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On the relationship between exchange rates and external imbalances: East and Southeast Asia

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Abstract

The role the real exchange rate plays in determining current account balances has gathered momentum as East and Southeast Asian countries have seen increasingly positive current account balances. This paper analyses the evolution of current accounts in the region. A cointegrating relationship between the real effective exchange rate and the ratio of the current account balance to the GDP is tested, based on both linear and nonlinear models. The half-life of current account imbalances is relatively short, implying high capital mobility. Results point to the existence of a long-run relationship, and in most cases the causality runs from the exchange rate to the current account.

JEL classification: C22, E32, F15.

Keywords: emerging markets, current account, half-life, East and Southeast Asia.

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1 Introduction

Current account imbalances have formed a topic of discussion among both policy makers and economists since the early debates about mercantilism and the accumulation of gold through current account surpluses as a result of restrictive trade practices. When the world economy moved from a system of monetary metals to fiat money and floating exchange rates, the emphasis shifted to industrialisation. This would be part of an export-oriented development strategy, and particularly one which may use currency manipulation to create a competitive advantage. Post World War II Japan has been given as a late twentieth century example of modern mercantilism. More recently, China has also been labelled a mercantilistic economy. Commonly used arguments for the rapid rise in foreign exchange reserves are based, mainly, on a currency that is deliberately undervalued so as to make domestic industries more competitive internationally.[1]

Nowadays, in particular since the worldwide financial crisis of 2008-2012, there is a lot of controversy over the role that capital inflows may have played in the growth of national credit, and whether these inflows of capital may have exacerbated credit expansion in some cases (see Magud et al., 2012). Hence, it is believed that foreign capital may have been used by national commercial banks to increase the liquidity in the system, boosting the bubble of the housing markets in some countries. If this is the case, tight monetary policy might be offset by flows of foreign capital.

In recent history, East Asian countries have been international creditors. Japan has had persistent current account surpluses since the early 1980s, while Taiwan and Singapore showed current account surpluses in the late 1980s and China joined the group in the early 1990s. Since the crisis in 1998, all East Asian countries have experienced current account surpluses. In our quarterly sample, only Thailand and Korea show some transitory negative values for their current accounts (see figure 1). Taken as a whole, the countries in the sample were net debtors before 1998 and became net creditors afterwards. The spread and persistence of the current account surpluses would suggest that this is not only the result of an active policy of international reserve accumulation but may also have something to do with the countries' exchange rate policies, at least since 1998.

[1] However, for an alternative view, see Prasad and Wei (2007) where the authors argue that China's international reserves accumulation is due to non-FDI capital inflows, rather than current account surpluses or FDI.

Some studies on current accounts have looked at the changes in the surplus or deficit, motivated by two dominant tendencies: the large US current account deficit and the large surpluses of the East and Southeast Asian countries. Likewise, this paper aims to look at the second pattern of large surpluses in the latter group. However, rather than identifying East and Southeast Asian countries with a regional dummy or country-specific dummies (e.g. Gruber and Kamin, 2005) within a larger panel of countries, this paper only includes countries from the region individually, so as to avoid any assumptions about the homogeneity of the parameters.

Most studies make use of bilateral real exchange rates (RERs), usually relative to the US dollar. Asian countries have generally preferred some sort of fixed exchange rate system, either fixed relative to the US dollar or to a basket of currencies in which the dollar is dominant. This is partially intended to avoid flexible exchange rates so as to reduce volatility, but is also due to the widespread use of the US dollar as the invoice currency in trade. Instead, we analyse the real effective exchange rate so as to avoid potential biases associated with the choice of base country in bilateral rates. The effective rate has generally been more attractive to economists and policy makers because it is a better measure for understanding trade flows and international competitiveness. In particular, East and Southeast Asian countries do not have particularly strong trade with the US. Japan usually accounts for a similar share in the trade of most of the countries in our sample, while China is becoming an important trade partner as well. The quick economic integration in the region has been an important factor in the international trade of these countries. The use of effective exchange rates seems appropriate from this perspective.

Hence, the aim of this paper is to shed some light on the relationship between current account balances and RERs in this group of countries. The connection between the current account and the exchange rate has been central in many models in the international macroeconomics literature. We first test whether capital inflows/outflows have had an influence on the RERs, or whether movements in the RER have had an impact in determining current account imbalances. We also estimate both linear and nonlinear error correction models in order to have some information on the long-run relationship between the two variables. Half-lives of shocks are also analysed, based on these models. Our main findings show there is a cointegrating relationship for these seven countries. We also find evidence of nonlinearities, which are modelled by means of the Hansen and

Seo (2002) approach.

The remainder of the paper is organised as follows. In the next section, we summarise briefly the main contributions on the topic to date. In section 3, we explain more specifically the relation between current accounts and RERs. In section 4, we present a summary of the econometric techniques used in this analysis, and in sections 5 and 6 we present the results and conclusions respectively.

2 Literature review

Surprisingly, empirical research on the relationship between the current account and the exchange rate is not extensive in terms of the number of works. Amongst mainstream empirical studies, the exchange rate does not have any role, being excluded from the empirical specifications.[2] For instance, authors who focus on the roles of saving and investment, such as Glick and Rogoff (1995) and Taylor (2002), model current account dynamics in the long and short run with no mention of exchange rate. Likewise, studies of current account sustainability, see among others Wickens and Uctum (1993) and Milesi-Ferretti and Razin (1996), rely mainly on a wide range of univariate stationarity tests with no consideration of exchange rate.

A third strand of the literature looks at the determinants of the current account, and it is also often the case that the exchange rate is omitted. The current account balance to GDP ratio is related to a wide range of potential fundamentals. Most of the determinants of current account balances are taken from previous cross-country studies on savings as well as other studies on investment. This interpretation is consistent with new models of an open economy where the current account plays a central role. However, the connection with theory is rather loose, with little consideration of the dynamics that are central to these models. The pioneering cross-country study of Chinn and Prasad (2003) estimates a battery of cross-sectional and panel regressions in a sample of 18 industrial and 71 developing countries. To smooth the effect of business cycle fluctuations, the empirical strategy they use to derive their main results is based on non-overlapping five-year average

[2] In the case of studies of the exchange rate, it is also generally the case that the current account is not considered in the analysis. A typical study of the exchange rate may involve the examination of the purchasing power parity condition, as in Taylor (2002), making use of univariate unit root tests. Likewise, the interest rate parity condition involves the estimation of the long-run relationship between these two variables, as in Edison and Pauls (1993).

data. This strategy eliminates a lot of the short-run dynamics of the current account to focus on the medium-run dynamics. Therefore, it is not possible to distinguish between the effects of transitory and permanent shocks. Their work has been followed by Gruber and Kamin (2005) and Chinn and Ito (2007), who expand the set of potential candidates for consideration as fundamentals, including items such as institutional factors, financial development and financial crises. The two latter studies' main aim is to explain the geographical pattern of current account deficits/surpluses: the large US current account deficit and cumulative surpluses in East and Southeast Asia since 1997 in particular[3] since this is the main pattern of the data which is difficult to explain. This paper is a contribution to the understanding of the large current account surpluses in East and Southeast Asia and their relationship to the exchange rate.

However, the exchange rate is included among the determinants considered. Therefore, these studies assume that changes in the exchange rate either have no effect on savings and investment or act as a proximate cause but have no medium or long-run effect on the current account. Gruber and Kamin (2005) argue that RER depreciation/appreciation and exchange rate policy intervention, as proximate determinants, should be excluded from the analysis so as to focus on the fundamentals of the current account. Nevertheless, changes in the exchange rate may be incorporated as a proxy for international competitiveness where the relative prices of tradable versus nontradable goods would affect the dynamics. This would suggest that analysis should focus on an empirical framework which takes advantage of the nonstationarity properties of current accounts. A number of recent empirical studies have taken the initiative in focusing on the dynamics of current accounts, and have pointed to RERs as an important factor that should be considered at the same time. They rely on the time series analysis of individual countries, with a longer time span, rather than panel data. Based on the traditional models of the open economy (such as the Mundell-Fleming model) and the new open economy macroeconomics literature (Obstfeld-Rogoff), the link between the RER and the current account is given by changes in the composition of the demand side. A partial equilibrium simplified version of the Obstfeld-Rogoff framework is enough to show how

[3]The definition of East Asia across studies may change. These authors include in their East Asia region the eight countries included in this study but Gruber and Kamin (2005) also include Hong Kong and Indonesia while Chinn and Ito (2007) add these two plus three countries from South Asia, Bangladesh, India and Sri Lanka.

changes in the exchange rate can affect the intertemporal decisions of the determinants of the current account (see next section).

Time series econometrics is an attractive tool with which to investigate both the long-run implications and the behaviour in the short run. Lee and Chinn (2006) make use of a bivariate structural vector autoregression (VAR) approach to explain the dynamic relation between these two variables for the G7 countries. The key assumption for the identification of the structural VAR model is that temporary shocks have no long-run effect on the RER. Lee and Chinn (2006) also present a simplified small open economy model where there are tradable and nontradable goods, and money enters into the utility function, which is consistent with their identification strategy. They find that temporary shocks have an important role in explaining variations in the current account balances of the G7 countries (except the US) while permanent shocks are more important in explaining changes in the exchange rate. Temporary shocks seem to depreciate the exchange rate and improve current account balances (except in the UK), while permanent shocks tend to lead to a permanent appreciation of the RER and the effect on current accounts is less clear and mostly insignificant.

In a more recent contribution, Arghyrou and Chortareas (2008) look at the cointegrating relationship between current accounts and the RER, together with domestic national income and foreign income, for a sample of ten European countries. Making use of the cointegration methodology, it is possible to study both the long-run determination and the short-run dynamics of current accounts. Accepting one cointegration relationship in each individual country from the rank and trace tests, the RER is found to be statistically significant in the cointegrating vector in six countries.[4] In those countries, there is a negative and significant long-run relationship between changes in the RER and the current account balance. In the short run, for most countries (seven out of ten), the adjustment in the current account is shown to be a nonlinear dynamic process, with the speed of convergence depending on the sign of the disequilibrium. The current paper adds to this literature, aiming to look more closely at the relationship between current accounts and exchange rates in East and Southeast Asia using cointegration analysis based upon both

[4]This is the number of countries for which the t-statistic of the exchange rate is statistically significant at 5 percent following the Johansen methodology. In table 4, the exchange rate is significant in seven countries in this study using the same methodology, the exception being Hong Kong.

linear and nonlinear models. From a methodological point of view, our results may be more directly comparable to Arghyrou and Chortareas (2008) than to any others.

3 Current account and real exchange rate

Amongst the most influential models of open economy macroeconomics, it is increasingly common to rely on the theoretical framework of the intertemporal approach to current account. This is a general equilibrium model in which individuals and firms make decisions by solving optimisation problems. The current account balance is part of the core of the model, allowing countries to smooth their consumption path through imports and exports, which is the result of forward-looking decisions that affect investments and savings. Obstfeld and Rogoff (1996) present a complete collection of the models that work in this fashion.

Rather than general equilibrium, this section takes a partial equilibrium approach to a simple international macroeconomic model to illustrate the type of relationship that exists between current accounts and RERs. Many of the dynamics of the model are omitted so as to simplify the mathematical presentation as much as possible. We will not present the dynamic decision problem of the firm, which means we do not consider the effect of the exchange rate on investments. Likewise, we do not explain how output evolves but consider this variable to be an endowment.

To simplify the framework, a small economy, with only two time periods, no public sector and no uncertainty (i.e. this is not a stochastic model) is considered. Therefore, the current account (CA) is defined as the difference between income (y) and consumption (c). Consumption is the main determinant of the utility function $u(c_t)$ which is strictly concave. The representative consumer maximises her lifetime discounted utility of the temporal sequence of consumption, $U = u(c_1) + \gamma u(c_2)$ subject to her budget constraint which constrains the present value of consumption expenditure not to exceed wealth (W), $c_1 + c_2/(1+r) \leq W$, where r is the national real interest rate. The solution to the maximisation problem provides the optimal consumption path, the so-called Euler equation, where changes in the current account balance would allow the intertemporal exchange of consumption.

Wealth is $W = y_1 + y_2/(1+r)$. The domestic real interest rate is related to the

international real interest rate (r^*) and the RER (q).[5] When the exchange rate is constant, the domestic interest rate is equal to the international interest rate. However, it may be the case that they are not the same if the exchange rate fluctuates. Instead, the domestic interest rate would include the appreciation rate of the RER, according to the uncovered interest rate parity hypothesis expressed in real terms:

$$r_t = r_t^* + E_t(\Delta q_{t+1})$$

Any expected appreciation (depreciation) of the national currency would imply that the interest rate of the small economy must be higher (lower) than the international interest rate. Since the countries in our sample are all considered to be small economies and may face the same international interest rate, most of the cross-country variation in current accounts is likely to be driven by changes in their exchange rates.[6] Since the international interest rate is given, according to the assumptions of the small economy, changes in monetary policy that affect the exchange rate are likely to have a direct impact on current accounts through a change in the composition of income. If the exchange rate is expected to appreciate, the domestic interest rate will increase, leading to an intertemporal replacement of present for future consumption and a decrease in the current account. This change in the composition of income implies that the current account deficit will increase (decrease).

However, notice that the relevant variable here is the expected exchange rate, while the observed variable is the realisation of the exchange rate. It could be the case that expectations and observed exchange rates are not aligned. Further, a change in the RER today might affect the expectations of future movements in this variable in the opposite direction. For instance, a sudden and unexpected appreciation of the currency might signal a depreciation of the exchange rate in the future. In this case, investments abroad will become more attractive, not only because the currency has appreciated today, but because a depreciation might happen at the maturity of the investment. Hence, the sign of the relationship between the RER and the current account balance might be ambiguous. This expenditure-switching mechanism of the exchange rate is the connection

[5] An increase is an appreciation of the national currency.

[6] Here we are assuming that expectations are formed by means of some type of autoregressive process.

to movements in the current account. Large and persistent movements in the current account balance may then be related to the long-run behaviour of the RER. The next section explores this relationship in some detail.

4 Econometric methods

In order to analyse the relationship between the current account (CA) and the RER (q) of this group of countries, we apply cointegration techniques, as the variables involved are I(1) processes.[7] Hence, we apply the traditional Johansen (1988, 1991) approach, and in order to gain some robustness in the analysis, we apply the Hansen and Seo (2002) technique based on nonlinear models.

The Johansen approach is based upon the estimation of the following vector error correction model (VECM) or cointegrated vector autoregression model (CVAR):

$$\Delta X_t = \alpha\beta' X_{t-1} + \sum_{i=1}^{p} \Gamma_i \Delta X_{t-i} + \epsilon_t \tag{1}$$

where X_t is a vector of variables, α is the matrix containing the loading or adjustment parameters, β is the matrix of long-run parameters, Γ is the short-run parameters' matrix and ϵ is the error term, which is expected to be stationary. The estimation process involves specifying the unrestricted model, stationarity tests, the rank of the β matrix, the identification of the long run, a weak exogeneity test and stability tests.

Note that the above equation is based on a linear model. However, it has been noted within the empirical literature on time series analysis that many variables might not behave in this linear fashion. Hence, we can encounter nonlinearities in the deterministic components (i.e. nonlinear trends) or nonlinearities in the parameters (i.e. asymmetric speed of adjustment or time-varying parameters). Whereas the first case is of no concern in the current analysis, as these trends should cancel out in the cointegrated space, the potential for asymmetric adjustment towards equilibrium needs to be accounted for. The necessity of considering nonlinear models is twofold. First, from the purely statistical point of view, tests may suffer from power problems, and be biased towards the commitment of type II errors, when nonlinearities are neglected (see Taylor and Peel,2000,

[7] See next section for details.

and Kapetanios et al., 2003). Second, from the economic point of view, it is rational to think that some economic variables may react differently in terms of moving towards equilibrium after a shock, depending on the strength and sign of the shock.

To the best of our knowledge, only Arghyrou and Chortareas (2008) have considered the possibility of a nonlinear adjustment in the relationship between RERs and current accounts. However, we follow a different strategy to theirs. They use a two-step approach where the (nonlinear) smooth transition vector error correction model (STVEC) is estimated in the second step, based on the cointegrated vector obtained from a linear model (applying Johansen's maximum likelihood estimator). Instead, in this paper, Hansen and Seo's (2002) approach is applied so as to assess the nonlinear behaviour of the relationship between the current account and the RER in our target countries. The advantage of this approach compared to that of Arghyrou and Chortareas (2008, p. 756, eq. 4) is that the error correction term is estimated within the nonlinear framework, rather than being borrowed from a pre-estimated linear equation (only one step). Also, two-step procedures may carry forward any mistakes from the first step into the second step.

Hansen and Seo (2002) propose the estimation of the following model:

$$\begin{aligned}\Delta x_t = &\left[\mu_1 + \sum_{i=1}^{p} \Gamma_{1,t-i}\Delta x_{t-i} + \sum_{i=1}^{p} \Phi_{1,t-i}\Delta y_{t-i} + \alpha_1(x-\beta y)_{t-1}\right] 1(x_t - \beta y_t \leq \lambda) + \\ &\left[\mu_2 + \sum_{i=1}^{p} \Gamma_{2,t-i}\Delta x_{t-i} + \sum_{i=1}^{p} \Phi_{2,t-i}\Delta y_{t-i} + \alpha_2(x-\beta y)_{t-1}\right] 1(x_t - \beta y_t > \lambda)\end{aligned} \tag{2}$$

$$\begin{aligned}\Delta y_t = &\left[\mu_3 + \sum_{i=1}^{p} \Gamma_{3,t-i}\Delta x_{t-i} + \sum_{i=1}^{p} \Phi_{3,t-i}\Delta y_{t-i} + \alpha_3(x-\beta y)_{t-1}\right] 1(x_t - \beta y_t \leq \lambda) + \\ &\left[\mu_4 + \sum_{i=1}^{p} \Gamma_{4,t-i}\Delta x_{t-i} + \sum_{i=1}^{p} \Phi_{4,t-i}\Delta y_{t-i} + \alpha_4(x-\beta y)_{t-1}\right] 1(x_t - \beta y_t > \lambda)\end{aligned} \tag{3}$$

where λ is the threshold. Note that this method imposes that the cointegrating relationship is the same in both regimes, whereas the dynamics and speeds of adjustment will differ depending on whether the deviation from the long-run equilibrium is larger or smaller than λ. These models are called threshold autoregression vector error correction models (TVECM). The estimation is based on maximum likelihood estimators and a

grid search (see Hansen and Seo, 2002, for further details). Seo (2011) shows that the estimators obtained by the Hansen and Seo (2002) method are superior in terms of their asymptotic properties to other linear alternatives.

Hansen and Seo (2002) also develop a test for linear cointegration versus threshold cointegration, based on the values of λ and the cointegrating parameter β. This is a SupLM type test where the null states that the short-run parameters in the above equation are the same whether the error correction term is less than or equal to, or larger than, λ. In other words, the null implies that the threshold effect is not important and that linear cointegration is appropriate. The empirical strategy consists of testing for linear cointegration, first making use of traditional cointegration tests, and then using the SupLM test to check the null of nonlinearity versus threshold cointegration.

Previous studies consider an important advantage of threshold cointegration to be that it allows one to take into consideration possible transaction costs or price stickiness, especially when combined with relatively fixed exchange rates, as in our case, since adjustment only happens if the deviations exceed some threshold. In the case of exchange rates, the region under study here (except for Japan) has moved from fixed (to the US dollar) exchange rate regimes pre-1997 to a range of more flexible regimes, but not freely floating regimes. In limited flexibility or managed floating regimes, it is natural to think of a threshold for the exchange rate since central banks would rather not allow movements in the nominal exchange rate due to shocks until it has reached a certain level. Together with managed floating, some countries have adopted inflation targeting (e.g. Korea and Thailand), which can also explain the existence of a threshold. In such circumstances, central banks would delay policy measures that may be in conflict with the inflation target.

More important to this study is the flexibility of the threshold cointegration model for introducing asymmetries into the dynamic adjustment towards the long-run equilibrium. The model can be interpreted as having two different regimes, where the relationship is linear and where whether the economy is in the first or second regime depends on the magnitude of the error correction term. Since both the current account and the exchange rate are variables that are relevant to economic policy, asymmetries may naturally arise from the behaviour of policy makers.

5 Results

In this section, we present the results for the long-run and short-run relations between the current account (CA) as a percentage of the GDP and the RER (q), for the countries in East and Southeast Asia. The sample includes all countries for which data availability permits: China, Hong Kong, Japan, Philippines, Singapore, South Korea, Malaysia, Taiwan and Thailand.[8] The current account balances and GDPs are obtained from the national authorities via the CEIC data service, while the RERs are obtained from the Bank for International Settlements, and they are real effective exchange rates. We have used quarterly observations and the data spans 1999:Q1 - 2012:Q1 for China, Hong Kong, Malaysia and Philippines, and for the remaining countries begins in 1998:Q1. The data have been seasonally adjusted using the X12 filter, assuming additive seasonality.

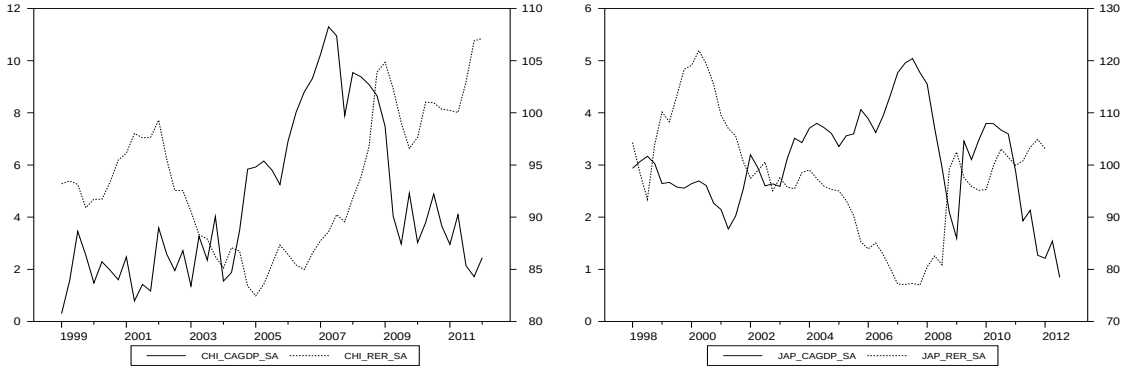
As aforementioned, in this paper we apply the CVAR method of Johansen (1988, 1991) to test whether there is a stable long-run relationship between the real effective exchange rate q_t and the current account balance ca_t.

Figure 1 displays the two variables for our target countries. From the graphs, there appears to be a negative relationship between the two variables for China, Japan and Malaysia, whereas it is not very clear whether a positive relationship exists for the rest of the countries. Whether we have a positive or a negative relationship seems to be time dependent. However, we can see an overall appreciation of the currencies along with an increase in the current account balance in most cases.

First, we test for the stationarity of the variables by country, using the Johansen approach, that is, we test whether the variables are 'cointegrated vectors' by themselves. The lag length and the deterministic components for each country have been chosen by means of goodness of fit and misspecification tests. According to table 1, the null of stationarity is rejected at conventional levels. In the next step we test for the presence of cointegrated relationships by means of the trace test. According to table 2, in all cases there is one cointegrating vector. Therefore, the nonstationarity of the data and the test of cointegration would suggest that we move ahead to a cointegration framework with appropriate diagnostic tests to estimate a bivariate CVAR model.

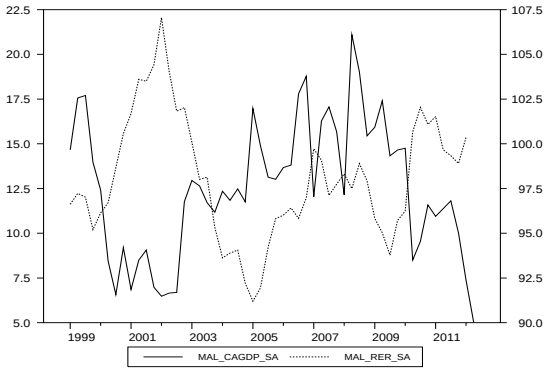
[8] No cointegrating relationships were found for Hong Kong. Hence, this country does not appear in the remainder of the analysis.

Figure 1: Real exchange rate and current account

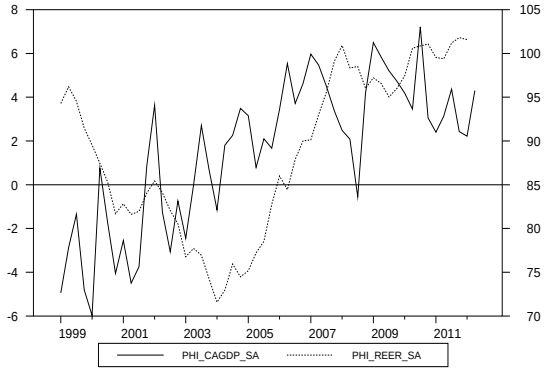


(a) China

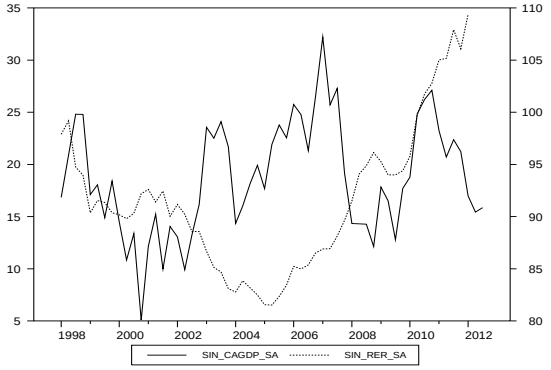
(b) Japan



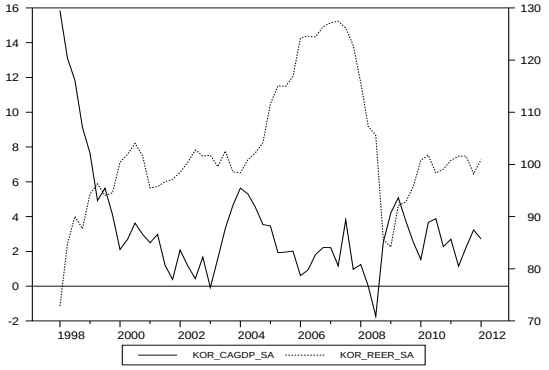
(c) Malaysia



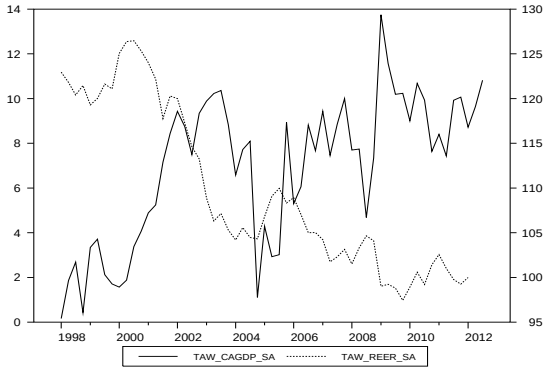
(d) Philippines



(e) Singapore



(f) South Korea



(g) Taiwan

(h) Thailand

Note: Right axis is for the RER and left for the CA.

Table 1: Tests of Stationarity

Country	q_t	ca_t
China	4.270 [0.039]	7.313 [0.007]
Japan	11.241 [0.000]	8.282 [0.004]
Malaysia	4.300 [0.038]	2.655 [0.103]
Philippines	9.569 [0.002]	3.463 [0.063]
Singapore	24.769 [0.000]	9.941 [0.002]
South Korea	16.343 [0.000]	6.227 [0.013]
Taiwan	15.757 [0.000]	8.357 [0.004]
Thailand	10.058 [0.002]	4.507 [0.034]

Note: p-values are given in brackets. The test is distributed as a $\chi^2(1)$, hence the critical value at the 5% is 3.841.

Table 2: Rank test

Country	p-r	r	Eig.Value	Trace	P-Value
China	2	0	0.212	15.600	0.047
	1	1	0.066	3.473	0.062
Japan	2	0	0.217	15.093	0.056
	1	1	0.034	1.886	0.170
Malaysia	2	0	0.160	13.328	0.103
	1	1	0.083	4.429	0.035
Philippines	2	0	0.183	10.644	0.094
	1	1	0.011	0.532	0.533
Singapore	2	0	0.398	24.920	0.001
	1	1	0.001	0.025	0.874
South Korea	2	0	0.226	17.113	0.007
	1	1	0.002	0.101	0.817
Taiwan	2	0	0.279	20.167	0.008
	1	1	0.039	2.166	0.141
Thailand	2	0	0.181	10.552	0.097
	1	1	0.004	0.184	0.739

Testing for the weak exogeneity of the variables, according to the results reported in table 3, the relationship is bidirectional for Korea, Singapore and Taiwan, implying that the dynamics of both the current account balances and the RERs of these countries adjust to the error correction term. In plain words, the variations in the current account

Table 3: Tests of weak exogeneity

Country	q_t	ca_t
China	0.058 [0.810]	8.510 [0.004]
Japan	0.001 [0.976]	9.755 [0.002]
Malaysia	0.726 [0.394]	2.184 [0.139]
Philippines	5.235 [0.022]	3.495 [0.062]
Singapore	3.911 [0.048]	20.058 [0.000]
South Korea	5.426 [0.020]	15.292 [0.000]
Taiwan	4.948 [0.026]	4.786 [0.029]
Thailand	1.530 [0.216]	8.294 [0.004]

Note: p-values are given in brackets. The test is distributed as a $\chi^2(1)$, hence the critical value at the 5% is 3.841.

Table 4: Cointegrating vector

	β'	
Country	ca_t	q_t
China	1.000 [NA]	0.607 [3.505]
Japan	1.000 [NA]	0.058 [5.356]
Malaysia	1.000 [NA]	0.551 [2.087]
Philippines	1.000 [NA]	−0.018 [−2.341]
Singapore	1.000 [NA]	0.415 [3.899]
South Korea	1.000 [NA]	−0.022 [−3.751]
Taiwan	1.000 [NA]	0.228 [4.916]
Thailand	1.000 [NA]	−0.044 [−3.212]

Note: t-statistics are given in brackets.

balances and the RERs are dependent upon long-run deviations from the equilibrium. A more interesting result is that the RER appears to be weakly exogenous in the cases of China, Japan, Malaysia and Thailand. This implies that it is the current account balance that adjusts to deviations in the long-run equilibrium and not the RER. One possible interpretation would be that, in these countries, the persistent current account surpluses

since 1998 may be partially the result of changes in their exchange rates. Changes in the relative price of domestic to foreign goods would generate a shock that would drive the current account balance away from the equilibrium. This would also be consistent with local governments intervening to maintain their currencies' competitiveness and promote external demand, in a region where the export sector is one of the main engines of growth.

The difference in the mechanism of adjustment towards equilibrium across countries may be related to the commitment of local governments to achieve RER stability. In the case of China, Japan, Malaysia and Thailand, this suggests that RER may be prevented from coming back to equilibrium by the government's interventions to control the RER. Therefore, objectives for the exchange rate are more important than current account considerations in these countries. It may also be the result of fear of floating in the region that prevents the exchange rate from getting back to equilibrium once there is a shock.

Next, in table 4, we display the identified cointegrated relationships, or β' matrix. The estimation of the cointegrating vectors is subject to some restrictions in the adjustment parameters from the weak exogeneity test. Weak exogeneity of the RER means that these variables do not react to a disequilibrium, and the coefficients in the a matrix are restricted to be zero. According to the sign of the long-run coefficients, a depreciation of the RER improves the current account balance for China, Japan, Malaysia, Singapore and Taiwan, which is the expected result. However, for the Philippines, South Korea and Thailand, the sign of the relationship is positive. This mimics a J-curve effect, although in this case we are talking about a long-run effect. What we observe here is that RER appreciations go together with capital outflows. As aforementioned, this is related to the fact that foreign assets become cheaper in relative terms and relatively more attractive.

In figure 2, we display the graphical representation of the Hansen and Johansen (1999) test for the stability of the cointegrating parameters. In these graphs we reproduce the evolution of the R representation and the $X1$ representation. In the R representation the dynamics are fixed in each recursive estimation, and according to Hansen and Johansen (1999), it is more relevant to analyse the stability of the cointegrating space. The estimated vectors are quite stable since the R representation is well below unity (scaled critical value at the 5% level). There is a problem with stability in the case of Thailand, due to a huge drop in her current account balance around 2005. For this country, the

estimated long-run relation should be considered as an average.

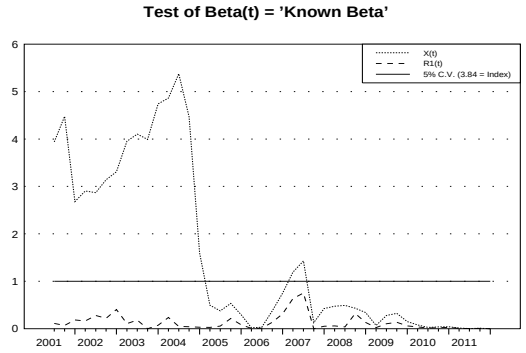
Table 5: Loading matrix

	α	
China	Δq_t	0.000 [0.000]
	Δca_t	−0.166 [−3.688]
Japan	Δq_t	0.000 [0.000]
	Δca_t	−0.401 [−3.528]
Malaysia	Δq_t	0.000 [0.000]
	Δca_t	−0.366 [−2.763]
Philippines	Δq_t	0.260 [2.414]
	Δca_t	−0.216 [−1.953]
Singapore	Δq_t	0.111 [2.018]
	Δca_t	−0.694 [−4.981]
South Korea	Δq_t	0.465 [2.395]
	Δca_t	−0.257 [−4.213]
Taiwan	Δq_t	−0.296 [−2.417]
	Δca_t	−0.334 [−2.375]
Thailand	Δq_t	0.000 [0.000]
	Δca_t	−0.243 [−3.379]

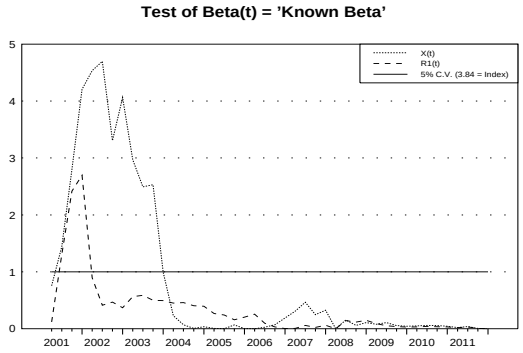
Note: t-statistics are given in brackets.

We also present, in table 5, the adjustment parameters or α matrix. In four out of seven cases, the estimated α appears as zero for the RER equation since, according to the results in table 3, the RER appeared as weakly exogenous for these countries. The estimated α for the current account is negative in all cases, implying an error correction mechanism, and their t-statistics are significant at least at 5%, and most of the time at 1%. Also, we present in figure 3 the recursive estimation of the loading parameters. Summing up the various results from the stability tests shown in figures 2 and 3, the estimated parameters seems to be fairly stable in all cases, except for Thailand for the above-mentioned reason.

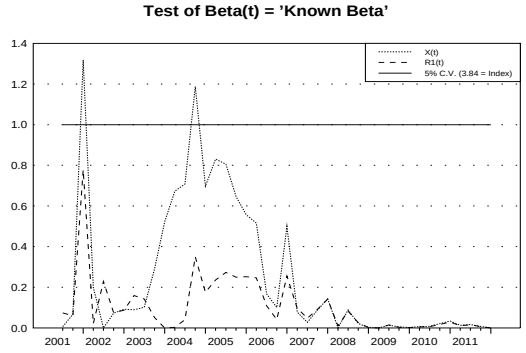
Figure 2: Test for β stability



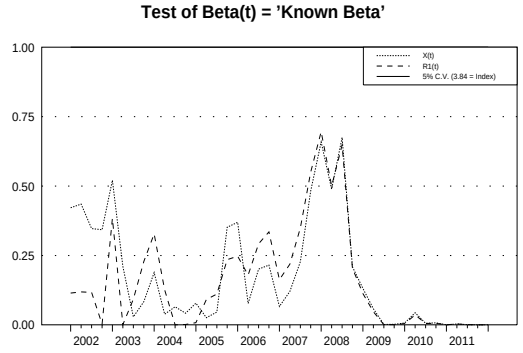
(a) China



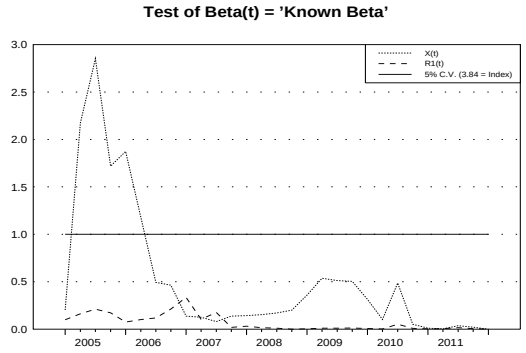
(b) Japan



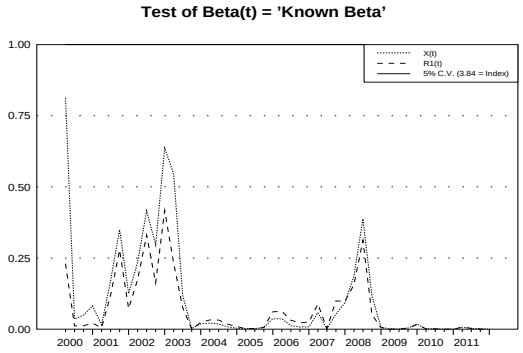
(c) Malaysia



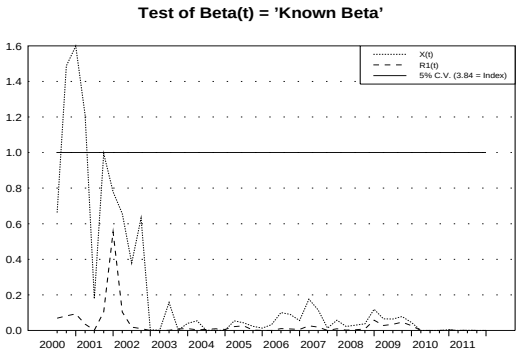
(d) Philippines



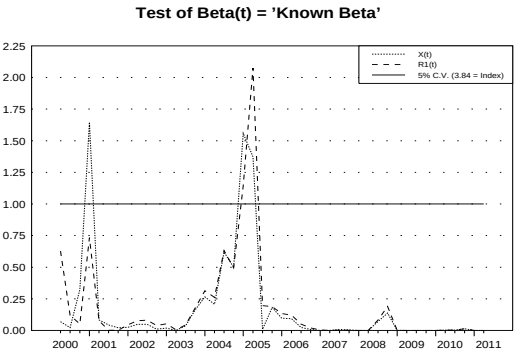
(e) Singapore



(f) South Korea

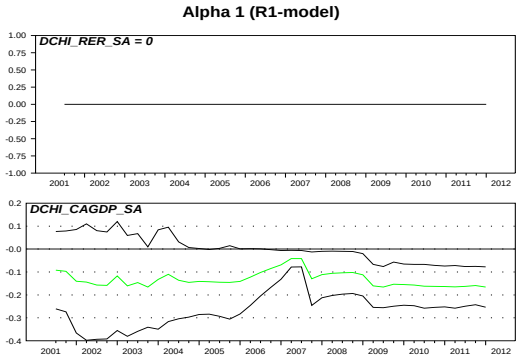


(g) Taiwan

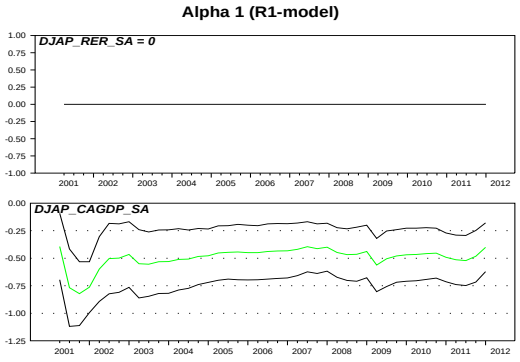


(h) Thailand

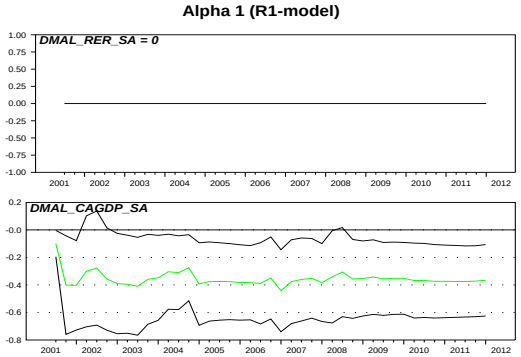
Figure 3: Test for α stability



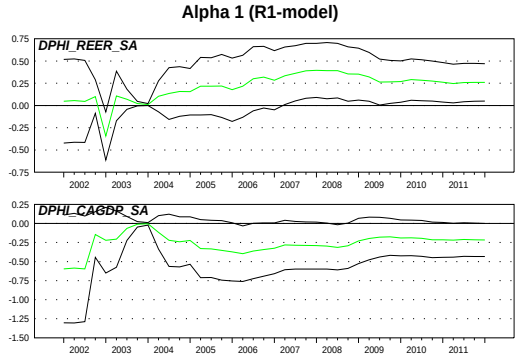
(a) China



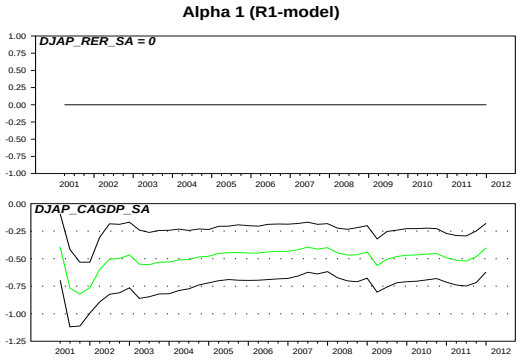
(b) Japan



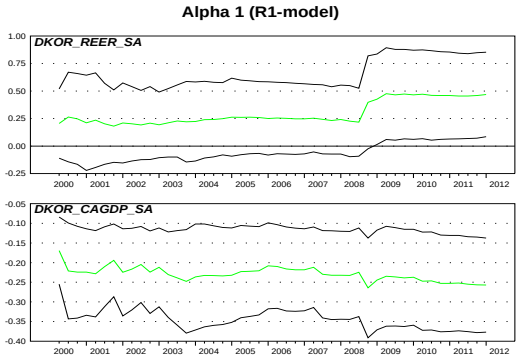
(c) Malaysia



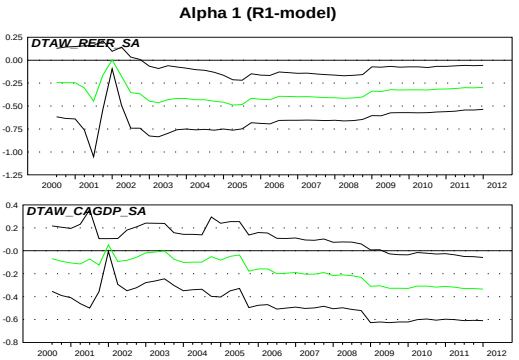
(d) Philippines



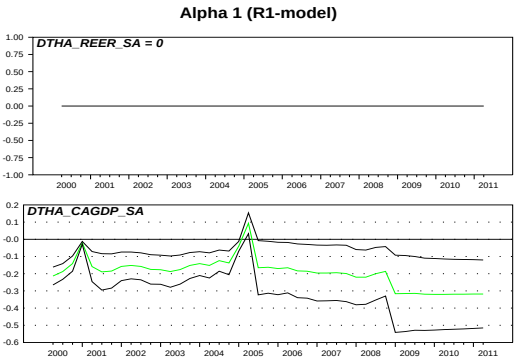
(e) Singapore



(f) South Korea



(g) Taiwan



(h) Thailand

Regarding the dynamics, the estimated parameters are presented in table 6. For the cases of China and Malaysia, a constant was initially introduced into the model, but was only found to be statistically significant for the current account equation. This makes sense since the current accounts of these countries were significantly in surplus during the analysed period. Japan, Singapore and Taiwan also have a significant constant in the current account equation. Interestingly, Malaysia's equation for the RER does not seem to be explained at all by the current account balance, since the RER is weakly exogenous, and only the constant for the current account equation seems to be significant. Hence, it seems that the dynamics for the current account in this country are only sensitive to long-run deviations from the equilibrium. Similar results are found for South Korea and Taiwan, with the difference that both the RER and the current account balance seem to be sensitive only to long-run deviations from the equilibrium. Based on a CVAR with the cointegrated vectors shown in (2) and the short-run parameters, we ran the recursive CUSUM test for stability and found no problems.[9]

In order to analyse the speed of adjustment towards equilibrium, we computed the half-life of shocks in the current account as

$$h = \frac{log(1/2)}{log(1+\alpha)} \tag{4}$$

The concept of the half-life considers how long it takes for the impulse response to a unit shock to dissipate by half, and it is commonly used as a measure of the speed with which the economy returns to equilibrium. For China, the current account takes nearly a year to reduce the gap to equilibrium by a half; for the Philippines, it takes between 8 and 9 months, for South Korea and Thailand 7 to 8 months, for Taiwan 5 to 6 months, for Japan and Malaysia 4 to 5 months and for Singapore less than 2 months. These magnitudes represent quite high speeds of adjustment. Taylor (2002) computes half-life figures for a sample of fifteen countries making use of time series with annual observations. In all cases, the half-lives of the shocks are larger than our estimate for China. The quickest country in his sample is Denmark (with a half-life of 13.9 months) while the slowest is Canada (71.1 months), which is quite a wide range. The average half-life of the full sample is 23.2, more than double that of China in our sample. Taylor's

[9]To save space results arenot presented here but are available upon request.

Table 6: Short run matrix

		Γ_i				
Country		CONSTANT	Δq_{t-1}	Δca_{t-1}	Δq_{t-2}	Δca_{t-2}
China	Δq_t	0.168 [0.039]	**0.387** [2.687]	−0.176 [−0.901]	-	-
	Δca_t	**10.118** [3.691]	0.136 [1.505]	−0.202 [−1.643]	-	-
Japan	Δq_t	**0.114** [0.011]	0.120 [0.871]	−0.263 [−0.194]	**-0.263** [−1.910]	−2.070 [−1.492]
	Δca_t	**3.539** [3.507]	0.001 [0.078]	**0.273** [2.181]	**0.049** [3.874]	**0.463** [3.631]
Malaysia	Δq_t	0.049 [0.009]	0.223 [1.544]	−0.024 [−0.265]	-	-
	Δca_t	**24.234** [2.737]	−0.123 [−0.527]	−0.045 [−0.302]	-	-
Philippines	Δq_t	-	0.215 [1.565]	−0.112 [−0.940]	−0.035 [−0.255]	**-0.289** [−2.552]
	Δca_t	-	**0.352** [2.495]	−0.163 [−1.331]	−0.206 [−1.444]	**-0.397** [−3.413]
South Korea	Δq_t	-	0.200 [1.500]	0.351 [0.888]	-	-
	Δca_t	-	−0.017 [−0.411]	−0.063 [−0.511]	-	-
Singapore	Δq_t	**-5.859** [−1.935]	−0.059 [−0.403]	**-0.182** [−3.041]	**0.563** [3.467]	**-0.122** [−2.000]
	Δca_t	**38.170** [4.978]	**1.579** [4.243]	**0.401** [2.647]	0.186 [0.452]	**0.581** [3.771]
Taiwan	Δq_t	**9.046** [2.324]	−0.030 [−0.217]	0.023 [0.184]	-	-
	Δca_t	**10.759** [2.410]	−0.117 [−0.733]	−0.128 [−0.902]	-	-
Thailand	Δq_t	-	**0.256** [2.778]	0.060 [0.880]	-	-
	Δca_t	-	0.112 [0.652]	**-0.212** [−1.668]	-	-

Note: t-statistics are given in brackets. Coefficients in bold are significant at least at 10%. In all countries a constant (unconstrained) but no trend has been added to the CVAR, except for Philippines, South Korea and Taiwan where there is no constant. Most countries have only one lag for the dynamics, except Japan and Philippines (2 lags) and Singapore (8 lags, where only the first two are reproduced here due to space limitations while the remaining are available upon request).

half-life estimate for Japan, the only country to appear in both samples,[10] is 16.2 months, which is around four times our own estimate. The general picture would be the same if the half-life were computed from the AR(1) model, as in Taylor (2002), rather than the bivariate CVAR. The new figures (in months) would be as follows: China = 19, Japan = 20.5, Malaysia = 6.5, the Philippines =6.5, Singapore = 6.6, South Korea = 6.6, Taiwan

[10]However, there are important differences. First, different periods of time are used since the sample in Taylor (2002) ends in 1992 while our sample starts in 1998. Second, our sample consists of quarterly observations while Taylor uses annual data.

Table 7: TVECM estimation

Country		Regime 1		Regime 2			
		Δca_t	Δq_t	Δca_t	Δq_t	β	λ
China	constant	-0.669	-0.675	-0.677	-0.455	0.047	-0.959
	α	-0.464	-0.162	0.119	0.309		
	Δca_{t-1}	-0.126	-0.690	0.021	0.060		
	Δq_{t-1}	-0.017	0.430	-0.078	0.252		
		N=25		N=26			
Japan	constant	-0.117	1.383	-0.054	1.554	0.031	0.166
	α	-0.213	2.434	-0.068	-0.777		
	Δca_{t-1}	0.188	-0.034	0.244	-2.885		
	Δca_{t-2}	0.258	-1.177	0.306	-4.556		
	Δq_{t-1}	-0.008	0.258	0.013	-0.043		
	Δq_{t-2}	0.049	-0.099	-0.037	-0.586		
		N=26		N=28			
Malaysia	constant	0.488	-0.656	0.708	-0.042	0.127	0.119
	α	0.003	-0.136	-0.606	0.108		
	Δca_{t-1}	-0.348	-0.152	0.227	-0.027		
	Δq_{t-1}	-0.210	0.086	-0.263	0.336		
		N=26		N=25			
Philippines	constant	-0.158	-0.127	0.652	-0.004	0.017	0.633
	α	-0.334	0.126	-0.448	0.299		
		N=26		N=25			
Singapore	constant	3.835	1.967	-0.568	0.977	0.204	-0.568
	α	0.074	0.380	-0.215	0.046		
	Δca_{t-1}	0.381	-0.211	-0.479	-0.012		
	Δca_{t-2}	0.982	0.171	-0.272	-0.148		
	Δq_{t-1}	1.270	0.447	1.431	-0.182		
	Δq_{t-2}	0.921	0.992	2.529	0.419		
		N=24		N=24			
South Korea	constant	-0.829	4.541	-0.661	1.468	0.029	-0.337
	α	-0.500	2.397	-0.081	0.055		
	Δca_{t-1}	-0.525	0.819	0.062	-1.473		
	Δca_{t-2}	-0.458	1.111	0.257	-0.055		
	Δq_{t-1}	0.118	0.247	-0.090	-0.109		
	Δq_{t-2}	-0.039	0.309	0.017	-0.410		
		N=28		N=26			
Taiwan	constant	1.726	-0.767	-0.811	-0.969	0.060	1.369
	α	0.195	-0.175	-0.004	0.192		
	Δca_{t-1}	-0.162	-0.117	-0.229	-0.119		
	Δq_{t-1}	-0.035	0.002	0.016	0.103		
		N=27		N=28			
Thailand	constant	-1.252	-0.322	-0.553	0.402	0.051	-0.190
	α	-0.570	-0.151	-0.155	-0.123		
	Δca_{t-1}	-0.164	0.208	-0.212	0.029		
	Δq_{t-1}	-0.091	0.331	0.143	0.259		
		N=27		N=25			

= 7.9 and Thailand = 5.8. The only two countries with large estimates are China and Japan. However, our figure for Japan is now much closer to that of Taylor.

The speed of adjustment to the equilibrium can be related to capital market mobility. A country with good access to the international market can experience sustained periods of current account deficits. However, a country with little access to the international capital market must correct any current account deficits quickly to prevent a balance of payments problem. Therefore, a large adjustment speed, which is the same as low persistence, can be associated with low financial integration. If the half-life of the shocks were small (close to zero), the country would be expected to have a flexible current account and the capacity to run persistent deficits or surpluses. A flexible current account would be associated with high capital market mobility. On the contrary, if the half-life of the shocks were high, the current account would tend to be rigid, deviations from the equilibrium would be hard to maintain, and capital market mobility would be low. In our sample, the high half-life figures seem to imply that the capital markets in the region are highly movable. This is consistent with the empirical observation that there are persistent current account surpluses/deficits around the world, with a large and persistent surplus in this region for this period, in particular.

In table 7, we display the results of the TVECM estimation. Previously, the assumption of linearity was tested based on the SupLM test suggested by Hansen and Seo (2002), which has the advantage that, under the null, there is no threshold effect and the model is reduced to the traditional linear cointegration model, the one used so far in this paper. In all cases, the null of linearity is strongly rejected, which suggests that the results from the TVECM in table 7 should be preferred to the linear one.[11] This is not surprising since the number of observations is more or less the same in each of the regimes while the estimated parameters differ quite a lot. Also, it can be observed that the sign of the estimated β implies in all cases that the current account balance and the RER have a positive relationship. This corroborates the results we found in some countries within the linear framework.

Threshold cointegration allows for asymmetric adjustments within two different regimes. In the linear cointegration framework, increases or decreases in the deviations from the long-run equilibrium are corrected in the same way. Asymmetric adjustments can occur,

[11] Results available upon request.

for example, if policy makers react asymmetrically to changes in the variables of the system, in this case the current account and the exchange rate. In the case of the current account, it would not be surprising if policy makers were more worried about the occurrence of a deficit than a surplus. Likewise, policy makers are more likely to intervene in currency markets when their currency is depreciating than when it is appreciating. In this context, threshold cointegration allows for some flexibility in the modelling of the dynamics of adjustment.

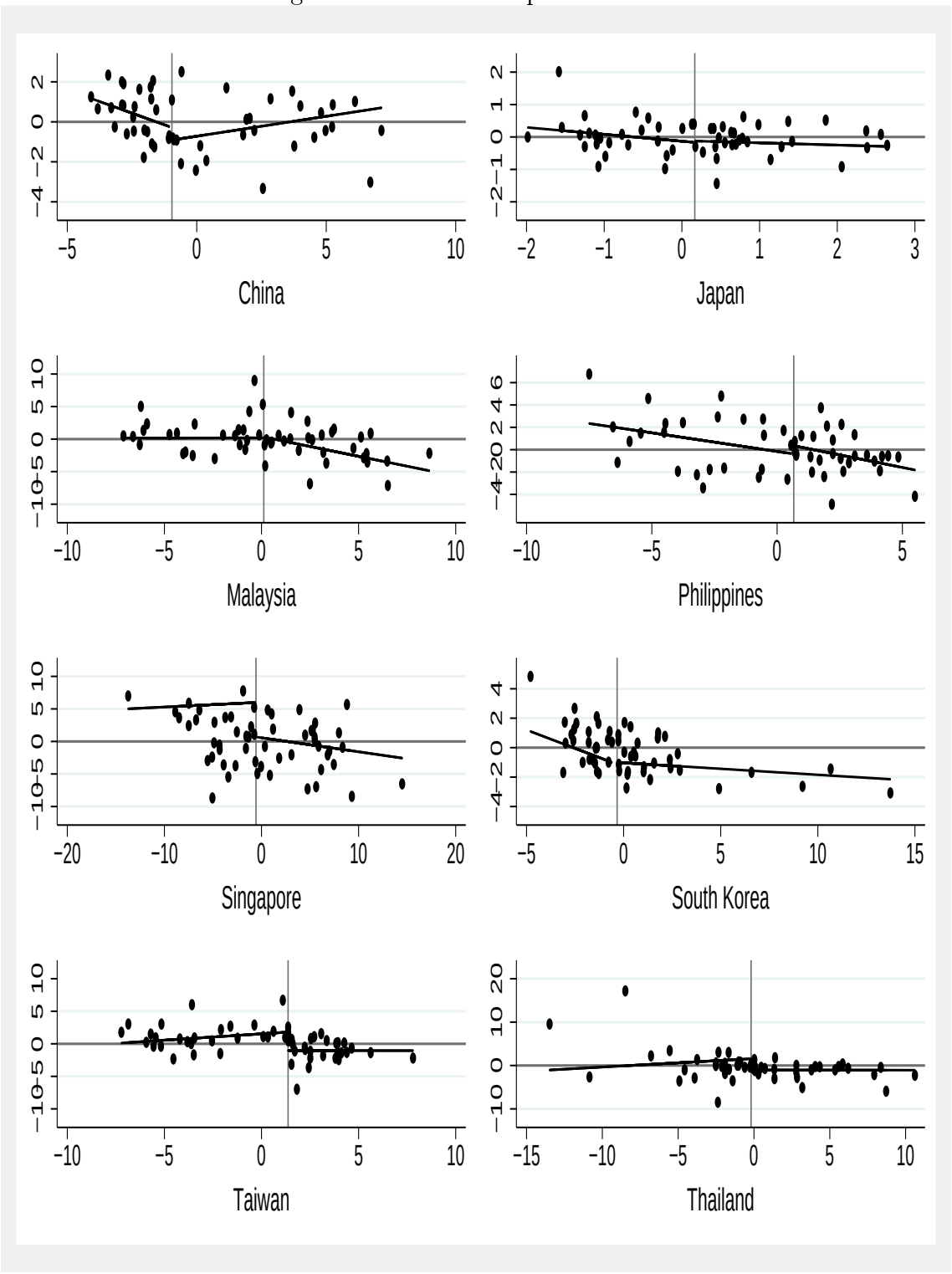
The α coefficients of the current account and RER equations provide information about the adjustment process back to the long-run cointegrating relationship. In general, it is much easier to find a negative a for the current account balance than for the RER, especially in regime 2. This is consistent with the weak exogeneity test in the linear case, in the sense that it is the current account in most cases that adjusts in order to push the economy back to the long-run equilibrium. However, looking at the current account equation, the coefficient of the error-correction term of one of the regimes is positive in the case of China (regime 2), Malaysia, Singapore and Taiwan (regime 1), and the adjustment, if any, would involve the RER.[12] That is, in four out of sixteen cases, the sign is not as expected. However, since significance levels are not available, the analysis of the sign of the adjustment parameters is incomplete. According to Hansen and Seo (2002), there is no formal distribution theory for the parameter estimates and standard errors; hence neither standard errors nor t-statistics are reported here. It is also the case that there may be some small sample concerns since the number of observations in each regime is rather small.[13]

From the TVEC estimation, it is possible to compute two different half-lives of shocks as in equation (3), depending on whether the economy is in regime 1 or regime 2. However, in some cases, the coefficient of the error-correction term in the current account equation of one of the regimes is positive, which not only suggests that the relationship is not stable and strong, but also that it is impossible to compute the half-life coefficient, which makes

[12]For China (regime 2) and Singapore (regime 1), the adjustment parameter in the RER equation is also positive, which implies that the economy would not adjust back to the equilibrium when facing a shock. Although this regime is in an unstable equilibrium, the economy may come back to the long-run equilibrium if a large enough shock pushed it back into the other regime.

[13]Maximum likelihood estimation is necessary because the threshold parameter is unknown. However, if λ were known, OLS for the two separate regimes would be enough, a clear indication that the short-run coefficients depend mainly on the observations of each regime.

Figure 4: Estimated alphas TVECM



any comparison rather difficult. Figure 4 shows the error correction term parameter in the two regimes for all the countries in our sample. In general, and unsurprisingly, the speed of mean reversion is faster than in the linear case in one regime but slower in the other one, except in the case of the Philippines which shows faster adjustment in both regimes (5.1 and 3.5 months in regimes 1 and 2 respectively). Thailand shows quick convergence rates towards the equilibrium in both regimes (in regime 1, the half-life is 2.5, and in regime 2 it is 12.3) but in regime 2 it is slower than before. For China, Korea and Malaysia, the current account adjustment in one of the two regimes is quick (3.3 and 3 for China and Korea in regime 1, and 2.2 months for Malaysia in regime 2) but in the other regime convergence is either slow (Korea = 24.6 months) or there is no convergence. On the other hand, there are three countries where the half-life from linear cointegration is shorter: Japan (where in regime 1 it is still quick, 8.7 months, but in regime 2 it is rather slow, 29.5 months), Singapore (quick adjustment in regime 2, with a half-life of 8.6 months, but in regime 1 it does not converge to equilibrium) and Taiwan (quite a large half-life in regime 1, >500 months, and no convergence in regime 2).

What we have found is supportive of the hypothesis that current accounts and RERs are strongly linked in this group of countries. For policy purposes, this means that capital flows have an influence on exchange rate movements, which might affect later on how international investors decide on their portfolios of assets in our target countries. It also affects how these countries invest abroad, bearing in mind that in most cases we are talking about surpluses. Now, whether or not it is a good idea to export or import capital is something outside of the scope of this paper.

6 Conclusion

Following the recent controversy in the literature over the link between competitiveness and capital flows, we have provided in this paper a thorough analysis of the link between these two variables for a group of East Asian economies. This study is motivated by the change from deficit to surplus of the current accounts of these countries following the financial crisis of 1997. Since 1998, most countries in the region have also increased the flexibility of their exchange rate and inflation targeting (Korea, Thailand, Indonesia and the Philippines) although they are still far from free floating. Hence, in this paper we

have analysed the potential connection between current account surpluses as a percentage of the GDP, and the competitiveness of the country. In most of the countries analysed, there appears to be a cointegrating relationship between the two variables, which might corroborate our initial hypothesis. However, the sign of this relationship varies between the countries. For the stronger/bigger economies, the relationship is negative, that is, a depreciation of the currency in real terms improves the current account balance. However, for smaller economies, the relationships seem similar to a J-curve, that is, a depreciation of the currency worsens the balance. The relationships are stable, despite the crisis of 1997-1998. Also, we find that, in some countries, the direction of the causality is bidirectional, implying that both capital flows and competitiveness affect each other in a recursive way. However, within the nonlinear framework, the results pinpoint a stylised fact, that is, RERs appreciated and current account surpluses increased, especially before 2008. These results open up the debate on whether or not imports and exports of capital and exchange rates should be controlled more tightly in this group of countries. In the case of China and Japan (but also Malaysia and Thailand), the fact that the exchange rate is weakly exogenous is consistent with currency intervention policies to maintain competitiveness. This result is relevant in the economic policy debate because China and Japan are two of the usual suspects in exchange rate manipulation, which leads to persistent current account surpluses. However, our investigation does not include any additional elements to test whether the Chinese or Japanese governments have actually carried out large-scale interventions in the currency market. Even if it is true, exchange rate manipulation may have other objectives than to sustain competitiveness, such as inflation targeting. According to our results, the evidence suggests that current accounts across countries in the region are rather rigid, which may be associated with high capital mobility. This conclusion is derived from the comparison of our half-lives of shocks with those from the international literature. This relatively high capital mobility is important in explaining the persistent current account surpluses in the region.

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