Effects of Real Effective Exchange Rates on Emerging Asian Countries' Exports

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Abstract: This paper examines how the real effective exchange rates impact the exports of eight emerging Asian economies. The results are as follows. First, the global economic activity drives the exports of emerging Asian markets. Second, a rise in the US exchange rates brings down exports in all subject countries significantly. Third, a rise in the Chinese exchange rates significantly reduced exports of the Asian countries, except for the Philippines. Fourth, a rise in the Chinese exchange rates drives the exports of the four Asian Tigers-South Korea, Hong Kong, Singapore, and Taiwan.

Keywords: Real effective exchange rate, Exports, Emerging Asian countries

I. INTRODUCTION

The currencies of emerging Asian economies are exposed to exchange rate risks when changing circumstances in the global market lead to rapid capital movements. The exports and national economies of emerging Asian countries are extremely exposed to capital markets and rely greatly on overseas markets. Consequently, they can be significantly affected by global economic and credit conditions. The rapid movements of capital among nations following the global credit crunch are influenced by interest rates and exchange rates, with exchange rates deemed most critical. Because they are very dependent on overseas markets, emerging Asian markets strongly factor in exchange rates when making economic decisions.

The US dollar is one of the key global currencies and is often used for payment in the world's import and export activities. Accordingly, the real effective exchange rate of the US is one of the most important factors that impact global trade. Since the beginning of the 2000s, however, China has risen in the global market, recording the world's second highest GDP, as such, China's real effective exchange rate may become significant for the exports of emerging Asian economies. Japan's real effective exchange rate may also have a significant impact on exports of these countries. China and Japan are important trade partners for emerging

Asian economies and they are geographically close, so they wield great influence over emerging Asian economies. Since the global financial crisis, Japan's recent policies for the yen, including quantitative easing, may have led to Japan's real effective exchange rate having a larger impact on the exports of emerging Asian economies.

It is generally known that depreciation of a currency has a positive effect on exports. Nonetheless, empirical findings on the impact of exchange rates changes on exports are inconsistent in conclusion. Among recent studies that found a significant impact of exchange rates on exports is a study by Dincer & Kandil (2011). This examined the impact of exchange rate fluctuations on 21 industries in Turkey and found that an unexpected rise of an exchange rate has a significantly negative impact, and the lesser the fluctuation, the more positive the impact on exports. Thorbecke & Kato (2012) found that a 10% rise in an exchange rate brings German exports down by 6%, with consumer goods being affected more than capital goods. Caglayan *et al.* (2013) examined the impact of changes in exchange rates on the exports of 28 emerging markets and found that the uncertainty surrounding exchange rates had a negative impact on exports in most of the subject countries. Among the studies that found exchange rates had no impact or a decreasing impact on exports is Ree & Choi (2014), which concluded that exchange rate fluctuations after the global financial crisis had a limited impact on South Korean exports. Ollivaud et al. (2015) also argued that the recent substantial changes in exchange rates in countries such as Britain and Japan did not lead to changes in the trade balance. Ahmed *et al.* (2015) reported that changes in real effective exchange rates showed a decreasing impact on exports of 46 countries in the world.

This paper is comprised of the following: in chapter 2, the data and models used for analysis are described; in chapter 3, the results of the empirical study are shown; and in chapter 4, conclusions are made.

II. DATA AND METHODOLOGY

The data used for this study include the real effective exchange rates of eight Asian countries—South Korea (KR), Hong Kong (HK), Singapore (SG), Taiwan (TW), Indonesia (ID), Malaysia (MY), Thailand (TH), and the Philippines (PH). The real effective exchange rates of the US, China, and Japan, and the time-series monthly data of the US industrial production index. We used the data of the World Bank and the Bank of International Settlement. The analysis period is from January 2006 to December 2016. Export demand is a function of global demand and real effective exchange rates of the local country and overseas countries. Long-term export demand can be expressed in the following log-linear model.

$$\ln X_{i,t} = \alpha_0 + \alpha_1 \ln Y_t^f + \alpha_2 \ln RE_{i,t} + \alpha_3 \ln RE_{i,t}^f + \epsilon_t, \tag{1}$$

Where, $X_{i,t}$ denotes country i's export volume at time t, Y_t^f indicates the US industrial production index as a measure of global economic activity at point t, $RE_{i,t}$ refers to country i's real effective exchange rate at time t, and $RE_{i,t}^f$ indicates the real effective exchange rates of overseas markets (the US, China, or Japan) at time t. In theory, it can be expected that a rise in global economic activity drives exports. It is also expected that a rise in the local s real effective exchange rate reduces exports while a rise in overseas' real effective exchange rate drives exports based on a relative effect. Therefore, it can be expected that α_1 and α_3 show a positive value while α_2 will be negative.

Table 1
Descriptive statistics

	Mean	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	J-B
EX_KR	10.5616	10.8519	9.9586	0.2115	-0.7412	2.4236	13.914***
EX_HK	10.4804	10.8142	9.9196	0.2186	-0.3847	2.1489	7.240**
EX_SG	10.2668	10.5532	9.7843	0.1758	-0.5988	2.5180	9.168**
EX_TW	10.0279	10.2606	9.4329	0.1755	-1.1147	4.0018	32.857***
EX_ID	9.4198	9.8335	8.9136	0.2286	-0.3607	2.1968	6.411**
EX_MY	9.7082	9.9588	9.2472	0.1603	-0.7225	2.8848	11.550***
EX_TH	9.6743	9.9630	9.0945	0.2134	-0.7988	2.5827	14.997***
EX_PH	8.3608	8.6881	7.8264	0.1581	-0.8976	4.4830	29.820***
RE_KR	4.6783	4.8817	4.4257	0.1115	0.3250	2.6677	2.931
RE_HK	4.6613	4.8349	4.5135	0.0741	0.5754	2.4343	9.045**
RE_SG	4.6348	4.7371	4.4986	0.0794	-0.3251	1.5554	13.803***
RE_TW	4.6288	4.7474	4.5772	0.0363	1.3061	4.3018	46.854***
RE_ID	4.5290	4.6308	4.3764	0.0562	-0.3632	2.7550	3.232
RE_MY	4.5720	4.6464	4.4347	0.0458	-1.4228	4.4898	56.742***
RE_TH	4.5964	4.7047	4.4770	0.0408	-0.0137	3.4889	1.551
RE_PH	4.6297	4.7766	4.4293	0.0861	-0.2165	2.3101	3.649
RE_US	4.6341	4.7777	4.5326	0.0627	0.3824	1.8646	10.306***
RE_JP	4.6592	4.8753	4.4282	0.1304	0.0067	1.9241	6.367**
RE_CN	4.4678	4.6707	4.2173	0.1294	-0.1494	1.7807	8.649**
IPI_US	4.6660	4.7265	4.5272	0.0507	-1.0768	3.1884	25.705***

Notes: EX_KR, EX_HK, EX_SG, EX_TW, EX_ID, EX_MY, EX_TH, and EX_PH each represent the exports of eight Asian countries respectively. RE_KR, RE_HK, RE_SG, RE_TW, RE_ID, RE_MY, RE_TH, RE_PH, RE_US, RE_JP, and RE_CN each represent the real effective exchange rates of eight Asian countries, US, Japan, and China respectively. IPI_US represents US industrial production index. *, **, and *** indicates a significance level of 10%, 5%, and 1%.

In the descriptive statistics of Table 1, South Korea's real effective exchange rate shows the largest fluctuations among emerging Asian economies. The skewness is a distribution with a long left tail, as all real effective exchange rates except for South Korea, Hong Kong, Taiwan, the US, and Japan showed negative values. As shown in the Jarque-Bera statistics, the hypothesis for a normal distribution, except for the real effective exchange rates of South Korea, Indonesia, Thailand, and the Philippines, is rejected.

In general, it is known that each time-series variable is a non-stationary process. The stationarity of the variables must be examined prior to analysis of time-series data. We used the Schwart information criterion-based Augmented Dickey Fuller (ADF) test and the Phillips-Perron (PP) test to perform unit root tests. Separate tests were run for intercept-only cases and trend-and-intercept cases, with two lags applied. As shown in Table 2, the test results of first-differenced variables reject the null hypothesis that all variables have a unit root. Accordingly, the variables subject to analysis are confirmed to have stationary time-series at a significance level of 1% and constitute an I(1) process. Therefore, we used first-differenced variables for analysis.

Table 2
Unit root test results

	ADF		PP	
	level	*1st difference*	*level*	*1st difference*
EX_KR	-3.8024**	-14.8738***	-3.4837**	-20.4991***
EX_HK	-1.2614	-4.2376***	-6.2605***	-25.1632***
EX_SG	-2.6299	-6.0555***	-3.2387*	-16.6693***
EX_TW	-3.1628	-18.2962***	-4.8220***	-19.1130***
EX_ID	-2.0075	-17.5098***	-2.8710	-17.5554***
EX_MY	-2.7757	-16.2790***	-3.5387**	-16.3762***
EX_TH	-3.2209*	-11.7789***	-4.2281***	-19.0793***
EX_PH	-3.3810*	-15.9014***	-4.6257***	-15.9574***
RE_KR	-1.8532	-8.3116***	-1.5236	-8.3116***
RE_HK	-1.2038	-9.7748***	-1.3460	-9.7736***
RE_SG	-0.5115	-11.4609***	-0.3620	-11.5348***
RE_TW	-2.4242	-8.3522***	-2.3632	-10.4530***
RE_ID	-2.2808	-9.9026***	-2.5090	-9.8448***
RE_MY	-1.3517	-9.6041***	-1.5424	-9.4718***
RE_TH	-3.6818**	-8.4005***	-3.3771*	-8.4394***
RE_PH	-3.1444	-9.1246***	-2.9305	-8.9277***
RE_US	-1.1786	-8.0468***	-0.9654	-7.9948***
RE_JP	-3.2273*	-7.7633***	-2.6635	-7.8212***
RE_CN	-1.8740	-7.8499***	-1.7098	-7.7945***
IPI_US	-2.8310	-4.1652***	-1.6980	-9.4004***

Notes: EX_KR, EX_HK, EX_SG, EX_TW, EX_ID, EX_MY, EX_TH, and EX_PH each represent the exports of eight Asian countries respectively. RE_KR, RE_HK, RE_SG, RE_TW, RE_ID, RE_MY, RE_TH, RE_PH, RE_US, RE_JP, and RE_CN each represent the real effective exchange rates of eight Asian countries, US, Japan, and China respectively. IPI_US represents US industrial production index. *, **, and *** indicates a significance level of 10%, 5%, and 1%.

III. EMPIRICAL RESULTS

Table 3 shows the effect the real effective exchange rate of the US had on the exports of Asian emerging countries. As expected, the US industrial production index (α_1) recorded a positive coefficient, showing that global economic activity has a positive impact on the Asian countries' exports. The local real effective exchange rate coefficients (α_2) recorded negative values except for Indonesia, Thailand, and the Philippines, indicating that a rise in the real effective exchange rates of emerging Asian economies or an appreciated currency brings exports down. However, the real effective exchange rate of the US (α_3) showed negative coefficients in all subject countries, contrary to the expectation.

Table 4 shows how the real effective exchange rate of China impacts the exports of emerging Asian countries. The US industrial production index coefficients, as expected, recorded positive values, showing

that global economic activity has a positive impact on the Asian countries' exports. The local real effective exchange rate coefficients recorded significantly negative values except for Indonesia, Thailand, and the Philippines, indicating that a rise in their real effective exchange rates brings the export down. In addition, the real effective exchange rate of China showed significantly positive coefficients except for the Philippines, as expected.

Table 3
The effects of US real effective exchange rates on eight Asian emerging economies' exports

	EX_KR	EX_HK	EX_SG	EX_TW	EX_ID	EX_MY	EX_TH	EX_PH
α_0	6.341**	12.873**	8.053**	13.581**	11.643**	22.114**	-3.100**	-0.722
α_1	3.709**	0.422	0.936**	2.162**	1.227**	1.481**	0.231	1.828**
α_2	-1.494**	-0.326	-0.167	-1.638**	0.767**	-1.461**	3.458**	0.630**
α_3	-1.315**	-5.293**	-1.632**	-1.308**	-2.462**	-2.727**	-0.906**	-0.510**
$\overline{R^2}$	0.632	0.479	0.806	0.553	0.528	0.673	0.606	0.574
F	75.999**	41.161**	182.68**	55.01**	49.785**	91.03**	68.083**	59.751**

Notes: EX_KR, EX_HK, EX_SG, EX_TW, EX_ID, EX_MY, EX_TH, and EX_PH each represent the exports of eight Asian countries respectively. * and ** indicate a significance level of 5% and 1% respectively.

Table 4
The effects of China real effective exchange rates on eight Asian emerging economies' exports

	EX_KR	EX_HK	EX_SG	EX_TW	EX_ID	EX_MY	EX_TH	EX_PH
α_0	2.057	2.233*	7.962**	13.033**	-5.165*	-6.273**	-4.828**	-2.634**
α_1	2.540**	1.568**	1.692**	2.074**	0.119	0.778**	-0.196	1.600**
α_2	-1.187**	-1.241**	-2.193**	-2.682**	2.051**	-0.400*	0.817**	0.995**
α_3	0.474**	1.420**	0.994**	0.758**	1.019**	0.687**	0.530**	-0.231
$\overline{R^2}$	0.530	0.703	0.768	0.374	0.440	0.451	0.603	0.539
F	50.235**	104.32**	145.73**	27.118**	35.315**	36.927**	67.359**	51.975**

Notes: EX_KR, EX_HK, EX_SG, EX_TW, EX_ID, EX_MY, EX_TH, and EX_PH each represent the exports of eight Asian countries respectively. * and ** indicate a significance level of 5% and 1% respectively.

Table 5 shows the effect of Japan's real effective exchange rate on the exports of emerging Asian countries. The US industrial production index coefficients, as expected, recorded positive values, showing that global economic activity has a positive impact on the Asian countries' exports. The local real effective exchange rate coefficients recorded significantly negative values for South Korea, Hong Kong, Singapore, and Taiwan, indicating that a rise in their real effective exchange rate s brings exports down. Japan's real effective exchange rate showed negative values for South Korea, Hong Kong, Indonesia, Malaysia, and the Philippines while recording significantly positive values for Singapore, Taiwan, and Thailand.

In the analysis above, as expected, the US industrial production index coefficients always showed positive values regardless of using the real effective exchange rate of the US, China, or Japan, indicating that global economic activity drives the exports of emerging Asian countries. As expected, South Korea,

Table 5
The effects of Japan real effective exchange rates on eight Asian emerging economies' exports

	EX_KR	EX_HK	EX_SG	EX_TW	EX_ID	EX_MY	EX_TH	EX_PH
α_0	2.899	12.067**	-6.493**	8.922**	1.638	-0.184	-15.52**	-2.205
α_1	3.494**	0.813	1.347**	2.612**	0.213	0.894*	0.614*	1.636**
α_2	-1.747**	-0.549	-0.401	-2.684**	1.753**	1.363**	4.387**	0.647**
α_3	-0.105	-0.631**	0.580**	0.300*	-0.226	-0.115	0.484**	-0.014
$\overline{R^2}$	0.498	0.176	0.584	0.394	0.136	0.196	0.580	0.535
F	44.354**	10.315**	62.402**	29.445**	7.881**	11.616**	61.267**	51.147**

Notes: EX_KR, EX_HK, EX_SG, EX_TW, EX_ID, EX_MY, EX_TH, and EX_PH each represent the exports of eight Asian countries respectively. * and ** indicate a significance level of 5% and 1% respectively.

Hong Kong, Singapore, and Taiwan, known as the Four Asian Tigers or the Four Asian Dragons, recorded positive values and negative values each in the US industrial production index coefficients and the local real effective exchange rate coefficients respectively. The four countries also recorded significantly positive values for Chinese real effective exchange rate coefficients, just as expected.

IV. CONCLUTIONS

This paper reports on an empirical study that examines how the real effective exchange rates of the US, China, and Japan impact the exports of emerging Asian economies. Data used in the analysis includes the local real effective exchange rates of eight Asian countries—South Korea, Hong Kong, Singapore, Taiwan, Indonesia, Malaysia, Thailand, and the Philippines; the local real effective exchange rates of the US, China, and Japan; and monthly time-series data of the US industrial production index. The analysis period was from January 2006 to December 2016.

The results are as follows: first, the coefficients of the US industrial production index showed positive values as expected, indicating that global economic activity drives the exports of emerging Asian markets.

Second, the analysis of how the US real effective exchange rate affects the Asian countries' exports showed that a rise in the US real effective exchange rate brings down exports in all subject countries at a significant level, as opposed to the expectation.

Third, a rise in the Chinese real effective exchange rate significantly reduced exports of the Asian countries, except for the Philippines.

Fourth, the Japanese real effective exchange rate recorded negative values for South Korea, Hong Kong, Indonesia, Malaysia, and the Philippines, while showing significantly positive values for Singapore, Taiwan, and Thailand.

The results showed that for the Four Asian Tigers, South Korea, Hong Kong, Singapore, and Taiwan, the US industrial production index coefficients and the local real effective exchange rate coefficients showed positive and negative values respectively, as expected. South Korea, Hong Kong, Singapore, and Taiwan recorded significantly positive values for Chinese real effective exchange rate coefficients, as expected, showing that a rise in the Chinese real effective exchange rate drives the exports of the four countries. The

four countries showed different patterns from the rest of the Asian countries, displaying identical reactions to global economic conditions and local and Chinese real effective exchange rates.

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