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Dynamic estimation of the Relationship between Trade Openness and Economic Growth in Singapore

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Abstract

This paper studies the relationship between trade openness and output growth for Singapore, using ARDL model. The findings for ARDL model of this study provide empirical evidence and indicating that higher revealed trade openness is the main engine explaining the Singapore economic-growth. In particular, our investigation finds that long run relationship among the variables such as capital formation; exports, imports and international trade have positive impact on economic growth. Furthermore, the results for Granger causality test indicates that there is a unidirectional relationship running from GDP per capita to trade (Export + Import). This is shows that GDP is very important to the trade sector in Singapore.

Keywords: Economic growth, Trade, ARDL model and Singapore.

يوخته

نهم لیّکوٚلینهوهیه هه لسهنگاندنیّکه بو پهیوهندی نیّوان بازرگانی کراوهو گهشهی ئابووری نه ولأتی سهنگاپوّره بهبهرکارهیّنانی موّدیّلی ئهی ئار دی ئیل موّدیّل، به پیّ ی ئهم لیّکوٚلینهوهیه ئهوهمان بوّ دهردهکهویّت که بازرگانی کراوه به یهکیّك نه ههرهگرنگترین فاکتهرهکانی گهشه ئابووری دادهنریت نهولاّتی سهنگا پووره بهتاییهتی هاورده و ناردهنی نیّهدهونّهتی دهوریّی پوّزهتیت دهبینن نهم رووهوه . وهههروهها موّدیّلیّکی تری گرنگی ستاتیستیکمان بهکار هیناوه بوّ نیّکوّنیّنهوهکهمان که برزگانی کراوه به یهکیّك نه ههرهگرنگترین و نهنه نجامدا ئهوهمان بهدهستهیّناوه که هاورده و ناردهنی پیّکهیّنه دیکی سهرهرکی بازگانی نیّودهونّهتی دهوریّی پوّزه تیتی بوونه تههی ئابوری و بهرزبوونه می ماورده و ناردهنی پیکهیّنه دیکی سهره دی بارزگانی نیّودهونّهتی و نه نه نجامیشدا

المستخلص

هذه الورقة تدرس العلاقة بين الانفتاح التجاري ونمو الناتج لسنغافوري، وذلك باستخدام نموذج ARDL، حيث وفر لنا هذا النموذج الأدلة التجريبية مشيرا إلى أن أعلى كشف للانفتاح التجاري وهو المحرك الرئيسي لشرح النمو الاقتصادي السنغافوري. على وجه الخصوص، خلص تحقيقنا أن العلاقة للمدى الطويل بين المتغيرات مثل تكوين رأس المال والصادرات والواردات والتجارة الدولية لها تأثير إيجابي على النمو الاقتصادي. وعلاوة على ذلك، فإن نتائج جرانجر لأختبار السببية اشارت إلى أن هناك علاقة وحيدة الاتجاه تتحدر من الناتج المحلي الإجمالي للفرد الواحد للتجارة (تصدير + الواردات). هذا يدل على أن الناتج المحلي مهم جدا لقطاع التجارة في سنغافواررة.

1. Introduction

Asia is an economic and financial region included of fifty countries with a market size of over 3 billion people. The region has experienced an impressive per capita income growth performance even after accounting for the negative impacts of the 1997–1998 financial and economic crises characterized in the previous literature as an economic miracle. For example, Singapore, Hong Kong, South Korea, China, India have grown on average at 6.741 percent since the 1960s.

In particular, the incredible and sustained growth rate observed in countries such as China (8.25%) and India (5.18%) from the 60s through 2012 has marked the potential of the region and its overall effect on the global economy. Similarly, economic growth has also been observed in other big economics such as Singapore, South Korea, and Malaysia. Regardless of the impressive economic performance in the region, Krugman (1994) and Young (1995) discussed that there is nothing miraculous about this economic performance. They believe that strong unprecedented accumulation of capital is reasons for this economic growth. Moreover, De La Dehesa (2007) found that Asia's outstanding economic performance accounts for the major reduction in both income inequality and poverty in the world. Particularly, Kuroda (2006) found that Asia has been a showcase of economic performance where an active and outward-looking trade policy takes a central role. On this regard, Wu and Chen (2004) investigated that China has a main economic cooperation with the Asia Pacific Region, – besides relationship with ASEAN countries–it has also developed trade policy and investment links over the five Central Asian countries.

Singapore is a large Asian economic country with an outstanding economic growth and very good performance record. Feng (2007) found that its successful economic transformation rests on the government's role in promoting free trade and encouraging foreign direct investment (FDI) in line with its outward-oriented industrialization policy. Furthermore, Krugman (1994) found that Singapore's impressive economic growth is the result of enormous resource reallocation, but not of efficiency gains in productivity deriving from trade openness. Moreover, trade openness did not result in the development of positive spillover impacts leading to efficiency gains in the period before the Asian financial crisis and, the Asian financial crisis of 1997-1998 South East Asian countries casted extreme doubts on the economic performance and its ability to continue performing at the fast pace it had up to that point. In addition, the 1997–1998 economic and financial criseshad brought trade integration efforts to a halt. As stated byPeng (2002), the financial crisis had made evident that East Asian economies were highly regionalized. Despite of the negative impacts of the financial crisis had on the overall countries economic structure of the ASEAN region, previous researchersdiscuss that the economic success performance of the region is due in part to the presence of alternative mechanisms beyond the conventionally-understood economic integration apparatus. Most interestingly, Peng (2002) investigated a systematic study of the informal integration in East Asian nations. He found that the presence of "invisible linkages" quietly shapes the Asian economic integration. He also found that the strong presence of three major informal mechanisms

Vol. (1) Issue (1) *PP: 27-37* Feb/2017

are the main drivers of the observed economic success, such as regional production networks, ethnic Chinese business networks and sub regional economic zones. Furthermore, Stubbs (2002) pointed out that earlier efforts to promote further economic integration.), remarks how the ASEAN plus Three (ASEAN + China, Japan and South Korea) process was at its time one of the most comprehensive proposal towards East Asian regional cooperation. Moreover, (Cai, 2001)found that Northeast Asian countries such as (Japan, South Korea, China, Mongolia, Taiwan, and Russia's far East) promoted the development of a free trade area to counterbalance growing protectionism and regionalism elsewhere. More recently, integration efforts pointed toward a larger Regional Comprehensive Partnership, which is a large free trade agreement including the 10 ASEAN countries and also its FTA members such as (Australia, Japan, South Korea, New Zealand, China and India).

This new effort is expected to replace the East Asia Free Trade Agreement (EAFTA) and the Comprehensive Economic Partnership in East Asia (CEPEA). Particularly, the RCEP aims at achieving a modern comprehensive high quality and mutually beneficial economic partnership agreement; establishing an open trade and investment environment; boost economic growth and equitable economic development; advance economic cooperation and broaden and deepen integration in the region. If successful, the RCEP would be touted as the largest free trade area in the world, and would serve as a balancing mechanism against the Trans-Pacific Partnership (TPP). Incidentally, on the flip side, Tang (2000, p. 375) argues, that non-member countries in the region will be adversely affected by these integration efforts. It is also relevant to note that in Asia, trade reform primarily includes – but is not limited to – the formation of invisible linkages (Peng, 2002), the pursuit of foreign trade agreements, and the attraction of foreign direct investment and promotion of business development.

Because of the predominant role that academics, policy makers, and practitioners place on trade reform and trade liberalization as drivers of the process of economic growth in Asia (the so called Asian Miracle), a thorough understanding of their linking mechanisms requires inquiring about both the short run (resource mobilization and reallocation) and long run (spillover effects and productivity gains) effects of trade policy on output growth. In this regard, Krammer (2010, p. 592) emphasizes on the relevance of understanding the mechanisms and channels of technology diffusion across countries, as the world becomes ever more integrated. Particularly, if the strong period of economic growth in the Asian region was driven by the expansion of trade – larger and faster trade openness – then several relevant questions need to be addressed to better understand if trade growth is the force behind economic growth. In this regard, this paper aims at shedding some light on the following set of questions: What have the effects of trade openness been on factor accumulation, productivity and output growth? Are there significant differences between the short run and long run effects of trade expansion on output growth and factors' productivity that have been largely overlooked in the literature? Do more open economies outperform the lesser open ones? Have all Asian countries move in the same direction and at the same speed? What lessons can be drawn from The Asian experience?

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The rest of the paper is structured as follows. Section 2 briefly reviews the empirical literature to date. Section 3 describes the used data, while Section 4 deals with the estimation technique and the empirical analysis of the results. Section 5 concludes the paper.

2. Literature Review

Empirically, the previous evidence had found that international trade has a positive effect economicgrowth by industrial structure upgrading, facilitating capital accumulation, technological progress and institutional advancement. More specifically, Lee, 1995 found that increased imports of capital and intermediateproducts, which are not available in the domestic market, mayresult in the rise in productivity of manufacturing. Furthermore, Wagner, 2007 is also investigated that more activeparticipation in the international market by promoting exports leads to more intensecompetition and improvement in terms of productivity.Learning-by-doing may be more rapid in export industry thanks to the knowledge andtechnology spillover effects. In addition, the best advantages of international trade are mainly related and generated from the external factors, appropriate trade strategy and structure oftrade patterns. There are many comprehensive empirical investigations on the effects of trade oneconomic growth. Before the 1960s, study and research on trade impacts was limited to a fewspecific countries.

With the progress of econometrics methodology, however, so many sophisticated methods based on a mathematical model were introduced to investigate and analyze the relationship between trade and economic growth. So far, the arguments in this area havebeen mostly divided into two categories. The first one concentrates on the causality relationshipbetween economic growthand international trade to examine whether economic growthis propelled by international trade or vice versa. The other mainly discusses thecontribution of foreign trade to economic growth. In addition, Maizels (1963) had discussed the positiverelationship between economic development and international trade by a rankcorrelation analysis among 7 developed countries.

Furthermore, Kavoussi (1984) studied 73low and middle -income developing countries, he found that higher rates of economicgrowth was strongly related with higher rates of export growth. He also illustrated that thepositive relationship exist between exports and growth for both middle- andlow-income countries, however, the effects tend to diminish according to the level ofdevelopment. Dollar (1992) haveargued that outward-orienteddeveloping economies achieved much more rapid growth than inward-orienteddeveloping ones. Moreover, Sachs and Warner (1995) constructed a policy index to investigate economic growth rate, and they found that the average growth rate in the period after tradeliberalization is significantly higher than that in the period before liberalization. Kraay (1999) have used panel data of 2105 Chinese industrial enterprises between 1988 and 1992 and he found the "learning" effects most pronounced among established exporters. Keller (2001) have also analyzed thatinternational trade which involves importing intermediate goods of a high qualitycontributed to the diffusion of technology.

Furthermore, Keller,w (2002) investigated the effect of trade on income and their result indicated that trade has a quantitatively large and robust positive impact on income even

though it is only moderately significant statistically. Coe and Helpman (1995) studied the international R&D diffusion among 21 OECD countries over the period of 1971-1990, and they had found that international trade is the best channel of transferring technology. In sum, most of the previous empirical studies support the positive impacts of openness on economic growth and from the comprehensive literature, both dynamic and static gains from trade could be found. The static gains from international trade refer to the improvement in output or social welfare with fixed amount of input or resource supply. They are mainly the results from the increase in foreign reserves and national welfare. Firstly, opening up to the global market offers an opportunity to trade at international prices rather than domestic prices. This opportunity provides a gain from exchange, as domestic consumers can buy cheaper imported goods and producers can export goods at higher foreign prices. Furthermore, there is a gain from specialization. Finally, international trade leads to strong institutional changes. International trade is notonly facilitating trade of goods and services, but it also ideas on market mechanisms. Developing countries are learning to apply market power more efficiently with lessintervention from government to increase openness. Especially in bilateral andmultilateral trade, participants should fulfill their commitments to international rulesand regulations to bridge the gap between developed countries.

3. DATA SOURCES AND ECONOMETRIC METHODOLOGY

The Data:

The four variables are used in this study such as Gross domestic product per Capita Gross Capital Formation as a share of GDP, Export of Goods & services as a share of GDP, Import of Goods & services as a share of GDP by using time-series data for over the span 1960–2015 as illustrated in table 1. The data are collected from World Development Indicator (WDI 2016).

Table 1: Description of variables.

Variable	Description	Source
GDPC	Gross domestic product per Capita	WDI (2016)
GCF	Gross Capital Formation as a share of GDP	WDI (2016)
EXP	Export of Goods & services as a share of GDP	WDI (2016)
IMP	Import of Goods & services as a share of GDP	WDI (2016)

ECONOMETRIC METHODOLOGY:

To analyze time series data in different order I(1) and I(0) together, Pesaran et al. (2001) suggested, the Autoregressive distributed lag approach (ARDL) to test for co-integration as an alternative to co-integration model for Engle-Granger (1989). The study uses the ARDL model to investigate the long run and the short run relationship between variables. The ARDL bound testing approach for co-integration can be written as following:

$$\Delta GDPC_t = \alpha_0 + \sum_{i=1}^p \alpha_1 \Delta GDPC_{t-i} + \sum_{i=0}^p \alpha_2 \ \Delta GCF_{t-i} + \sum_{i=0}^p \alpha_3 \ \Delta Exp_{t-i} + \sum_{i=0}^p \alpha_4 \ \Delta IMP_{t-i}$$

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$$+b_1GDPC_{t-1} + b_2GCP_{t-1} + b_3Exp_{t-1} + b_4Imp_{t-1} + \mu_t$$
 (eq. 1)

Here Δ is the first difference operator; Δ GDPC_t refers for the natural log of Gross domestic product per capital, Δ GCF_trefers for the natural log of gross capital formation as a share of GDP, Δ Exprefers for the natural log of Export of Goods & services as a share of GDP , Δ Imprefers for the natural log of Import of Goods & services as a share of GDP, and μ_t refers for the error correction term.

The F test is used to determine whether the long-run relationship exists between the variables through testing the significance of the lagged levels of the variables. When the long-run relationship exists, the F test will illustrate which variable should be normalized.

The null hypotheses of no co-integration amongst the variables are

$$H_0: b_{1i} = b_{2i} = b_{3i} = b_{4i} = 0 \tag{eq. 2}$$

Against the alternative hypothesis

$$H_1:b_{1i} \neq b_{2i} \neq b_{3i} \neq b_{4i} = 0 \tag{eq. 3}$$

for i=1, 2, 3, 4.

The *F* test has a standard distribution which depends on; (a) whether the variables are included in the ARDL model are I(0) or I(1); (b) the number of independent variables; (c) whether the ARDL model contains an intercept and a trend; and (d) the sample size of the variables. According to Narayan (2005), the rejection of the null depends on the F-test and the critical bound tabulated value for small sample size.

The long run relationship among the variables exists if the calculated value of F - statistic is greater than the upper critical bound (UCB), and if the calculated value of F- statistic is less than the lower critical bound (LCB), the long run relationship does not exist. If the calculated value of the F-statistic comes in between the range of LCB and UCB, then the long run relationship is inconclusive, Mintz (1990) Hassan &Kalim, (2012). The optimal lag can be selected using the model selection criteria like Akaike Information Criterion (AIC). Narayan (2005) stated the maximum lags for small sample size is two lags.

4. RESULTS AND DISCUSSIONS

We begin the empirical analysis with examine of the unit root test for the variables and we assumed that, the data used in this estimation are stationary. If the results of stationary are violated, this might lead to spurious results. In examining the time-series data properties, there are several models to test the stationary, but the most important one are the Augmented Dickey–Fuller (ADF) (Dickey and Fuller, 1979, 1981) and the Phillips–Peron (PP) (Phillips and Peron, 1988) unit root tests. Table 2 explains the result of the stationary test for ADF and PP unit root test respectively for the case of China. Both tests have illustrated that GDPC has a unit root at level, but it becomes stationary at first difference, which implies that GDPC is I (1). In addition, all other variables are found to be significant at first difference and thus it indicates the variables are I (1) as we have illustrated at table 3. As the results point out, the variables are either I(0) or I(1), therefore

implying that we can confidently apply the ARDL approach to this model as using ARDL requires the data to be stationary at the level I(0) and first difference I(1) see (Narayan, 2005).

Variables	ADF test		PP test		
	Intercept	Intercept and trend	Intercept	Intercept and trend	
ln(GDPC)	0.430391	-2.435663	1.446349	-1.343694	
ln(GCF)	-2.349624	-2.334847 ^c	-2.345741	-2.324628	
ln(EXP)	-1.479867	-2.712584	-1.617018	-3.029799	
ln(IMP)	-2.514992	-3.030864	-2.576268	-3.145894	

Table 2 ADF and PP unit root tests on log levels of variables.

^aDenotes significant at 1%, ^bDenotes significant at 5%, ^cDenotes significant at 10%,

Table 3 ADF and PP unit root tests on first differences of log levels of variables.

Variables	ADF test		PP test	
	Intercept	Intercept and trend	Intercept	Intercept and trend
ln(GDPC)	-4.423511 ^a	-4.615376 ^a	-4.307519 ^a	-4.615376 ^a
ln(GCF)	-7.405351a	-7.827343a	-7.405350^{a}	-7.823119 ^a
ln(EXP)	-7.027633 ^a	-6.942158 ^a	-7.026403 ^a	-6.939966 ^a
ln(IMP)	-7.981851 ^a	-7.889106 ^a	-7.995496 ^a	-7.902289 ^a
^a Denotes signifi	icant at 1% ^b 1	Denotes significant at 50	% CDanotas si	phificant at 10%

Denotes significant at 1%, "Denotes significant at 5%, "Denotes significant at 10%,

Furthermore, Table 4 represents the co-integration test analysis, and the existence of a long run relationship has been established among the model's variables. Results show that the computed F-statistics are 5.28 the relevant critical value bounds at ten percent level (with unrestricted intercept and no trend) are 5.28 and for the lower and upper bounds respectively. Then, the computed F-statistics is higher than the critical value of the upper bound, the null hypothesis of no long run co-integration correlation among the variables can be simply rejected.

TABLE 5	Results	from	bound	tests.
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Lag Structure	e:					ARDL(1,1,0,1)
F-statistics	1% Crit	ical value	5% Crit	ical value	10% Cri	itical value
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
4.6173**	4.244	5.726	3.068	4.334	2.578	3.710
K=4, N=60						
The critical	value acco	ording to N	arayan (20	005) (Case II	I: Unrestric	ted intercept and no
trend)						

(^{**}) Significant at 5%

Table 4 shows the estimated coefficients of the long-run association which are significant for GCF, these are also significant for trade (Export + Import). In addition; GCF has a positive and significant impact on GDPC at the 1% level. This is illustrating that the growing correlation between gross capital formation and economic growth in Singapore. Which motivate the inflow of n economic activity?

Muhammad Shahbaz and Saleheen Khan (2013) found that their empirical evidence confirmed our finding and they illustrated that long run relationship among the variables

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such as financial development, capital, exports, imports and international trade have positive impact on economic growth.

TABLE VLONG RUN RELATIONSHIPS

ARDL(1,1,0,1) selected	l based on Schwarz I	Bayesian Criterion	
Variable	Coefficient	t-Statistic	Probability
Constant	-1.3047	11625	.908
$\ln (GCF_t)$	1.7953 ^a	2.0321	.048
$\ln(EX_t)$	12.3026 ^a	2.9845	.004
$\ln(IMP_t)$	-11.3686 ^a	-2.0432	.047
R-squared	.99814		
F-statistic	4.6173		
DW-statistic	1.6989		
(a) Ciamificant at 101			

^(a) Significant at 1%.

Moreover, all variables are also passes all diagnostic tests against serial correlation (Durbin Watson test and Breusch– Godfrey test), heteroskedasticity (White heteroskedasticity test), and normality of errors (Jarque–Bera test). The Ramsey RESET test also suggests that the model is well specified as shown in table 6.

TABLE 6 Results of diagnostic tests.

Test statistics:	x^2 statistic	Probability
Jarque-Bera(normality)	6.2604	n/a
LM test (1) correlation	3.9221	.048
ARCH test	1.3949	.238
Ramsey RESET test	.043895	.834
CUSUM test	Stable	Stable
CUSUMQ test	Stable	Stable

Table 7 reveals the result of Granger causality test, there is a unidirectional relationship running from GDP per capita to trade (Export + Import). This is shows that GDP is very important to the trade sector in Singapore and efforts need to be geared towards improving the GDP per capita to increase the trade and development in Singapore.

Furthermore, Muhammad Shahbaz and Saleheen Khan (2013) also found that their empirical evidence supported our investigation and they showed that the Granger causality analysis revealed that unidirectional causal relationship running from economic growth and, international trade and economic growth.

Table 7:	Granger	Causality Test
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Null Hypothesis	F-Statistic(Prob.)
LGDPC does not Granger Cause LEXP	0.10281*(0.9025)
LEXP does not Granger Cause LGDPC	2.22083* (0.1193)
LIMP does not Granger Cause GDPC	1.91366 [*] (0.1584)
GDPC does not Granger Cause LIMP	0.47198 [*] (0.6266)

* denotes Significant at 1%, . The number of lags is 2.

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Finally, when analyzing the stability of the long-run coefficients together with the the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMQ) which are applied Following as Pesaran cited in Bahmani-Oskooee (2001), the stability of the regression coefficients is evaluated by stability tests and they can explain whether or not the model equation is stable over time. This stability test is appropriate in time series data, especially when we are unsure about when structural change may be have taken place. CUSUM and CUSUMQ statistics are plotted against the critical bound of 5% significance. According to Bahmani-Oskooee and Wing NG (2002), if the plot of these statistics remains within the critical bound of the 5% significance level, the null hypothesis (i.e. That all coefficients in the error correction model are stable) cannot be rejected. The plot of the cumulative sum of the recursive residual is presented in graph 1-2. As shown, the plot of both the CUSUM and the CUSUMQ residual are within the boundaries. That is to say that the stability of the parameters has remained within its critical bounds of parameter stability. It is clear from both the graphs presented in Figure (1-2) that both the CUSUM and the CUSUM

FIGURE 1 CUMULATIVE SUM OF RECURSIVE RESIDUALS.



FIGURE 2 CUMULATIVE SUM OF SQUARES OF RECURSIVE RESIDUALS



5. CONCLUSIONS

In this paper, we have applied the autoregressive distributed lag (ARDL) and granger causality model of trade openness and economic growth in Singapore. Our results suggest that trade openness may impact favorably on growth of real GDP per capita. On the other hand, the impact would appear to be lagged and relatively modest. It means that trade different in their intensity and depth, or never amount to an immediate shift to free trade. Through time of course economies become more open, partly as a consequence of incremental trade reforms but also due to other factors such as reductions in

communication costs transportation, and technological change. The pay-off to this increased openness may be greater, as manifested in consistently higher coefficients from the Sachs–Warner proxy. Our results suggest that four factors might be at work in explaining why the previous literature on the trade-growth relationship is so inconsistent. Firstly, there is a sample sizes and composition differ as do methodological approaches. Secondly, different analysts have been used various measures; some are ex ante indicators of trade openness, some are ex post and others are clearly indicators of openness. Finally, it is obvious that many econometrics models which have been estimated are miss-specified.

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