Does export lead growth? evidence from Japan

Fadzil, Atikah and Masih, Mansur

INCEIF, Malaysia, Business School, Universiti Kuala Lumpur, Kuala Lumpur, Malaysia

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Atikah Fadzil[1] and Mansur Masih[2]

Abstract: Japan shifted towards export-led growth strategy in the 1980s. This study analyzes the role of export performance in the Japanese economic growth. In order to examine the causal relationship between exports and economic growth, the study applied standard time series techniques. The results indicate that imports are important in positively affecting economic growth, indicating that economies should permit a greater flow of imports into the domestic economy through lowering trade barriers. Secondly, in terms of the role of exports, the evidence of export-led growth for Japan indicates that there is a strong argument for governments to follow an export-promotion strategy thereby providing exporters greater incentives to export, for example, by implementing export subsidies and adopting a favorable exchange rate policy. This analysis indicates that export growth tends to have positive long-run effect on output growth in Japan, which thereby supports the export-led growth hypothesis.

Keywords: Export-led growth, VECM, VDC, Japan

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[1] INCEIF, Lorong Universiti A, 59100 Kuala Lumpur, Malaysia.

2 **Corresponding author**, Senior Professor, UniKL Business School, 50300, Kuala Lumpur, Malaysia.

Email: mansurmasih@unikl.edu.my

1.0 Introduction: Objective and Motivation

The economy of Japan is the third-largest in the world by nominal GDP and the fourth-largest by purchasing power parity (PPP) and is the world's second largest developed economy. According to the International Monetary Fund, the country's per capita GDP (PPP) was at $37,519, the 28th highest in 2014, down from the 22nd position in 2012 Japan is a member of the G7. Due to a volatile currency exchange rate, Japan's GDP as measured in dollars fluctuates widely. Japan has a well-educated, industrious work force and its large, affluent population makes it one of the world's largest consumer markets. Manufacturing has been the most remarkable and internationally renowned, feature of Japan's economic growth. Today, Japan is a world leader in the manufacture of electrical appliances and electronics, automobiles, ships, machine tools, optical and precision equipment, machinery and chemicals. Japanese firms have countered this trend to a degree by transferring manufacturing production to low-cost countries. Japan's services sector, including financial services, now plays a far more prominent role in the economy, accounting for about 75 per cent of GDP. The Tokyo Stock Exchange is one of the world's foremost centers of finance.

International trade contributes significantly to the Japanese economy, with exports equivalent to approximately 17 per cent of GDP in April 2016. Key exports include vehicles, machinery and manufactured goods. In 2015, Japan's major export destinations were the United States (20.1 per cent), China (17.5 per cent) and the Republic of Korea (7.0 per cent). Despite a weaker Yen because of stimulatory economic policies linked to the Japanese government’s Abenomics policies, export growth remains sluggish. Abenomics is based upon fiscal stimulus, monetary easing and structural reforms.

The Japanese Yen, abbreviated as JPY or ¥ is the official currency of Japan. It is the third most traded currency in the foreign exchange market after the United States dollar and the euro. It is also widely used as a reserve currency after the U.S. dollar, the euro, and the pound sterling. The Japanese Yen has been the national currency of Japan starting in 1872. Initially, Yen banknotes were created to modernize Japan’s currency and their value was linked to the market value of gold. Upon the devaluation of the currency in the immediate post World War II era, the Yen was pegged to the United States dollar and remained so until the dissolution of the Bretton Woods monetary

system in 1971. The early 1970s marked the beginning of the current monetary system in Japan. As the United States dollar ended its relationship with gold, the Yen could become a free-floating currency. A free-floating currency derives its value from the world's currency markets. The government and national banks of Japan focus on keeping the Yen stable at low levels. These low levels are advantageous to the huge export sector of the country's economy and are fostered by national monetary policy. When Japan was faced by the Great East Japan earthquake in 2011, the currency managed to rise. The perplexing status of the Yen as a safe-haven currency is driven in part by Japan's record debt levels.

Japan has achieved a miraculous economic development to become the first country to move from less-developed to developed economy status in the post-WWII era (Goto, 2001). Japan promoted a rapid expansion in export-led strategies for promoting economic growth. Indeed, the relationship between real exports and real GDP suggesting that the two variables are correlated. However, careful analysis of the literature, particularly that solely focusing upon Japan, together with consideration of data and methodological issues suggests that the simple presumption of an export-led growth panacea is potentially misleading.

Back to history, World War II had a devastating impact on the Japanese economy with approximately 80 percent of production capacity being lost (Goto, 2001). Thus, in the immediate aftermath of the 1950s, Japan was forced to import large amounts of food, energy and raw materials to support its population. In order to earn foreign exchange to pay for these imports, Japan was left little alternative but to focus upon exports with the resulting pattern of trade known as processing trade because it produced goods by processing imported raw materials (Goto, 2001). After the adoption of this export oriented policy in the 1950s Japan developed rapidly with an annual GDP growth rate of 10.5 percent between 1960 and 1970 (World Development Report, 1980). Crucially, however, the composition of exports changed significantly over time. Initially, in the 1950s labor-intensive products, such as textiles were earning the foreign exchange, however, throughout the 1960s exports became more capital intensive, whilst by the mid-1970s more complex products such as automobiles and color televisions became significant exports. Finally, government policies shifted their emphasis in the 1980s to high technology machinery and electronic industries (Magaziner and Hout, 1980; Nakamura, 1985).

Hence, the motivation for this paper, which seeks to examine the export-growth relationship for Japan is the general esteem in which this country is frequently held-up as economic beacons for other countries to follow. Several, sometimes intertwining, forces have combined in the last two decades to accelerate the opening of national economies, thereby placing additional emphasis on the hypothesized benefits of exports in relation to economic growth. However, close observation of the available literature indicates that the causality of this relationship is far from clear and cannot be guaranteed to be beneficial. Thus, an empirical investigation of Japan in terms of the causality between trade and growth offers potentially useful insights given the general perception that export-led growth has been instrumental to post-WWII economic development. Japan was the earliest Asian countries to experience high rates of economic growth after World War II. Hence, this paper specifically focuses on the economy of Japan which has grown rapidly since 1950s and the 1960s, respectively.

This paper contributes to the existing literature in the following dimensions. Firstly, previous studies frequently include South Korea and Japan countries as part of larger samples in relation to, inter alia, low, middle, high income countries; selected Asian countries; and as OECD countries (Dutt and Ghosh, 1996; Riezaman et al., 1996; Rahman and Mustafa, 1997; Islam, 1998; Kónya, 2004). Four previous studies focus on Japan alone (Grabowski et al., 1990; Boltho, 1996; Hatemi-J, 2002; Awokuse, 2005b). Secondly, this paper includes real imports as an explanatory variable to independently test the import-led growth hypothesis. This is potentially significant since the import-led growth hypothesis indicates that export growth relieves the foreign exchange constraint, allowing capital and intermediate inputs to be imported to boost domestic production (Asafu-Adjaye and Chakraborty, 1999). Indeed, a few previous studies (Riezman et al., 1996; Asafu-Adjaye and Chakraborty, 1999; Thangavelu and Rajaguru, 2004) include imports as an additional variable when examining the causal relationship between exports and economic growth whereby failure to account for its role could produce misleading results in the analysis of the relationship between export growth and output growth.

Thirdly, this paper seeks to investigate the causality between both real exports and real imports in relation to real GDP using more recent techniques in terms of Johansen's multivariate cointegration framework. We examine the Granger causality test within the context of a vector autoregression (VAR) model and vector error correction model (VECM). When cointegration is

found, an error correction model is applied to the direction of causation. Finally, whereas most previous studies rely upon annual data, here quarterly data is used whereby temporal aggregation issues from use of the former could result in the lack of causation (Bahamani-Oskooee and Alse, 1993).

The paper is organized as follows. Section 2 outlines the economic theories underlying the relationship between exports, imports and economic growth. Section 3 presents a general overview of the empirical literature, prior to focusing on studies relating to Japan. Section 4 describes the data and econometric methodology which is followed by our empirical results (Section 5). Finally, Section 6 presents some concluding remarks.

2.0 Theoretical Underpinnings

The possible relationship between exports and economic growth can be categorized as follows: export-led growth, growth-led exports, the bi-directional causal relationship, negative correlation and non-causality between the two variables. In relation to the former, export performance and export expansion are hypothesized to make several major contributions to economic growth. Firstly, through higher exports easing the foreign exchange constraint and permitting higher imports of capital goods and intermediate goods (Kemal et al., 2002). Secondly, the home country can concentrate investment in those sectors where it enjoys a comparative advantage (Fosu, 1990). Thirdly, the addition of international markets gives scope for economies of scale in the export sector (Kemal et al., 2002). Fourthly, export growth may represent an increase in demand for the country's output and thus serves to increase real output (Giles and Williams, 2000) by providing a channel through which a country can gain new technologies and new ideas. Finally, export growth can promote greater saving and investment which accelerates overall economic growth (Todaro, 2000).

However, there are logical arguments for reverse causality resulting in the second category of growth-led exports. Bhagwati (1988) notes that an increase in GDP generally results in a corresponding expansion of trade, unless growth induces supply and the corresponding demand creates an anti-trade bias. Moreover, economic growth may have little to do with government policy to promote exports, rather than being related to the accumulation of human capital, cumulative production experience, technology transfer from abroad, or physical capital accumulation (Jung and Marshall, 1985). Finally, Giles and Williams (2000) argue that economic

growth may lead to the enhancement of skills and technology which creates a comparative advantage and thereby facilitates exports, whilst higher output growth can stimulate higher investment, part of which can be for increasing export capacity (Kemal et al., 2002).

A further complication is the recognition of the potential for bi-directional causality between economic growth and exports indicating that they may be interrelated in a cumulative process. According to Bhagwati (1988), increased trade produces more income which facilitates more trade thus creating a virtuous circle. Thirlwall (2003) supports this model since if output growth (caused by export growth) induces productivity growth, this makes goods more competitive and therefore accelerates export growth. Hence, once an economy obtains a growth advantage it will tend to keep it, thereby explaining why growth and development through trade tends to focus on countries whilst other countries are left behind (Thirlwall, 2003).

However, it is also possible to postulate a hypothesis concerning the fourth category of negative correlation between the two variables, whereby increased output growth might lead to a decrease in export growth. For example, if real growth induced by an exogenous increase in consumer demand is heavily concentrated in exportable and non-traded goods, then a decline in exports would occur (Jung and Marshall, 1985). Similarly, Dodaro (1993) argues that more output might be absorbed domestically leaving relatively less for the export market as a consequence of the increase in aggregate demand. A contrary explanation is that export growth might cause reduced output growth. For example, Jung and Marshall (1985) suggest that increased exports arising from some types of inward foreign direct investment might lower domestic output due to various distortions. According to Dodaro (1993), export growth might lead to a decline in output growth when exports are promoted at the expense of domestic consumption and efficiency, whilst Kemal et al. (2002) also point out the possibility that the adoption of export-led growth strategies by a number of less developed countries simultaneously could be self-defeating as it can generate excessive competition amongst them in the world market.

Economic theories suggest that appreciation in exchange rate will adversely affect export of the respected country. Thus, the appreciation of local currency will make the price of local goods and services expensive to foreign consumer and vice versa. Same goes to the exchange rate volatility whereby the more volatile the currency is, the lower of FDI inflow will be recorded. Investors tend

to buy financial securities in less volatile and stable currency because of less uncertainty in credit worthiness, governance, and monetary policies of a host country (Amarita, 2016).

Finally, there is potential for no causal relationship between exports and economic growth such that the growth paths of the two variables are determined by other, unrelated variables, in the economic system (Giles and Williams, 2000). Alternatively, Yaghmaian (1994) argues that both exports and economic growth may be caused by the process of development and structural change whereby exports and economic development are both the result of the same forces. Thus, no causal relationship may exist between them.

In addition to these five hypothesized relationships between exports and economic growth, we also consider in this paper the inter-relationship between imports and growth since there are a number of theoretical reasons to believe that an economy could experience import-led, rather than export-led, growth. In particular, this emphasizes the process of modernization and transfer of advanced technology through acquisition of sophisticated capital and materials which boosts domestic production and leads to economic growth (Marwah and Tavakoli, 2004). Moreover, cumulative causation effects between imports and economic growth from the unbundling of new technologies would also be expected, whereby higher output will increase the incentive for producers to take advantage of foreign technology by increasing imports into the domestic economy (Thangavelu and Rajaguru, 2004).

3.0 Literature Review

A variety of time-series and cross-sectional techniques have been employed to test the relationship between exports and economic growth with initial studies investigating the relationship by applying rank correlation to developing countries (Michaely, 1977; Balassa, 1978; Tyler, 1981; Kavoussi, 1984; Singer and Gray, 1988). Later, the aggregate production function was examined in cross-section studies, which considered exports as an additional input to capital and labour (Balassa, 1978 and 1985; Tyler, 1981; Feder, 1983; Kavoussi, 1984; Ram, 1985; Rana, 1988; Kohli and Singh, 1989; Moschos, 1989; Fosu, 1990; Otani and Villaneuva, 1990; Dodaro, 1991; Esfahani, 1991; Salvatore and Hatcher, 1991; De Gregorio, 1992; Greenaway and Sapsford, 1994; Amirkhalkhali and Dar, 1995; Burney, 1996). Generally, these studies tend to support the view that export growth promotes overall economic growth, however, it is recognized that they do not address the issue of causality, whilst the cross-country regressions provide little insight into the

way the various explanatory variables affect growth and the dynamic behaviors within countries (Giles and Williams, 2000).

The recognition of these inadequacies led to a number of studies which examined the export-led growth hypothesis by employing causality tests and time series analysis (Jung and Marshall, 1985; Chow, 1987; Ahmad and Kwan, 1991; Bahmani-Oskooee et al., 1991; Dodaro, 1993). However, Bahmani-Oskooee and Alse (1993) argue that there are three primary shortcomings of these time-series studies. Firstly, none tested for the cointegrating properties of the time-series variables, whereby standard Granger or Sims causality tests are only valid if the time series variables are not cointegrated. Consequently, if the time series variables are cointegrated, any causal inferences based on the above techniques will be invalid. Secondly, most previous time-series studies utilized rates of change of output and exports that are close to the concept of first differencing. However, first differencing filters out long-run information, thus to remedy this problem the cointegration technique and error-correction modelling are recommended to combine the short-run and long-run information. Finally, most earlier studies employed annual data whereby the lack of causation could be the result of temporal aggregation. Consequently, Bahmani-Oskooee and Alse (1993) employ quarterly data and use the techniques of cointegration testing and error correction modelling. Subsequently, several studies have adopted this revised methodology (Marin, 1992; Dutt and Ghosh, 1996; Rahman and Mustafa, 1997; Islam, 1998; Ekanayake, 1999; Anoruo and Ramchander, 2000; Love and Chandra, 2004 and 2005; Thangavelu and Rajaguru, 2004). Furthermore, of significance, several previous studies adopt a multivariate approach using import growth as an additional explanatory variable (Riezman et al., 1996; Asafu-Adjaye and Chakraborty, 1999 Thangavelu and Rajaguru, 2004). Hence, it is within this established body of literature that our study is located.

In relation to the countries that are of specific interest to this study, we have identified thirteen time-series studies for Japan (Grabowski et al., 1990; Marin, 1992; Arnade and Vasavada, 1995; Boltho, 1996; Dutt and Ghosh, 1996; Riezman et al., 1996; Rahman and Mustafa, 1997; Islam, 1998; Yamada, 1998; Hatemi-J, 2002; Kónya, 2004; Thangavelu and Rajaguru, 2004; Awokuse, 2005b). However, approximately one-third employ quarterly data, from which they either detect no export-led growth (Yamanda, 1998), growth-led exports (Awokuse, 2005b), or bi-directional causality (Marin, 1992; Hatemi-J, 2002). Of the studies applying multivariate analysis, a mixed

series of findings emerge supporting export-led growth (Grabowski et al, 1990; Islam, 1998), growth-led exports (Riezman et al., 1996; Konya, 2004; Thangavelu and Rajaguru, 2004; Awokuse, 2005b), bi-directional causality (Marin, 1992) and non-causality (Arnade and Vasavada, 1995), whilst one way causation from exports to growth is examined by Yamanda (1998), but finds no evidence for export-led growth. In contrast, bivariate analysis finds evidence for export led growth (Rahman and Mustafa, 1997; Islam, 1998), growth-led exports (Boltho, 1996; Riezman et al., 1996; Kónya, 2004), bi-directional causality (Hatemi-J, 2002) and non causality (Dutt and Ghosh, 1996). Finally, several studies investigate the Granger causality test using an error correction model (Marin, 1992; Arnade and Vasavada, 1995; Rahman and Mustafa, 1997; Thangavelu and Rajaguru, 2004), which indicate mixed causality results. Dutt and Ghosh (1996) report no causality because there is no cointegration between exports and economic growth, whilst four studies apply augmented VAR level Granger causality test based on Toda and Yamamoto (1995) and suggest no export-led growth (Yamada, 1998), growth-led exports (Kónya, 2004; Awokuse, 2005b) and bi-directional causality (Hatemi-J, 2002). The remaining use the standard Granger causality test and indicate evidence of export-led growth (Grabowski et al., 1990; Islam, 1998) and growth-led exports (Boltho, 1996; Riezman et al., 1996).

Consequently, it is evident from these previous studies examining Japan that the relationship between exports and economic growth remains ambiguous with the empirical studies illustrating a diverse series of results, whilst frequently omitting the issue of the import-growth nexus.

4.0 Data and Methodology

The aggregate production function used in the study can be expressed as:

$$Y = f(K, L, X, M)$$

Where Y represents real gross domestic product and K, L, X, M represent capital, labor, exports and imports respectively. This model has been used to examine the export-led growth hypothesis for Japan economy. The study has used quarterly data for 23 years starting from Q1 1994. Data on real GDP per capita (GDP), real exports (EXP), real imports (IMP), real gross capital formation (GCF) and real exchange rate (ER) has been compiled from Federal Reserve Bank of St. Louis, World Development Indicators (WDI) online database and DataStream. All the variables are taken in their natural logarithms to avoid the problem of heteroskedasticity (Gujarati 1995). The

variables used in this study are real GDP, real exports and real imports in billions of constant local currencies, which are then expressed in the form of natural logarithms. Nominal GDP is deflated using the GDP deflator, nominal values for exports and imports are deflated using the export price index and import price index respectively.

5.0 Empirical Result and Interpretation

Step 1: Unit Root test

Prior to kicking off the process, the stationarity of variable should be checked first. The variable is stationary if it always has a constant mean, variance, covariance throughout the time. In this step, the objective is to check whether the variables chosen were stationary or not. The test can be done by using the Augmented Dickey-Fuller (ADF) test and Phillips-Perron Test (PP).

ADF Test

We kicked off our empirical testing by determining the stationarity of the variables chosen. In order to proceed with the testing of cointegration later, ideally, our variables should be I (1), in that in their original level form, they are non-stationary and in their first differenced form, they are stationary. The differenced form for each variable used is created by taking the difference of their log forms. For example, DGDP = $LGDP_t$ - $LGDP_{t-1}$. We, then conducted the Augmented Dickey-Fuller(ADF) test on each variable in both level and differenced form. The table below summarizes the results.

Variables	Test Statistic	Critical Value	Result
Logarithm Transformed Variables			
LGDP	2.2465	3.4620	Non-Stationary
LEX	3.1305		Non-Stationary
LIMP	3.2535		Non-Stationary
LGCF	1.9946		Non-Stationary
LLAB	1.0150		Non-Stationary
LER	3.1878		Non-Stationary
First-Differenced Transformed Variables			
DGDP	5.2213	3.4626	Stationary
DEX	5.5662		Stationary
DIMP	5.9484		Stationary
DGCF	4.3733		Stationary
DLAB	4.5166		Stationary
DER	4.1153		Stationary

Table 1: Result ADF Test

The above table shows that in level form, we couldn't reject the null hypothesis, while with the difference form we could reject the null hypothesis. By relying primarily on the AIC and SBC criteria, the conclusion that can be made is all the variables in this analysis are I (1) and therefore can proceed to next step. For ADF test statistics, we have selected the ADF regression order based on the highest computed value for AIC and SBC.

PP Test

The Phillips-Perron (PP) test also gave us the same results. In the PP test, the null hypothesis is that the variable is non-stationary. The null cannot be rejected if the test statistics is lesser than the critical value in absolute terms and can be rejected if the test statistics is larger than the critical value. We tested the variables based on these judgement criteria and accordingly get the results that all variables are I (1).

Variables	Test Statistic	Critical Value	Result
Logarithm Transformed Variables			
LGDP	2.1153	3.4597	Non-Stationary
LEX	2.2304		Non-Stationary
LIMP	2.5733		Non-Stationary
LGCF	1.4275		Non-Stationary
LLAB	0.52902		Non-Stationary
LER	1.8543		Non-Stationary
First-Differenced Transformed Variables			
DGDP	8.7946	3.4626	Stationary
DEX	7.4116		Stationary
DIMP	7.4035		Stationary
DGCF	5.7776		Stationary
DLAB	8.5918		Stationary
DER	7.1230		Stationary

Table 2: Result PP Test

Augmented Dickey- Fuller (ADF) test and Phillip-Perron (PP) test (including constant with trend) for five variables namely LEX, LIMP, LGCF, LLAB and LER have been applied to check whether series are stationary or not. The results revealed the presence of unit root for all series at levels. After differencing, all series were found to be stationary.

Step 2: VAR Lag Order Selection Criteria

Prior of doing cointegration test, we must determine order of the VAR which helps us to select how many lags we are going to use for cointegration test. Vector auto regression (VAR) is the test that needs to be done before moving on to the test for cointegration. In VAR, the number lags need to be used in this study. Table below show the AIC and SBC.

Choice Criteria	**AIC**	**SBC**
Optimal Order	1	4

Table 3: Order of VAR

Exogenous Variable: INPT			
Order	AIC	SBC	LR Test
4	1448.0	1263.9	NA
3	1464.8	1324.9	38.3803
2	1479.4	1383.7	81.2149
1	1481.8	1430.3	148.3394
0	1459.0	1451.6	266.0756

Table 4: Results of VAR Lag Order Selection Criteria

From the above table, it showed a contradicting optimum order given by the highest value of AIC and SBC. As expected, SBC gives lower order (order 4) as compared to AIC (order 1). This difference is due to the AIC tries to solve for autocorrelation while SBC tries to avoid overparameterization. Given this apparent conflict between recommendation of AIC and SBC, we address this in the following manner. First, we checked for serial correlation for each variable and obtained the following result.

Variables	**LM(P-value)**	**Implication at 10% significance level**
DGDP	0.176	No serial correlation
DEX	0.498	No serial correlation
DIMP	0.640	No serial correlation
DGCF	0.395	No serial correlation
DLAB	0.723	No serial correlation
DER	0.177	No serial correlation

Table 5: Tests for serial correlations of the variables

According to the table, serial correlation does not exist in any of the six variables. Therefore, if we adopted a lower order of lags, the effects of serial correlation may be encountered. On the other hand, if a higher order of the lag is taken, it leads to the disadvantages of risking overparameterization.

Step 3: Cointegration Test

The cointegration test is very important in the sense that it checks whether all variables are theoretically related or not. If the variables are cointegrated each other, it means that there is a co-movement among these variables in the long term reaching the equilibrium, although they might move differently in the short term.

This test is very useful because it will prove the untested hypothesis or theory. Once we have established that the variables are I (1) and determined the optimal VAR order as 2, we are ready to test for cointegration. We have performed two tests to identify cointegration between the variables, so called Johansen method and Engle-Granger method.

Johansen Method

The Johansen method uses maximum likelihood (i.e. eigenvalue and trace) and may identify more than one cointegration vectors while the Engle-Granger method can only identify one cointegration vector. According to the table 6 below, we have not found that there is cointegrating vectors between the variables based on eigenvalue. In the case when the null hypothesis is r = 0, there is no cointegration when we fail to reject the null. If the t-statistics are lower than critical value (CV), we fail to reject the null, that is no cointegration between variables and otherwise there is cointegration if the null is rejected. Meanwhile, if we see the output with the trace statistics, we have found two cointegration vector between the variables.

Null	Alternatives	Statistics	95% Critical	90% Critical Value
Maximal Eigenvalue Statistic				
r = 0	r = 1	41.2861	43.6100	40.7600
r<= 1	r = 2	35.7056	37.8600	35.0400
r<= 2	r = 3	20.3870	31.7900	29.1300
r<=3	r = 4	20.0790	25.4200	23.1000
r<=4	r = 5	7.3349	19.2200	17.1800
r<=5	r = 6	4.6811	12.3900	10.5500
Trace Statistic				
r = 0	r> = 1	129.4738	115.8500	110.6000
r<= 1	r> = 2	88.1877	87.1700	82.8800
r<= 2	r>= 3	52.4820	63.0000	59.1600
r<=3	r>= 4	32.0950	42.3400	39.3400
r<=4	r>= 5	12.0160	25.7700	23.0800
r<=5	r = 6	4.6811	12.3900	10.5500

Table 6: Johansen Test

From the above results, we select two cointegrating vector based on the Eigen value and trace test Statistics at 95% level. If we follow eigenvalue test, there is no cointegration. But with the trace tests of cointegration, we can find there is two cointegrating vectors among the variables, since null hypothesis of having no cointegration is rejected based on t-Stat. > 95% C.V. Here we have conflict problem between the eigenvalue and trace test.

Engle Granger Test

We also conducted Engel-Granger test whether the test results consistent with Johansen method. In E-G test, we assumed an OLS regression based on theories and empirical studies;

$LGDP = \alpha + \beta_1\ LEX + \beta_2\ LIMP + \beta_3\ LGCF + \beta_4\ LLAB + \beta_5\ LEX + \varepsilon_t$.

The result was made by comparing test statistics of the highest value of AIC and SBC with Dickey-Fuller (DF) critical value at 95%. In this result, we couldn't find cointegration among variables based on AIC and SBC value which are smaller than DF critical value (-4.9054).

	Test Statistics	**DF Critical Value at 95%**
AIC	-2.7650	-4.9054
SBC	-2.8664	

Table 7. Engel-Granger Test Result

Even though no cointegration was found in this test, it is still concluded that there is two cointegrating vector as what we found with the Johansen test. If they are cointegrated, then there is a long-term equilibrium relationship between the variables. The results show both exports and imports have an impact on GDP growth. There is a causal effect from export growth to GDP growth for Japan. Cointegration cannot tell us the direction of Granger causality as to which variable is exogenous and which variable is endogenous, for which the Vector Error Correction Modeling technique (VECM) will be applied. Thus, to make the coefficients of the cointegrating vector consistent with theoretical expectations, we applied the long run structural model (Masih and Algahtani, 2008).

Step 4: Long Run Structural Model (LRSM Testing)

This step will estimate theoretically meaningful cointegrating relations. we impose on those long-run relations and then test the over-identifying restrictions according to theories and information of the economies under review. In other words, this step will test the coefficients of variables in

the cointegration equations against theoretical expected value. This LRSM step also can test the coefficients of variables whether they are statistically significant or not.

In this study, we want to see the impact of exports, gross capital formation, import, labor force and exchange rate on GDP. In other words, our focused variable in this paper is LDGDP. Thus, we first normalized LDGDP (i.e. normalizing restriction of unity) at the 'exactly identifying' stage (Panel A). Next, we imposed restriction of zero on the other variable at the 'over identifying' stage (Panel B until Panel F). By calculating the t-ratios manually, we found that only LGFC was significant.

	PANEL A	**PANEL B**	**PANEL C**	**PANEL D**	**PANEL E**	**PANEL F**
LGDP	1.000 (**NONE**)	-0.62196 (5.2038)	0.08346 (0.70241)	-0.59820 (0.48968)	0.013834 (0.11440)	0.24555 (2.0710)
LEX	-1.6078 (13.4523)	1.000 (**NONE**)	-0.13415 (0.11836)	0.096181 (0.11673)	-0.022243 (0.028272)	-0.39481 (0.55013)
LIMP	11.9852 (100.8984)	-7.4543 (6.5769)	1.000 (**NONE**)	***-0.71696*** ***(0.32432)***	***0.16681*** ***(0.076023)***	2.9430 (1.7473)
LGFC	-16.7167 (136.8387)	10.3971 (12.6184)	***6.0311*** ***(2.7653)***	1.000 (**NONE**)	***-0.23126*** ***(0.033621)***	***-4.1048*** ***(1.3705)***
LLAB	72.2843 (597.7418)	-44.9577 (57.1423)	6.0311 (2.7653)	***-4.3241*** ***(0.62863)***	1.000 (**NONE**)	***17.7495*** ***(5.0757)***
LER	4.0725 (34.3471)	0.081763 (0.092980)	0.33979 (0.20174)	0.0078640 (0.0015188)	***0.056339*** ***(0.016111)***	1.000 (**NONE**)

Table 8. Exact and Over Identifying Restrictions on the Cointegrating Vector

Japan experienced bi-directional causality between imports and economic growth in the short-run thereby confirming the established notion that when the growth of output increases and living standards rise, this leads to the country importing goods, including capital goods and intermediate goods, which will boost domestic production. Moreover, advanced foreign technology and knowledge also flow into the domestic economy through imports, which will improve domestic performance in a cumulative process. Furthermore, as previously discussed, imports appear to play a similar role for both economies whereby they possess the common characteristics of geographical location and poor endowment of natural resources. Hence, the necessity to import raw materials and other similar goods.

Step 5: Vector Error Correction Model

Error-correction term (ECT) is the stationary error term, in which this error term comes from a linear combination of our non-stationary variables that makes this error term to become stationary

if they are cointegrated. It means that the ECT contains long-term information since it is the differences or deviations of those variables in their original level form. VECM uses the concept of Granger causality that the variable at present will be affected by another variable at past. Therefore, if the coefficient of the lagged ECT in any equation is insignificant, it means that the corresponding dependent variable of that equation is exogenous. This variable does not depend on the deviations of other variables. It also means that this variable is a leading variable and initially receives the exogenous shocks, which results in deviations from equilibrium and transmits the shocks to other variables. On the other hand, if the coefficient of the lagged ECT is significant, it implies that the corresponding dependent variable of that equation is endogenous. It depends on the deviations of other variables. This dependent variable also bears the brunt of short-run adjustment to bring about the long-term equilibrium among the cointegrating variables. The previous four steps tested theories and confirm that there is cointegration between the variables but it did not show which were the leader and the follower variables. Step 5 onwards allows us to answer this shortcoming. The statistical results generated from these steps will be welcomed by policy makers. Policy makers want to know which variable is the leader to focus their policies on those variables to make the biggest impact. We found only exchange rate is endogenous and the rest variables are exogenous.

Variables	**ECM (-1) t-ratio[p-value]**	**Implications**
LGDP	1.9382[0.057]	Exogenous
LEX	1.0554[0.295]	Exogenous
LIMP	4.4729[0.000]	Exogenous
LGCF	2.7757[0.007]	Exogenous
LLAB	1.6244[0.109]	Exogenous
LER	3.0240[0.470]	Endogenous

Table 9: Exogeneity and Endogeneity of Variables

This result means that, as the exogenous variable, when GDP, export and import receive market shocks, exchange rate will be affected by the shocks. This tends to indicate that the GDP, export, import, gross capital formation and labor force lead to volatility of exchange rate. Since VECM does not give information about relative exogeneity and endogeneity, we perform the next step to identify the ranking of the variables.

Our analysis indicates that export growth tends to have positive long-run effect on output growth in Japan, which thereby supports the export-led growth hypothesis. Japanese exports combine

favorably both price and non-price characteristics whereby any price premium is likely to be outweighed either by non-price considerations and/or their incalculable 'desirability' which is strongly associated with electronic consumer durables based on innovative technology.

Step 6: Variance Decomposition Analysis

VDC test will help us to ascertain the relative degree of endogeneity among those variables. The relative exogeneity or endogeneity of a variable can be determined by the proportion of the variance explained by its own past. If a variable is mostly explained by itself, it is the most exogenous variable. Meanwhile, the most endogenous variable is mostly explained by others. The relative endogeneity and exogeneity of the variables are important for policy makers. Firstly, it assumes that when variable is shocked, all other variables are switched off. Secondly, it is dependent on ordering of variables thus, the first variable would report as the highest percentage. Therefore, generalized VDCs was used, and compared the exogeneity and endogeneity of variables for 20 horizon time. Generalized VDCs is more reliable than orthogonalized VDCs, since it does not make such a restrictive assumption and independent on ordering of variables. However, when we interpret the numbers generated by the Generalized VDCs, we need to be careful and perform additional computations to make the numbers add up to 100% for a specified horizon (the numbers add up to 100% in the case of orthogonalized VDCs). Based on generalized VDCs, the forecast error variance of each variable is as table 10.

Forecast at horizon= 20

	LEX	**LIMP**	**LGCF**	**LGDP**	**LLAB**	**LER**
LEX	91.64%	24.47%	6.64%	41.19%	0.94%	0.38%
LIMP	45.93%	82.33%	21.12%	16.68%	17.80%	21.74%
LGCF	16.73%	7.11%	75.07%	20.26%	2.06%	8.02%
LGDP	32.19%	6.94%	58.57%	72.02%	1.57%	5.75%
LLAB	2.12%	26.06%	36.03%	14.91%	60.90%	8.28%
LER	1.85%	13.14%	20.59%	0.48%	4.26%	54.15%

Table 10: Generalized Variance Decompositions

We depicted the above result tables into the table 11 below. The variable relative exogeneity/ endogeneity of our variables are as table 11 below.

No.	Variable
1	LEX
2	LIMP
3	LGCF
4	LGDP
5	LLAB
6	LER

Table 11: The Variable Exogeneity and Endogeneity

From the above table, export can be said to be the lead variable compared to the others and then followed by import, gross capital formation, GDP, labor force and exchange rate. From the above result, we can conclude that, export is most influential factor to the other variables.

This is particularly the case where such industries play an increasingly important role in international manufacturing trade whereby these dynamic industries can have important positive effects on productivity and competitiveness, thereby laying the ground for future economic growth (OECD, 1999). Hence, the impact of such exports accounted for much of the growth in trade over the past decade with high-and medium-high technology industries in Japanese manufacturing exports in 2003 was over 83%. (OECD, 2005).

Step 7: Impulse Response Function (IRS)

The information which is presented in the VDCs also can be equivalently represented by Impulse Response Functions (IRFs). IRFs will present the graphical explanations of the shocks of a variable on all other variables. In other words, IRFs map the dynamic response path of all variables owing to a shock to a variable. The IRFs trace out the effects of a variable specific shock on the long-run relations.

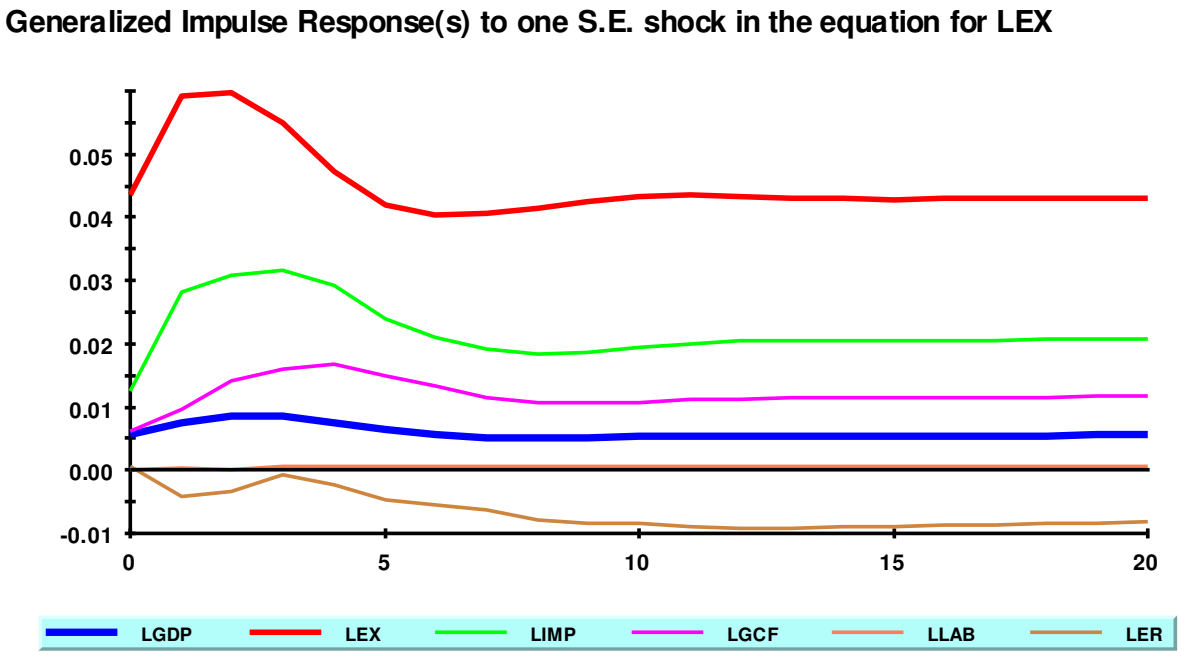

Figure 1: Generalized Impulse Response for LEX

Step 8: Persistence Profile

The persistence profile illustrates the situation when the entire co-integrating equation is shocked, and indicates the time it would take for the relationship to get back to equilibrium. Here the effect of a system-wide shock on the long-run relations is the focus instead of variable specific shocks as in the case of IRFs. The chart below shows the persistence profile for the cointegrating equation of this study, the chart indicates that it would take approximately 7 horizon time for the co-integrating relationship to return to equilibrium following a system-wide shock.

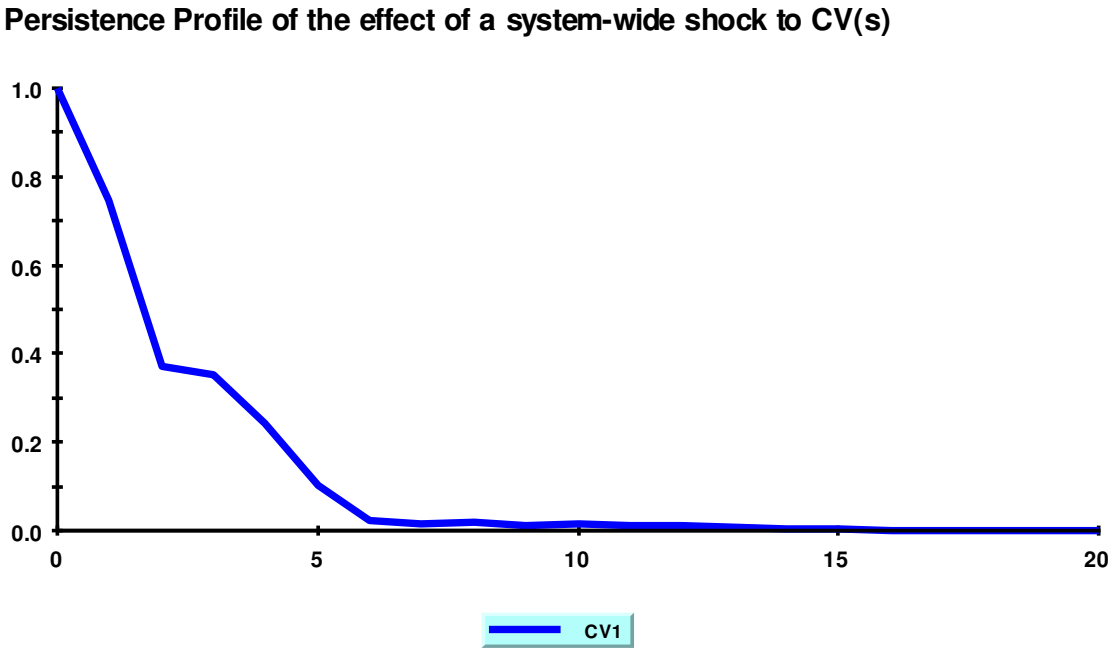

Figure 2: Persistence Profile of the effect of a system wide-shock

We find evidence to support the hypothesis that the profits earned through such exports are fed back into the domestic economy, this fails to create a virtuous circle of growth leading to increased exports. The Japan government is at a crossroad with regards to the structure of its economy. After a few decades of blistering growth, it is now engineering a shift away from exports and towards more reliance on domestic consumption. Thus, while it has focused on keeping the currency undervalued in the past, officials now welcome a strong Yen. A strong currency will reduce the price of imports and increase the price of exports. Domestically, the lower import prices should encourage consumption, something the government is encouraging.

6.0 Conclusion and Suggestions for future research

In this paper, the causality test is performed under Johansen's multivariate VAR framework and vector error correction model. Our findings suggest that real exports, real imports, real GDP and GCF are cointegrated for Japan. We recognize, however, that this study only examines the impact of exports and imports on economic growth, thereby ignoring the myriad of other factors that may also affect economic growth. Furthermore, it should be noted that there are potential problems in using the Granger causality test. Firstly, it relates to the final equations of an econometric system

whereby this information is different in nature from the economic causation used in building a structural model (Osborn, 1984). Secondly, in a realistic macroeconomic context the number of variables involved and the maximum lag order to be considered will be large (Osborn, 1984). Finally, as Nair-Reichert and Weinhold (2001) argue, there is a possibility that it is the (correct) expectation of future high growth rates that has caused the increased exports. However, our study is located within a large body of literature, which have utilized similar approaches to analyze these issues.

The empirical results indicate that real exports and real imports have different effects on economic growth. In terms of imports, they possess a positive cyclical effect on economic growth for both countries in short-run. This similar effect might be a consequence of both countries lacking natural resources and thereby importing similar goods. However, in terms of the inter-relationship between exports and growth, our analysis indicates that over the period studied Japan appears to have experienced export-led growth. Consequently, profits through Japanese exports are directed back into the domestic economy, which in turn fosters further increases in economic growth.

These findings possess policy implications for Japan of seeking to emulate their apparent successful combination of exports and growth in the post-WWII period. Firstly, the results indicate that imports are important in positively affecting economic growth, indicating that economies should permit a greater flow of imports into the domestic economy through lowering trade barriers. Secondly, in terms of the role of exports, the evidence of export-led growth for Japan indicates that there is a strong argument for governments to follow an export-promotion strategy thereby providing exporters greater incentives to export, for example, by implementing export subsidies and adopting a favorable exchange rate policy.

In the specific case of Japan, given that its economy was recently in recession for over a decade, the desirable long-run effect on economic growth that exports appear to possess could be a possible solution to aid its depressed domestic economy. However, with the current global economic downturn such a strategy is compromised through diminished demand affecting the majority of potential export markets. Finally, Japan indicate that there is no automatic beneficial relationship between exports and economic growth. Thus, attention should be paid to the overall economic policies, institutions and business structures that form the framework which creates the environment for national economic development.

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