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A New Look at the Determinants of Growth in Asian Countries

by Manuk Ghazanchyan, Janet G. Stotsky, and Qianqian Zhang

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Abstract

This study examines the drivers of growth in Asian countries, with focus on the role of investment, the exchange rate regime, financial risk, and capital account openness. We use a panel data set of a sample of Asian countries over the period 1980 to 2012. Our results indicate that private and public investments are strong drivers of growth, while more limited evidence is found that reduced financial risk and higher foreign direct investment support growth. The exchange rate regime does not appear to be a strongly significant determinant of growth, but some specifications suggest that more flexible regimes are beneficial in this respect. Financial crises have a stronger dampening effect on growth in countries with more open capital accounts.

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I. INTRODUCTION

This paper takes a new look at key determinants of growth in Asia. It focuses on one of the traditional pillars of growth, the role of investment, but also considers the impact on growth of the exchange rate regime, financial risk, and capital account openness under different fiscal and monetary policy settings. It comes at a time when Asian countries, notably China, are facing a possible slowdown in growth, following several decades of remarkable growth performance in much of the region.

The paper covers the period 1980-2012 for 25 countries and economies in East and South Asia. During this time, Asian countries tended to have high levels of private investment and more modest levels of public investment. In some, the major portion of investment was funded by internal sources while elsewhere foreign direct investment (FDI) was significant. Although many of the countries are relatively open to capital flows, there has been reluctance among a number of them to open fully the capital account on the concern that it may prove challenging to macroeconomic management and exchange rate policy.

Asian countries exhibit a range of exchange rate regimes, from fixed to free floating. The majority of countries have some form of flexible regime that we term an intermediate float because the currency is not fully flexible. There are signs of gradual movement towards greater exchange rate flexibility in number of countries in the region. However, the propensity for foreign exchange intervention and exchange rate management among central banks in the region remains fairly high, with most countries seemingly more sensitive to avoiding exchange rate appreciation than depreciation.

Prior to the Asian financial crisis in the late 1990s, many central banks in East Asia had maintained a de facto, if not de jure, fixed exchange rate regime with a belief that exchange rate stability was essential for promoting trade and investment. However, the fixed exchange rate regime became difficult to maintain once capital accounts were liberalized. Some emerging market economies, such as Indonesia and Thailand, received large capital inflows followed by large and sudden outflows as the crisis took hold. In the process of trying to maintain fixed exchange rates, central banks ran down their foreign reserves, resulting in a currency crisis. Since the late 1990s, many emerging market economies have tried to combine a flexible exchange rate with an inflation targeting framework, when monetary and financial conditions are appropriate, in order to lessen the probability of a currency crisis while maintaining the stability of domestic prices.

In this paper we combine these different factors—the role of investment, financial risk and capital account openness, and policy choices (including the exchange rate regime)—into one analytical block. We examine the relationship between growth and its determinants in Asia by using two econometric approaches—the generalized method of moments (GMM) to

control for endogeneity and the feasible generalized least squares (FGLS) method to control for group heteroscedasticity.

Section II reviews the literature. Section III describes the empirical approach. Section IV presents our results and Section V concludes.

II. EARLIER STUDIES

The empirical literature on growth is vast with key papers (Mankiw, Romer and Weil, 1992 and Levine and Renelt, 1992) finding investment, education and population growth as the main determinants of growth. However, the empirical significance of exchange rate policy in macroeconomic performance remains an open question, with Ghosh, Gulde, and Wolf (2002), Klein and Shambaugh (2010) and Rose (2011) providing an extensive survey of literature in this area. Monetary neutrality suggests that the nominal exchange rate regime should have no bearing on long-run economic growth. On the other hand, the exchange rate regime influences how countries adjust to real and nominal shocks, hence it may have some bearing on growth. A flexible exchange rate regime may lead to better growth performance because it provides stronger resilience to external real shocks, whereas a fixed exchange rate regime may be considered more advantageous for countries experiencing significant nominal shocks. Also, exchange rate uncertainty may have a negative impact on investment and therefore growth, in which case exchange rate stability may lead to better outcomes. However, if a peg is not credible or leads to a misalignment, then it may adversely affect investment and growth. Countries with more developed financial markets may be better able to contain exchange rate volatility associated with a flexible exchange rate, and thus are able to achieve the benefits of flexible rates in terms of enhancing the ability to adjust to real shocks without sacrificing the stability that a credible peg may entail, (Aghion and others, 2005).

Earlier studies that were focused on the role of the exchange rate regimes on growth include Bleaney and Francisco (2007), De Vita and Kyaw (2011), Ghosh, Ostry, and Tsangarides (2010), Harms and Kreschmann (2009), Husain, Mody, and Rogoff, (2005), Levy-Yeyati and Sturzenegger (2003), Miles (2006) and Rogoff and others, (2004). Except for Levy-Yeyati and Sturzenegger, in which the authors come to the conclusion that less flexible regimes are associated with slower growth, as well as greater output volatility, the preponderance of empirical work suggests that the regime does not have a significant effect on growth in developing countries, once other relevant variables are taken into account.

On the role of the real exchange rates and institutional features that figure prominently as empirical determinants of growth, there is some evidence that overvaluation is bad for growth and some more limited evidence that undervaluation may be beneficial for growth. Berg and Miao (2010), Johnson, Ostry, and Subramanian (2007), and Rodrik (2008) cover these issues in depth. The issue of exchange rate regimes and growth gets even more

complicated when one delves into how facto regimes are distinguished from de jure regimes. Calvo and Reinhart (2000) find that countries that say they allow their exchange rate to float mostly do not. This is particularly relevant to Asian countries, which have historically been reluctant to float freely and employ some mode of exchange rate stability.[2]

On the role of exchange rate regimes in growth in Asia, several key points are worth mentioning. First, based on the East Asian experience, different exchange rate arrangements may be appropriate in countries with different structural characteristics (Frankel, 2003). Second, although in a number of countries the U.S. dollar is weighted heavily in baskets to which most Asian countries peg, the currencies of several Southeast Asian countries have tended to exhibit increasing stability vis à vis the Chinese renminbi (Henning, 2012, and for a more general discussion, Ghosh and others, 2014). These countries rely heavily on export development, and trade extensively with China; hence excessive exchange rate flexibility could undermine cross-county production networks. Third, managed floats and "fear of appreciation" are common (Rajan, 2011, and Sokolov and others, 2008).[3] Rajan compares de jure and de facto exchange rate regimes in a group of Asian countries in 1999–2009. He finds gradual movement towards greater exchange rate flexibility in many of the Asian countries but also that "fear of appreciation" and thus managed floating regimes are prevalent. Such policies focused on tradables may not always be the best approach, but managed flexibility retains appeal by supporting cross-country production networks.[4]

Schnabl (2007) compares the growth performance of East Asia against emerging Europe under different exchange rate regimes, controlling for the impact of capital controls, institutional development (proxied by inflation) and crisis periods. Based on cross-country panel estimations, the author finds a negative impact of exchange rate volatility on growth both in emerging Europe and East Asia. Similarly, Goyal (2010) reviews the macroeconomic performance in South Asian countries, and analyzes why despite increased openness at a time of major international shocks they have done reasonably well. Goyal attributes this strong performance to judicial management of the exchange rate combined with increased openness and market development. The choice of flexible exchange rate regimes with restrained volatility contributed to the desired stability.

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[2] For more on the debate about exchange rate classifications, see Eichengreen and Razo-Garcia (2011).

[3] This is not to say that policy makers choose fear of floating as a monetary policy tool. Instead this could be the results of broader price stability or growth concerns, although Rodrik (2008) argues that central bank actions aimed at exchange rate undervaluation should be an integral part of the optimal growth strategy in developing economies. Some authors suggest that formal or informal monetary policies that target inflation produce this fear of appreciation phenomenon (Eichengreen, 2002; Detken and Gaspar, 2003; and Kumhof et al, 2007).

[4] In developing and emerging Asia, Coudert and Dubert (2005), Huang and Malhotra (2005), and McKibbin and Lee (2004) find that floating and managed floats have a positive growth effect compared to pegs.

III. EMPIRICAL SPECIFICATION

We extend the literature by focusing on three key elements: First, we combine all the relevant variables for growth and exchange rate regimes into one analytical block by studying extensively the determinants of growth, the roles of financial risk and capital account openness under different exchange rate policy settings with and without monetary anchors and taking into account "fears" of floating and pegging. Second, we study a broader set of countries in Asia by including 25 economies including Singapore, Hong-Kong SAR and China. Third, we use a longer time series than is generally employed in this analysis on Asia by extending the definition of exchange rate regime classifications through the whole period 1980-2012 (See Appendix B).

We examine the impact of foreign exchange rate regimes on growth by using generalized method of moments (GMM) to control for endogeneity and feasible generalized least squared (FGLS) method to control for group heterosckedasticity. Hence, our econometric results are based on estimating the following equation:

$$\text{Growth}_{i,t} = \alpha X_{i,t} + \beta R_{i,t} + \sigma_i + \gamma_t + \varepsilon_{i,t} \qquad (1)$$

where $\text{Growth}_{i,t}$ is the growth rate of real per capita GDP in national currency of country i in year t; $X_{i,t}$ is a vector of explanatory variables measured in separate regressions both at the beginning and as averages over the period t described below; $R_{i,t}$ is a vector of exchange rate regime dummies, where the coefficients represent the performance of flexible exchange regimes relative to a pegged regime, which is the omitted category; σ_i are country specific effects; γ_t are time specific effects; $\varepsilon_{i,t}$ are error terms; and α and β are parameters to be estimated. As mentioned above, we used the Arellano and Bond (1991) GMM estimation technique to address two important econometric problems that arise in estimating cross-country growth regressions: potential endogeneity of the explanatory variables and correlation between the unobserved country-specific effects and the explanatory variables. Thus, we estimate equation (1) on a large sample of 25 countries with time series extending from 1980 to 2012.[5]

To alleviate concern that the use of annual data biases the results owing to business cycle effects, we also estimate our models using the non-overlapping averages of the annual observations over three and five year time intervals. These intervals are long enough to eliminate business cycle effects and minimize attenuation bias from measurement error that may result from the use of annual data, but at the same time they are sufficiently short to

[5] We exclude small Pacific Island countries, Australia and New Zealand, and countries with missing data for key variables of interest.

enable us to maintain a time-series of data. Not all data series are complete for all countries and thus the panel data set is unbalanced. Appendix A describes the data and provides summary statistics on key variables used in the regression equations.

For the explanatory variables, we draw upon the rich empirical growth literature and propose specifications of exchange rate regimes that affect growth based on the literature on the role of exchange rate regimes in determining growth. In constructing our measure of the exchange rate regime, we adopt the definition of de jure and de facto exchange regimes, as indicated in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER, various years). The de jure classification reflects the officially announced exchange rate regime while the de facto classification reflects the actual policies in place at that time and is a backward looking assessment by the IMF staff of the prevailing exchange rate regime without necessarily implying a change in policy commitments.

We map the IMF classifications into three regimes (i.e., pegged, intermediate, and floating) and use two dummy variables to describe the de facto floating and intermediate regimes and two to describe the de jure regimes, where pegged regimes are the omitted category for both.[6] When using three- and five-year periods, the dummy variables capture the average or typical regime during this interval. In cases where the classification changed during the five-year period, the typical regime is the one that occurred most of the time (i.e., at least three out of five years or two out of three years). Over the sample period, only four out of 25 countries did not change their exchange regime.[7]

In our baseline model, we use several other explanatory variables as follows:

- **Per capita income** measured in natural log form, where, according to neoclassical theory, if there is income convergence across countries, the coefficient on per-capita income should be negative because the economy of a country with a relatively low level of initial per-capita GDP should grow faster to catch up to the steady-state level of growth.

- **Private and public investments** are measured as a share of GDP, where we would expect a higher share of investment should lead to higher growth.

[6] See Appendix B for the methodology of exchange regime classifications.

[7] Several other approaches rely on economic outcome data to distinguish de jure from de facto regimes. Levy-Yeyati and Sturzenegger (2003) use data on changes in nominal exchange rates, the volatility of these changes, and the volatility of international reserves, with cluster techniques, to group countries into de facto regimes. Reinhart and Rogoff (2004) rely on exchange rate movements and black market data, which were not available for our sample. In view of the difficulty in classifying intermediate regimes, we also conduct robustness checks on ways of specifying the dummy variables in the regime classifications, following Eichengreen and Razo-Garcia (2011). We find no substantive difference in our results with these variants.

- **Public consumption** is also measured as a share of GDP, where we would expect a higher level of consumption to have an ambiguous effect on growth for the following reasons. From a demand perspective, higher government spending may stimulate growth, but if excessive, may lead to higher inflation rather than growth. From a supply perspective, public spending, on human capital, which is often characterized as consumption in the government accounts, may induce higher growth. However, wasteful spending, such as on excessive compensation to civil servants or unproductive state enterprises, might lead to lower growth. Besides its effects on growth, by including this variable we aim to account for fiscal considerations that could affect the credibility and also the sustainability of the exchange rate regime.

- **Financial risk** is captured by an index as defined in the International Country Risk Guide, which measures a country's risk on the basis of three factors: political risk, economic risk, and financial risk, with a 50 percent weight applied to the first factor and 25 percent weights applied to the other two. The higher the index value, the lower the financial risk. Reduced risk is expected to improve growth through a number of channels excluding investment, which is already captured in the regression.

- **Capital account openness** is defined in several ways. One measure uses a methodology relying on the calculation of stocks of net foreign assets adjusted for reserves, measured in relation to developed economies (i.e., the G7 and OECD countries) and in relation to the 60^{th},70^{th}, and 75^{th} percentiles of all economies in the world (Lane and Milesi-Ferretti, 2007). In the baseline model with the variables described above, we use the relative openness to OECD countries for the measure of capital account openness. A larger value implies a more open capital account. This is a de facto methodology that does not rely on the stated policy of a country, which may not be entirely reflective of actual practice. We would expect a more open capital account to be beneficial, when accompanied by supporting policies of financial prudence, in that it deepens the sources of investment inflow to capital deficient economies, and allows more productive use of factors of production. However, if capital account openness mainly generates higher investment, then it might have no independent effect, after controlling for investment. Capital account openness has been approached cautiously because of the potential for disruptive swings in inflows and outflows that are difficult for countries to accommodate, especially those without fully developed financial markets. For this reason, we are somewhat agnostic on the sign of this variable in our Asian sample, especially one covering recent turbulent periods in international capital markets.

- **Real exchange rate misalignment** is captured following Aghion and others (2005), who use a measure of annual volatility of the growth of the real effective exchange rate (REER). A volatile real exchange rate can have detrimental effects on growth. We might also expect an overly appreciated REER to have a negative effect on

growth but it is difficult to distinguish empirically an appreciating REER from one that is above its fundamentals.

- **Dummy variables:** We identify two crisis periods in our sample—the Asian financial crisis (1997-99), and the global financial crisis (2008-11). We define a dummy variable that captures both periods of crisis to delineate the impact of crisis on growth.

Variations to the baseline model examine (i) foreign direct investment (FDI), measured as a share of GDP, which might have an effect independent of investment; (ii) inflation, to capture macroeconomic developments or as a proxy for institutional development; (iii) financial deepening, measured by the ratio of credit to GDP; (iv) trade openness, measured as the share of exports and imports in GDP, and (v) health and education indicators to capture human capital dimensions to growth.

To capture the fear of appreciation that some Asian countries exhibit, we also constructed measures of fear of floating and fear of pegging. For fear of floating, we assign "1" to a dummy variable whenever the de jure floating regime is associated with de facto less flexible regimes and for fear of pegging, we assign "1" to a dummy variable whenever the de jure pegged regime is associated with de facto more flexible regimes. We would expect that countries that practice these policies could have a stronger growth experience but are somewhat agnostic on this result, especially as there may be some overdetermination of the variable with the regime dummies.

Following Bailliu and others (2003), we also try to address potential inconsistencies between the exchange rate regime and the monetary arrangement. For both de jure and de facto cases, we construct a variable interacting the exchange rate regime dummy variable with a variable that measures whether inflation is below a 10 percent threshold, as a proxy for whether there is an effective monetary anchor in place. The expectation is that flexible regimes would have a different effect when inflation is controlled than when it is not controlled.

IV. RESULTS

A. Baseline Models

We present our baseline results in Tables 1a through 1c showing regression results for annual and 3- and 5-year averaged data. Both baseline models—FGLS and GMM—use private and public investments, government consumption, exchange rate regime dummies defined according to our tripartite classification scheme (i.e., pegged, intermediate, and floating), financial risk, a dummy variable for the crisis periods, an index of capital account openness, and real exchange rate volatility. We also include an interaction term for crisis dummies and capital account openness. Finally, we test specifications where the FGLS model has initial income and the GMM model uses the lagged dependent variable, e.g., lagged real GDP per

capita growth, as additional explanatory variables. The results of the two econometric approaches are robust with the number of instruments not exceeding the conventional level.

Private and public investments are consistently positive and statistically significant across all samples, in accord with our priors. The marginal impact of public investment is consistently larger than that of private investment. An increase in the ratio of private investment to GDP of one percentage point leads to an increase in growth per capita per period in the range of 0.13 to 0.20 percent in the three samples, with the averaged samples having somewhat larger coefficients than the annual sample. An increase in the ratio of public investment to GDP of one percentage point leads to an increase in growth per capita per year in the range of 0.18 to 0.32 percent in the samples.

The initial level of real GDP per capita is not significant, implying no convergence of incomes in this sample of countries. The lagged growth rates are positive and significant only in the annual sample. Government consumption is negative, in accord with priors, but not consistently significant, implying some weakly negative effect of spending on growth. The exchange rate regime dummy variables are inconsistently significant, but when they are, they imply that more flexible regimes boost growth. The volatility of the real exchange rate is negative and significant in the three-year averaged estimations and in the five-year averaged FGLS de facto estimation, offering limited but not consistent evidence that exchange rate volatility is bad. The results thus provide some evidence that more flexible regimes are beneficial to growth and volatility may damage growth, in accordance with other research on Asian countries.[8]

Financial risk is positive and statistically significant in the annual and in five-year averaged GMM de jure estimations, suggesting that reducing financial risk boosts growth, even after controlling for investment, but the strength in the annual sample may reflect some unaccounted for business cycle effects given that the significance diminishes in the averaged samples. The crisis dummy is negative but also inconsistently significant, while the capital account openness variable is not significant in any regression, which may reflect in part the relative lack of change over the sample or else that after controlling for investment, the opening of the capital account did not further alter growth. The results employing a dummy variable reflecting only the Asian crisis were not significantly different from our baseline results and the coefficients were slightly bigger for the average samples, confirming our earlier expectation that the recent crisis had little impact on Asian growth. The interaction term of crisis and capital account openness is negative and generally statistically significant, suggesting that the interaction of a more open capital account with financial turmoil amplifies the effect of turbulence on growth though marginally.

[8] We also tried a specification with the change in the REER to test the effect of appreciation on growth but did not find a significant effect.

Table 1a. Drivers of Growth, Annual Data, 1980–2012

Dependent variable: Real GDP per capita growth

	FGLS		Sys GMM	
	(1)	(2)	(3)	(4)
Lag of real GDP per capita growth			0.147*	0.135*
			(0.057)	(0.060)
Initial real per-capita GDP	0.071	0.077		
	(0.083)	(0.079)		
privateinv_ngdp	0.132***	0.147***	0.146*	0.141*
	(0.035)	(0.033)	(0.057)	(0.053)
publicinv_ngdp	0.322***	0.276***	0.218**	0.184*
	(0.036)	(0.031)	(0.067)	(0.064)
govc_ngdp	-0.120**	-0.081	-0.095	-0.067
	(0.046)	(0.051)	(0.076)	(0.075)
floatdf	1.021*		0.712	
	(0.440)		(0.604)	
intdf	0.595		0.170	
	(0.342)		(0.490)	
floatdj		0.072		0.397
		(0.506)		(0.752)
intdj		1.016*		1.207
		(0.417)		(1.194)
frisk	0.111***	0.093**	0.088**	0.087**
	(0.033)	(0.033)	(0.024)	(0.024)
crisis	-1.868	0.582	-1.584**	-1.551**
	(1.025)	(1.342)	(0.417)	(0.387)
kaopen	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.002)	(0.001)	(0.002)
kaopen*crisis	-0.005	-0.006*	-0.003**	-0.003*
	(0.003)	(0.003)	(0.001)	(0.001)
reer_sd	-0.008	0.016	0.021	0.030
	(0.027)	(0.027)	(0.024)	(0.031)
_cons	-3.173*	-5.471***	-2.838*	-3.258*
	(1.244)	(1.553)	(1.129)	(1.293)
r2	0.540	0.542		
rmse	2.329	2.328		
Number of instruments 1/			118	118
Number of observations	334	334	334	334

Source: IMF staff estimates

* Significant at 10 percent level
** Significant at 5 percent level
*** Significant at 1 percent level

1/ Our results are robust to reducing the number of instruments to 66.

Table 1b. Drivers of Growth, 3 year averages, 1980-2012

Dependent variable: Real GDP per capita growth				
	FGLS		Sys GMM	
	(1)	(2)	(3)	(4)
Lag of real GDP per capita growth			0.049	0.005
			(0.080)	(0.066)
Initial real per-capita GDP	0.124	0.188		
	(0.103)	(0.104)		
privateinv_ngdp	0.160***	0.173***	0.178***	0.202***
	(0.035)	(0.032)	(0.038)	(0.035)
publicinv_ngdp	0.321***	0.286***	0.275**	0.239*
	(0.058)	(0.054)	(0.083)	(0.084)
govc_ngdp	-0.127*	-0.125	-0.135*	-0.107
	(0.055)	(0.064)	(0.052)	(0.072)
floatdf	1.423**		0.529	
	(0.491)		(0.658)	
intdf	0.783		0.504	
	(0.410)		(0.401)	
floatdj		0.443		0.048
		(0.497)		(0.806)
intdj		1.160**		1.019
		(0.413)		(0.492)
frisk	0.037	0.015	0.041	0.027
	(0.038)	(0.037)	(0.024)	(0.023)
crisis	-0.169	-1.347*	-0.288	-0.402
	(0.559)	(0.538)	(0.484)	(0.453)
kaopen	0.001	0.001	0.001	0.001
	(0.002)	(0.002)	(0.001)	(0.002)
kaopen*crisis	-0.007**	-0.007**	-0.012**	-0.009***
	(0.002)	(0.002)	(0.003)	(0.002)
reer_sd	-0.116***	-0.118***	-0.108*	-0.094*
	(0.018)	(0.019)	(0.044)	(0.041)
_cons	-2.214	-1.964	-1.276	-2.100
	(1.797)	(1.751)	(1.429)	(1.332)
r2	0.695	0.691		
rmse	1.474	1.519		
Number of instruments			51	51
N	123	123	123	123

Source: IMF staff estimates

* Significant at 10 percent level
** Significant at 5 percent level
*** Significant at 1 percent level

Table 1c. Drivers of Growth, 5 year averages, 1980-2012

Dependent variable: Real GDP per capita growth

	FGLS		Sys GMM	
	(1)	(2)	(1)	(2)
Lag of real GDP per capita growth			0.066	0.033
			(0.113)	(0.119)
Initial real per-capita GDP	0.126	0.116		
	(0.101)	(0.125)		
privateinv_ngdp	0.171***	0.168**	0.193**	0.160**
	(0.038)	(0.054)	(0.055)	(0.042)
publicinv_ngdp	0.320***	0.258***	0.269***	0.204*
	(0.058)	(0.058)	(0.062)	(0.094)
govc_ngdp	-0.114	-0.087	-0.078	-0.022
	(0.058)	(0.066)	(0.092)	(0.106)
floatdf	1.617**		0.324	
	(0.525)		(0.505)	
intdf	0.385		-0.172	
	(0.311)		(0.392)	
floatdj		-0.071		-0.336
		(0.667)		(0.518)
intdj		0.536		0.410
		(0.486)		(0.494)
frisk	0.032	0.035	0.068	0.099*
	(0.002)	(0.002)	(0.001)	(0.001)
crisis	-1.867***	-0.944	-0.735	-0.973
	(0.420)	(0.494)	(0.510)	(0.523)
kaopen	0.001	0.000	-0.000	-0.001
	(0.001)	(0.002)	(0.001)	(0.002)
kaopen*crisis	-0.010***	-0.009***	-0.011***	-0.010***
	(0.002)	(0.002)	(0.001)	(0.001)
reer_sd	-0.051**	-0.040	0.016	0.058
	(0.019)	(0.022)	(0.048)	(0.053)
_cons	-2.741	-1.723	-3.062*	-3.836**
	(1.427)	(2.253)	(1.157)	(1.160)
r2	0.755	0.697		
rmse	1.153	1.264		
Number of instruments			35	35
N	76	76	76	76

Source: IMF staff estimates

* Significant at 10 percent level
** Significant at 5 percent level
*** Significant at 1 percent level

B. Alternative Specifications

We present selected results from our alternative models in Tables 2a through 2c, showing again regression results for annual, and three and five year averaged data. Both baseline models—FGLS and GMM—include the same set of variables as used in the baseline models, except the volatility of the real effective exchange rate. We also now include inflation (which is highly correlated with the exchange rate) and add FDI and dummy variables for fear of floating and fear of pegging to assess whether countries modified their stated monetary and exchange rate framework in practice. As seen, the basic results reported in Tables 1a-c continue to hold, although the exchange rate regime dummies became somewhat less significant and the lagged growth is no longer significant.

In addition, we see that FDI is significantly positive in affecting growth, in some specifications, while inflation now has a significantly negative impact on growth in all samples except in the 5-year averaged sample with the GMM model. Our dummy variables for fear of floating and fear of pegging are not significant in any of the samples.[9] The results reported here are intuitively plausible and continue suggest the overriding importance of investment in driving growth. However, macroeconomic instability, as evidenced through higher inflation or financial crisis, continues to be an important influence as well.

[9]Once dummy variables for fear of floating and fear of pegging are included, the specifications using de facto and de jure regimes might give very similar results. Consequently, we have also estimated our specifications without the exchange rate regime dummies. Our results were identical in that neither fear of floating nor fear of pegging had any significant impact on growth.

Table 2a. Drivers of Growth, Annual Data, 1980–2012

Dependent variable: Real GDP per capita growth

	FGLS		Sys GMM	
	(1)	(2)	(3)	(4)
Lag of real GDP per capita growth			-0.341	-0.065
			(0.347)	(0.180)
Initial real per-capita GDP	0.087	0.104		
	(0.076)	(0.076)		
privateinv_ngdp	0.146***	0.144***	0.262*	0.190*
	(0.034)	(0.035)	(0.114)	(0.083)
publicinv_ngdp	0.337***	0.304***	0.386*	0.249**
	(0.037)	(0.041)	(0.176)	(0.058)
govc_ngdp	-0.164**	-0.139*	-0.267	-0.166
	(0.055)	(0.054)	(0.157)	(0.081)
floatdf	0.979		2.250	
	(0.622)		(1.260)	
intdf	0.892*		0.886	
	(0.368)		(0.887)	
floatdj		0.801		1.394
		(0.608)		(1.602)
intdj		1.013*		2.113
		(0.471)		(1.437)
frisk	0.098**	0.094**	0.109*	0.074
	(0.033)	(0.034)	(0.038)	(0.034)
crisis	-1.643*	1.900	-2.092*	-1.663*
	(0.736)	(1.462)	(0.900)	(0.603)
kaopen	-0.001	-0.000	-0.001	-0.000
	(0.002)	(0.002)	(0.003)	(0.003)
kaopen*crisis	-0.008**	-0.008**	-0.011	-0.009**
	(0.003)	(0.003)	(0.005)	(0.002)
fdi_ngdp	0.057	0.045	0.117**	0.104**
	(0.038)	(0.037)	(0.034)	(0.031)
inf	-0.042***	-0.041***	-0.065*	-0.047**
	(0.009)	(0.010)	(0.024)	(0.012)
fear of floating	0.005	-0.351	0.218	0.014
	(0.396)	(0.441)	(0.759)	(1.054)
fear of pegging	-0.535	-0.063	-1.518	-0.371
	(0.576)	(0.596)	(0.930)	(0.812)
_cons	-2.955*	-6.028***	-3.626*	-2.926
	(1.413)	(1.597)	(1.644)	(1.606)
r2	0.564	0.558		
rmse	2.409	2.413		
Number of instruments			48	48
Number of observations	311	311	311	311

Source: IMF staff estimates

* Significant at 10 percent level
** Significant at 5 percent level
*** Significant at 1 percent level

Table 2b. Drivers of Growth, 3 year averages, 1980-2012

Dependent variable: Real GDP per capita growth				
	FGLS		Sys GMM	
	(1)	(2)	(3)	(4)
Lag of real GDP per capita growth			-0.034	-0.081
			(0.082)	(0.081)
Initial real per-capita GDP	0.048	0.077		
	(0.136)	(0.135)		
privateinv_ngdp	0.185***	0.196***	0.232***	0.228***
	(0.041)	(0.041)	(0.042)	(0.044)
publicinv_ngdp	0.282***	0.221**	0.309**	0.257*
	(0.067)	(0.076)	(0.098)	(0.110)
govc_ngdp	-0.164**	-0.149*	-0.116	-0.102
	(0.062)	(0.058)	(0.119)	(0.123)
floatdf	1.173		0.393	
	(0.680)		(1.051)	
intdf	0.809		0.530	
	(0.450)		(0.383)	
floatdj		-0.154		-0.309
		(0.901)		(1.094)
intdj		0.805		0.945
		(0.508)		(0.492)
frisk	0.047	0.041	0.036	0.048
	(0.961)	(0.713)	(0.463)	(0.423)
crisis	-1.449	-0.675	-0.127	-0.003
	(0.961)	(0.713)	(0.463)	(0.423)
kaopen	0.000	-0.000	0.001	0.001
	(0.002)	(0.002)	(0.002)	(0.002)
kaopen*crisis	-0.008***	-0.009***	-0.010***	-0.010***
	(0.002)	(0.002)	(0.001)	(0.001)
fdi_ngdp	0.038	0.026	0.033	0.028
	(0.022)	(0.025)	(0.025)	(0.024)
inf	-0.052***	-0.049***	-0.055***	-0.056***
	(0.006)	(0.005)	(0.012)	(0.011)
fear of floating	0.678	0.781	-0.261	0.279
	(0.371)	(0.601)	(0.680)	(0.686)
fear of pegging	0.035	0.209	0.046	-0.022
	(0.516)	(0.482)	(0.555)	(0.416)
_cons	-1.640	-1.279	-2.462*	-2.477*
	(1.495)	(2.083)	(1.078)	(1.129)
r2	0.751	0.703		
rmse	1.547	1.622		
Number of instruments			55	55
N	114	114	114	114

Source: IMF staff estimates

* Significant at 10 percent level
** Significant at 5 percent level
*** Significant at 1 percent level

Table 2c. Drivers of Growth, 5 year averages, 1980-2012

Dependent variable: Real GDP per capita growth				
	FGLS		Sys GMM	
	(1)	(2)	(3)	(4)
Lag of real GDP per capita growth			-0.118	-0.090
			(0.237)	(0.233)
Initial real per-capita GDP	0.042	0.056		
	(0.129)	(0.132)		
privateinv_ngdp	0.212***	0.222***	0.172*	0.163*
	(0.055)	(0.056)	(0.064)	(0.069)
publicinv_ngdp	0.320***	0.284**	0.317**	0.292**
	(0.072)	(0.084)	(0.102)	(0.090)
govc_ngdp	-0.130	-0.129	-0.118	-0.101
	(0.072)	(0.073)	(0.132)	(0.106)
floatdf	1.205		0.049	
	(0.738)		(1.064)	
intdf	0.405		-0.177	
	(0.367)		(0.537)	
floatdj		-0.407		0.124
		(0.883)		(0.695)
intdj		0.240		0.448
		(0.441)		(0.679)
frisk	0.010	0.025	0.116	0.115*
	(0.962)	(1.077)	(0.499)	(0.527)
crisis	-1.955*	-1.021	-0.682	-0.828
	(0.962)	(1.077)	(0.499)	(0.527)
kaopen	0.001	0.000	-0.000	-0.000
	(0.002)	(0.002)	(0.002)	(0.002)
kaopen*crisis	-0.009**	-0.009**	-0.011***	-0.010***
	(0.003)	(0.003)	(0.002)	(0.002)
fdi_ngdp	-0.002	-0.002	0.003	0.010
	(0.028)	(0.033)	(0.037)	(0.040)
inf	-0.055***	-0.056***	0.021	0.029
	(0.011)	(0.011)	(0.059)	(0.053)
fear of floating	0.709	0.904	-0.283	-0.231
	(0.542)	(0.701)	(0.734)	(0.642)
fear of pegging	0.782	0.957	0.003	0.264
	(0.931)	(0.879)	(0.636)	(0.634)
_cons	-2.351	-2.610	-3.683*	-3.920*
	(1.599)	(1.575)	(1.489)	(1.345)
r2	0.828	0.797		
rmse	1.317	1.308		
Number of instruments			28	28
N	71	71	71	71

Source: IMF staff estimates

* Significant at 10 percent level
** Significant at 5 percent level
*** Significant at 1 percent level

Table 3 presents the results for our model iterations with both sample and specification changes, where we include the variables from both baseline and alternative models and add variables for education, and health and for the monetary anchor. As with the baseline results, we show both FGLS and GMM model results in separate columns but in summary form, with regard to the robustness of the results to specification changes and exchange rate regime. We confirm our earlier results that Asian growth is investment driven. The positive and significant effect of private and public investments is robust to model specification. Our results also show that FDI has a positive and significant effect on growth in Asia when alternative models are specified possibly reflecting a learning-by-doing influence. We do not find that the presence or absence of nominal monetary anchors alters the impact of exchange rate regimes on growth, although inflation has a statistically significant negative effect on growth. Again we do not find strong evidence that fears of floating or pegging have a significant impact on growth for Asian countries.

Table 3. Alternative Models: Summary of the Results 1/

	FGLS	Arellano-Bond System GMM
Private investment	pos/+++/yes/yes/yes	pos/++/yes/yes/yes
Public investment	pos/+++/yes/yes/yes	pos/++/yes/yes/yes
Volatility of the REER	neg/+++/no/no/yes	neg/+/no/no/yes
Financial risk	pos/+++/no/no/yes	pos/++/no/no/yes
Capital account openness	neg/+++/yes/yes/yes	neg/++/yes/yes/yes
Inflation	neg/+++/no/no/no	neg/+/no/no/no
Capital account openness * crisis	neg/++/no/yes/yes	neg/+++/no/yes/yes
De facto floating regime	pos/++/no/no	pos/++/no/no
De facto intermediate regime	pos/++/no/no	pos/++/no/no
FDI	pos/++/yes/no/yes	pos/+/yes/no/yes
Trade openness	neg/++/yes/no/no	neg/++/yes/no/no
Crisis	neg/++/no/no/no	neg/++/no/no/yes
Inflation targeting regime	neg/+/no/no/yes	neg/++/no/no/no
Education	pos/+/no/no/no	pos/+/no/no/no
Fear of floating	pos/++/no/no/yes	not significant
Lag of Real GDP per capita growth		pos/+/no/no/no
Fear of pegging	not significant	not significant
Health	not significant	not significant
Monetary anchor 2/	not significant	not significant
Government consumption	not significant	not significant
De jure floating regime	not significant	not significant
De jure intermediate regime	not significant	not significant
Initial real per-capita GDP	no convergence	

1/ The indicator per variable signifies the (i) sign of the coefficient (ii) its significance with the number of plus signs showing significance at 1(+++), 5(++) and 10(+) percent; (iii) robustness to specification changes; (iv) robustness to data sampling and (v) robustness to exchange rate regime classifications.
2/ Interaction variable with exchange rate regime dummies and inflation, see Table A1, Appendix A.

V. Conclusions and Policy Implications

In this paper, we attempt to add several innovations to the understanding of what determines growth in Asia and the role of exchange rate regimes. Our study considers a broad spectrum of economic and financial variables, including ones measuring the occurrence of crises and capital account openness, to reveal what factors determine growth in Asia. We look at the determinants of growth under different policy regimes and macroeconomic stability requirements. Our analysis also extends over a longer time frame than most other studies, classifying both the de jure and de facto exchange rate regimes for the period 1980-2012, which included both the Asian crisis in the late 1990s and the recent global financial crisis.

Our study reveals a number of interesting features of growth in Asian countries in recent decades. The most robust result is that private and public investments are significant determinants of growth. Lower financial risk and higher FDI also appears to support growth. Public consumption may exert some drag on growth. Some evidence suggests that growth in Asian economies benefits from more flexible exchange rate regimes. On the other hand, we did not find that either the fear of floating or real exchange rate volatility limits growth, while a more open capital account in the face of financial turbulence may reduce growth but only marginally.

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Appendix A.

Table A1. Asian Countries in the Full Sample

		Income Level
1	Bangladesh	Low-income
2	Bhutan	Lower-middle-income
3	Brunei Darussalam	High-income
4	Cambodia	Low-income
5	China	Lower-middle-income
6	Fiji	Upper-middle-income
7	Hong Kong SAR, China	High-income
8	India	Lower-middle-income
9	Indonesia	Lower-middle-income
10	Japan	High-income
11	Korea	High-income
12	Lao P.D.R.	Low-income
13	Malaysia	Upper-middle-income
14	Maldives	Lower-middle-income
15	Mongolia	Lower-middle-income
16	Myanmar	Low-income
17	Nepal	Low-income
18	Pakistan	Lower-middle-income
19	Papua New Guinea	Lower-middle-income
20	Philippines	Lower-middle-income
21	Singapore	High-income
22	Sri Lanka	Lower-middle-income
23	Taiwan Province of China	High-income
24	Thailand	Lower-middle-income
25	Vietnam	Low-income

Source: World Bank

1/ Economies are divided among income groups according to 2013 gross national income (GNI) per capita, calculated using the World Bank Atlas method. The groups are: low income, $1,045 or less; lower middle income, $1,046–4,125; upper middle income, $4,126–12,745; and high income, $12,746 or more.

The sample in this study includes six high income, two upper-middle-income, eleven lower-middle-income, and six low income economies. Singapore, Hong-Kong SAR and Taiwan Province of China have had an extensive history of exchange rate regimes. Indonesia, Korea, the Philippines, and Thailand have, at different times, adopted inflation targeting regimes.

Table A2. Definition of Variables and Sources

Variable	Description	Sources
Dependent variable		
rgdppcg	Real GDP growth per capita (percent)	IMF, WEO
Independent variables		
govc_ngdp	Government consumption (percent of GDP)	IMF, WEO
privateinv_ngdp	Private investment (percent of GDP)	IMF, WEO
publicinv_ngdp	Public investment (percent of GDP)	IMF, WEO
fdi_ngdp	FDI (percent of GDP)	IMF, WEO
frisk	Financial risk (index)	International Country Risk Guide (ICRG).
Volatility of REER	Standard deviation of REER change	IMF, INS
openness	Sum of imports and exports (percent of GDP)	IMF, WEO
healthexp	Health expenditure (percent of GDP)	World Bank, WDI
pri_enroll	Primary school enrollment rate (percent of the population of relevant age)	World Bank, WDI
inf	Inflation (percent)	IMF, WEO
floatdj	Floating exchange rate regime dummy, de jure regime classification	IMF AREAER publication, various years.
intdj	Intermediate exchange rate regime dummy, de jure regime classification	IMF AREAER publication, various years.
floatdf	Floating exchange regime dummy, de facto regime classification	IMF AREAER, Bubula and Ötker-Robe (2002), and Chinese University of Hong-Kong, http://intl.econ.cuhk.edu.hk/index.php
intdf	Intermediate exchange rate regime dummy, de facto regime classification	IMF AREAER, Bubula and Ötker-Robe (2002), and Chinese University of Hong-Kong, http://intl.econ.cuhk.edu.hk/index.php
float_10b	Floating exchange regime dummy with below 10% inflation, de facto regime classification	Staff estimates based on earlier classification
int_10b	Intermediate exchange regime dummy with below 10% inflation, de facto regime classification	Staff estimates based on earlier classification
float_10a	Floating exchange regime dummy with above 10% inflation, de facto regime classification	Staff estimates based on earlier classification
int_10a	Intermediate exchange regime dummy with above 10% inflation, de facto regime classification	Staff estimates based on earlier classification
fear of floating	The country announces a de jure floating exchange regime but de facto deviates from it	Staff estimates based on earlier classification
fear of pegging	The country announces a de jure pegged exchange regime but de facto deviates from it	Staff estimates based on earlier classification
IT	Inflation targeting: denoting countries with inflation targeting regimes.	IMF, INS
kaopen	Variable measuring capital account openness.	Relative openness to OECD countries, based on the database provided by Lane and Milesi-Ferretti (2007)

Table A3. Descriptive Statistics, 1980-2012

Variable	Mean	Standard Deviation	Min	Max
Real GDP per capita growth (percent change)	4.2	3.6	-11.5	16.2
Private investment (percent of GDP)	19.0	6.4	3.0	41.0
Public investment (percent of GDP)	7.3	5.6	2.0	32.8
Government consumption (percent of GDP)	10.3	2.9	3.5	17.6
Standard deviation of REER growth (units)	6.4	5.1	0.6	41.0
Financial risk (index)	37.5	7.4	14.0	48.5
FDI (percent of GDP)	4.0	6.6	-2.8	53.1
Capital account openness (index)	88.9	172.5	5.5	1024.6

Source: IMF staff estimates

Table A4. Selected Variable Means by Type of Exchange Rate Regime, 1980-2012
(de Jure classification)

Regime classification	Floating (109)	Intermediate (153)	Pegged (74)
Real GDP per capita growth (percent change)	3.7	4.8	3.5
Private investment (percent of GDP)	20.3	18.2	19.0
Public investment (percent of GDP)	5.1	8.9	7.1
Government consumption (percent of GDP)	11.1	10.5	8.9
Standard deviation of REER growth (units)	8.2	5.4	6.1
Financial risk (index)	37.0	38.1	37.0
FDI (percent of GDP)	2.0	4.9	5.2
Capital account openness (index)	22.6	67.3	229.7

Source: IMF World Economic Outlook and staff estimates.

Table A5. Selected Variable Means by Type of Exchange Rate Regime, 1980-2012
(de Facto classification)

Regime classification	Floating (48)	Intermediate (181)	Pegged (107)
Real GDP per capita growth (percent change)	3.0	4.4	4.3
Private investment (percent of GDP)	17.2	20.6	17.4
Public investment (percent of GDP)	4.7	6.9	9.1
Government consumption (percent of GDP)	10.7	10.6	9.7
Standard deviation of REER growth (units)	6.5	6.7	5.9
Financial Risk (index)	34.9	38.3	37.4
FDI (percent of GDP)	3.0	4.1	4.4
Capital account openness (index)	22.7	62.5	162.9

Source: IMF World Economic Outlook and staff estimates.

Table A6. Variable Correlations

	rdpppc	inincome0	privateinv_ngdp	publicinv_ngdp	floatdf	intdf	govc_ngdp	frisk	reer_sd	crisis	kaopen
rdpppc	1										
inincome0	-0.0535	1									
privateinv_ngdp	0.2196	0.5	1								
publicinv_ngdp	0.331	-0.5371	-0.2965	1							
floatdf	-0.1367	0.0222	-0.1209	-0.193	1						
intdf	0.0723	0.2133	0.2546	-0.0659	-0.4412	1					
govc_ngdp	0.1169	-0.1275	0.0025	0.4337	0.0392	0.1106	1				
frisk	0.3133	-0.0273	0.4178	0.1868	-0.1436	0.1097	0.1781	1			
reer_sd	-0.165	-0.1157	0.1168	-0.1602	-0.0047	-0.0873	0.2149	-0.1324	1		
crisis	-0.1923	0.0398	0.0829	-0.0169	0.295	-0.0218	0.0807	0.1501	-0.0609	1	
kaopen	-0.0357	-0.0073	0.1777	-0.1732	-0.1563	-0.1666	-0.2153	0.2352	0.1676	-0.0769	1

Sources: IMF World Economic Outlook and staff estimates.

Appendix B. De Jure and De Facto Classification

Characterizing accurately the exchange rate regime is critical in assessing the relationship between exchange rate regimes and economic growth. In our empirical study we adopt two classification schemes:[10] The IMF de jure regime classification, based on the regime that governments claim to have in place, and a de facto classification, with both published by the IMF in its *Annual Report on Exchange Rate Agreements and Exchange Restrictions* (various issues).[11] Thus, we complement the IMF de jure classification scheme with the de facto scheme for comparison. Regarding the IMF de facto classification, from 1999, the IMF has moved from using a purely de jure classification to a hybrid one, which combines information obtained through bilateral discussions with or provision of technical assistance to the country authorities and also from the IMF's own assessment of the countries' de facto policies and the observed behavior of the exchange rate within the existing exchange rate regime framework. This new methodology was applied by the IMF to the years after 1999 up to the present and also retrospectively. The data are available through the annual issues of the *AREAER*. We have filled in any missing data for the Asian countries using the database available through the Chinese University of Hong-Kong (CUHK).

Table B1 shows the regime distributions of both de jure and de facto observations According to the official IMF de jure classification, floating regimes constitute about one-fourth of all observations, while pegged regimes slightly dominate intermediate regimes in the sample. Under the de facto categorization, there are only half as many floating regimes, which may be indicative of a "fear of floating" in Asian countries. Pegged regimes slightly prevail in the de facto sample.

Table B1. Distribution of Regimes

Regime	IMF (de Jure)	Percent (in total)	IMF (de Facto)	Percent (in total)
Floating	203	24.6	102	12.4
Intermediate	293	35.5	347	42.1
Pegged	329	39.9	376	45.6
Total	825	100	825	100

Source: IMF AREAER and staff estimates.

[10] We examine other statistically-based regime classification approaches proposed in the literature (for example, Levy-Yeyati and Sturzenegger (2001, 2003) and Reinhart and Rogoff (2004), but focus on the IMF and Bubula and Ötker-Robe (2002) classifications. We do not use the Reinhart and Rogoff regime classification scheme, whose distinguishing feature is its use of black market premium data, which are not consistently available for our set of countries.

[11] All classifications are at end of year. The AREAER's cutoff date for the assessment of the de facto exchange rate arrangement is April 30.

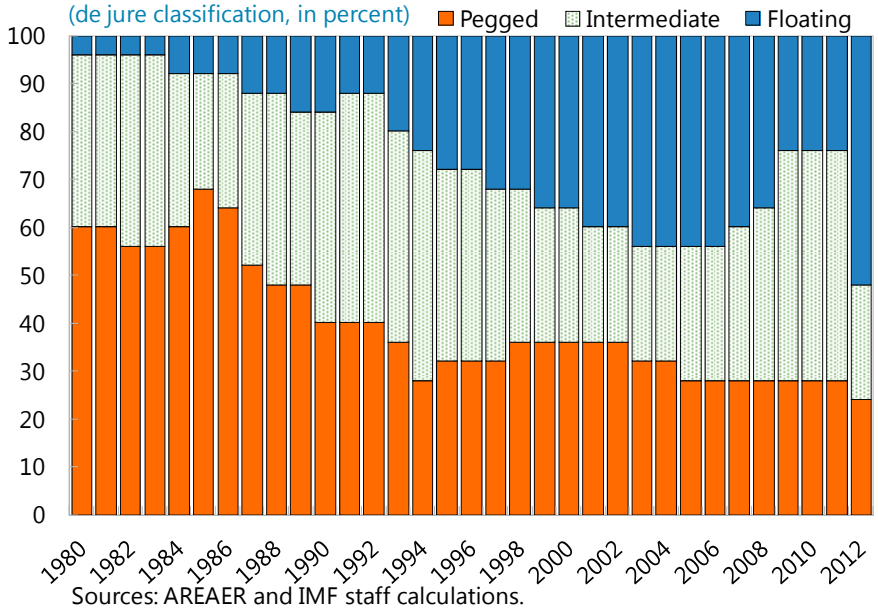
Among the countries in our sample presented in Table B2, we identified economies that never had floating regimes: Bangladesh, Brunei Darussalam, China, Fiji, Hong Kong SAR, Lao P.D.R, Maldives, Myanmar, Nepal, Singapore, and Vietnam. Economies that never had pegged regimes are Japan, Korea, and Taiwan, Province of China, and there are only two economies that at no time had an intermediate regime: Nepal and Pakistan. Sri Lanka, Singapore, Korea, Indonesia, and Cambodia had intermediate regimes most of the time.

Table B2. Distribution of de Facto Regimes by Country

	Floating	Intermediate	Pegged	Floats in Percent of Total
Bangladesh	0	17	16	0
Bhutan	0	0	33	0
Brunei Darussalam	0	8	25	0
Cambodia	1	22	10	3
China	0	13	20	0
Fiji	0	1	32	0
Hong Kong SAR, China	0	5	28	0
India	5	15	13	15
Indonesia	3	21	9	9
Japan	14	19	0	42
Korea	5	28	0	15
Lao P.D.R.	0	16	17	0
Malaysia	1	14	18	3
Maldives	0	8	25	0
Mongolia	4	14	15	12
Myanmar	0	18	15	0
Nepal	0	0	33	0
Pakistan	24	0	9	73
Papua New Guinea	4	15	14	12
Philippines	10	20	3	30
Singapore	0	26	7	0
Sri Lanka	2	30	1	6
Taiwan Province of China	24	9	0	73
Thailand	5	11	17	15
Vietnam	0	17	16	0
Total	102	347	376	12

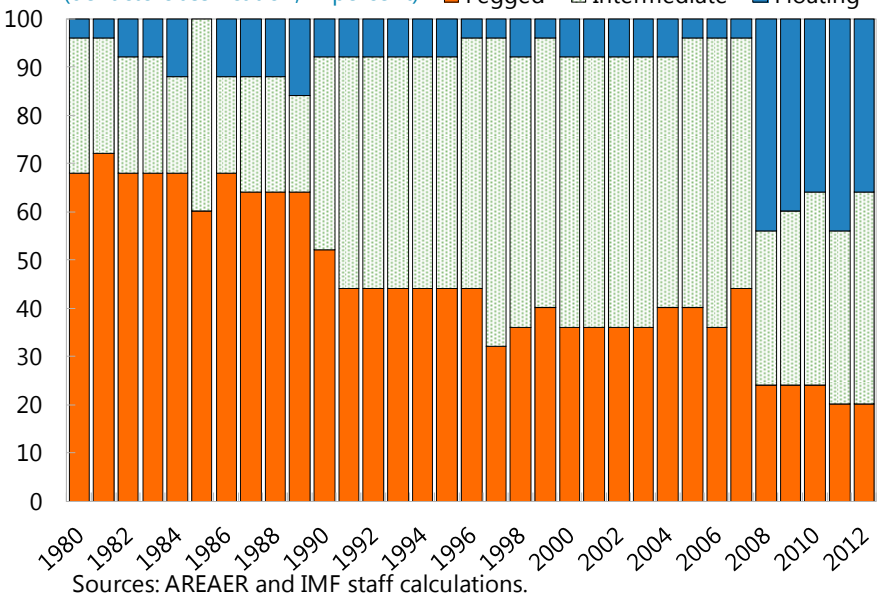
Source: IMF country information.

Figure B1. Frequency Distribution of Exchange Rate Regimes, 1980-2012
(de jure classification, in percent)



Sources: AREAER and IMF staff calculations.

Figure B2. Frequency Distribution of Exchange Rate Regimes, 1980-2012
(de facto classification, in percent)



Sources: AREAER and IMF staff calculations.