROWTH: EVIDENCE OF INDONESIA <i>Dr. CHENG-WEN LEE &amp; NURHIKMAH OLA LAIRI</i>	1
2.	AN ANALYSIS OF THE CONTRIBUTION OF VALUE ADDED TAX TO MADHYA PRADESH STATE FINANCE <i>Dr. VAIBHAV MODAK &amp; Dr. SURESH SILAWAT</i>	6
3.	ECONOMIC FEASIBILITY STUDY OF PLASTIC MIX BITUMEN ROAD <i>DEEPIKA SWAIN &amp; Dr. KAILASH MOHAPATRA</i>	10
4.	THE ECONOMICS OF PUBLIC SERVICE ADVERTISING OF HEALTH CARE SERVICE SECTOR – A LITERATURE REVIEW <i>Dr. DHANANJOY DATTA &amp; Dr. AMITA KUMARI CHOUDHURY</i>	15
5.	IMPACT OF RURAL DEVELOPMENT PROGRAMMES ON ASSET, INCOME AND EMPLOYMENT IN HIMACHAL PRADESH: A CASE STUDY OF MANDI DISTRICT <i>Dr. K.C. SHARMA &amp; RAKSHA SHARMA</i>	19
6.	A STUDY ON THE PROBLEMS FACED BY THE FARMERS CULTIVATING SUGARCANE WITH SPECIAL REFERENCE TO ERODE AND TIRUPUR DISTRICTS <i>Dr. S. UMARANI</i>	22
7.	DYNAMICS AND DETERMINANTS OF IPO INVESTING BY RETAIL INVESTORS: EVIDENCE FROM INDIAN STOCK MARKET <i>Dr. SATHYANARAYANA &amp; BHAVYA N</i>	27
8.	A STUDY ON CUSTOMER PERCEPTION TOWARDS VALUE ADDED SERVICES IN PUBLIC SECTOR BANKS WITH SPECIAL REFERENCE TO ERODE DISTRICT <i>M. SURESH KUMAR &amp; Dr. G. SURESH</i>	36
9.	SWAY ON FDI IN INDIA: SOME RUDIMENTARY CORROBORATIONS <i>Dr. JOSEPH JAMES V, Dr. SAJEEVE V P &amp; CATHERINE E PERIERA</i>	45
10.	PATIENTS' OPINION TOWARDS QUALITY HEALTHCARE SERVICES PROVIDED BY CO-OPERATIVE HOSPITALS: A STUDY ON SHRI J G CO-OPERATIVE HOSPITAL SOCIETY LTD., GHATAPRABHA <i>DINESHA K &amp; Dr. LAXAMANA P</i>	52
11.	THE BILATERAL RELATIONS BETWEEN INDIA AND SAUDI ARABIA <i>Dr. SHEETAL VARSHNEY</i>	55
12.	IMPACT OF TQM PRACTICES ON ECONOMIC PERFORMANCE AT WORKING IRON AND STEEL FIRMS KARNATAKA <i>K C PRASHANTH</i>	58
13.	CORPORATE SOCIAL RESPONSIBILITY PRACTICES BANKS IN INDIA: A STUDY OF TWO PRIVATE SECTOR BANKS <i>DHRITABRATA JYOTI BHARADWAZ</i>	64
14.	DEMOGRAPHIC AND SOCIO-ECONOMIC CONDITIONS OF MGNREGS BENEFICIARY HOUSEHOLDS IN PUNJAB: AN EMPIRICAL STUDY <i>Dr. SARBJEET SINGH &amp; JAGDEV SINGH</i>	69
15.	AN EMPIRICAL STUDY OF LIFE INSURANCE IN GANGTOK, SIKKIM <i>KEWAL RAI, ARUN ACHARYA, ROSHAN SHARMA, ANIL RAI &amp; TSHERING LHAMU BHUTIA</i>	77
16.	EMPOWERMENT OF WOMEN IN INDIA THROUGH EDUCATION <i>Dr. P. OMKAR</i>	84
17.	IMPACT OF GOODS AND SERVICES TAX (GST) ON COMMON MAN IN INDIA <i>DODDA YALLAPPA JINDAPPA</i>	87
18.	STATUS OF WOMEN IN EGYPT SINCE INFITAH <i>EREIPHY KEISHING</i>	89
19.	INCOME AND INVESTMENT PATTERN AMONG WORKING WOMEN WITH REFERENCE TO MADURAI CITY – A CASE STUDY <i>R. VENNILA</i>	92
20.	DIGITAL INDIA: INFUSE TECHNOLOGY IN GOVERNANCE <i>POOJA</i>	95
	<b>REQUEST FOR FEEDBACK &amp; DISCLAIMER</b>	98

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## VAR ANALYSIS OF EXPORTS, IMPORTS AND THE ECONOMIC GROWTH: EVIDENCE OF INDONESIA

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**ABSTRACT**

*This paper is an attempt to investigate the impacts of exports and imports on GDP of Indonesia using Unrestricted Vector Autoregressive Model (VAR) for the period 1981- 2015. The result from Granger Causality test shows that all export lag variables do not cause GDP. There is short run causality running from export to GDP as well as from import to GDP. The result from lagrange multiplier test shows that the model is very significant because there is no autocorrelation. The probability value from all models is less than 5 %. The model is desirable. The model is well specified because the residuals are normally distributed. The aim of this study is to analyze the impact of exports and imports on GDP. The result of this study is very important for policy makers to determine the appropriate steps and strategies as well as policies.*

**KEYWORDS**

exports, imports, gross domestic product, unrestricted vector autoregressive model (VAR), granger causality test.

**1. INTRODUCTION**

Export and import play important role in economic development of one country. Some studies have been done to find out the relationship between export and economic growth, import and economic growth, or the combination of three variables between export, import and GDP.

According to Rodrick (1999) argued that imports play a significant role to long-run economic growth because export growth is usually associated with rapid import growth. Therefore, the analysis on the export growth which is not included imports may cause the omitted variable that may over stating exports and economic growth impacts.

Most studies focus on the effect of exports on GDP or economic growth ignores the contributions of imports. Some studies have been done to find out the relationship between export and economic growth, import and economic growth, or the combination of three variables between export, import and GDP. Most studies focus on the effect of exports on GDP or economic growth ignores the contributions of imports.

Export development has two substantial, one is macro economy perspective and second is micro economy perspective. From the point of view of macro economy, exports can lead national economy to grow foreign exchanges reserves, prepare labor work, create backward and forward linkages and achieve high standard of living. From the point of view of micro economy, according to Terpstra and Sarathy (1994), exports activities can create competitive advantage, increase financial position of the company, increase use capacity and improve technology standard (Czinkota, Rivoli, Ronkainen:1992)

Yuhong, Li and et.al. (2010) using co-integration analyses with import, export and economic growth and the result is growth of import greatly promoted economic growth of china while export performed an opposite one.

This paper has significant contribution to the literatures because previous studies focus on the export and economic growth while this study examines the impacts and relationship between export and imports on GDP using multivariate framework.

The aim of this paper is to investigate direct linkages among export and import on gross domestic product in Indonesia.

**2. INDONESIA CURRENT POSITION****2.1 GDP OF INDONESIA****TABLE 1: GDP PERFORMANCE OF INDONESIA**

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
<b>GDP (US\$)</b>	364.6	332.2	510.2	539.6	755.1	893	917.9	910.5	888.5	862
<b>GDP (%)</b>	5.5	6.3	6.0	4.6	6.2	6.2	6.0	5.6	5.0	4.8
<b>GDP/capita</b>	1,590	1,861	2,168	2,263	3,125	3,708	3,764	3,685	3,541	3,379

Source: Central Bureau Statistics of Indonesia

**TABLE 2: GDP AVERAGE GROWTH**

Period	Average growth
1998 – 1999	- 6.65
2000 – 2004	4.60
2005 – 2009	5.62
2010 – 2015	5.63

Source: Central Bureau Statistics of Indonesia

**2.2 EXPORTS OF INDONESIA**

Indonesia's exports and imports have shifted from oil and gas to non-oil and gas commodities since 1987. The shift occurred due to government deregulations of exports, which increased non-oil and gas exports. In 1998, the value of non-oil and gas exports reached 83.88% from the total exports of Indonesia. Then in 1999, due to the monetary crisis, the role of the non-oil and gas export values decreased to 79.88%. Looking into the data as presented in table below, Indonesia currently focus its strategy in non-oil and industry sides.

The trend of exports was highlighted by the World Bank that it is moving towards southern countries, particularly in the Asia and Africa regions. In most cases, Asia is a key destination for Indonesia's exports.

TABLE 3: INDONESIA EXPORT DEVELOPMENT BASED ON SECTOR FROM 2012-2016 (in US\$)

Sector	2012	2013	2014	2015	2016	Sector role
I. Oil and Gas	36,977,261.4	32,633,031.3	30,331,863.8	18,551,929.6	13,105,454.1	9.07%
Processing Industry	4,172,515.8	4,309,677.7	3,627,826.9	1,766,386.0	916,385.2	0.63%
Mining	32,804,745.6	28,323,353.6	26,704,036.9	16,785,543.5	12,189,068.9	8.44%
II. Non-oil and gas	153,043,004.7	149,918,763.4	145,960,796.5	131,730,327.3	131,384,371.7	90.33%
Agriculture	3,597,679.8	3,598,497.8	3,373,241.8	3,725,342.7	3,436,233.5	2.38%
Processing Industry	118,115,188.9	115,158,610.5	119,753,706.4	108,598,960.8	109,797,311.7	75.99%
Mining	31,322,920.7	31,154,290.3	22,827,379.1	19,400,115.5	18,145,962.6	12.56%
Others	7,215.3	7,364.8	6,469.2	5,908.3	4,863.9	0.00%
<b>Totals</b>	<b>190,020,266.0</b>	<b>182,551,794.7</b>	<b>176,292,660.3</b>	<b>150,282,256.9</b>	<b>144,489,825.8</b>	<b>100%</b>

Data retrieved from: The Ministry of Industrial Department of the Republic of Indonesia – 2016

### 2.3 IMPORTS OF INDONESIA

The biggest import in Indonesia is from oil and gas sector. The export of oil and gas has decreased start from 2011 but the import of oil and gas has increased high. The government is expected to build and invest in oil and gas in domestic managerial so that Indonesia will decrease the import from this sector. This figure can be seen in the table below.

TABLE 4: INDONESIA IMPORT DEVELOPMENT BASED ON SECTOR FROM 2012-2016 (in US\$)

Sector	2012	2013	2014	2015	2016	Sector role
I. Oil and Gas	42,564,185.2	45,266,350.7	43,459,900.5	24,613,165.1	18,739,319.9	13.81%
Processing Industry	31,737,505.6	31,680,536.1	30,387,469.4	16,549,897.6	12,008,739.4	8.85%
Mining	10,826,679.6	13,585,814.6	13,072,431.1	8,063,267.5	6,730,580.5	4.96%
II. Non-Oil and Gas	149,125,286.3	141,362,319	134,718,916	118,082,406	116,913,562	86.19%
Agriculture	7,694,696.4	7,996,557.3	8,698,689.4	7,166,100.2	7,411,221.4	5.46%
Processing Industry	140,329,091.7	132,079,225.7	124,564,269.6	109,515,778.6	108,240,425.4	79.79%
Mining	1,092,358.3	1,273,985.2	1,441,048.9	1,387,473.7	1,251,599.7	0.92%
Others	9,139.8	12,551.0	14,908.2	13,054.5	10,315.6	0.01%
<b>Totals</b>	<b>191,689,471.5</b>	<b>186,628,669.9</b>	<b>178,178,816.6</b>	<b>142,695,572.0</b>	<b>135,652,881.8</b>	<b>100.00%</b>

Data retrieved from: The Ministry of Industrial Department of the Republic of Indonesia - 2016

### 3. LITERATURE REVIEWS

Akanni (2004) concluded that exports and economic growth exhibits Bi-directional cause structure which causes long run export led growth and short run growth less export. Akanni used vector autoregressive (VAR) model in doing his research on export and economic growth nexus in Indonesia.

Francisco and Ramos (2001) find out that there is a unidirectional causality between exports, imports and economic growth and there is a feedback effect between exports-output growth and import-output growth. The study implemented granger causality between the three variables using data from Portugal period 1865-1998. They emphasized the role of the variable import in the exports output causality investigation which enables one to test for the cases direct causality, indirect causality and spurious causality between export growth and output growth. The study showed that there was no any significant causality between import export growths.

Hussain M and Saaed A. (2014) used granger causality and co integration test to examine the nexus of exports, imports and economic growth in Saudi Arabia. The study found out that both trace and maximum eigenvalue indicated cointegration at 5% level of significance which showed that variables have a long-run relationship. There was a unidirectional causality between export and import. However, the causation between exports and economic growth and also imports and economic growth was insignificant.

According to Pereira and Xu (2000), the ratio of exports to gross domestic product provides us information about the exports important factors to the national economy. This is because ratio of exports to GDP is index of openness. It means that if the ratio of exports is higher than the economy is more open. Larger economies as of area, population and domestic market size produce and absorb larger share of domestic output and they tend to have low ratios, however low ratios of exports to GDP can reflect restrictive trade policies.

Ahmet Ugur (2008) through his study on "Imports and Economic Growth in Turkey: Evidence from a Multivariate VAR Analysis" analyzed the relationships between imports and economic growth in Turkey. The empirical results derived from IRFs and VDCs show that there is a bidirectional relationship between the GDP and investment goods imported and the raw materials of imports. However, there is a unidirectional relationship between the GDP and imported consumption goods and other imported goods.

Alam and Ahmad (2012) indicate that some research in the economics field and academia argued that exchange rates should be determined in a free condition by the supply and demand mechanism. It means that the optimal level of an exchange rate has to be determined by the markets.

### 4. DATA AND METHODOLOGY

#### 4.1 DATA

This research uses data from World Development Indicators (WDI), Central Bureau Statistics of Indonesia from 1981 to 2016 and Ministry of Industrial Department of the Republic of Indonesia.

#### 4.2 MODEL

This research examines the causal relationship between exports, imports and GDP in the short run. The independent variables exports and imports follow by theoretical explanation on dependent variable which is GDP. All variables are taken in real value in US dollar. The number of observations is 36 which is sufficient for this study to examine the objective of this study. This study uses unrestricted VAR to estimate the effects of exports and imports on GDP. The study uses Johansen test of cointegration, Granger causality test and the study also tests the residuals whether it is normally distributed or not.

##### 4.2.1. UNIT ROOT

Unit roots have function to examine the stationary of a time series. Non stationary regress or causes invalidates the results of standard empirical. A stochastic trend presence is determined by unit root testing. This test uses Augmented Dickey- Fuller model (1979)

##### 4.2.2. JOHANSEN TEST OF COINTEGRATION

Before running a Johansen test of cointegration, pre-conditions of the Johansen test of cointegration had to be met. The preconditions were the variables had to be non-stationary at the level, but when all the variables were converted into the first difference, then the variables become stationary. It means that it is integrated in the same order.

A Johansen test of co-integration was used to see if the variables had a long-run association. If the variables had a long-run association, it meant they would move closely together over time. There are two likelihood ratio tests in this test. The first likelihood ratio test was the maximal Eigenvalue. The maximal Eigenvalue is used to evaluate the null hypothesis and the alternative hypothesis. The second test is a maximum statistic test.

##### 4.2.3 VECTOR AUTOREGRESSIVE

This test will give explanation on the causal relationship between variables. Vector autoregressive models are used for multivariate time series.

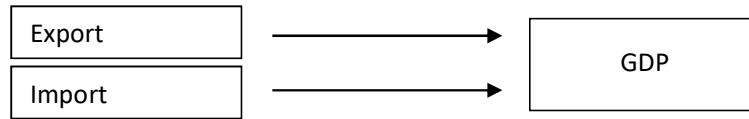
4.2.4 TEST ON AUTOCORRELATION

To test auto-correlation we use Granger causality test. Granger causality test provides information whether change in one variable will be followed by change others. The rule for the causality is if the null of non-Granger causality from X to Y is rejected at 5% level of significance then it can be said that Granger X causes Y but if both test rejected the null so we can say that there is lag on feedback effect or bi-directional relationship.

4.2.5 TEST ON RESIDUAL

The model will be well specified if the residuals are normally distributed. To get the results of this residual we use Jarque-bera test.

5. CONCEPTUAL FRAMEWORK



6. RESEARCH HYPOTHESIS

- H1: Exports positively affects on gross domestic product
- H2: Import positively affects on gross domestic product
- H3: Simultaneously export, import positively affects on the gross domestic product.

7. RESULTS

The results use unrestricted VAR model using three variables namely Exports, imports and GDP of Indonesia.

7.1 UNIT ROOT TEST

We firstly do unit root test and the result of the unit root test is all variables are non stationary at level but after first difference all variables such as export, import and GDP becomes stationary. Therefore, we fulfill the condition of running Johansen test of co-integration.

TABLE 5: UNIT ROOT TEST- ADF TEST

No	Variable	Augmented Dickey Fuller Test					
		Level	First Differences				
		t-statistics	5 % critical value	Prob	t-statistics	5 % critical value	Prob
1	GDP	-1.162	-3.560	0.9180	-3.927	-3.564	0.0112
2	EXPORTS	-2.073	-3.560	0.5612	-4.885	-3.564	0.0003
3	IMPORTS	-2.539	-3.564	0.3088	-6.809	-3.568	0.0000

7.2 JOHANSEN COINTEGRATION TEST

The next step is using Johansen test of co-integration to see if the variables have long run association which means they will move closely together over time. There are two likelihood ratio tests in this test. The first likelihood ratio test is maximal eigenvalue. Maximal eigenvalue is used to evaluate the null hypothesis and the alternative hypothesis. In VAR bivariate, Null hypothesis means that there is no co integration among variables and alternative hypothesis means that there is no integration among variables. The result of the test is the trace statistic is less than critical value. The trace statistics is 24.33 which is less than critical value of 29.68. It means that null is correct. It means that we do not reject null hypothesis rather than we accept null hypothesis. It implies that there is no co integration among variables. The second test is maximum statistic test. Trace statistic and maximum statistic test shows the same result that the variables are not co integrated.

TABLE 6: JOHANSEN CO-INTEGRATION TEST RESULT

Eigenvalue	H0	Trace statistic	5% critical value	Lmax statistic	5% critical value
0.33061	R=0	24.2314*	29.68	13.2457	20.97
0.21269	r≤1	10.9856	15.41	7.8913	14.07
0.08951	r≤2	3.0944	3.76	3.0944	3.76

7.3 VECTOR AUTO REGRESSION

In unrestricted VAR, it has been stated above that the variables are not co integrated. Therefore, this model has no long run association so the study analyzes the short run causality running from independent variables to dependent variables

TABLE 7: VECTOR AUTO REGRESSION

		coefficient	std error	z	Prob
Gdp	gdp				
	L1	2.231753	0.37391	5.89	0.000
	L2	-1.341856	0.5737103	-2.34	0.019
	L3	-0.3748352	0.4321916	-0.87	0.386
	Export				
	L1	-4.202308	1.382752	-3.04	0.002
	L2	4.886973	1.690145	2.89	0.004
	L3	1.553085	1.543402	1.01	0.314
	Import				
L1	5.822384	2.806941	2.07	0.038	
L2	-2.46686	3.056699	-0.81	0.420	
L3	-4.262889	2.221508	-1.92	0.055	
Cons					
		21.68169	97.45946	0.22	0.824

Loglikelihood	-341.555
Akaike info Criterion	22.51849
FPE	1281821
Hannan –Quinn Criterion	22.97624
Det (Sigma_ml)	196157.7
SBIC	23.87895

**7.4 GRANGER CAUSALITY TEST**

The next test is to check the short run causality jointly whether the variables jointly can cause GDP growth or not. To take the result of this then we imply Granger Causality Test. The null hypothesis in the Granger Causality test is all export lag variables does not cause GDP while alternative hypothesis is all lags variables causes GDP.

In this test, the analyses find out that there is short run causality running from export to GDP and there is short run causality running from import to GDP. When consider all variables, all variables have probability value less than 5 % critical value. It means that we can reject null hypothesis. The result is there is short run causality running from export and import to GDP. The causal relation result between GDP and import to export is GDP has short run causality to export and import also has short run causality to export. Both GDP and import has short run relationship to export. However, there is no short run relationship running from GDP to import because the probability value is more than 5% which is 81.8% and also there is no short run relationship running from export to import because the probability value is 74.3% and as a whole there is no short run relationship running from export and GDP to import.

**TABLE 8: GRANGER CAUSALITY TEST**

Equation	Excluded	Chi2	prob>chi2
Gdp	Export	26.924	0.000
Gdp	Import	9.9961	0.019
Gdp	All	28.906	0.000
Export	GDP	38.325	0.000
Export	Import	10.667	0.014
Export	All	43.535	0.000
Import	GDP	.92975	0.818
Import	Export	1.241	0.743
Import	All	2.4845	0.870

**7.5 AUTOCORRELATION TEST**

In the research, it is essential to check whether the residual is auto correlated or not. We use Lagrange Multiplier test to check whether residuals are auto correlated or not. Our null hypothesis is there is no autocorrelation. The result of the test is there is no autocorrelation. We accept null hypothesis. It means that the model is well specified and desire. The probability value is 9.35% at lag 1. This result is desirable.

**TABLE 9: LAGRANGE MULTIPLIER TEST**

Lagrange-multiplier Test			
Lag	chi2	df	Prob> chi2
1	14.9059	9	0.9355
2	17.7552	9	0.3812

**7.6 TEST ON THE RESIDUALS**

The model is well specified because the residuals are normally distributed. This can be shown in Jarque-bera test. The probability Chi2 is very high. GDP's probability Chi2 is 74.41%.

**TABLE 10: JARQUE-BERA TEST**

Equation	chi2	df	prob>chi2
Gdp	0.591	2	0.74416
Export	6.556	2	0.03770
Import	0.356	2	0.83714
All	7.503	6	0.27685

**8. CONCLUSION**

The objective of this research is to investigate whether export and import play important role on the economic growth of Indonesia. The study also examines the causality relationship between export, import and GDP growth of Indonesia. This study finds out that there is short run causality running from export to GDP and there is short run causality running from import to GDP. When consider all variables, all variables have probability value less than 5 % critical value. It means that we can reject null hypothesis. The result is there is short run causality running from export and import to GDP. GDP has short run causality to export and import also has short run causality to export. Both GDP and import has short run relationship to export. However, there is no short run relationship running from GDP to import because the probability value is more than 5% which is 81.8% and also there is no short run relationship running from export to import because the probability value is 74.3% and as a whole there is no short run relationship running from export and GDP to import.

The study also finds out that there no long run association between export, import (independent variables) and GDP (dependent variable) so the study analyzes the short run causality running from independent variables to dependent variables

The model is well specifying and significant because there is no autocorrelation and the residuals are normally distributed.

The important result from this research is very useful for policy makers in Indonesia that they have to focus to strategize the policy of export and import and to analyze business demand in order to get maximum result in economic growth effort.

**9. RECOMMENDATION**

For future research, researchers can use more comparative data based on industrial sectors of exports. The next research also needs to do exports with sources analysis based on regions or provinces in Indonesia.

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