Real exchange rate and economic growth in East Asian countries: The role of financial integration

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Abstract

This study examines the role of financial integration in determining the relationship between the real exchange rate and economic growth in East Asian countries. It hypothesizes that a competitive real exchange rate could play a greater role in promoting economic growth in countries with a low degree of financial integration. A growth model was specified using a real exchange rate misalignment index and its interaction terms with financial integration as explanatory variables. Different proxies for financial integration were employed to verify the interaction. The empirical results demonstrate the significance of the interaction terms and largely validate the hypothesis. This result demonstrates that a competitive real exchange rate policy is not a general solution for economic growth and its effectiveness could largely depend on a country's degree of financial integration.

JEL classification: O11; F43; F31

Keywords: Real exchange rate misalignment; Economic growth; Financial integration; East Asian countries

1. Introduction

Based on the neo-classical view, the manifesto of Washington-based institutions for developing countries, known as the Washington consensus, proposed that an equilibrium real exchange rate to promote growth is constrained by supply-side factors (Williamson, 1990). While there is a consensus that developing countries should avoid overvaluation, the influence of undervaluation on economic growth is the subject of growing debate.

The relationship between undervaluation and economic growth has been examined in a large number of empirical studies. A majority of empirical studies seem to suggest that undervaluation has growth-enhancing effects (Béreau, Villavicencio, & Mignon, 2012; Bhalla, 2007; Bleaney & Greenaway, 2001; Gala, 2008; Hausmann, Pritchett, & Rodrik, 2005; Prasad, Rajan, & Subramanian, 2007; Razin & Collins, 1999) and these effects tend to be more significant in developing countries (Razmi, Rapetti, & Skott, 2012; Rodrik, 2008; Vieira & MacDonald, 2012). However, counterevidence can be found in recent studies that demonstrate the importance of revealing the channels of influence of undervaluation (Nouira & Sekkat, 2012; Schröder, 2013).

Despite plentiful evidence supporting a correlation between undervaluation and economic growth, the understanding of the nature of this relationship is still limited. The hypotheses are mostly focused on the role of undervaluation in supporting the tradable sector (Prasad et al., 2007; Rodrik, 2008), and in stimulating capital accumulation (Gala, 2008; Gluzmann, Levy-Yeyati, & Sturzenegger, 2012; Ibarra, 2011; Razmi et al., 2012). Gluzmann et al. (2012) also found that undervaluation affects saving and employment. Porcile and Lima (2010) offer a balance-of-payments constrained macrodynamic model that explains the impact of undervaluation through both channels. Devaluation increases a country’s exports and releases constraints on the balance of payment. This eventually leads to a higher level of investment.

This paper examines the role of financial integration in determining the relationship between the real exchange rate (RER) and economic growth. Based on arguments about the capital accumulation channel, it could be hypothesized that the growth-enhancing effect of a competitive real exchange rate would be more robust in economies with a low level of financial integration that are subject to balance of payments constraints. This research used a sample consisting of nine East Asian countries, namely: Hong Kong, South Korea, Singapore, Malaysia, Indonesia, Philippines, Thailand, China and Vietnam. These countries have attained a high economic growth rate over recent decades and share common features in the development process, such as an export-led growth strategy with a high degree of openness, and a focus on the manufacturing and tradable goods sectors. The RER, therefore, could be important to economic growth due to those characteristics.

This paper is set out as follows. Section 2 describes the empirical models used to test the underlined hypothesis. Section 3 presents an estimation strategy, regression results and implications. Section 4 provides the conclusion.

2. Model specification

2.1 Real exchange rate misalignment estimation

Following the reduced equation approach (Edwards, 1988; Elbadawi, 1994; Elbadawi, Kaltani, & Schmidt-Hebbel, 2008; Razin & Collins, 1999), an index of real exchange rate misalignment was computed in three steps. First, a real exchange rate (RER) was estimated by using the nominal exchange rate (NER) measured as the number of national currency units per US dollar and adjusting it from a price index (PI). Consumer price index (CPI) and GDP deflator were used as price indices in this research.

$$RER_{it} = \frac{NER_{it}}{NER_i^*}\frac{PI_i^*}{PI_{it}}\frac{PI_{US,t}}{PI_{US}^*} \qquad \text{............1}$$

Where i and t are country and time indices, respectively. The asterisk indicates values at the base year.

In the next step, the equilibrium RER level was estimated by specifying an econometric model that includes fundamental factors expected to influence the behaviour of the RER in the medium term.

$$RER_{it} = \alpha_0 + \alpha_1 TOT_{it} + \alpha_2 GDPR_{it} + \alpha_3 OPN_{it} + \alpha_4 FDI_{it} + \alpha_5 FIC_{it} + u_{it} \qquad \text{............2}$$

Where TOT is the terms of trade; $GDPR$ is the ratio of a country's per capita income to US per capita income; OPN is the degree of openness measured as the ratio of trade volume to GDP; FDI is the ratio of foreign direct investment inflows to GDP; andFIC is the ratio of foreign income to GDP. The equilibrium real exchange rate level is the fitted values $\left(\widehat{RER}_{it}\right)$ from Eq. (2). Unless stated otherwise, the data source of variables used in this study was the World Development Indicators dataset that is publicly available on the World Bank's website. Appendix I summarizes the regression result of Eq. (2).

Finally, a RER misalignment index (MIS) was computed as the ratio of the real exchange rate to the equilibrium real exchange rate. Due to the construction of the MIS index, the higher it is, the more competitive a RER is.

$$MIS_{it} = \frac{RER_{it}}{\widehat{RER}_{it}}$$

The exchange rate could be considered to be undervalued or overvalued if MIS is greater or less than unity, respectively.

2.2 Growth model specification

To examine the influence of financial integration on the relationship between RER misalignment and economic growth, a growth model was specified in which RER misalignment and its interaction term with financial integration were used as explanatory variables:

$$\begin{aligned} GDPG_{it} = \beta_0 + \sum\nolimits_{p=1}^{m} \beta_1 GDPG_{i,t-p} + \sum\nolimits_{p=1}^{n} \beta_2 MIS_{i,t-p} \\ + \sum\nolimits_{p=1}^{n} \beta_3 MIS_{i,t-p} * F_{i,t-p} + \sum\nolimits_{p=1}^{n} \beta_3 F_{i,t-1} \\ + \sum\nolimits_{p=1}^{l} \theta C_{i,t-p} + u_{it} \end{aligned} \quad \ldots\ldots\ldots\ldots 3$$

Where $GDPG$ is the per capita income growth rate; F is a variable proxying for a country's degree of financial integration; C is a vector of control variables including the share of government spending in GDP (GOV), inflation (INF) and the ratio of gross fixed capital formation in GDP (FCF). Notably, the contemporary terms of explanatory variables were dropped to avoid the endogeneity problem.

Based on the availability of data in the sampled countries, this research employed three indicators as alternative proxies for the degree of financial integration, including the inflows of foreign direct investment (FDI) measured as percentage of GDP: a financial openness indicator (FOP) constructed by the method suggested by Chinn and Ito (2008); and dummy variables (H and L) which categorized the sampled countries subjectively according to the degree of financial integration. H equals 1 in the case of newly industrialized countries (Hong Kong, South Korea and Singapore) which were considered to be highly financial integrated; H equals 0 otherwise. Similarly, L equals 1 in case of transitional economies (China and Vietnam) which are characterized by lower degrees of financial integration; L equals 0 otherwise. Chinn and Ito (2008) index was updated until 2012 and is available online[1]. Notably, FDI could also be used as a control variable in regressions as it reflects the degree of openness of an economy.

3. Empirical analysis

Firstly, a unit root test for panel data developed by Im, Pesaran, and Shin (2003) (IPS) was applied to assure the stationarity of variables in Eq. (3). The result of the panel unit root test is provided in Appendix II.

As the sample was characterized by a large time dimension and a small panel dimension, the panel-corrected standard error (PCSE) estimator proposed by Beck and Katz (1995) was applied. The nature of the PCSE method is to compute the panel-corrected standard error under the assumption of contemporaneously correlated disturbance across panels, while making use of parameters estimated by OLS or Prais–Winsten regression (Prais & Winsten, 1954). The choice between OLS or Prais–Winsten regressions depends on the existence of a serial correlation in the disturbance. The lag length of explanatory variables in Eq. (3) was determined by the 'general to specific' testing strategy proposed by Hall (1994) and Campbell and Perron (1991). Starting from a chosen maximum lag length of a variable, $P^{max} = 5$, if its highest lag term is not

[1]Chinn and Ito (2008) index is available at http://web.pdx.edu/~ito/Chinn-Ito_website.htm

statistically significant, then lag length is reduced by one. This reduction process was iterated until either achieving significance or $p = 1$.

A test for the existence of serial correlation in a panel-data model developed by Wooldridge (2010) was conducted. The null hypothesis of no first-order serial correlation was rejected at the 1% level in all model specifications (Tables 1 and 2). Consequently, a first-order serial correlation (AR(1)) structure of disturbances was specified for the panel data models in which a common coefficient of the AR(1) process was applied to all the panels. Prais–Winsten estimates were produced in regressions.

Tables 1 and 2 present the estimations of the impact of RER misalignment on economic growth. Each table displays the result of six regressions. CPI was used as the price index to compute the RER misalignment index in Table 1 whereas the GDP deflator was used to compute the figure in Table 2. The first regression estimated the effect of RER misalignment and a set of control variables on output growth, without an interaction term. The rest of the regressions added interaction terms between RER misalignment and measures of financial integration. The second regression employed FDI as a proxy for financial integration, whereas the third regression used Chinn and Ito's (2008) capital openess indicator. The last three regressions examined the divergence of the growth effect of RER misalignment among sub-groups of countries classified by their degree of financial integration.

Table 1. Panel regression of economic growth, using CPI as a price index

	(1a)	**(2a)**	**(3a)**	**(4a)**	**(5a)**	**(6a)**
$GDPG_{t-1}$	0.4762*** (0.0789)	0.4746*** (0.0768)	0.4007*** (0.0756)	0.3466*** (0.0756)	0.3541*** (0.0745)	0.4724*** (0.0764)
MIS_{t-1}	0.0209* (0.0120)	0.0386*** (0.0139)	0.0691*** (0.0153)	-0.0069 (0.0176)	0.0070 (0.0126)	0.0385*** (0.0147)
Financial integration proxies and interaction term						
FDI_{t-1}	-0.0347 (0.0317)	0.2404* (0.1299)	-0.0441 (0.0316)	-0.0744** (0.0317)	-0.0409 (0.0308)	-0.0339 (0.0302)
$(MIS * FDI)_{t-1}$		-0.2832**				

		(0.1427)				
FOP_{t-1}			0.0327*** (0.0089)			
$(MIS * FOP)_{t-1}$			-0.0324*** (0.0088)			
L				-0.1152** (0.0483)	-0.1084** (0.0424)	
$(MIS * L)_{t-1}$				0.1332*** (0.0462)	0.1212*** (0.0404)	
H				-0.0064 (0.0226)		0.0370* (0.0216)
$(MIS * H)_{t-1}$				0.0163 (0.0242)		-0.0365 (0.0232)
Control variables						
GOV_{t-1}	0.1840*** (0.0694)	0.1904*** (0.0668)	0.1518** (0.0701)	0.0739 (0.0665)	0.0939 (0.0657)	0.1735** (0.0687)
INF_{t-1}	-0.0574 (0.0352)	-0.0696** (0.0349)	-0.0987*** (0.0344)	-0.0824** (0.0346)	-0.0940*** (0.0330)	-0.0745** (0.0361)
INF_{t-2}	0.0558** (0.0268)	0.0559** (0.0264)	0.0566** (0.0256)	0.0223 (0.0248)	0.0269 (0.0243)	0.0535** (0.0264)
FCF_{t-1}	0.0758* (0.0399)	0.0806** (0.0401)	0.1205*** (0.0407)	0.0464 (0.0391)	0.0694* (0.0380)	0.0824** (0.0408)
$Intercept$	-0.0395** (0.0156)	-0.0574*** (0.0169)	-0.0896*** (0.0181)	0.0121 (0.0223)	-0.0085 (0.0180)	-0.0565*** (0.0173)
Time fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Wooldridge test for autocorrelation	F(1,8) = 121.434 Prob> F =	F(1,8) = 111.006 Prob> F =	F(1,8) = 117.338 Prob> F =	F(1,8) = 127.206 Prob> F =	F(1,8) = 121.195 Prob> F =	F(1,8) = 123.795 Prob> F =

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
AR(1) specification	Yes	Yes	Yes	Yes	Yes	Yes
No. of Obs	240	240	240	240	240	240
R-squared	0.6623	0.6698	0.6799	0.6889	0.6845	0.6673

Note: *When AR(1) process of error is specified, the coefficients were estimated by Prais–Winsten regression.*
Standard errors are presented in parentheses.
****, ** and * indicate significance at 1%, 5% and 10%, respectively.*
Dependent variable: growth rate of per capita output.
Source: Authors' estimations

Table 2. Panel regression of economic growth, using GDPdeflator as a price index

	(1b)	**(2b)**	**(3b)**	**(4b)**	**(5b)**	**(6b)**
$GDPG_{t-1}$	0.4682*** (0.0789)	0.4632*** (0.0778)	0.4145*** (0.0756)	0.3684*** (0.0747)	0.3762*** (0.0744)	0.4401*** (0.0756)
MIS_{t-1}	0.0263** (0.0117)	0.0403*** (0.0127)	0.0534*** (0.0132)	0.0102 (0.0151)	0.0095 (0.0114)	0.0521*** (0.0164)
Financial integration proxies and interaction term						
FDI_{t-1}	-0.0392 (0.0314)	0.1816 (0.1129)	-0.0391 (0.0327)	-0.0629** (0.0315)	-0.0387 (0.0306)	-0.0281 (0.0305)
$(MIS * FDI)_{t-1}$		-0.2160* (0.1121)				
FOP_{t-1}			0.0215*** (0.0081)			
$(MIS * FOP)_{t-1}$			-0.0221*** (0.0078)			
L				-0.0989**	-0.1064***	

				(0.0415)	(0.0397)	
$(MIS * L)_{t-1}$				0.1151*** (0.0390)	0.1179*** (0.0376)	
H				0.0167 (0.0239)		0.0499** (0.0244)
$(MIS * H)_{t-1}$				-0.0086 (0.0253)		-0.0506* (0.0262)
Control variables						
GOV_{t-1}	0.1891*** (0.0703)	0.1904*** (0.0668)	0.1384* (0.0745)	0.0756 (0.0689)	0.0875 (0.0693)	0.1928*** (0.0691)
INF_{t-1}	-0.0660* (0.0353)	-0.0761** (0.0350)	-0.0882*** (0.0341)	-0.0850*** (0.0328)	-0.0854*** (0.0323)	-0.0932*** (0.0357)
INF_{t-2}	0.0534** (0.0268)	0.0535** (0.0266)	0.0479* (0.0253)	0.0288 (0.0249)	0.0331 (0.0247)	0.0499* (0.0260)
FCF_{t-1}	0.0887** (0.0394)	0.0915** (0.0392)	0.1164*** (0.0400)	0.0611 (0.0381)	0.0790** (0.0383)	0.1061*** (0.0399)
$Intercept$	-0.0481*** (0.0166)	-0.0613*** (0.0169)	-0.0700*** (0.0161)	-0.0069 (0.0205)	-0.0117 (0.0184)	-0.0740*** (0.0198)
Time fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Wooldridge test for autocorrelation	F(1,8) = 120.255 Prob> F = 0.0000	F(1,8) = 121.970 Prob> F = 0.0000	F(1,8) = 124.364 Prob> F = 0.0000	F(1,8) = 112.927 Prob> F = 0.0000	F(1,8) = 115.970 Prob> F = 0.0000	F(1,8) = 115.714 Prob> F = 0.0000
AR(1) specification	Yes	Yes	Yes	Yes	Yes	Yes
No. of Obs	240	240	240	240	240	240
R-squared	0.6681	0.6739	0.6762	0.6925	0.6879	0.6736

Note: *A first-order autoregressive process of error was specified and the coefficients were estimated by Prais–Winsten regression.*

Standard errors are presented in parentheses.

****, ** and * indicate significance at 1%, 5% and 10%, respectively.*

Dependent variable: growth rate of per capita output.

Source: Authors' estimations

Regressions (1a) and (1b) illustrate the influence of RER misalignment on economic growth. The coefficient of RER misalignment was positive and significant at the 5% level in the model using GDP deflator as a price index, whereas it was positive and significant at the 10% level when CPI was used. The positive coefficients demonstrate that a more competitive real exchange rate could result in a higher rate of economic growth. Moreover, as the model captures a linear relationship between RER misalignment and growth, the empirical result also means that a higher degree of overvaluation reduces economic growth. These results are consistent with previous studies on the relationship between RER and growth that considered different country samples.

While the growth enhancing effect of a competitive real exchange rate is evident, regressions (2a) and (2b) examined how this effect varies across countries. The inflow of FDI was used to measure the degree of financial integration, and an economy was considered to be highly financial integrated if its ratio of FDI inflow to GDP was high. The coefficients of the interaction terms between RER misalignment and FDI were found to be significantly negative at the 5% level in regression (2a) and the 10% level in regression (2b). This implies that the growth enhancing effect of a competitive real exchange rate is more robust in less financially integrated countries, as expected. Supposing a rise in the level of undervaluation or a decrease in the level of overvaluation, the less financially integrated a country is, the more its growth rate increases.

Chinn and Ito's (2008) capital openess index replaced FDI in the regressions (3a) and (3b) to proxy for financial integration. The coefficients of interaction terms in both regressions were negative and significant at the 1% level.Due tothe construction of the capital openess index (Chinn & Ito, 2008), a higher value of the index indicates a higher degree of finanical integration. The result, therefore, demonstrates a stronger positive impact of a competitive exchange rate on less financially integrated countries and is consistent with the regression (2a and 2b) results.

The growth enhancing effect of a competitive real exchange rate was found to be more substantial in less financially integrated economies. The combined interacted and non-interacted coefficient of the MIS variable was significantly higher in transitional economies compared to semi-industrialized and newly industrialized economies in East Asia, as shown in regressions (4a), (5a), (4b) and (5b). The significance level of the interaction term was 1% in all four regressions. Moreover, there is evidence that newly industrialized economies are less sensitive to RER misalignment. Regression (6b) shows that the combined interacted and non-interacted coefficient of the MIS variable in newly industrialized economies is lower than in other countries at the 10% level of significance.

An important economic implication of the interaction between RER misalignment and financial integration is that the benefit of a policy targeting an undervalued RER could be substantial when it helps a less financially integrated economy overcome the obstacles caused by a balance of payments constraint. In contrast, in a highly financially integrated economy not facing a serious balance of payments constraint, such a policy has minor benefit that might not outweigh its side effects.

Conclusion

Following the success of some developing countries in manipulating domestic currencies to support economic growth, there is a huge body of empirical literature that provides evidence for the growth enhancing effect of undervaluation. In this paper, it is argued that instead of examining separately the impact of RER misalignment, it is important to consider the interaction between RER misalignment and financial integration, especially in economies relying on an export-led growth strategylike East Asian countries. The hypothesis is that a competitive exchange rate could play a greater role in promoting economic growth in countries that have a low degree of financial integration.

This paper focuses on a relatively small number of diversified economies that share similarities, rather than the large sample commonly used in other studies. The panel data from East Asian countries largely validate the hypothesis. This result is economically important as it suggests that a competitive exchange rate is not a general solution for economic growth in every country. It seems that the effectiveness of a competitive exchange rate policy depends greatly on the circumstances in which it is applied and the degree of financial integration is an essential factor.

Appendix I:

Table 3. Equilibrium real exchange rate model

Variables	**Panel A**		**Panel B**	
	Coefficient	S.E	Coefficient	S.E
TOT	-0.0012*	0.0007	-0.0029***	0.0009
$GDPR$	-0.1570*	0.0851	-0.4514***	0.1155
OPN	0.0095	0.0280	-0.0932**	0.0381
FDI	0.2470	0.4359	1.5823**	0.6177
FIC	-0.1493	0.6015	-3.9202***	0.7864
$Cons$	1.000***	0.1290	1.3890***	0.1548
Time dummies	Yes		Yes	
Country dummies	No		No	
Number of obs	242		246	
R-squared	0.4682		0.4994	
F-statistic	F(36, 205) = 7.85 Prob> F = 0.000		F(36, 209) = 6.34 Prob> F = 0.000	

Note: *Pane A uses CPI, and Panel B use GDP deflator as a price index*

***, ** and * indicate significance at 1%, 5% and 10%, respectively.*

Dependent variable: Real exchange rate.

Source: Authors' estimations

Appendix II:

Table 4.IPS panel unit root tests

Criterion to chose number of lags	**AIC**	**BIC**	**HQIC**
	W_{t-bar}		
$GDPG$	-10.7776 ***	-11.1024***	-11.6275***
MIS^{a}	-1.4521 *	-1.2014	-1.4521*
MIS^{b}	--1.2227	-1.6472**	-1.2227
FDI	-2.6189***	-4.0739***	-2.8897***
GOV	-2.5882***	-3.1372***	-3.4332***
INF	-7.4662***	-6.1296***	-5.4811***
FCF	-2.4049***	-2.6205***	-2.6205***
FPO^{c}	-1.5585*		

Note:

a: *MISindicator was calculated by using CPI*

b: *MISindicator was calculated by using GDP deflator*

c: *There was an insufficient number of time periods to compute W_{t-bar} as lagged terms are introduced in the Augmented Dickey–Fuller regressions. For this reason, zero lag length was used.*

*****, ** and * indicate significance at 1%, 5% and 10%, respectively.*

Source: Authors' estimations

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