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THE RENMINBI AND POOR-COUNTRY GROWTH

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PREFACE

The recent debate on global rebalancing has focused mainly on the Sino-American currency dispute, while ignoring the implications of potential policy actions for the developing countries. The present paper attempts to fill this specific gap in the debate. In policy and academic circles, it has been widely argued that China's currency peg to the US dollar has not been beneficial for the developing countries. The main argument for that assertion has been that an undervalued renminbi has shifted jobs from poor countries to China.

The present paper takes a resolute development perspective

- by empirically investigating the degree of renminbi undervaluation in the context of China's relative per capita income and convergence process,

- by summarising the literature on the interaction of exchange rates and growth through incentives for shifting resources towards highly productive export industries, and

- by producing new empirical evidence of the change in growth association between China and developing countries, considering both low- and middle-income countries, as well as non-oil exporters.

Based on these findings, the authors warn against renminbi appreciation that would hamper China's growth, and as a result would undermine global poverty reduction through growth spillover effects on and reduced export competition with the developing countries.

The present paper has served as a background paper for the OECD *Perspectives on Global Development 2010*. It is a timely contribution to the current policy debate, as it illustrates the implications of the renminbi's appreciation for development, beyond the issue of global rebalancing.

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September 2010

RÉSUMÉ

Les discussions sur la meilleure façon de sortir des déséquilibres mondiaux afin de créer une économie mondiale plus équilibrée ont ignoré l'impact sur les pays pauvres des propositions visant à corriger ces déséquilibres. Le présent document vise à combler ce manque. Il évalue d'abord le degré de sous-évaluation du renminbi (RMB) ; il décrit ensuite les évolutions simultanées du degré de sous-évaluation du RMB et du taux de croissance du PIB chinois ; puis, il passe en revue le rôle du taux de change effectif réel - à la fois son niveau et sa stabilité au cours du temps – dans la croissance des pays en développement, surtout dans les grandes économies duales comme la Chine et l'Inde ; enfin, le document présente de nouvelles analyses sur les liens, au cours des deux dernières décennies, entre la croissance chinoise et celle des pays pauvres et passe en revue la littérature traitant des effets potentiels de l'appréciation du RMB sur la croissance. L'analyse permet d'identifier parmi les pays en développement, les bénéficiaires et perdants potentiels, en fonction de différents scénarios d'ajustement du renminbi dans les prochaines années.

Classification JEL: F15; F31; O11 ; O47

Mots clés: croissance économique; théorie de la parité de pouvoir d'achat; taux de change effectifs réels

ABSTRACT

Discussions on how best to exit from global imbalances to create a more balanced world economy have ignored the impact on poor countries of proposals to redress these imbalances. This paper aims at filling that gap. It gauges the degree of renminbi (RMB) undervaluation; presents evidence on RMB undervaluation and China's GDP growth rate; surveys the role of the real effective exchange rate – both its level and its stability over time – for underpinning growth in developing countries, especially in large dual economies such as China and India; finally, the paper presents new evidence on growth linkages between China and poor countries for the last two decades and surveys literature on potential displacement effects of RMB appreciation. The analysis allows broad conclusions to be drawn about the potential developing-country beneficiaries and losers from various renminbi adjustment scenarios in the forthcoming years.

JEL Classification: F15; F31; O11 ; O47

Keywords: economic growth; purchasing power parity; real effective exchange rates

I. INTRODUCTION

Discussions on how best to exit from global imbalances and to create a more balanced world economy have ignored the impact on poor countries of proposals to redress these imbalances[1]. Highly publicised global imbalances in the current accounts of the balance of payments – embodied in sizable Chinese foreign exchange reserve accumulation and deepening US current account deficits over the past decade – have drawn much attention to the question of renminbi misalignment from policy makers, economists and journalists. On 19 June 2010, China announced it would allow a more flexible renminbi, signalling an end to the currency's two-year-old peg to the dollar a week before the Group of 20 summit held in Toronto. The People's Bank of China also made clear that there was no room for large-scale appreciation[2].

This paper introduces a development perspective into the debate on global rebalancing, especially as far as the valuation level of the renminbi is concerned. The aim is to provide evidence-based analysis on why and how the renminbi matters for poor countries. It is hoped that the paper will help inform the policy debate on global rebalancing and the renminbi in the Group of 20 and beyond by adding empirical evidence to some crucial elements of that debate. These are:

- The degree of currency undervaluation and its relationship with per capita income (convergence), as informed by the Harrod-Balassa-Samuelson (HBS) framework;

- The role of the real effective exchange rate, both its level and its stability over time, for underpinning growth in developing countries, especially in large dual economies such as China and India.

- New empirical evidence on growth linkages between China and poor countries for the last two decades and on potential displacement effects of RMB appreciation.

These elements should help to form a judgement about the potential developing-country beneficiaries and losers from various renminbi adjustment scenarios in forthcoming years. The paper thus hopes to fill an increasingly disturbing gap in the current global rebalancing debate, namely the implications of changes in China's role as the new engine of developing-country growth and how this role will be affected by changes in the valuation of the renminbi.

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1. There have been op-ed pieces, but they fail to present empirical evidence.

2. http://www.pbc.gov.cn/english/detail.asp?col=6400&id=1488

II. BY HOW MUCH HAS THE RENMINBI BEEN UNDERVALUED?

Much debate has been generated about the responsibility of China to "play fair" with its trade partners, and to dismantle what some have called a "protectionist" fixed exchange rate policy. From the development perspective, most of the debate has wrongly blamed the valuation of the renminbi on China's growing external surplus, crucially ignoring the exchange-rate implications of the fact that China is still a poor country, with a low per capita income relative to advanced countries. This section examines competing values for China's exchange rate misalignment using the Harrod-Balassa-Samuelson (HBS) effect, which explicitly considers the relationship between economic development and the relative price of non-tradables to tradables to define an equilibrium real exchange rate (i.e. the nominal exchange rate adjusted for price differences between countries). Using a simple empirical model based on the HBS theory, we assess the degree of misalignment of the renminbi and other emerging countries' currencies from their income-adjusted purchasing power parity values.

Many studies purport to measure the degree of renminbi undervaluation using various theoretical constructs: Purchasing Power Parity (PPP), Fundamental Equilibrium Exchange Rates (FEER), Behavioral Equilibrium Exchange Rates (BEER), Permanent Equilibrium Exchange Rate (PEER), and the Current Account of the Balance of Payments[3]. Each of these approaches uses different methods to construct an equilibrium exchange rate for the renminbi and derive a degree of misalignment compared to this equilibrium rate. While most of these studies agree that the renminbi is undervalued, the measured level of undervaluation varies according to the methodology used and the data sources employed; estimates on the degree of undervaluation in the 2000s vary from nearly nil to 40% (see, for example, Chen, 2007; Cheung *et al.*, 2010; Cline and Williamson, 2008 and 2010; Goldstein and Lardy, 2008).

The Harrod-Balassa-Samuelson (HBS) effect, described first by Balassa (1964) and independently posited by Samuelson (1964) and Harrod (1933), can be used to explain the real exchange rate by a country's relative productivity level. To be sure, poor-country currencies are normally undervalued compared to their purchasing power parity values. Convergence towards rich country productivity levels through income per capita growth will imply considerable correction of that undervaluation. Services (and wages) are cheap in poor countries and

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expensive in rich countries, while prices for internationally traded goods are roughly equalised in a common currency. When the productivity in traded goods rises (while productivity growth for haircuts and other services are very limited), more income is generated and spent on services. The price ratio of non-traded to traded goods will rise. In other words, the real exchange rate will appreciate. The real exchange rate should therefore tend towards purchasing power parity in the long run.

Hence, part of the undervaluation ascribed to China's currency results from market forces that make non-traded goods relatively cheap in poor countries, rather than from deliberate currency manipulation by China's authorities. While growing and converging fast, China is still poor. Its per capita income in 2008 was USD 3 266 or 7.0% the level of the US at market rates and USD 5 970 or 12.9% of US levels at purchasing power parity (PPP)-adjusted rates, according to the latest World Development Indicator data.

How purchasing power parity exchange rates are constructed can have far reaching consequences for measures of currency misalignment derived from the HBS framework. For more than 40 years the International Comparison Program (henceforth ICP) has organised international efforts at comparing price levels and constructing purchasing power parity exchange rates. Each ICP round estimates PPP exchange rates in a given year for a certain number of benchmark countries and then extrapolates these results across the cross-sectional dimension to non-benchmark countries, and then backwards and forwards across time for each country using national inflation figures.

Each successive round of the ICP has increased the number of countries used as benchmarks and has attempted to improve the basis on which comparable price data is collected. The most recent round, ICP 2005, was the most comprehensive survey to date, and broadened the group of benchmark surveys to an unprecedented number of developing countries, for whom price data was previously extrapolated, notably including China and India. The updated methodology used in ICP 2005 resulted in revised PPP exchange rates that for many developing countries are quite different from the PPP rates derived from the previous ICP survey results. These new estimates for PPPs have attracted controversy because they led to large downward revisions in the living standards of a number of developing countries, including China and India. For China, the change in PPPs implied an upward revision in average price levels on the order of 40%, which accordingly reduced estimates of the value of China's GDP at PPP rates by 40%[4].

While the World Bank's World Development Indicators (henceforth WDI) have updated their historical PPP series with the revised ICP 2005 results, the Penn World Tables, currently in version 6.3 (henceforth PWT 6.3), have not yet revised their PPP series with the new results. Maddison and Wu (2008) argue that the new PPPs available from the WDI do not adequately represent price levels for rural areas in developing countries like China and India. The 40% price level increase implied by the revised PPPs may therefore be due to an urban bias in the ICP 2005 price surveys. Given the new PPP exchange rate values for 2005, projecting Chinese growth backwards using an average growth rate (of 5.5%) for the period 1952–2004 would yield a per capita GDP estimate for 1952 that would be below the minimum level of per capita GDP required

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4.   For more on what has become a lively debate, with broad implications for global poverty and distributional issues see Deaton and Heston (2010), Deaton (2010), Ravallion (2010), Chen and Ravallion (2008).

to sustain a population. Deaton and Heston (2010) also underline many of these issues with the revised PPPs, and try to correct for the overestimation of Chinese prices with a PPP rate that is between the value found in WDI and PWT 6.3.

In response to Reisen (2009)[5], Subramanian (2010) uses the above argument to posit that measures of currency undervaluation derived using the new PPPs are inaccurate because they overstate the Chinese price levels, and thus understate the degree of undervaluation in the renminbi (i.e. the size of the residual between the observed values for China and the HBS regression line). He uses Deaton and Heston's corrected PPPs to assert that undervaluation is actually closer to 30%.

However, using the old PPPs to analyse currency misalignment today may in fact be problematic due to economic growth itself: Growing economies are increasing their productivity faster than stagnant economies, so price levels are changing faster, too. It is unclear whether the PPPs drawn from PWT 6.3, which are based on price surveys from 15 years ago that have been updated using national inflation figures, are less bias prone than the admittedly imperfect price surveys from the latest ICP round. The PPPs in high growth economies like China and India may have changed because the structural compositions of consumption and production in the country have changed. Indeed, between 1993 and 2005 the structure of China's economy changed markedly. Not only have the structure and distribution of Chinese manufacturing changed over this time period, also the interaction between the rural and urban areas has changed as well. Rural-urban migration produced a large amount of rural inhabitants working in the urban areas and sending back remittances to rural China. So it is not inconceivable that the cost of living in rural China has increased markedly over this time period. This argument lends credence to the belief that, all things being equal, the revised PPPs give us a better understanding of not only the current price level in China, but also it's structure.

In much the same spirit, Ravallion (2010) shows that much of the change in the Chinese PPP values observed in the ICP 2005 surveys can be attributed to economic growth in the country itself rather than methodological issues with the ICP surveys. While he concedes that the ICP price surveys for China, which focused on 11 Chinese cities, did overestimate rural income to a certain degree, he argues that the magnitude of that overestimation is not enough to account fully for the 40% price level increase. Ravallion regresses the change in ratio of PPP to market exchange rates between the ICP 1993 and the ICP 2005 rounds on the change in income per capita for a large sample of countries. He finds that some two-thirds of the observed increase in China's PPP can be accounted for by economic growth. Even when addressing Maddison and Wu's concerns that Chinese growth is systematically overestimated by the Chinese authorities, the results still hold and even at reduced growth rates, most of the increase in Chinese PPPs is due to economic growth itself. Additionally, Ravallion (2010) also provides valuable insights into techniques to calculate more reliable estimates of updated PPP data for non-benchmark years instead of relying on the traditional inflation adjustment method.

The need to endlessly debate whose corrected PPP estimates are the most appropriate will hopefully become less important when the next Penn World Tables data is released, which

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5. Reisen (2009), using the new PPPs provided by the World Bank's WDI, had estimated a 12% undervaluation of the renminbi below the HBS regression line for end 2008.

will integrate the new ICP price survey findings into Penn's impressive growth accounting framework. Penn World Tables 7.0 is expected to incorporate the ICP 2005 results, although it remains unclear how much their PPP figures will differ from the World Bank's WDI. Despite the fact that both Penn World Tables and the World Bank both rely on the ICP surveys, they aggregate the price data across time and across sectors differently, and hence the national PPP exchange rates are expected to differ between WDI and PWT 7.0 as well[6]. The release of Penn World Tables 7.0 is eagerly awaited as it will provide valuable new evidence to help assess the degree to which the PPP changes are due to problems with the ICP 2005 price surveys themselves, or with economic growth and development in high-growth developing countries.

In order to assess the degree to which the recent revision of purchasing power parity exchange rates affects measures of HBS-implied currency misalignment, proxies for the real exchange rates were constructed from both the old and new PPPs to estimate a simple empirical model based on the HBS effect. In its simplest terms, the HBS effect explains the real exchange rate by a country's productivity level. Numerous models based on the HBS theory have been analysed over the last half century[7]. To analyse the HBS-implied currency misalignment for a given year, the following simple empirical model was estimated:

$$\log\left(PPP_i \middle/ e_i^m\right) = \alpha + \beta.\log\left(GDPpercap_i\right) + \varepsilon_i \text{ for country } i = 1,\ldots,n \qquad (1)$$

OLS is used to estimate a cross-country log-regression of the values of a price level index, PPP_i / e_i^m, where PPP_i is the implied purchasing power parity exchange rate and e_i^m is the nominal market exchange rate versus the US dollar, on the GDP per capita (in 2000 constant US dollars) for each country. In this way, PPP_i / e_i^m serves as a PPP-based estimate of the real exchange rate for each country i of our sample, while log GDP per capita provides a proxy of the country's productivity level, reflecting the state of economic development. Given the wide variance of the price level index values for advanced economies, GDP per capita (in constant 2000 US dollars) is used as the dependent variable and not the ratio of GDP per capita compared to the US level[8]. There is no explicit reason to assume that countries are converging to the productivity level of the United States specifically, despite the fact that the US currency is used as the numeraire in the price level index.

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6. The release of PWT 7.0 was initially expected in the second half of 2009, but according to an email received by the authors from the UPenn Center for International Comparisons, it has been delayed until sometime in 2010. It is likely that the delay is related to the need to ensure the compatibility of Penn's national accounts statistical methods with the revised practices employed in the ICP 2005 survey.

7. Most models use least squares regression to estimate the effect of a country's productivity level on it's internationally comparable price level for a specific year (or between averages of the variables over several years to smooth out short-term fluctuations). Starting with Kravis and Lipsey (1983), many studies chose variables relative to a country of reference, typically the United States. Recently, Kharas (2010) used the ratio of GDP per capita (in PPP terms, constant 2005 US dollars), relative to the US level. Notably however, the choice of a reference country exhibits a strong influence on the results.

8. This has no implication on the static degree of misalignment, since this is just normalization to 1 for the US level of GDP per capita. Nevertheless, the further analysis of the individual appreciation paths across time can be less easily analysed if depending too much on the variations of the US levels, even if the country has no strong cyclical links with the United States.

Data for GDP per capita and the nominal market exchange rate were obtained from the World Development Indicators (World Bank, 2009) for the time period 1990-2007. For PPP exchange rates, two sets of regressions were performed using both the PPPs available from the World Development Indicators based on the International Comparison Project 2005 round, as well as the PPPs available from the Penn World Tables 6.3 based on the previous ICP round.

The sample consists of all countries for which data was available, excluding countries whose populations were less than one million and some countries for which the currency and PPP data are at odds to such a degree they could be considered outliers[9]. This leaves a total sample of around 125 countries. The degree of HBS-implied misalignment of the exchange rate from its income-adjusted Purchasing Power Parity is derived using the following ratio:

$$\left(\text{degree of misalign}\right)_i = \frac{\left(\text{real exchange rate value on the regression line}\right)_i - {PPP_i}/{e_i^m}}{\left(\text{real exchange rate value on the regression line}\right)_i}$$

Below we compare the difference in currency misalignment estimates found with the HBS model using the World Bank's PPPs based on ICP 2005 versus those found using the Penn World Tables 6.3 PPPs based on the previous survey. The results are based on a series of cross-sectional regressions performed for the years 1990-2007 using both sets of PPPs. Depending on the country, the choice of the version of PPPs has a strong impact on the measure of misalignment[10]. In the case of China, the use of the newer PPPs leads to estimates of undervaluation which correspond to the smallest estimates mentioned in the literature (between 0%-15% undervaluation) whereas the use of the older PPPs leads to estimates of undervaluation which correspond roughly to the largest estimates mentioned (between 25-35%).

For each year (between 1990 and 2007), the log-regression led to coefficients significant at the 1% level, regardless whether ICP 2005 or PWT 6.3 was used. The R-squared also appear high for each year. For instance for 2007, we found the following results (Table 1):

Table 1. **Cross-country log-regression between the real exchange rate and the GDP per capita, in 2007**

	log (PPP/e)	
	PWT 6.3	WDI 2009
log GDP per capita (constant 2000 USD)	0.289***	0.200***
	(0.018)	(0.012)
Constant	-2.966***	-2.075***
	(0.143)	(0.091)
Observations	129	126
R-squared	0.666	0.708

Notes: Standard errors in parentheses. *** significant at 1%

Source: Authors' calculations based on data described in the text.

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9.   These included Zimbabwe, Sudan, Uzbekistan, Yemen, Syria, Iran, Nigeria, Slovakia and Ecuador.

10.   Among the BIICS, the influence is strong for China and India, and to a certain extent Indonesia, whereas there is only little influence on the results for Brazil and South Africa.

Figure 1. **Exchange rate misalignment implied by the Harrod-Balassa-Samuelson model, 2007**

Using PPP/e data from the World Bank (based on ICP 2005)
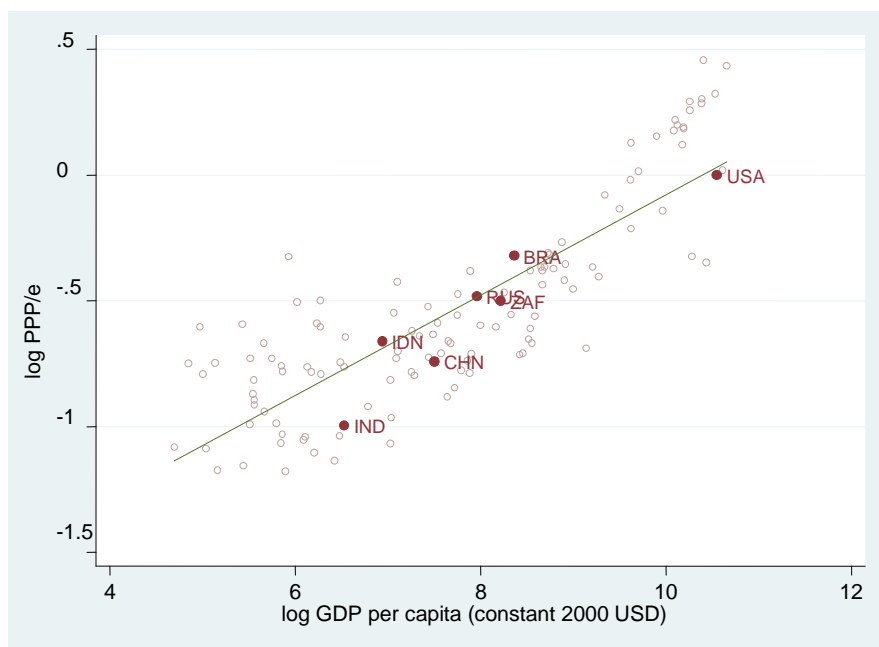
Using PPP/e data from Penn World Tables (PWT 6.3)
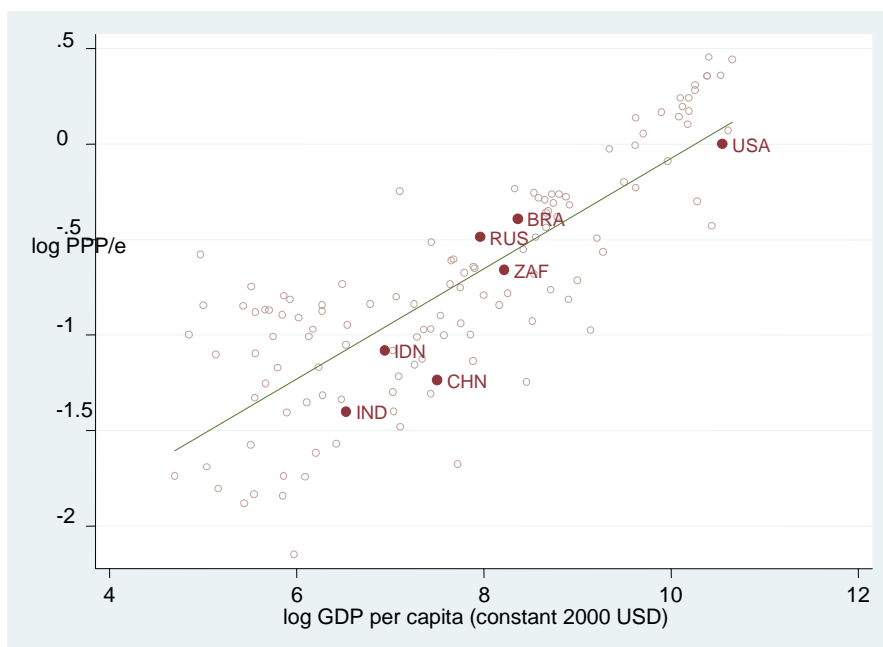
Source: Authors' calculations based on World Bank (2009); Aten *et al.* (2009).

Regarding the degree of HBS-implied misalignment of the emerging countries' currencies, the main results for the year 2007 are the following:

- Using the new PPPs provided by World Bank (i.e. based on ICP 2005), we find that, in 2007, the degree of HBS-implied undervaluation is estimated to be around 15% for the renminbi, 20% for the Indian rupee, 6% for the South African rand. The Brazilian real appeared overvalued by around 8% and the Indonesian rupee by around 3%, following a decade of undervaluation (see below)[11].

- Using the older PPPs drawn from PWT 6.3, we find that the degree of undervaluation is significantly more important for China, India and Indonesia. The renminbi appears then significantly undervalued over the whole period, with a degree of undervaluation of around 35% in 2007. The corresponding estimates of undervaluation of 27% for the Indian rupee, 11% for the Indonesian rupee, 7% for the South African rand, and to an HBS-implied overvaluation of 17% for the Brazilian real.

In either case, from the results and discussion above it is clear that the Chinese currency was undervalued up to around 15% in 2008 even when taking into account the level of Chinese development. In section III, which follows, we look at adjustment scenarios, and what effects a possible renminbi appreciation may have on continued Chinese growth. In section IV we look at how this growth may in turn impact on other poor countries.

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11. The ICP 2005 revisions to PPP tended to be larger in a magnitude the poorer a given country, either due to methodological difficulties measuring prices in poor countries or because the overall price structure has changed most in poor countries over the last 15 years.

III. RENMINBI APPRECIATION AND CHINA'S GROWTH

It is hard to forecast the effects of real renminbi appreciation on China's future growth rate. Much will be depend on the scale and speed of currency appreciation; much will depend on the counterfactual growth effects of policy status quo of pegging the renminbi to the US dollar; and much will depend on whether the real appreciation occurs through nominal appreciation or through positive inflation differentials with trade partners. But development economists must be concerned nevertheless about a potential slowdown triggered by currency appreciation, not least because China has contributed to global growth in general and to poor-country growth in particular in the 2000s (as will be shown in section IV).

Stellar growth performance in China and India has gone along with a stable path of real exchange rates. As John Williamson (2000) suggests, large fluctuations of real effective exchange rates can undermine incentives to invest in non-traditional sectors[12]. A recent McKinsey survey (2009) confirmed that executives from different countries expect investment decisions to be significantly affected by heightened exchange rate volatility.

Figure 2. **Individual adjustment paths between 1990 and 2008**
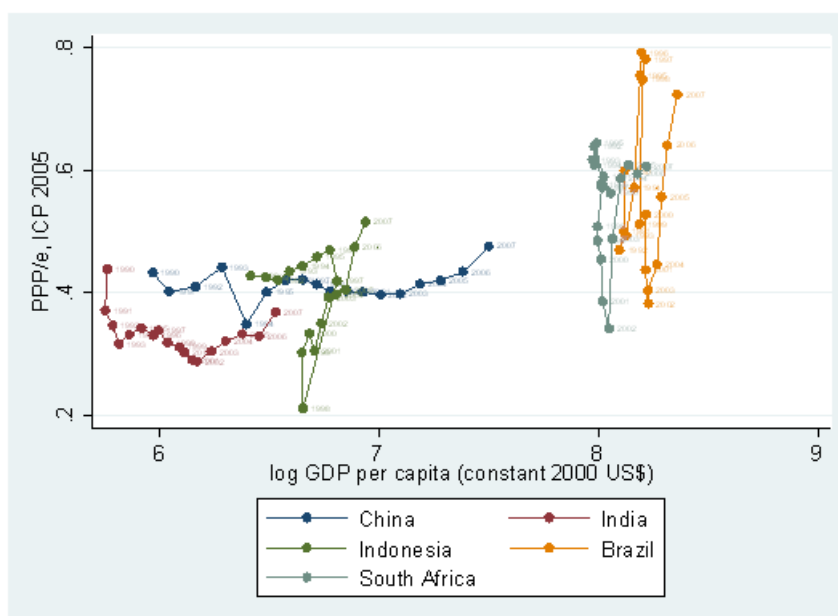
Source: Authors' calculation based on data from World Bank (2009).

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12.   See for instance: http://www.iie.com/publications/papers/paper.cfm?ResearchID=392

Stable does not imply flat: the HBS model suggests convergence be accommodated through upward real currency appreciation. This is exactly what was observed in China and India during the last two decades (see Figure 2). The smooth real exchange rate path in China and India is contrasted to the other three countries with which the OECD is in 'Enhanced Engagement', namely Brazil, Indonesia and South Africa. These countries have been characterised by considerable exchange rate instability over the last two decades. Figure 2, which relates the PPP estimate of the real exchange rate (US = 1) to the logarithm of the corresponding countries' per capita GDP, shows a striking association of exchange rate stability and income convergence. Figure 2 suggests that sustained growth benefits from an exchange rate that is not only competitive, but also stable.

There is analysis and evidence that warns against real exchange-rate instability and premature currency appreciation during a country's convergence process. Post-war development economists emphasised a dualistic framework which assumed a large subsistence, stagnant agricultural sector containing surplus labour existing side by side with a small, growing and dynamic capitalist urban industrial sector characterised by rising productivity. The outlines of this framework are often attributed to Nobel Prize winner Sir Arthur Lewis (see Lewis, 1954) who modelled an economy with a rural-urban divide in productivity and labour markets. Note that Lewis' work has implications for understanding inequality in large developing countries (Kuznets, 1955; McKinley, 2009): a rapid move of resources from the rural subsistence sector reinforces the significant income gap that exists between rural agriculture and urban industry and moves the structure of the economy to the sector with greater intrasectoral inequality, i.e. the urban industry.

Rodrik (2008) presents evidence that growth in large "dual" economies such as China and India is supported by a competitive exchange rate. In the absence of perfect financial markets, a competitive exchange rate is a powerful policy instrument to incentivise resources (including subsistence labour) to move from low- to high-productivity sectors. High-productivity activities are concentrated in otherwise inefficiently small export industries, which hold the learning capacity through gradual technological and skill upgrading of productive activities that allow increasing sophistication and value-added in domestic production.

A mercantilist policy approach of 'exchange-rate protection', however, is at odds with the neoclassical view that real exchange rate misalignment creates distortions that are themselves bad for long-run growth (e.g. Corden, 1994). A recent IMF paper (Berg and Miao, 2010) argues that the determinants of exchange rate misalignment are themselves independent drivers of growth; still, the IMF paper confirms Rodrik's analysis by producing empirical evidence, with a dataset based on 181 country observations during eleven five-year periods from 1950-54 to 2000-04, that not only are currency overvaluations bad for growth but that undervaluations are also good for developing-country growth.

Figure 3. **China and India: HBS-implied misalignment between 1990 and 2007**

% deviation of market rate from PPP rate

China

India
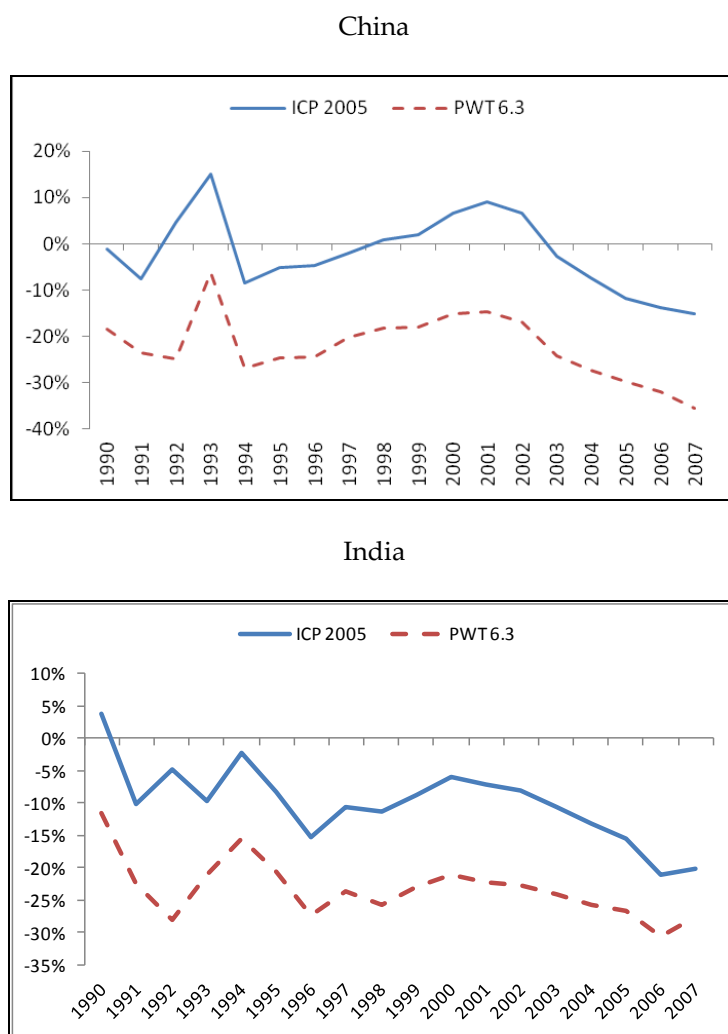
Note: Calculations based on both the new PPPs derived from the International Comparison Project's most recent round (ICP 2005) and using the old PPPs, which still can be found in Penn World Tables Version 6.3.

Source: World Bank (2009); Aten *et al.* (2009).

The evidence presented above argues against overvaluation and, implicitly, premature currency appreciation. However, when the country has reached a certain level of development, a real gradual appreciation can accompany a sustained convergence toward higher GDP per capita levels. The real appreciation of the domestic currency can stimulate domestic demand (through raising purchasing power of consumers) and help rebalance an economy toward the internal market. This could be particularly accurate description of the Chinese economy if the demand from OECD countries slows down in the future. The degree to which appreciation threatens to

cool down China's export-led growth engine depends on the sophistication of China's exports and the timing of that appreciation as measured by the degree of convergence with advanced economies. Figure 3 suggests that now may be the right time for some renminbi appreciation. The degree of HBS-implied implied undervaluation of the renminbi has globally increased between 1990 and 2007, with some fluctuations[13]. Until China loosened its dollar peg in June 2010, there had been a recent accentuation in the degree of undervaluation, which is consistent with the increasing Chinese current account surpluses. The degree of HBS-implied undervaluation that has evolved during period of the strong convergence has been equally marked for India's currency, the rupee.

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13.   When using the ICP 2005, the renminbi appeared even slightly overvalued at the beginning of the 2000s.

IV. CHINA'S GROWTH AND POOR-COUNTRY GROWTH

Whether the renminbi will continue to underpin China's growth is of increasing importance to poor countries, as will be shown in this section. Recent research by Levy-Yeyati (2009) shows that growth for a sample of emerging economies[14] from 2000 onwards has been more dependent on growth in China than in the G7, a reversal of their dependence in the 1990s. Splitting the data between earlier (1993-99) and later (2000-09) periods, Levy Yeyati finds that the explanatory power of G7 growth virtually disappears in the later period, as a result of increasing Chinese influence. Splitting the two components reveals that the percentage elasticity of growth in the sample to G7 growth in the later period was just 0.267; the corresponding elasticity to China's growth, meanwhile, had grown to 1.115; that is, one percentage point of GDP growth in China was associated with growth in the sample of emerging economies of more than one percentage point[15].

To analyse the impact of China's growth on a broad group of poor (rather than merely the 'emerging') countries, we look at the relationship between China's growth rate and those of 122 developing and emerging countries for the period between 1990 and 2009. The impact of China's growth can be quantified using a fixed-effects model, which allows us to analyse a cross-section of developing countries over time. The fixed-effects estimator allows the constant term to differ across cross-section units, which captures the cross-country factors that differ. Additionally the time series dimension of the data provides us with additional information.

Our empirical model includes only the external growth as the driver of growth, where as there may be other factors driving growth, as in growth models. We assume that using the fixed-effects estimator overcomes this and other potential problems that may be caused by omission of these factors.

As we are interested in the long-run economic growth linkages, not business cycle synchronicity which relies on the cyclical component of GDP, we use real GDP growth rates in our analysis both for the dependent and explanatory variables (not the de-trended series). The business cycle models may be more suitable for analysing output shocks, a fixed-effects panel

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14. Argentina; Brazil; Chile; Colombia; Mexico; Peru; Hong Kong, China; India; Indonesia; Malaysia; Philippines; Singapore; Chinese Taipei; Thailand; Czech Republic; Hungary; Poland; Turkey; and South Africa.

15. Levy Yeyati tests whether EM sensitivity to global growth has declined over the years by regressing EM growth on G7 growth and evaluating how the coefficients have evolved since the inception of emerging markets as an asset class in 1993. Splitting the data between early (1993-99) and a late (2000-09) periods, and assuming for simplicity that trend growth remained stable within each, the specification is a regression of the growth rate of economy's cyclical output (relative to a log linear GDP trend) on the G7 and Chinese cycles, based on quarterly, seasonally adjusted GDP data, identifying the late period (2001-09) with an interacting dummy.

approach is more appropriate for analysing longer term trends. Since China's impact on long-run growth of developing economies is our question of interest, we follow the latter methodology.

We are interested in the following outcomes: *i)* the significance of the impact of industrialised (i.e. high-income OECD) economies on the developing economies; *ii)* the stronger growth association between China and the developing economies replacing the previous economic link between industrialised and developing economies; *iii)* the implications of these relationships for possible outcomes of a renminbi appreciation, i.e. how much a 1% of slowing down of the Chinese economy would affect the growth rates of the developing economies.

The empirical framework is a fixed effects panel regression with the following specification:

$$g_{it} = \alpha + \mathbf{x}_{it}\,\boldsymbol{\beta} + u_{it}, \; t = 1990,\ldots, 2009 \text{ and } i = 1,\ldots,\text{N} \qquad (3)$$
$$u_{it} = \eta_i + v_{it}$$

$$\mathbf{x}_{it} = \begin{bmatrix} g_{industrial,t} \\ g_{china,t} \\ g_{china,t} * dummy_{2000} \\ g_{adv,t} * dummy_{2000} \\ dummy_{2000} \end{bmatrix}$$

The analysis uses annual data for 1990-2009. The dependent variable **g** is the annual real GDP growth rate;   is the matrix of parameters to be estimated; **X** is the matrix of independent variables that included growth rates for OECD economies and China, **dummy₂₀₀₀** is the dummy variable that takes on the value of 1 for the years 2000,…, 2009 and zero otherwise; **u** is the error term[16].

Our model of estimation can also be written more explicitly as:

$dlog$(GDP$_{i,t}$) = α+ β_1 $dlog$ (GDP $_{industrialised,t}$)+ β_2 $dlog$(GDP $_{industrialised,t}$)*dummy $_{2000\text{-}2009}$ +

β_3 $dlog$(GDP $_{China,t}$) + β_4 $dlog$(GDP $_{China,t}$))*dummy $_{2000\text{-}2009}$+ dummy$_{2000\text{-}2009}$+ u$_{i,t}$

where u$_{i,t =}$ v$_{it}$+ η$_{itI}$ $\qquad\qquad$ (4)

Hypotheses:

H1: If the growth association between China and the developing economies has increased over the last decade, β_4 should be positive and significant.

H2: If the growth association between industrialised and developing economies has increased over the last decade, β_2 should be positive and significant.

H3: If China has replaced the industrialised economies as the new source of growth for developing economies, we should observe a non-significant and/or negative β_2 <u>AND</u> a positive and significant β_4 .

The GDP data is obtained from IMF's WEO and IFS databases for the time period 1990-2009. The GDP growth rates are calculated as log differences using annual data. We use a time-break to segregate the 1990s and the 2000s; our hypotheses are based on the fact that these two

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16. Since the regressions are on growth rates, it is not necessary to test for unit roots and co-integration in the data. The Hausman tests show that the use of fixed-effects rather than random-effects is more appropriate for the data. The results are available from the authors upon request.

time periods differ significantly for both the global economy and the developing world. The 1990s represent a highly volatile period particularly for the emerging and developing economies with several financial crises, whilst the 2000s can be considered a more tranquil period for the developing countries with enhanced integration of the global economy, a rising profile of China in the world economy (with WTO membership since 2001), and high global liquidity. Two interaction terms are included as explanatory variables in order to capture the impact of OECD growth and China's growth in the second period. Our sample consists of 122 emerging and developing countries which we divide first into income groups and then into export groups, as we expect the impact of China across these groups to differ significantly. The income groups, low and middle, are formed based on the World Bank definitions. The first grouping serves to test whether the links between China and the low- and middle-income economies are significantly different because of the different economic and trade linkages these groups have with China.

In addition, countries are grouped by exports into oil- and non oil-exporters[17] (see Table 4. in Annex). This serves as a robustness check for the results that we obtain from the income-group analysis. A significant number of countries in the developing world are oil or raw-material exporters. With increasing demand from China for these commodities, China became a large trading partner for these economies in the 2000s. By focusing on how the changes in growth association differ across these two groups, we are able to see whether China's rise as the new engine of growth was driven solely by the commodity linkage. Therefore, results are reported for the non-oil group. This group consists of middle-income economies that are not oil exporters to make the results comparable, since the oil-exporters are principally middle income countries[18].

An additional explanatory variable is the average annual growth rate for industrialised economies. This is computed as the average of individual growth rates of high-income OECD economies[19] weighed by the dollar GDP of the previous year.

To estimate the impact of a slowdown in the Chinese economy on individual developing countries, a series of panel regressions are run. Rather than attempting to isolate each of the channels by which Chinese growth might be expected to influence growth in the developing countries, this paper focuses solely on quantifying the impact of variations in both OECD and Chinese growth. The results for low- and middle-income emerging/developing economies are reported first. Secondly, the results for the oil exporting economies are discussed. The results are presented in Table 2. The first column presents the figures for the low-income group of countries, whereas the second column presents these for the middle-income group. In the third column, the results for the non-oil exporting countries are shown.

Similar to Levy-Yeyati (2009), we find that introduction of China into the model decreases the impact of OECD countries in the 2000s, i.e. the coefficient on OECD growth becomes negative and/or insignificant[20].

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17. These are based on the categories defined by the IMF (WEO October 2009).

18. Except Chad, all the oil-exporting countries are in the middle-income group.

19. Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, UK and US.

20. We do not report these results here for the sake of brevity, however available upon request.

Table 2. **Impact of China on the low- and middle-income countries[21]**

	Low-income	Middle-income	Non-oil	Oil+Raw Mtrl.
OECD ($\odot_1$)	**0.207**	**0.162**	0.104	**0.425**
	-3.059	-2.48	-1.52	2.48
OECD$_{2000s}\odot\odot_2$)	**-0.294**	0.133	0.122	-0.213
	(-1.97)	-1.16	-0.96	-0.85
CHINA ($\odot_3$)	**-0.267**	**0.008**	0.027	-0.141
	(-5.45)	-0.23	-0.84	-1.43
CHINA$_{2000s}\odot\odot_4$)	**0.562**	**0.363**	**0.43**	0.247
	-4.27	-3.09	-3.49	1.26
Dummy	**-0.016**	**-0.014**	**-0.016**	-0.003
	-3.51	-2.87	-6.03	-0.39
Observations	645	1384	1086	621
Cross-sections	39	83	65	37
R^2	0.45	0.43	0.46	0.34

Note: Reported are the estimated coefficients with their t-statistics in parentheses. Figures in boldface indicate significance at the 10% level[22][23].

The main findings of our analysis are:

1. The impact of China's growth on both the low- and middle-income countries has grown significantly in the 2000s. The results show that a 1% change in China's growth rates will result in a change around 0.3% in the same direction in the low-income countries. As for the middle-income countries, the corresponding growth association is 0.4%.

2. The impact of OECD countries has significantly decreased over the same period for the low-income countries with a coefficient close to zero (-0.07% to be precise). As for the middle-income countries though, there has not been a significant increase in the impact of OECD growth in the 2000s. The total impact is around 0.3% change in the growth rates per 1% change in OECD growth rates. The impacts of China and OECD growth seem to be of similar magnitude. This can be attributed to the higher integration of the group of middle-income economies with the global economy, whereas the low-income economies tend to be more segmented.

3. Though growth associations of both the low- and the middle-income countries with China have significantly increased in the 2000s, the magnitude was larger for the low-income group (denoted by a coefficient of 0.562).

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21. The results have been corrected for serial correlation, cross-sectional heteroskedasticity.

22. The reported R-squared value is the 'within' R-squared. The overall R-squared values for the four groups are 0.28, 0.31, 0.29 and 0.30 respectively. The difference between these two reported figures provide us with the additional explanatory power obtained from the fixed-effects estimation.

23. The reported standard errors have been calculated using White period method for coefficient covariance (Arellano (1987), White (1980)) to correct for any serial correlation.

These results clearly illustrate strengthening growth associations between China and the developing countries. In this case, any shock to China's growth will be reflected in the growth rates of these countries. Should the revaluation of the renminbi result in decreasing growth rates in China, the developing countries would significantly suffer from this external shock.

The third column of Table 2 illustrates the results for the non-oil exporter developing economies. The results of the export-based analysis d show that the China impact is not limited to oil-exporting developing countries. On the contrary, the increasing growth association with China in the 2000s is a robust finding that pertains to non-oil countries. Consequently, China's strengthening growth engine role for poor countries is not merely driven by the oil-exports channel.

Why are these new growth linkages important in the context of RMB valuation? Rodrik (2010) has produced panel regressions which suggest that a 10% nominal effective appreciation of the Renminbi would reduce China's annual per capita growth by 0.86 percentage points. This reduction in China's growth would translate into a drop of GDP growth (based on our growth sensitivity estimates of 0.56) to 0.26 percentage points of annual per capita income growth in poor countries. To be sure, these are back-of-the-envelope calculations that ignore adjustment and substitution effects, but they serve to illuminate potentially high adjustment cost that a renminbi appreciation might entail for the world's poor outside China, an aspect entirely neglected in current macroeconomic policy debates.

Recent estimates (Chhibber and Nayyar, 2007) for 52 low and middle-income countries during the period from 1990 to 2000 put the elasticity of poverty to growth at around −2. A rise of one percentage point in China's annual per capita income growth and taking the poor-country growth elasticity of 0.56 estimated above would thus translate into a slowdown of poverty reduction by 1.25%. In other words, roughly annually 15 million of the *world's 1.2 billion poor outside China* (according to the most recent World Bank poverty analysis data) would be lifted from abject poverty, defined as a daily consumption level below one dollar, through each percentage point of China's per capita growth. In this sense, China may have been the most potent poverty reduction engine *outside* its borders during the first decade of the 21st century.

China's rapid growth and the attendant demand for other countries' goods have had positive spillover effects to poor countries. Still, higher tradable goods production in China results in lower traded goods production elsewhere in the developing world – entailing a growth cost for these countries. Are these the poor countries, as suggested by Subramanian (2010)? Quite the contrary.

The trade patterns of growing countries tend to be quite dynamic. If factors are being accumulated at differential rates, the composition of output can change quite quickly. When one of the factors of production advance faster, e.g. skills in China, then China's skill-intensive output will rise disproportionately[24]. Moreover, the terms-of-trade impact of the Asian drivers depend heavily on the source of the growth, with capital-driven growth increasing agricultural and energy prices much more than productivity-driven growth. Changes in the variety and quality of exports – as emphasised by Hummels and Klenow (2005) – can greatly increase the

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24.   This is called the *Rybczynski* effect.

welfare benefits to the Asian giants and their trade partners. Either higher real wages or real appreciation of the Chinese currency will quicken China's structural upgrading. This would further soften the price pressures on low-skilled goods and on low-income countries. At the same time, technological upgrading in China would move China's price impact from the middle-income countries to the high-income economies. This process is likely to be protracted, given the considerable reserve army of unskilled labour in China, however.

Using the unit prices of exports to investigate changing comparative advantage and the evolution of export sophistication, Fu *et al.* (2010) find that middle-income countries are the most affected by China's export expansion through price competition particularly after the late 1990s as a consequence of China's market expansion, its WTO entry and exchange rate variation. The unit price of China's exports appears to have a significant impact on the unit prices of the exports from middle- and high-income countries. For the exports from the low-income countries, their price does not appear to be in significant price competition with those from China.

In their study on the impact of China's exports on global manufactures prices, Fu *et al.* (2010) perform a two-period test, choosing 1997 as the break point for their sample period 1989-2006, both because it marked the deepening of intensive innovation-based growth in China and because of the 1997 Asian financial crisis's impact on excess capacity in the region. After 1997, they find considerable changes in the competitive advantage of China and its major competitors in Asia. Whereas prior to the late 1990s the prices of low-income countries were most affected by Chinese exports, after 1997, it was the middle-income countries that were most affected by China's export expansion. Moreover, evidence from this study also indicates a price depression effect of China's exports on high-income countries in low-technology product markets. The real effective exchange rate of the renminbi exerted a significant pressure on the export prices of middle-income countries after 1997, but there were no significant impacts in that regard for low income countries.

V. CONCLUSIONS

The Harrod-Balassa-Samuelson effect has several important and far-reaching policy implications for China and the world economy:

- First, the major part of the undervaluation ascribed to China's and other currencies results from market forces that make non-traded goods relatively cheap, rather than from deliberate currency manipulation by China's authorities alone;

- Second, a rapid convergence of per capita income to rich-country levels will gradually eliminate the Balassa-Samuelson effect, leading to a real effective currency appreciation either through nominal exchange-rate upward flexibility or through positive inflation differentials with rich-country trade partners;

- Third, the resulting real currency appreciation implies heavy valuation losses on official foreign exchange reserves in renminbi terms as these are held in key advanced-country currencies. China is an 'immature' lender to the extent that it cannot lend to them in its own currency yet. It has an interest, therefore, to shrink the overall level of foreign exchange reserves or, alternatively, shrink its rich-country currency share, for example by investing in gold and other stores of value.

Although China's surpluses are structural and linked to its unequal growth, the appreciation of its real exchange rate is bound to pay a significant role in rebalancing China's future growth performance toward consumption. Economic history suggests that fast-growing economies like China can appreciate considerably versus mature economy currencies due to rapid productivity increases. Between 1960 and 1978, for example, the deutsche mark appreciated cumulatively by almost 60% against the US dollar, while the Japanese yen appreciated by almost 50% (Ferguson and Schularick, 2009).

Given the size of these historical appreciation episodes, the potential trajectory of renminbi appreciation creates an acute risk-management challenge for Chinese entities that have foreign currency assets or revenue streams, for which hedging instruments or proxies have to be developed – gradually. It is thus important that any renminbi appreciation is gradual along the convergence path depicted in Figure 2 and along financial-sector development rather than squeezed into a short time span. This is not just important for China but also for the other poor and middle-income countries whose growth has recently been strongly associated with China's growth.

Table 3 summarises the discussion and the potential growth impact of renminbi for low- and middle-income countries[25].

Table 3. **The potential growth impact of renminbi appreciation on developing countries**

Impact channel Country	Indirect growth effect	Price competition effect	Total effect
Low-income countries	Negative	Insignificant	Negative
Middle-income countries	Negative	Positive	Ambiguous

Source: See discussion in text based on own estimates; Fu *et al.* (2010); Levy Yeyati (2009); and Rodrik (2008).

Poor countries must be concerned that China as an engine of their recent growth performance is not pushed into a precipitous, deflationary currency appreciation as was Japan until 1995. Japan's long-lasting deflationary slump, after the yen had more than quadrupled relative to the US dollar from 1971, replete with a near-zero interest liquidity trap and heavily impaired bank balance sheets provides a strong warning should China be pushed into the same fate (McKinnon and Schnabl, 2009). Considering the evidence on the lack of export competition between China and poor countries and their dependence on China's growth for their own growth performance, the growth impact for poor countries of a sudden and perhaps 'excessive' renminbi appreciation would be likely to be very negative, indeed. The growth impact on middle-income countries would be indeterminate, as the negative engine effect of a slowdown in China's growth might be compensated through increased competitiveness that resource-poor middle-income countries would enjoy as a result of an appreciated renminbi.

By extension, therefore, not just China but likewise other poor countries – in particular those which now have a low index of export similarity with China – have a vested interest in China's exchange rate to remain conducive to growth. This does in no way imply that exchange rate parities should remain at current levels; to the contrary, further convergence will require renminbi appreciation. However, it should also not be ignored that an undervalued exchange rate seems to stimulate growth in China more than it does in the average sample of developing countries due to the large reservoir of surplus labour and the huge gap in the productivity levels of modern and traditional parts of the economy; the same observation should hold for India in particular[26]. Consequently, a persistent positive growth differential for the converging middle-income and poor-country world may well depend on the continued competitiveness of the Chinese renminbi.

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25. This is obviously a very broad summary of likely effects which does not do justice to country situations. For example, the net growth effect for resource-rich middle-income countries is likely to resemble the negative impact that a real effective appreciation of the renminbi would have on low-income countries. However, the empirical evidence presented in the literature reviewed does not allow further country disaggregation.

26. To the extent that the need to reduce global imbalances does not entirely obviate Rodrik's (2010) estimates.

ANNEX

Table 4. **Country Groupings**

By Income Level		By Main Source of Export Earnings	
LOW INCOME	**MIDDLE INCOME**	**OIL**	**RAW MATERIALS**
BANGLADESH	ALBANIA / LESOTHO	ALGERIA	BURKINA FASO
BENIN	ALGERIA / LIBYA	ANGOLA	BURUNDI
BURKINA FASO	ANGOLA / LITHUANIA	AZERBAIJAN	CHILE
BURUNDI	ARGENTINA / MACEDONIA	CHAD	CONGO DR
CAF	ARMENIA / MALAYSIA	COLOMBIA	GUINEA
CAMBODIA	AZERBAIJAN / MALDIVES	CONGO REPUBLIC	GUINEA BISSAU
CHAD	BELARUS / MAURITIUS	ECUADOR	GUYANA
COMOROS	BELIZE / MEXICO	GABON	MALAWI
CONGO DR	BHUTAN / MOLDOVA	INDONESIA	MALI
ERITREA	BOLIVIA / MONGOLIA	IRAN	MAURITANIA
ETHIOPIA	BOTSWANA / MOROCCO	KAZAKHSTAN	MONGOLIA
GAMBIA	BRAZIL / NAMIBIA	LIBYA	MOZAMBIQUE
GHANA	BULGARIA / NICARAGUA	MEXICO	NAMIBIA
GUINEA	CAMEROON / NIGERIA	NIGERIA	PAPUA
HAITI	CAPE VERDE / PAKISTAN	RUSSIA	SIERRA LEONE
KENYA	CHILE / PANAMA	SUDAN	SOLOMON
KYRGYZ	COLOMBIA / PAPUA	SYRIA	ZAMBIA
LAO	CONGO REP / PARAGUAY	TURKMENISTAN	
LIBERIA	COTE D'IVOIRE / PERU	VENEZUELA	
MADAGASCAR	COSTA RICA / PHILIPPINES	YEMEN	
MALI	DJIBOUTI / POLAND		
MAURITANIA	DOMINICA / ROMANIA		
MALAWI	DOMINICAN / RUSSIA		
MOZAMBIQUE	ECUADOR / SAFRICA		
MYANMAR	EGYPT / SAMOA		
NEPAL	EL SALVADOR / SRI LANKA		
NIGER	FIJI / ST. KITTS		
RWANDA	GABON / ST. LUCIA		
SENEGAL	GEORGIA / ST. VINCENT		
SIERRA LEONE	GRENADA / SUDAN		
TAJIKISTAN	GUATEMALA / SURINAME		
TANZANIA	GUYANA / SWAZILAND		
TOGO	HONDURAS / SYRIA		
UGANDA	INDIA / THAILAND		
VIETNAM	INDONESIA / TUNISIA		
YEMEN	IRAN / TURKEY		
ZAMBIA	JAMAICA / URUGUAY		
ZIMBABWE	JORDAN / VENEZUELA		
	KAZAKHSTAN		
	LATVIA		

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