Exports, imports and economic growth in South Korea and Japan:

a tale of two economies

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Abstract

This paper investigates the relationship between exports, imports and economic growth for South Korea and Japan by constructing a vector autoregression (VAR) model. Causality is examined between real GDP, real exports and real imports. Several principal results emerge from the empirical work. Firstly, the three variables are cointegrated for both countries, implying that a long-run steady state exists. Secondly, there is evidence of bi-directional causality between imports and economic growth for both countries. Finally, Japan seems to experience export-led growth, while GDP growth in South Korea has a negative effect on export growth. These contrasting findings could result from export goods in Japan exhibiting greater non-price competitive aspects, although their success fails to trigger a virtuous circle since growth fails to lead to increased exports, whilst for South Korea, output growth leads to a decrease in export growth suggesting a strong domestic market.

I. Introduction

South Korea and Japan are frequently referred to as ‘economic miracles’ as a consequence of their remarkable pace of economic growth achieved after World War II. In particular, these sustained high rates of economic expansion transformed South Korea in just three decades from one of the poorest developing countries to a newly industrialized nation (Kwon, 1997). Similarly, 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). Both countries promoted a rapid expansion in exports such that it appeared that they followed export-led strategies for promoting economic growth. Indeed, the relationship between real exports and real GDP indicates a strong rising trend for both countries, suggesting that

the two variables are correlated. However, careful analysis of the literature, particularly that solely focusing upon these two countries, together with consideration of data and methodological issues suggests that the simple presumption of an export-led growth panacea is potentially misleading.

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 labour-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 colour 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).

In contrast to being a sovereign nation like Japan, from 1910-45 Korea was itself a Japanese colony, whilst following liberation after the conclusion of World War II Korea was divided into South Korea and North Korea. The Korean War (1950-3) resulted in the devastation of the South Korean economy such that until 1962 its scarce resources, supplemented by large inflows of foreign aid, were devoted to reconstructing the war-destroyed economy and embarking on a strategy of import-substitution industrialization (Kwon, 1997). However, by 1963 South Korea switched to an outward-looking, export-oriented strategy, seeking to overcome a lack of natural resources and a small domestic market. Hence, the expansion of exports was adopted as the fundamental development strategy from the early 1960s whereby the government promoted exports of labour-intensive manufactured goods. In the 1970s, South Korea restructured the composition of exports in favour of heavy and chemical industries, whilst in the 1980s its export strategy was again modified with investment focused on technological innovation in light industries. Finally, since the 1990s, it has concentrated on high value-added, knowledge and technology intensive-industries (Kwon, 1997). Subsequently, its economy has experienced rapid growth with an average annual growth rate of GDP of 8.5 percent between 1960 and 1970, rising to over 9 percent in the following twenty years (World Development Report, 1980 and 1994).

Although there are clear differences in the post-WWII political and economic development of Japan and South Korea, there are some notable similarities. Firstly, both countries experienced high rates of economic growth and adopted export-oriented

development strategies after World War II. Since both lacked natural resources, export promotion was aimed at earning foreign exchange to facilitate importation of necessary raw materials. Secondly, the composition of exports shifted from labour-intensive goods to technology-intensive goods with Japan approximately a decade ahead of South Korea. Thirdly, trade policies (export subsidies, interest rate policy, exchange rate policy) were employed to provide producers with incentives to export. Finally, although both nations placed significant emphasis on the expansion of exports, the apparatus of planning and policymaking was more centralized and streamlined in South Korea compared to being more diffuse in Japan (Shinohara *et al*., 1983).

Hence, the motivation for this paper, which seeks to examine the trade-growth relationship for both Japan and South Korea, is the general esteem in which these countries are frequently held-up as economic beacons for other countries to follow. A number of, sometimes intertwining, forces have combined in the last two decades to accelerate the opening of national economies, thereby placing additional emphasis on the hypothesised 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 and South Korea 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 their post-WWII economic development. Moreover, excluding the relatively small Asian Tigers (Hong Kong, Taiwan and Singapore), South

Korea and Japan were the earliest Asian countries to experience high rates of economic growth after World War II. Hence, this paper specifically focuses on the two large regional economies of Japan and South Korea, which have grown rapidly since 1950s and the 1960s, respectively.

In particular, this paper contributes to the existing literature in the following dimensions. Firstly, previous studies frequently include both 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). Only one previous study (Awokuse, 2005a) focuses exclusively on South Korea, whilst only 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 for the two countries. 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 number of 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 the majority of 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 organised as follows. Section II outlines the economic theories underlying the relationship between exports, imports and economic growth. Section III presents a general overview of the empirical literature, prior to focusing on studies relating to Japan and South Korea. Section IV describes the data and econometric methodology which is followed by our empirical results (Section V). Finally, Section VI presents some concluding remarks.

II. Theoretical considerations

The possible relationship between exports and economic growth can be categorised 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 hypothesised 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 particular 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.

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 hypothesised 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 emphasises the process of modernisation 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).

III. 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 recognised 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 behaviours 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 utilised 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, a number of 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 particular 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, there have been fourteen time-series empirical studies examining the relationship between exports and economic growth for South Korea (Jung and Marshall, 1985; Chow, 1987; Bahmani-Oskooee *et al*., 1991; Bahmani-Oskooee and Alse, 1993; Dodaro, 1993; Arnade and Vasavada, 1995; Dutt and Ghosh, 1996; Riezman *et al*., 1996; Rahman and Mustafa, 1997; Islam, 1998; Ekanayake, 1999; Anoruo and Ramchander, 2000; Kónya, 2004; Awokuse, 2005a). However, among these studies only Bahmani-Oskooee and Alse (1993) and Awokuse (2005a) use quarterly data and both find evidence of bi-directional causality. In contrast, over a third apply a multivariate analysis which supports the hypotheses of export-led growth (Riezman *et al*., 1996; Islam, 1998), growth-led exports (Arnade and Vasavada, 1995), bi-directional causality (Anoruo and Ramchander, 2000; Awokuse, 2005a) and increased output growth leading to reduced exports (Kónya, 2004). Additionally, when undertaking bivariate analysis, studies reported bi-directional causality (Chow, 1987; Bahmani-Oskooee *et al*., 1991; Bahmani-Oskooee and Alse, 1993; Rahman and Mustafa, 1997; Ekanayake, 1999), non-causality (Dodaro, 1993; Dutt and Ghosh, 1996; Riezman *et al*., 1996; Islam, 1998) and that increased output growth leads to a decrease in export growth (Jung and Marshall, 1985; Kónya, 2004). Furthermore, several studies investigate the Granger causality test using the error correction model with bi-directional causality detected

(Bahmani-Oskooee and Alse, 1993; Rahman and Mustafa, 1997; Ekanayake, 1999; Anoruo and Ramchander, 2000; Awokuse, 2005a), while evidence of non-causality (Dutt and Ghosh, 1996) and growth-led exports (Arnade and Vasavada, 1995) are also found. For the remaining studies Chow (1987) applies Sim's causality test and finds bi-directional causality, whilst Kónya (2004) uses an augmented VAR level Granger causality test based on Toda and Yamamoto (1995) to reveal a negative link running from GDP to exports. In contrast, the standard Granger causality test is used in the majority of studies (Jung and Marshall, 1985; Bahmani-Oskooee *et al*., 1991; Dodaro, 1993; Riezman *et al*., 1996; Islam, 1998), which report bi-directional causality in bivariate analysis (Bahmani-Oskooee *et al*., 1991), negative correlation (Jung and Marshall, 1985), export-led growth in multivariate analysis (Riezman *et al*., 1996; Islam, 1998) and non-causality (Dodaro, 1993).

For Japan we have identified thirteen time-series studies (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, in contrast to those for South Korea, 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;

Kónya, 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, a number of 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 twenty-seven previous studies examining both South Korea and 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.

IV. Data and methodology

Data

Our analysis uses seasonally adjusted quarterly time-series data for both South Korea and Japan collected from the IMF's International Financial Statistics. The time period is 1963-2003 for South Korea and 1957-2003 for Japan. Different time periods are used, firstly, to maximise sample size, and secondly, to capture the commencement of the export promotion policies adopted in the 1950s in Japan and in the 1960s in South Korea. The variables used in this study are real GDP, real exports and real imports in billions of constant local currency, which are then expressed in the form of natural logarithms. Nominal GDP is deflated using the GDP deflator for both Japan and South Korea, whilst for Japan, nominal values for exports and imports are deflated using the export price index and import price index respectively. However, for South Korea, nominal exports and imports are deflated using unit value of exports and unit value of imports because price indexes are not available. In the following discussion X_t, Y_t and M_t denote the natural logarithms of real exports, real GDP and real imports respectively.

Empirical methodology

Unit root test. Stationarity can be tested by determining whether the data contain a unit root. The Augmented Dickey-Fuller (ADF) test is used here for testing for stationarity as well as for the existence of a unit root. If the level of a variable is found to be non-

stationary, then the ADF test is performed on the first difference of the variable. If the first difference of the variable is found to be stationary, we conclude that the variable is integrated of order one I(1) and it has a unit root. The results of ADF tests for the levels and first differences of the three variables considered are reported in Tables 1 and 2. It is clear that the levels of all the variables are non-stationary and the first differences of all variables are stationary. As differencing once produces stationarity, we conclude that each of the series is characterised by one unit root or integrated of order one I(1).

[Tables 1 and 2 about here]

Cointegration analysis. Given that all the variables are integrated to the order one, the next step is to find whether they are cointegrated using Johansen's Vector Autoregression (VAR) procedure. The optimal lag length is chosen to be four using the Schwarz Information Criterion (SIC) for both South Korea and Japan. The results of Johansen's tests for cointegration for the two countries are shown in Table 3. Both the trace and maximum eigenvalue test statistics indicate that a cointegration rank of one is present for both countries. This implies that there is one long-term stationary relationship between real GDP, real exports and real imports for both South Korea and Japan.

[Table 3 about here]

Vector error-correction model and Granger causality test. If all the variables are integrated of order one and cointegrated of order one, then an error correction model

should be specified (Toda and Yamamoto, 1995). The vector error correction model (VECM) with cointegrating rank r is shown as below

$$\Delta Z_t = \mu + \alpha\beta Z_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta Z_{t-i} + \varepsilon_t$$

where the error correction coefficient is α and the cointegrating vector β are (n×r) matrices. For example, when r=1, α and β take the form

$$\alpha = \begin{pmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \end{pmatrix} \text{ and } \beta = \begin{pmatrix} \beta_1 \\ \beta_2 \\ \beta_3 \end{pmatrix}$$

For the three variables case, the VECM is the following

$$\Delta Y_t = \mu_1 + \alpha_1 EC_{t-1} + \sum_{j=1}^{p-1} \phi_{1j} \Delta Y_{t-j} + \sum_{j=1}^{p-1} \theta_{1j} \Delta X_{t-j} + \sum_{j=1}^{p-1} \Psi_{1j} \Delta M_{t-j} + \varepsilon_{1t}$$

$$\Delta X_t = \mu_2 + \alpha_2 EC_{t-1} + \sum_{j=1}^{p-1} \phi_{2j} \Delta Y_{t-j} + \sum_{j=1}^{p-1} \theta_{2j} \Delta X_{t-j} + \sum_{j=1}^{p-1} \Psi_{2j} \Delta M_{t-j} + \varepsilon_{2t}$$

$$\Delta M_t = \mu_3 + \alpha_3 EC_{t-1} + \sum_{j=1}^{p-1} \phi_{3j} \Delta Y_{t-j} + \sum_{j=1}^{p-1} \theta_{3j} \Delta X_{t-j} + \sum_{j=1}^{p-1} \Psi_{3j} \Delta M_{t-j} + \varepsilon_{3t}$$

where $EC_t = Y_t + (\beta_2 / \beta_1) X_t + (\beta_3 / \beta_1) M_t$ is the normalized equation.

In the above VECM framework, ΔY_t, ΔX_t and ΔM_t are influenced by both long-term error correction terms (EC_{t-1}) and short-term difference lagged variables (ΔY_{t-j}, ΔX_{t-j} and ΔM_{t-j}). Given the short-run and long-run relationships in a VECM, the causality test should be the joint significance of all the lagged difference variables and the error correction term (Thangavelu and Rajaguru, 2004).

The paper follows Thangavelu and Rajaguru's (2004) technique and uses a two-stage method to determine the causal relationship between the variables. In the first stage,

we test the joined significance of the lagged difference variables and the long-run error correction term. For example, the joint test of the lagged difference variables (θ_{1j}) and long-run error correction term (α_1) is tested to establish the overall causality from X_t to Y_t. If the joint test result is statistically significant, it means there is an overall causality from X_t to Y_t. We can go on and determine the long-run and short-run casual relationships respectively. Otherwise, it is concluded that there are no short- or long-run relationships.

The short-run causal relationships between the variables are determined by the joint significance of the lagged difference variables (Thangavelu and Rajaguru, 2004). For example, the short-run Granger causality from X_t to Y_t is the joint test of θ_{1j} is statistically significant from zero. The Wald test is employed to establish the causality. The direction of the short-run causality from X_t to Y_t is established by the sign of the sum of the estimated coefficients (θ_{1j}).

The long-run causal relationships are determined by the joint significance of the respective cointegrating vectors (β) and the error correction coefficient (α) (Thangavelu and Rajaguru, 2004). For example, the long-run Granger causality from X_t to Y_t is the joint significance of (β_2 / β_1) and the error correction coefficient (α_1). The direction of the long-run causality from X_t to Y_t can be established by the sign of $\alpha_1 \beta_2$.

V. Empirical results

Granger causality test results. Since the three variables are cointegrated, the next step is to cast the Granger procedure in terms of error correction modelling. Table 4 reports F-statistics for the test of joint significance of the error correction term and the lagged difference variables for the two countries under study. The results show both exports and imports have an impact on GDP growth. In particular, there is a causal effect from GDP growth to export growth for South Korea and a causal effect from export growth to GDP growth for Japan. Additionally, two-way relationships between import growth and GDP growth are also found for both countries.

[Table 4 about here]

Short-run causality test results are presented in Table 5 which indicates the existence of a negative effect from real GDP to real exports for South Korea, but no relationship between real GDP and real exports for Japan. Moreover, in terms of imports, positive bi-directional causality between real imports and real GDP is found for both countries.

[Table 5 about here]

Table 6 shows the long-run causality test results. We find that there is no long-run effect among the three variables for South Korea, although a positive effect is established from real exports to real GDP for Japan.

[Table 6 about here]

Finally, the short-run, long-run and overall causality tests on real imports, real exports and real GDP are summarised in Table 7 indicating that both countries 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.

[Table 7 about here]

However, a significant difference between the two countries occurs with the role of exports. 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. In contrast, a short-run negative causality running from GDP growth to export growth exists in South Korea. Thus exports appear to possess fundamentally different properties for both countries. In addition to the previously outlined theoretical considerations, several reasons might explain these differences. Firstly, many Japanese exports combine favourably 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.

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 the share of high- and medium-high technology industries in Japanese manufacturing exports in 2003 was over 83%, compared to 68% in South Korea (OECD, 2005).

Furthermore, whilst both Japan and South Korea are evidently major exporters of high-technology products, the value content of exports from South Korea remains low (Dahlman and Andersson, 2000). For example, Japanese consumer electronics especially in audio-visual equipment and computer games, together with motor vehicles which remain Japan’s premier world-class industry have been highly competitive and thereby carried the entire economy and driven the growth in exports (Nezu, 2006; Shibata, 2006; Takeuchi, 2006). Consequently, Japan is the home of numerous highly-ranked companies, for consumers in terms of automobiles, electronics, digital cameras and gaming software, and for business in a wide range of products requiring high precision and quality (Shibata, 2006).

However, although for Japan 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. In contrast, for South Korea, its exports appear less internationally competitive whereby output growth leads to a decrease in export growth, potentially indicating the presence of a voracious domestic market for nationally produced goods which suppliers regard as easier to satisfy.

VI. Conclusion

In this paper, the Granger causality test is used to determine whether there is link between export growth, import growth and economic growth in South Korea and Japan. The causality test is performed under Johansen's multivariate VAR framework and vector error correction model. Our findings suggest that real exports, real imports and real GDP are cointegrated for both countries.

We recognise, 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 utilised similar approaches to analyse 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, whilst GDP growth in South Korea had a negative effect on export growth. We hypothesis, *inter alia*, that Japanese exports possess superior price and non-price competitive features than those of South Korea. Consequently, profits through Japanese exports are directed back into the domestic economy, which in turn fosters further increases in economic growth, whilst for South Korea economic growth appears to result in output being diverted to the domestic market and away from exports.

These findings possess policy implications for both the two countries in question and

those 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 favourable 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 seen as 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. In contrast, for South Korea there would appear to be a need to reverse the current association between exports and growth to establish a positive relationship by improving both their price and non-price aspects. As previously discussed, whilst its export profile is significantly geared towards high-technology goods, these possess a low value content. Finally, for other countries the mixed experience of Japan and South Korea 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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Table 1. ADF unit root test on the levels of the variables

	Variables	3 lags pre-selected	AIC	SIC
South Korea	X_t	-2.033 (0.578)	-2.033 (0.578) 3 lags	-2.033(0.578) 3 lags
	Y_t	-0.086 (0.995)	-0.086 (0.995) 3 lags	-0.086 (0.995) 3 lags
	M_t	-2.245 (0.461)	-2.094 (0.545) 2 lags	-2.094 (0.545) 2 lags
Japan	X_t	-1.301 (0.885)	-1.301 (0.885) 3 lags	-1.072(0.930) 0 lag
	Y_t	-2.012 (0.591)	-2.012 (0.591) 3 lags	-2.012 (0.591) 3 lags
	M_t	-2.562 (0.298)	-2.058 (0.565) 2 lags	-2.058 (0.565) 2 lags

Table 2. ADF unit root test on the first differences of the variables

	Variables	2 lags pre-selected	AIC	SIC
South Korea	ΔX_t	-11.934 (0.000)	-11.934 (0.000) 2 lags	-11.934 (0.000) 2 lags
	ΔY_t	-98.010 (0.000)	-98.010 (0.000) 2 lags	-98.010 (0.000) 2 lags
	ΔM_t	-7.369 (0.000)	-8.928 (0.000) 1 lag	-17.945 (0.000) 0 lag
Japan	ΔX_t	-6.824 (0.000)	-6.824 (0.000) 2 lags	-7.224(0.000) 1 lag
	ΔY_t	-44.538 (0.000)	-44.538 (0.000) 2 lags	-44.538 (0.000) 2 lags
	ΔM_t	-6.653 (0.000)	-6.911 (0.000) 1 lag	-6.911 (0.000) 1 lag

Table 3. Trace and Maximum eigenvalue tests for cointegration

	Trace test			Max-eigenvalue test		
South Korea	H_0	statistic	critical value(1%)	H_0	statistic	critical value(1%)
	r=0	48.511	35.65	r=0	29.982	25.52
	r≤1	18.529	20.04	r≤1	15.723	18.63
	r≤2	2.806	6.65	r≤2	2.806	6.65
Japan	H_0	statistic	critical value(1%)	H_0	statistic	critical value(1%)
	r=0	133.499	35.65	r=0	121.558	25.52
	r≤1	11.941	20.04	r≤1	9.911	18.63
	r≤2	2.029	6.65	r≤2	2.029	6.65

Table 4. Overall causality test

	$Y_t \rightarrow X_t$	$X_t \rightarrow Y_t$	$Y_t \rightarrow M_t$	$M_t \rightarrow Y_t$
South Korea	16.182 (0.000)	1.402 (0.227)	3.429 (0.006)	4.159 (0.002)
Japan	1.113 (0.356)	4.196 (0.001)	5.986 (0.000)	6.303 (0.000)

Table 5. Short-run causality test

	$Y_t \rightarrow X_t$	$X_t \rightarrow Y_t$	$Y_t \rightarrow M_t$	$M_t \rightarrow Y_t$
South Korea	19.24 (0.000) negative		4.269 (0.003) positive	4.121 (0.003) positive
Japan		1.044 (0.386)	4.261 (0.003) positive	4.560 (0.002) positive

Table 6. Long-run causality test

		South Korea	Japan
$Y_t \rightarrow X_t$	LR	0.107 (0.743)	
	ECM	-0.020 (0.037)	
$X_t \rightarrow Y_t$	LR		4.725 (0.030)
	ECM		0.017 (0.000) positive
$Y_t \rightarrow M_t$	LR	0.107 (0.743)	1.818 (0.178)
	ECM	0.004 (0.428)	-0.003 (0.369)
$M_t \rightarrow Y_t$	LR	0.125 (0.723)	1.358 (0.244)
	ECM	0.008 (0.030)	0.017 (0.000)

Note: LR is likelihood ratio test statistic with chi-square distribution.

Table 7. Short-run and long-run causality tests in the VECM

		$Y_t \rightarrow X_t$	$X_t \rightarrow Y_t$	$Y_t \rightarrow M_t$	$M_t \rightarrow Y_t$
South Korea	Overall	Yes	None	Yes	Yes
	SR	Negative		Positive	Positive
	LR	None		None	None
Japan	Overall	None	Yes	Yes	Yes
	SR		None	Positive	Positive
	LR		Positive	None	None

Notes: SR is short-run causality results and LR is long-run causality results.