REAL EXCHANGE RATE, EFFECTIVE DEMAND, AND ECONOMIC GROWTH: THEORY AND EMPIRICAL EVIDENCE FOR DEVELOPED AND DEVELOPING COUNTRIES, 1960-2010

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Abstract: This paper seeks to assess the effects of an undervalued currency on economic growth. Based on a reformulation of Rodrik's undervaluation index, our econometric results suggest that real exchange rate undervaluation has, to differing degrees, been able to enhance the economic growth of developed and developing countries. Nevertheless, when we disaggregate the main components of aggregate demand for different clusters of developed and developing countries using the Stock Flow Consistent approach (SFC), we find that in general, an undervalued currency has expansionary and contractionary effects in the short-run, specifically via the export sector and the level of aggregate consumption, respectively. This paper also estimates the effects of an undervalued currency on the level of investment and the trade balance.

Key words: Undervalued Currency, Developed and Developing Countries, Effective Demand Components, Economic Growth, Panel Data Models.

JEL Classification: **F50, F31, F41, C32**

1 INTRODUCTION

In the current context of slow economic growth experienced by many developed and developing countries and in light of the well-documented set of economic policies undertaken by several East Asian economies leading to the so-called Asian 'miracle' (e.g., Amsden 2001; Chang 2006; UNCTAD 2012), some economists have proposed the use of the nominal exchange rate as a 'policy variable' with the purpose of maintaining an undervalued real exchange rate, in order to boost national exports and investment in the tradable sector, which would lift productivity, employment, and economic growth (e.g., Rodrik 2008; Razmi et al. 2009; Bhalla 2012).

Given that the exchange rate is a macroeconomic-price capable of having considerable influence on the allocation of resources (mainly financial resources e.g., foreign direct investment and industrial employment), it is likely that the lack of economic growth that many economies have experienced is due, to some extent, to recurring periods of exchange rate

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overvaluation, which has limited the process of industrial upgrade, created permanent trade deficits and maintained low levels of domestic savings and foreign exchange reserves.

This diagnosis could be especially true for African and Latin American economies, which on average, during the years 1981-2010, have been performing worse than in previous periods (1960-1980) and other developing countries (see table 1).

Table 1: Average Economic Growth by Regions

	1960-2010		1960-1980		1981-2010	
Countries	Growth	Growth S.D.	Growth	Growth S.D.	Growth	Growth S.D.
All countries (96)	4	4.74	4.98	5.32	3.45	4.27
Developed (25)	3.87	3.41	5.27	3.53	3.07	3.06
Developing (71)	4.05	5.13	4.87	5.84	3.58	4.62
Africa (35)	3.83	5.62	4.61	6.73	3.44	4.9
Asia (18)	5.49	4.52	5.90	5.34	5.23	3.91
L.A. (20)	3.68	4.4	4.87	4.53	2.92	4.16

The numbers in parenthesis indicate the number of countries. S.D. stands for standard deviation.

In this paper, I adopt the standard measure of exchange rate undervaluation. Thus, the focus of this investigation is to make a critical analysis of the effects and consequences of maintaining an undervalued currency upon the economic growth of developed and developing countries for the periods 1960-2010, 1960-1980, and 1981-2010. I begin by reformulating an undervaluation index proposed by Johnson et al. (2007) and Rodrik (2008). This standard methodology for the construction of the real exchange rate (*RER*) and an undervaluation index uses the Purchasing Power Parity (*PPP*) conversion factor calculated by the Penn World Tables 7.1, which assumed 2005=100 as the base year or equilibrium reference for prices, thus the deviation of the PPP conversion factor from the market exchange rate (*XRAT*) is considered a measure of currency misalignment (under/over-valuation).[2]

$$PPP\ conversion\ factor = GDP\ Deflator_{Counry\ x}/GDP\ Deflator_{US}$$

$$RER = XRAT/PPP \qquad (1)$$

It is worth mentioning that this measure of under/over-valuation is based on comparison of countries' price levels relative to the U.S. and differs substantially from an estimated level of the real exchange rate that would achieve balance of payment equilibrium. Also, this standard measure of under/over-valuation differs substantially from the estimated measure of under/over-valuation according to the classical perspective (see Shaikh 1999; Martinez 2010), which links the long-run behavior of the real exchange rate to the changes of the relative real unit labor cost using a determined base year.

[2] The ratio in equation 1, also referred to as the national price level, indicates the number of units of a country's currency required to buy the same amount of goods and services in the domestic market as a U.S. dollar would buy in the United States, so it makes possible to compare the cost of the bundle of goods that make up gross domestic product (GDP) across countries.

The selection of an arbitrary base year for the calculation of the real exchange rate or the relative real unit labor cost does not affect the trends of either variable, but it does determine the level of their deviations and *hence the periods in which the deviations are positive or negative –i.e. the periods in which the rxr is under/over-valued*. The most important point is that the two (classical and neoclassical) approaches are based on opposing arguments and will generally give different measures of over- and under-valuation.[3]

In this paper, I test econometrically the impact of an undervalued currency "as defined by the standard approach" upon the economic growth of different set of countries and periods. Our results confirm what other empirical investigations have previously concluded (Rodrik 2008; Razmi et al. 2009). Overall, in the medium-to-long-run an undervalued real exchange rate has a positive effect on economic growth mainly via the size of the export sector and the maintained period of undervaluation. Contrary to Rodrik's results, our results suggest that this positive effect applies not only to developing countries but also to developed countries.

Nevertheless, when I disaggregate the main components of aggregate demand for different clusters of developed and developing countries, we found that in general, an undervalued currency has expansionary and contractionary effects in the short-run, specifically via the export sector and the level of aggregate consumption, respectively. Therefore, we believe that the analysis of the effects of an undervalued currency upon economic growth should also be carried out on a case-by-case basis, in order to try to evaluate 'correctly' the structural parameters of each economy (types of exports, degree of trade openness, level of foreign indebtedness (public and private), etc.) and 'all the channels' through which a currency depreciation could affect the level of economic activity.

After this introduction, the second section develops a reformulation of Rodrik's (2008) exchange rate undervaluation index, whose main sample considers 96 countries, and different sub-samples, makes distinction between developed and developing countries, countries from Africa, Asia, and Latin America. This section shows different Balassa-Samuelson effects among developing countries, something other researchers have overlooked. The third section estimates the long-run effect of the real exchange rate (*RER*) on the growth rate of the GDP and the growth rate of the GDP per capita. The fourth section, drawing on the stock flow consistent (SFC) approach, for different clusters of developed and developing countries, I compare the degree of exchange rate over/under-valuation with the three main components of aggregate demand and the national wage-share in order to identify shifts in any of these components of aggregate demand and possible variations in income distribution associated with changes in the value of the currency. The fifth section estimates the effect of the real exchange rate (*RER*) on the level of investment with respect to GDP (I/GDP) and the trade balance of goods (X/M) for our different clusters of developed and developing countries.

2. UNDERVALUATION AND GDP PER CAPITA: THE CROSS-COUNTRY EVIDENCE BY WORLD REGIONS THROUGH TIME

Building on the work by Johnson, Ostry, and Subramanian (2007), Rodrik (2008) and Bhalla (2012), I computed an index of exchange rate undervaluation in three steps. First, I define the

[3] The author thanks Professor Anwar Shaikh for clarifying this point to me.

real exchange rate (*RER*) in its natural log form as the log of the ratio of the data on exchange rates (*XRAT*) and Purchasing Power Parity conversion factors (*PPP*)[4].

$$\ln RER_{it} = \ln(XRAT_{it}/PPP_{it}) \quad (1B)$$

where *i* is an index for countries and *t* is an index for (1-year) time periods. *XRAT* and *PPP* are expressed as national units per U.S. dollar. When **ln *RER*** is greater than ZERO it indicates that the value of the currency is lower (more depreciated) than is indicated by purchasing-power parity (*PPP*) conversion factor, which is considered the 'equilibrium' level of exchange rate, so that the deviation of XRAT from PPP measures the level of currency misalignment (under/over-valuation).

A second step in the construction of the *RER* is to take into consideration the price difference (due to unequal productivities) between tradable and non-tradable goods among developed and developing countries. That is, according to the Balassa-Samuelson effect, higher productivity in the tradable sector of rich countries, pushes up the general level of prices and the real exchange rates; while low productivity in the tradable sector of poor countries tends to maintain or lower the general level of prices and more devaluated/depreciated exchange rates. So to discount this income effect over the real exchange rate, equation 2 regresses ln *RER* on the log of per-capita GDP (LRGDP_PC):

$$\ln RER_{it} = \alpha + \beta \ln RGDP\_PC_{it} + f_t + u_{it} \quad (2)$$

Where $\boldsymbol{f_t}$ is a fixed effect (hereafter, FE) for time period and $\boldsymbol{u_{it}}$ is the error term. Using equation 2, for a sample of 184 countries for the period 1950-2004 and with data from the Penn World Tables **6.2**, Rodrik (2008) and Razmi et al. (2009) found a $\boldsymbol{\widehat{\beta} = -0.25}$, which means that when income per capita increases by 10%, the real exchange rate for developed and developing countries appreciates around 2.5%. When we tried to replicate this exercise and expand the time span by using the "**revised**" Penn World Tables (PWT) **7.1** for the period 1960-2010 and for a sample of 94 countries (which were selected due to the availability of the data for XRAT and PPP for this used period), we identified a dissimilar pattern for the relationship of the unadjusted LRER (**from equation 1B)** and the log of the income per capita of developed and developing countries as is shown in Figure 1.

Figure 1 clearly shows that developed countries follow completely the relationship first pointed out by Balassa and Samuelson. Meanwhile the (unadjusted) *RER* of developing countries as a whole seems to follow a lower rate of change (i.e. overvaluation) as income per capita increases. When we split up our sample of countries (as in figure 1) into two periods (1960-1980 and 1981-2010), the same patterns remain (Please see Figure 5 at the appendix)[5]. The upshot is that trying to estimate equation 2 for a combined sample of developed and developing countries might be misleading and biased. Therefore, we basically decided to

[4] Bhalla (2012) used the inverse definition of real exchange rate (ln PPP/XRAT).

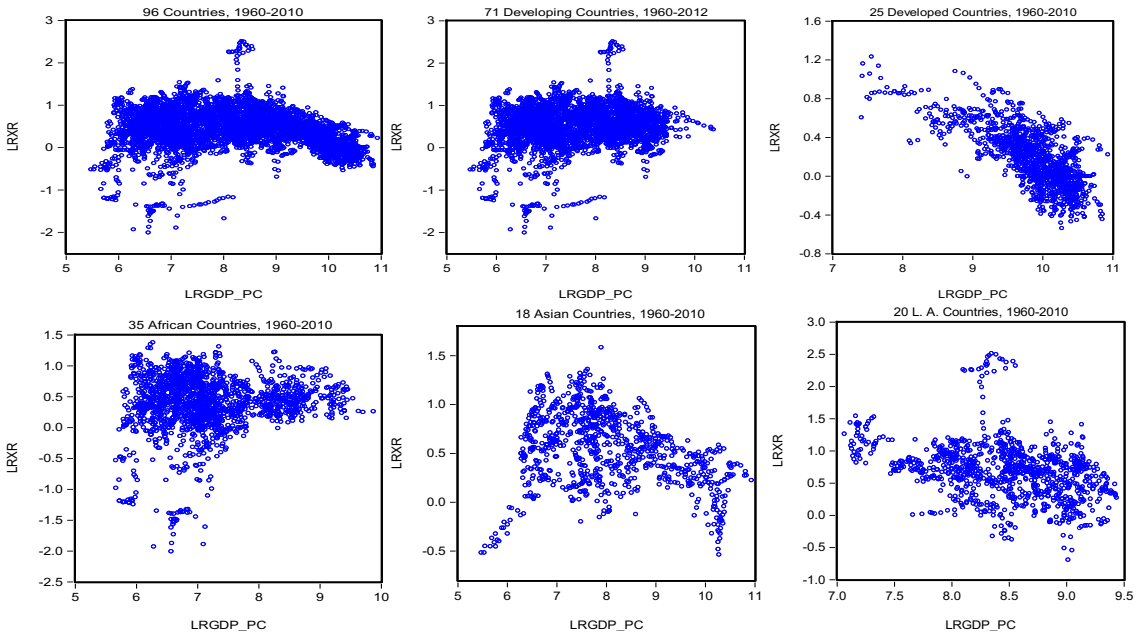
[5] It is worth mentioning that Polterovich and Popov (2002) also reported this different long-run path of the real exchange rate between developed and developing countries. According to them, this difference path is the result that developing countries as a group were not catching up with rich countries in productivity levels during the 1975-1999 period.

estimate the adjusted (for income) *RER* taking up different blocks of countries (as in Figure 1) using equation 3, which is similar to equation 2 but which adds a fixed effect for cross-sections, to consider different initial conditions between countries.

$$\ln RER_{it} = \alpha + \beta \ln RGDP\_PC_{it} + f_i + f_t + u_{it} \qquad (3)$$

Where f_i is a FE for cross-section and f_t is a FE for time period and u_{it} is the error term.

Figure 1: Real Exchange Rate and GDP Per Capita (PWT 7.1), 1960-2010



Using equation 3, we estimated panel (two-way) FE models for different periods (1960-1980, 1981-2010, and 1960-2010) and blocks of countries in order to estimate the parameter beta in equation 3 (the Balassa-Samuelson effect). Our main sample considers 96 countries (developed and developing), and in order to take into account different stages of development (measured by income per capita) and geographic regions through time, we split up this main sample into different groups of countries as follows: 25 developed countries, 72 developing countries, 35 countries from Africa, 18 countries from Asia, and 20 countries from Latin America. The list of countries for each group can be found at the appendix. Using these more homogeneous groups of countries allows for more precise estimates and reveals interesting differences in the estimated coefficients based on different structural characteristics.[6]

The econometric results of these panel regressions for different time periods and samples are shown in table 2.[7] Our investigation uses annual data, and a priori, we did not

[6] It is worth mentioning that perhaps this lack of convergence between the prices of developed and developing countries explains the failure of PPP theory.

[7] It is worth mentioning that my FE panel regressions for equation 1 differs in several aspects to those estimated by Johnson et al. (2007) and Rodrik (2008). While Johnson et al. (2007) estimated panel regressions for *each* year; Rodrik (2008) used five-year averages to calculate his FE (one-way for time-period) panel model, using data from the Penn World Table 6.1.

impose any restriction on our econometric panel models (i.e., pooled model, one-way, or two-way FE), that is, we decided which sort of panel model to estimate based on a Chow test (Baltagi 2005:13).

Table 2: Balassa-Samuelson Effect

	1960-2010			1960-1980			1981-2010		
	β	Adj-R^2	FE	β	Adj-R^2	FE	β	Adj-R^2	FE
All countries (96)	-0.09 [-4.7]	0.54	2w	-0.13 [-5.2]	0.79	1w, C	-0.24 [-8.8]	0.65	2w
Developed (25)	-0.32 [-18]	0.67	1w, C	-0.32 [-7.8]	0.60	1w, P	-0.30 [-4.9]	0.64	1w, C
Developing (71)	0.13 [5.3]	0.56	2w	0.09 [3.8]	0.81	1w, C	-0.10 [-3.2]	0.50	2w
Africa (35)	0.16 [7.2]	0.32	1w, C	0.37 [6.2]	0.83	2w	0.09 [3.2]	0.47	2w
Asia (18)	-0.13 [-7]	0.46	2w	-0.15 [-5]	0.64	1w, C	-0.20 [-5]	0.79	2w
L.A. (20)	-0.31 [-3.6]	0.10	1w, P	-0.20 [-3.7]	0.93	1w, C	-0.39 [-5.2]	0.53	1w, C

Note: The numbers in brackets stand for the t-statistic (based on White cross-section or White period standard errors & covariance).
The numbers in parenthesis indicate the number of countries in each panel regression.

Performing a Chow test to our different block of countries and time-periods allowed to consider the heterogeneity between countries and possible changes over time. Thus my strategy was to estimate two Chow (*F*) tests for each block of countries. The first *F*-test compared a pooled (restricted) model against a **cross-section FE** (unrestricted) model. The second *F*-test compared a pooled (restricted) model against a **period FE** (unrestricted) model. The results of these *F*-tests showed that in all the cases but two, the cross-section FE models (1w, C) captured most of the variability of the dependent variable (**ln *RER***) due to the fact that these *F*-tests were highly statistically significant with high r-squares. In other instances, the second *F*-test showed that the period FE models (1w, P) captured some part of the variability of the dependent variable (**ln *RER***), due to the fact that some *F*-tests were statistically significant with high r-squares. In one-third of the cases the combination of cross-section and period FE models resulted in highly statistically significant parameters and high r-squares, which paves the way for well-estimated two-way (2w) FE models.

The results on Table 2 show that there has been a differentiated B-S effect among countries through time, since the estimated $\hat{\beta}$ parameter (the B-S effect) from equation 3 is different for each block of countries. However, the estimated $\hat{\beta}$s for each block are relatively similar for the three estimated periods. The only exceptions were the estimations for the main sample of 96 countries and that for developing countries, whose averages for the first two periods (1960-1980 and 1981-2010) do not match the estimated parameter for the total sample (1960-2010).

The results on Table 2 also show that the developed countries have maintained a relatively high but stable B-S effect for the whole period ($\hat{\beta}$ = -0.32). I would highlight that Balassa (1964) found the same value for developed countries. The second block of countries that reported a relatively high B-S effect were the Latin American countries, which for the whole period showed an almost similar B-S effect to the developed countries ($\hat{\beta}$ = -0.31). However, Table 2 shows that Latin American economies' exchange rate appreciation on average has been growing over time, since in the first period they had a much lower B-S effect ($\hat{\beta}$ = -0.20) than in the second estimated period ($\hat{\beta}$ = -0.39).

The Asian countries maintained a relatively low B-S effect for the whole period ($\hat{\beta}$ = -0.13), although from the first to the second period the B-S effect increased in 0.5 per cent points (from $\hat{\beta}$ = -0.15 to $\hat{\beta}$ = -0.20). Finally, for the three estimated periods, the sample of African countries reported an unusual positive B-S effect ($\hat{\beta}$ = 0.16), which suggests that the level of income per capita tends to increase with the level of undervaluation, or vice versa, depending on the true process of causality between these variables.

Finally, to arrive at my index of undervaluation for each block of countries and period, I take the difference between the actual real exchange rate (from equation 1) and the Balassa-Samuelson-adjusted rate (from equation 3) as follows:

$$\ln UNDERVAL_{it} = \ln RER_{it} - \ln \widehat{RER}_{it} \qquad (4)$$

Where $\ln \widehat{RER}_{it}$ is the predicted values from equation 3.

Defined in this way, ln UNDERVAL is comparable across countries 'within' each block of countries and over time. Whenever ln UNDERVAL exceeds ZERO, it indicates that the currency in dollar terms is undervalued. When ln UNDERVAL is below ZERO, the currency is overvalued. Thus, this measure of undervaluation is centered at 0.

3. UNDERVALUATION AND ECONOMIC GROWTH

Having estimated an index of undervaluation based on conventional methodology, the aim of this section is threefold: (i) to analyze the statistical relationship between the *RER* and economic growth for the blocks of countries that we defined in the previous section, (ii) to draw some conclusion about the rate of real exchange rate that helps in the medium-to-long-run to stimulate economic growth, and (iii) to estimate through econometric panel models the effects of an undervalued currency on economic growth.

Statistical Analysis by Regions

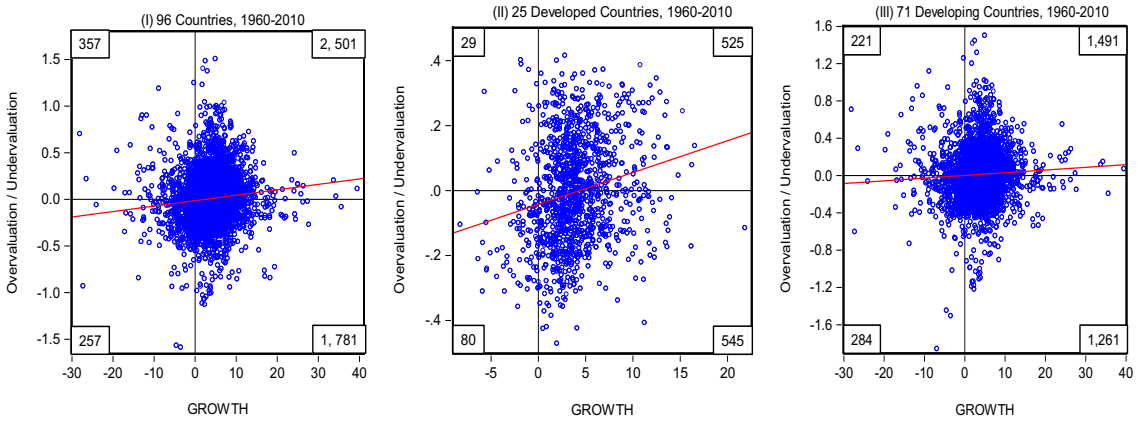
Figures 2 and 3 show six scatterplots that relate the index of under/over-valuation and economic growth for each block of countries. Each scatterplot has the measure of over/under valuation on the *y* axis (centered at zero) and economic growth on the *x* axis (almost centered at cero). At the upper and bottom corners of each scatterplot lies a chart that indicates the number of observations within each quadrant. We also added the default trend line estimated by Eviews 9.

Scatterplot (I), which encompasses the full sample of countries (96), shows that these economies have experienced more periods of economic growth with an undervalued currency (Quadrant I). Quadrant number 2, however, indicates that undervaluation could also have contractionary effects for some economies. Quadrant 4 shows that some countries can also grow with an overvalued currency.

Scatterplot (II), which contains the sample of developed countries (26), shows that developed economies have experienced almost the same periods of economic growth with an

undervalued and overvalued currency. It also shows that developed countries had had the lowest relative number of contractionary-devaluating periods (29/554) for the whole sample of 96 countries. Scatterplot (III), which plots the sample of developing countries (71), resembles almost entirely the same conclusion from Scatterplot (I).

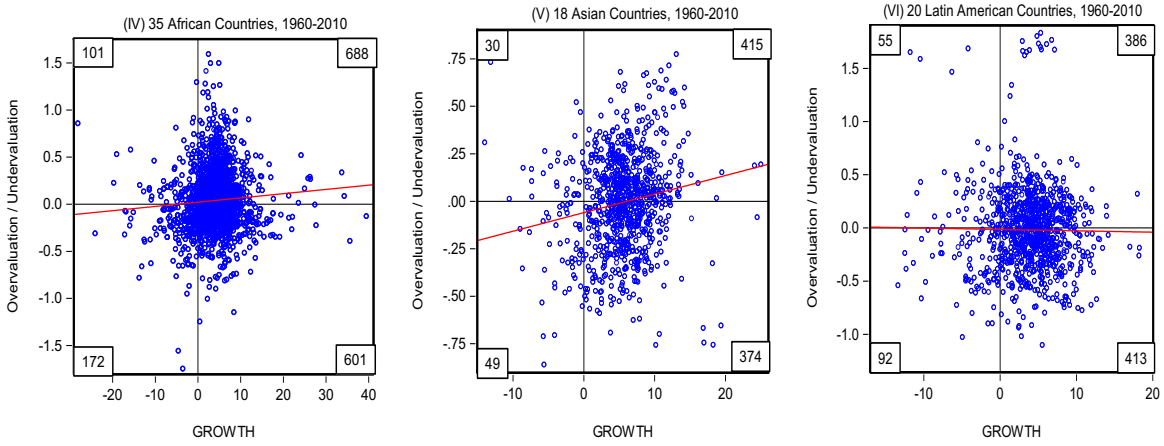
Figure 2: Currency Under-Over/Valuation and Economic Growth



The numbers (in the charts) for the developing countries indicate that having an undervalued currency has the highest probability of ending up in a context of positive economic growth (0.457%-0.06%=0.39%):

$$(I)\frac{1{,}491}{3{,}257} = 0.457 + (II)\frac{221}{3{,}257} = 0.06 + (III)\frac{284}{3{,}257} = 0.08 + (IV)\frac{1{,}261}{3{,}257} = 0.38 = 1$$

Figure 3: Currency Under-Over/Valuation and Economic Growth



Scatterplot (IV), which depicts the sample of African countries (35), indicates that these countries have experienced more periods of economic growth with an undervalued currency (Quadrant I) than with an overvalued currency (Quadrant IV). Scatterplot (V), which features the sample of Asian countries (18), shows that these countries had had the second relative lowest

number of contractionary-devaluating periods (30/445) and that high levels of economic growth are associated positively with an undervalued currency and lower levels of overvaluation.

Scatterplot (VI), which shows the sample of Latin American countries (20), indicates that economic growth does not seem to have a particular relationship with an under/over-valuated currency. In addition, the numbers in the charts indicate that the countries of the Latin American economies' on average, had had the relative largest periods of overvaluation (505/946) in comparison with other economic areas.

Based on the visual inspection of scatterplots (I) through (IV), but especially on (III), I infer that, by and large, the rate of real exchange rate that has been able to boost economic growth in the medium-to-long-run within the group of 96 countries, and in particular within the group of 71 developing countries, is the rate around the 'equilibrium' real exchange rate (around zero with an undervaluation rate of around 25% and overvaluation rate of around 15%). Furthermore, the scatterplots (I, IV, and III) also show that higher levels of under-and-overvaluation (above 40% and 30% respectively) are associated with lower levels of economic growth. Hence, it seems that the best policy action that national authorities could undertake to stimulate economic growth in the medium-to-long run is to try to avoid large real exchange rate misalignments (under-and-over-valuation) (Johnson et al. 2007; Berg and Miao 2010) and to try to avoid exchange rate volatility, which tends to discourage trade and investment (Eichengreen 2008:3).

In short, the conclusion drawn from Scatterplots (I, III, and IV) suggests that a growth rate of the real exchange rate 'around' zero in the long run is the most beneficial rate to reach higher economic growth, especially for the case of developing countries. However, the exception is the case of the sample of 18 Asian countries, which in general for the period 1960-2010 seems to maintain a positive association between an undervalued currency and economic growth.

Econometric Evidence

Based on my reformulated index of undervaluation, I estimated through different econometric specifications and panel data models, the effect of an undervalued currency on economic growth for the classification of countries by economic regions defined above. It is important to beer in mind that for each block of countries I estimated a particular undervaluation index, due to the fact that I identify different Balassa-Samuelson effects between developed and developing countries and among developing countries. Therefore, I start by estimating a panel model with 96 countries and then I estimated smaller panel models consisting of more-or-less homogeneous groups of countries. Before I explain my econometric results in depth, I briefly review the results obtained by other empirical analyses that have tested the relation between economic growth and undervaluation.

In his empirical investigation, Rodrik (2008) used a real exchange rate adjusted for the Balassa-Samuelson effect (similar to equation 2 above) for a sample of 184 countries and eleven 5-year time periods from 1950-1954 through 2000-04. He found (using equation 6 below which is a 2w FE model) that an undervalued currency has a positive effect on economic growth (*growth*). However, this positive effect operates only for developing countries (with a $\delta^* = 0.027$), as the estimates for developed countries were not statistically significant different from

zero. According to Rodrik, the effect of undervaluation on growth operates through its positive impact on the relative size of industry measures as the ratio of industry to GDP.

In another study with the same methodology, number of countries and periodicity of data, Razmi et al. (2009) found also that an undervalued currency has a positive effect on economic growth for a sample of 184 countries. However, when this sample of 184 is divided and classified by developed and developing countries, the authors found econometric evidence indicating that although the results are more robust for developing countries (in the range between $\delta^* = 0.017$ and $\delta^* = 0.026$), there is evidence that undervaluation affects growth positively in developed countries as well (in the range between $\delta^* = 0.014$ and $\delta^* = 0.017$). According to the authors, the effect of undervaluation on growth operates through its positive impact on investment, which only operates in developing countries according to different specifications and econometric methods.

Using a series of panel data regressions with six different samples and three different periods, I use the following two econometric specifications in order to test the effects of undervaluation on economic growth:

$$growth_{it} = \alpha + \beta \ln RGDPCH_{it-1} + \delta \ln UNDERVAL_{it} + f_i + f_t + u_{it} \quad (5)$$

$$growth^*_{it} = \alpha^* + \beta^* \ln RGDPCH_{it-1} + \delta^* \ln UNDERVAL_{it} + f_i + f_t + u^*_{it} \quad (6)$$

Equations 5 and 6 depict two two-way FE models where the dependent variable in equation 5 is the annual growth rate of real GDP (*growth*), the dependent variable in equation 6 is the annual growth rate of real GDP per capita (*growth**), $UNDERVAL$ is our measure of undervaluation, $RGDPCH_{it-1}$ is the initial income per capita level which captures the converge term, f_t is a time specific effect, f_i is a country specific effect, u_{it} and u^*_{it} are error terms. The estimated values using Eviews 9 for the parameters δ and δ^* from equation 5 and 6, respectively, are shown in Table 3.

Table 3: Undervaluation and Economic Growth, Fixed Effect Models

	1960-2010				1960-1980				1981-2010			
	$\widehat{\delta}$	lag(s)	$\widehat{\delta}^*$	lag(s)	$\widehat{\delta}$	lag(s)	$\widehat{\delta}^*$	lag(s)	$\widehat{\delta}$	lag(s)	$\widehat{\delta}^*$	lag(s)
All countries (96)	2.18	1	1.77	1	1.90	0	2.67	0	1.91	1	1.70	1
	[7.28]		[6.37]		[2.74]		[3.82]		[5.50]		[4.85]	
Developed (25)	3.82	0	2.45	0	4.75	0	4.22	0	4.10	0	2.94	0
	[5.18]		[2.75]		[4.02]		[3.31]		[3.02]		[3.82]	
Developing (71)	2.12	1	1.84	1	2.41	2	2.64	2	1.57	1	1.5	1
	[6.48]		[5.67]		[2.42]		[2.8]		[4.1]		[3.65]	
Africa (35)	1.52	0	2.36	0	**-2.54**	0	**-2.76**	0	2.46	0	2.09	0
	[2.68]		[4.42]		[-1.71]		[-1.88]		[4.03]		[3.18]	
Asia (18)	3.2	0	2.25	0	2.7	1	**2.59**	**1**	**2.11**	3	**1.62**	3
	[4.66]		[4.13]		[2.12]		[1.89]		[1.85]		[1.83]	
L.A. (20)	1.91	**1**	2.35	**1**	3.7	**1**	3.43	**1**	2.64	**1**	2.65	**1**
	[3.55]		[4.11]		[3.23]		[2.72]		[4.83]		[3.7]	

Note: The numbers in brackets stand for the t-statistic (based on White cross-section or White period standard errors & covariance).
The numbers in parenthesis indicate the number of countries in each panel regression.

The estimated results from equation 5 and 6 show that for the six different samples of countries for the whole estimated period 1960-2010, an undervalued currency has been associated

positively with *growth* and *growth**. An outstanding result for these estimations suggests that developed countries have had a larger positive impact of an undervalued currency on *growth* and *growth** ($\hat{\delta} = 3.82$ and $\hat{\delta}^* = 2.45$) than the developing countries ($\hat{\delta} = 2.12$ and $\hat{\delta}^* = 1.84$). For the case of developing countries, the estimated elasticities ($\hat{\delta}$ and $\hat{\delta}^*$) suggest that, *ceteris paribus*, an annual increase of 20% in undervaluation would boost *growth* and *growth** by 0.42% and 0.36% annually, respectively (2.12*0.20=0.424% and 1.84*0.20=0.368%), a non-negligible amount by any measure.

When I split up each of the six samples into two sub-periods (1960-1980 and 1981-2010), the results on table 3 show that for all the sample of countries the effect of undervaluation on *growth* and *growth**, although positive, had a little larger effect in the first period than in the second one. The only exception to this positive pattern was the case of the African countries, which according to its estimated elasticities, an undervalued currency had a considerably large negative impact on *growth* and *growth** during the first period.

As is very well-known, it is possible that the estimated parameters using panel FE models from equation 5 and 6 suffer a problem of endogeneity bias as there could be a problem of contemporaneous simultaneity effect between the dependent variables (*growth* and *growth**) and the independent variable ($\ln UNDERVAL$), which would lead to the underestimation of $\hat{\delta}$ and $\hat{\delta}^*$. However, a dynamic specification with a lagged dependent variable is likely to improve our estimates considerably in the presence of persistence effects and omitted supply-side factors (such as institutional variables). Using the General Method of Moments (GMM) corrects for both of these problems, because it allows the inclusion of a lagged dependent variable (in levels and in different forms) and also controls for endogeneity through the use of instrumental variables (Arellano and Bond 1991).

$$growth_{it} = \beta^{**} growth_{it-1} + \delta^{**} \ln UNDERVAL_{it} + f_t + u_{it}^{**} \qquad (7)$$

Equations 7 depicts a GMM specified equation where the dependent variable is the annual growth rate of real GDP (*growth*), $growth_{it-1}$ is a lagged variable of the dependent variable, $UNDERVAL$ is our measure of undervaluation, f_t is a time specific effect, and u_{it}^{**} is an error term. The estimated results for equation 7 using Eviews 9 are shown in Table 4.

Table 4: Undervaluation and Economic Growth, Dynamic Panel Data

	1960-2010			1960-1980			1981-2010		
	$\hat{\delta}^{**}$	lag(s)	PD	$\hat{\delta}^{**}$	lag(s)	PD	$\hat{\delta}^{**}$	lag(s)	PD
All countries (96)	2.33 [4.44]	1	Yes	2.90 [3.07]	0	Yes	2.07 [2.27]	1	No
Developed (25)	3.23 [2.86]	0	Yes	3.10 [2.20]	0	Yes	3.55 [2.40]	0	Yes
Developing (71)	2.77 [4.34]	1	Yes	3.34 [47]	1	No	1.87 [2.06]	1	Yes
Africa (35)	1.44 [2]	0	No	-3.27 [-475]	0	No	2.16 [2.32]	1	Yes
Asia (18)	2.75 [3.28]	1	No	1.92 [5.82]	2	No	3.64 [2.68]	3	No
L.A. (20)	2.8 [2.5]	**1**	No	3.51 [2.24]	**1**	No	3.5 [4.23]	**1**	Yes

Note: The numbers in brackets stand for the t-statistic (based on White cross-section or White period standard errors & covariance).
The numbers in parenthesis indicate the number of countries in each panel regression. PD stands for period dummies.

The estimated results using the GMM method on table 4 suggest similar conclusions drawn from the results on table 3 using panel FE models. That is, for the six samples of countries for the period 1960-2010, there has been a positive long-run effect of an undervalued currency on *growth*. Moreover, when we split up each of the six samples into two sub-periods (1960-1980 and 1981-2010), the GMM results show almost similar results to those estimated with FE panel models. There are, however, two important differences to be noted. First, for the first estimated period (1960-1980), the GMM results suggest that an undervalued currency had a considerably larger negative impact on *growth* for the African countries than the results estimated with the FE model. Second, the GMM results indicate that the Asian countries were able to achieve faster economic growth (*growth*) through an undervalued currency as the positive impact (elasticity) almost doubled from the first ($\hat{\delta}^{**} = 1.92$) to the second period ($\hat{\delta}^{**} = 3.64$).

In short, Tables 3 and 4 confirm what other empirical investigations have found in regard to the relationship between undervaluation and economic growth, that is, these results mainly suggest that in the long-run the real exchange rate has not been neutral in stimulating the economic activity. The purpose of the following sections is to identify the channels through which the positive stimulus of undervaluation to economic growth operates and to investigate if this positive stimulus also holds in the short-run.

4. UNDERVALUATION, EFFECTIVE DEMAND, AND ECONOMIC GROWTH IN THE SHORT RUN

According to standard open economy models, a real depreciation of the exchange rate has an expansionary short-run effect via aggregate demand, provided that price elasticities satisfy the Marshall-Lerner (M-L) condition (so that the trade balance improves) and there are unemployed resources in the devaluing country (so that output can increase). A real depreciation can also yield benefits on the supply side by increasing the relative price of tradable goods, which creates incentives to shift domestic production towards tradables and demand towards non-tradables, thereby freeing up a greater surplus for exports (Blecker and Razmi 2008:87).

However, in two cases, a real depreciation of the exchange rate could have a contractionary short-run effect even if the M-L condition is fulfilled: (*i*) if the devaluation leads to higher domestic prices due to higher costs (mainly imports), which may create a shift in the distribution of income in favor of capital and against labor, by enabling firms to increase price-cost margins (i.e., lower real wages). If capital owners have a higher propensity to save than workers, then overall aggregate demand may fall in spite of increased exports; and (*ii*) if the devaluation increases the indebtedness ratio of firms and governments indebted in foreign currency (Diaz-Alejandro 1963; Blecker and Razmi 2008). Furthermore, if the response of exports (and import substitution) to the change in relatively prices is slow, then the currency depreciation may result in the short-run in a worsening of the trade balance, the terms of trade and of profits (López and Perrotini 2006).

Most of the studies that have estimated empirically the effects of the changes of the real exchange rate on economic growth, focus mainly on the effects of exchange rate devaluations on the external sector, specifically on the performance of the national export sector; that is, for these analyses, an undervalued currency leads to a favorable change(s) in the relative prices of commercial goods, which tend to raise exports and investment in the tradable sector,

employment and economic growth (e.g., Rodrik 2008; Razmi et al. 2009; Bhalla 2012). However, we believe that the foregoing chain of causation, although probably correct, does not describe the full picture associated with exchange rate devaluations. That is, in developing countries, and even in some developed countries, changes in the *RER* also see important changes in the other components of aggregate demand (aggregate consumption, investment, government expenditure), and even changes in the stance of monetary policy, and thus on economic growth in the short-run.

In this section, drawing mainly on the works by Taylor (2004) and Shaikh (2012), we make use of the GDP national accounting identity in terms of the three main sectoral balances (private sector, government, and the rest of the world) under the framework of the Stock-Flow Consistent (SFC) model in order to identify shifts in any of these three components of aggregate demand due to periods of exchange rate undervaluation. Furthermore, we also contrast the degree of exchange rate over/under-valuation with the level of the national wage-share (Wages+Salaries/GDP) in order to detect possible variations in income distribution due to changes in the value of the currency. I carried out these analyses for different clusters of developed and developing countries. Before showing and describing our empirical findings, we briefly refer to the underlying points of the SFC model.

For the SFC theorists, in any national economy, the level of economic activity is influenced not just by a country's income distribution but also by the outcome of the balance between demand "injections" – private investment in fixed capital and inventories, public spending, and exports – and "leakages" – private saving, taxes, and imports (Taylor 2004:13). That is, the level of economic activity 'over any time period' is determined by the difference between domestically available aggregate demand (D) and domestically available aggregate supply (Q):

$$E \equiv D - Q = (C + I + G + X) - (Y + M) \tag{8}$$

Where E stands for excess demand, C consumption, I investment in desired stocks of fixed capital and inventories, G government spending, X export demand, Y domestic supply, and M imports. Now, let T=total private sector (households and business) taxes, so equation 8 can be written in terms of three sectoral contributions to excess demand: the private sector deficit, which is the excess of its expenditures over its disposable income $[(C + I) - (Y - T)]$; the government deficit $[G - T]$; and the foreign trade surplus $[X - M]$ (Shaikh 2012:126):

$$\begin{aligned} E \equiv D - Q &= [(C + I) - (Y - T)] + [G - T] + [X - M] \\ &= [I - sY] + [G - tY] + [X - mY] \end{aligned} \tag{9}$$

Where s, t, and m stand respectively for saving rate, the import propensity, and the tax rate. Moudud (2010:92) and Shaikh (2012:127) emphasize that there is nothing in this *ex ante* relation which requires that the three balances add up to zero. It is, however, the incorporation of the undesired inventory change into investment over some putative 'short run' period which converts the *ex-ante* non-zero balance into an *ex-post* zero-balance identity which reflects the real financial balances of the economy:

$$\dot{D} + \dot{Z} + \dot{A} = [I - sY] + [G - tY] + [X - mY] = 0 \qquad (10)$$

Where $\dot{D}$ $(= dD/dt)$, $\dot{Z}$, and $\dot{A}$ stand respectively for the net change per unit time in financial claims against the private sector, in government debt, and in foreign assets. Equation (10) shows how claims against an institutional entity must be growing when its demand contribution to *Y* exceeds *Y* itself. So when $X < mY$, net foreign assets of the home economy are declining, while $G > tY$ means that its government is running up debt (Taylor 2004:14). Due to the nature of this budget constrained equation 10, any excess demand by one (or two) institutional entity(ies) must be exactly offset by the other (two) institutional entity(ies). In words of Godley and Lavoie (2007:38), "everything comes from somewhere and everything goes somewhere… … Within this framework, 'there are no black holes' (Godley 1996:6)". Therefore, it is true from (10) that $\dot{D} + \dot{Z} + \dot{A} = 0$.

Explicitly we are not presenting (modeling) any behavioral equation as the purpose of this investigation is only to analyze the changes (if any) of the main components of aggregate demand due to changes of the real exchange rate. Along these lines, figures 5, 6, 7, 8, and 9 in the appendix show the three main macroeconomic sectoral balances with respect to GDP (for the period 1990-2012) along with the degree (percentage) of undervaluation (in a shaded area only for the period 1990-2010). In a second graph these figures also show the economic growth rate and the degree (percentage) of over/under-valuation. In a third graph the figures also show the degree (percentage) of over/under-valuation along with the wage-share (as percentage of the GDP) for 6 developed countries, 6 African countries, 9 Asian countries, and 9 Latin America countries. The source of data is mentioned in the appendix.

In general terms, for our sample of countries (developed and developing), we can summarize our main findings as follows:

- With the exception of countries like Greece, Tanzania (in the 2000s), Senegal, and Guatemala, it seems that the M-L conditions are fulfilled by our sample of countries in the short-run.
- With the exception of countries like Senegal, Japan, South Korea, Malaysia, Singapore, Thailand, and Chile, it seems that an undervalued currency affects in a negative way the income distribution of developed and developing countries.
- Undervaluation has mostly helped to propel the economic growth of East Asian countries, and in a few cases, other countries (Tanzania, Argentina, Mexico, and Panama).

The foregoing results were drawn based on the visual inspections of the Figures (5-9) (from the appendix) and the average short-run multipliers in Table 5. For each country, these multipliers were measured as the average (for the period 1990-2010) of the ratios of the annual sectoral balance with respect to GDP divide by the corresponding degree (percentage) of currency undervaluation[8]. Hence, these multipliers measure the change in the financial position of the three main sectoral balances as a result of a change in the degree of undervaluation. Due to the nature of the budget-constrained equation 10, in Table 5 for each row the sum of the first three columns (the last one with an opposite sign) adds up to zero. In Table 5 columns four and five

[8] It is worth mentioning that I did not take into consideration years of exchange rate over-valuation. The estimation of these multipliers corresponds only to years with real exchange rate undervaluation.

measure the average changes in income distribution and economic growth as a result of a change in the degree of undervaluation, respectively.

The main findings of this short-run analysis can be understood by looking at the average estimation for these ratios for each region, where we can see that for our sample of African and Latin American countries, on average, an undervalued currency is correlated with low economic growth (as their average ratios $(growth/\%rxr) < 1$), that is, real devaluations have tended to be contractionary with a regressive distribution of income (as the average ratio $(\Delta(W/GDP)/\%rxr) < 0$), especially for African countries. For the case of the Latin American countries, although real exchange rate devaluations have stimulated economic growth via their stimulative effects on private investment (0.207) and external sector (0.135), these multiplier effects have been week, especially if we compare these multiplier effects with those calculated for the Asian countries (4.17 and 2.82, respectively).

For the case of developed countries, although the sample is very small, we can surmise that only for these countries an undervalued currency has had very negligible effects on economic growth ($(growth/\%rxr) = 1.06$) as well as having a negative effect on the income distribution for these countries ($(\Delta(W/GDP)/\%rxr) < 0$). For these developed countries, the driving force of economic growth, on average, has been the excess of government expenditure over taxes, that is, public debt.

For the case of the Asian countries, the short-run multipliers (correlations) in Table 5 show that this region has outperformed the other regions of the world. That is, for these Asian countries, an undervalued currency has tended to boost aggregate demand via a higher level of exports over imports, which is connected or explained by an increasing difference between total investment and national total savings, that is, increasing levels of foreign investment, mainly foreign direct investment (FDI). Although these countries have also seen a regressive distribution of income as a consequence of the undervaluation of the currency, on average, this reduction in equity has been lower than the other regions of the world.

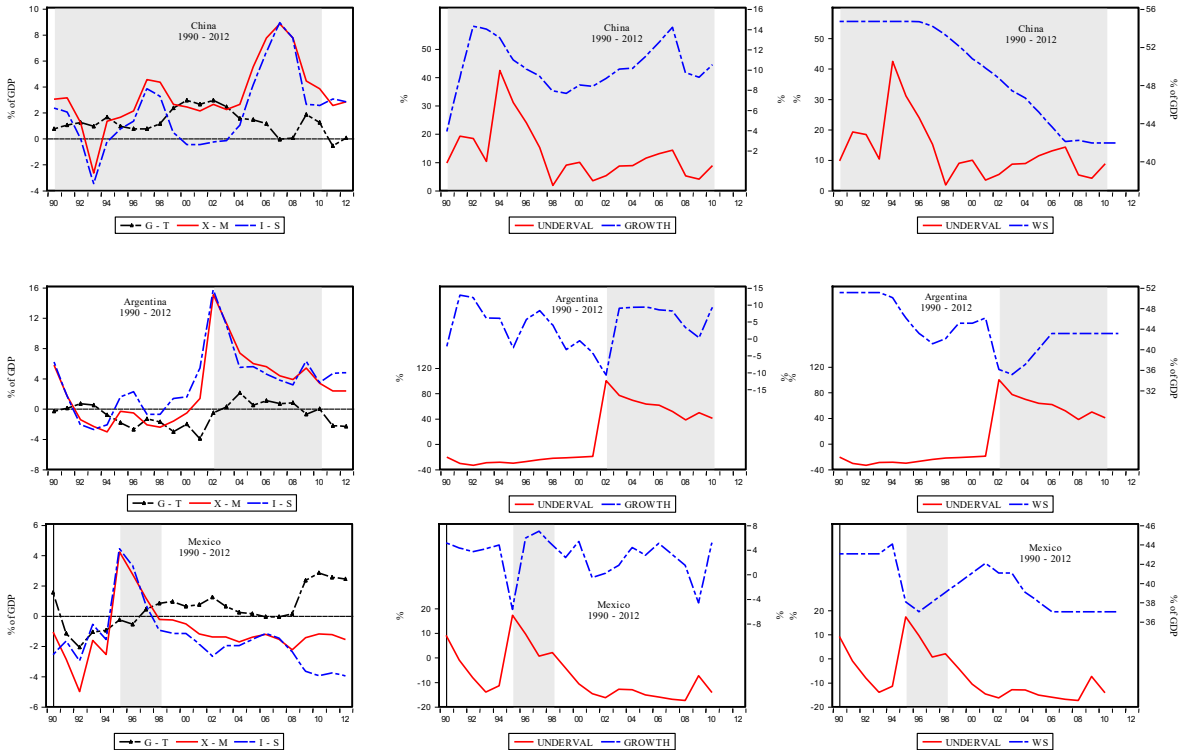
The results in Table 5 explain, to some degree, why the Latin American countries *vis-à-vis* the Asian countries have been unable to create more economic growth through an undervalued currency. Other factors that help to explain these poor results are the structural economic problems of Latin America such as low levels of productive investment, structural trade imbalances, and low productivity growth (Palma, G. 2010); all of these traits are associated with the worst income distribution in the world (ECLAC 2012).

Finally, Figure 4 shows the changes in total effective demand due to changes in the degree of undervaluation for the contrasting cases of China, Argentina, and Mexico. On the one hand, we observe that changes in the degree of undervaluation of the renminbi are closely associated with changes in the growth rate, and a positive increase in the level of investment over saving, and the level of exports over the imports. An undervalued renminbi also seems to be correlated negatively with the China's wage-share. On the other hand, in the cases of Argentina (2002) and Mexico (1995), we observe the classical effects of a real devaluation on the economy: i.e. the fulfillment of the M-L condition, an initial strong drop of the real GDP (despite the strong increase in the level of investment over saving) and a strong drop in the wage-share.

Table 5: Aggregate Demand Components: Short-Run Multipliers, 1990-2010

Countries	$\frac{(I-S)}{(\%rxr)}$	$\frac{(G-T)}{(\%rxr)}$	$\frac{(X-M)}{(\%rxr)}$	$\frac{\Delta(W/GDP)}{(\%rxr)}$	$\frac{growth}{(\%rxr)}$
Belgium	1.39	1.62	3.01	-0.16	2.59
Canada	0.137	0.290	0.427	-0.118	0.476
France	-0.211	0.396	0.185	0.007	0.224
Greece	-0.934	0.265	-0.669	0.059	0.226
UK	-7.02	-0.01	-7.03	-0.31	0.84
US	-4.869	-1.228	-6.098	-0.110	2.000
Average by Region	**-1.92**	**0.22**	**-1.70**	**-0.11**	**1.06**
Camerun	0.204	-0.019	0.185	-0.033	0.438
Cote d' Ivore				0.00	2.80
Egypt	-0.188	-0.054	-0.242	-0.021	0.267
Nigeria				0.045	0.242
Senegal	-3.089	0.045	-3.044	-0.374	0.476
South Africa				-0.13	1.77
Tanzania			-0.989	-0.10	0.84
Average by Region				**-0.089**	**0.98**
China	0.29	0.20	0.50	-0.10	1.26
Hong Kong	5.02	-1.25	3.76	-0.49	3.18
India	-1.07	0.61	-0.46	-0.27	1.55
Indonesia	-0.88	0.64	-0.24	-0.08	1.63
Japan	1.085	-0.694	0.392	0.176	0.626
Korea	0.45	-0.77	-0.32	-0.04	3.58
Malaysia	4.17	-0.98	3.19	0.00	1.76
Singapore	22.03	-6.30	15.73	0.42	5.59
Thailand	6.41	-3.59	2.82	0.31	0.68
Average by Region	**4.17**	**-1.35**	**2.82**	**-0.009**	**2.21**
Argentina	0.101	0.007	0.108	0.001	0.100
Brazil	-0.286	0.408	0.122	-0.060	0.210
Chile	-0.013	-0.078	-0.091	0.160	0.424
Colombia	0.157	-0.213	-0.056	-0.021	0.276
Guatemala	-2.811	0.019	-2.791	-0.135	0.972
Mexico	0.089	0.189	0.277	0.369	2.090
Panama	0.356	0.158	0.515	-0.043	0.994
Peru	4.156	-1.078	3.078	-0.383	3.169
Uruguay	0.109	-0.059	0.050	-0.018	0.299
Average by Region	**0.207**	**-0.072**	**0.135**	**-0.015**	**0.948**

Figure 4: Undervaluation and Effective Demand: China, Argentina, and Mexico



Although the real devaluation was much stronger and longer maintained in Argentina than in Mexico, which allowed the former to maintain trade surpluses for several years, it is likely that the quicker reversion of the drop in the wage-share in Argentina compared with Mexico was due to quick and socially targeted government intervention. In Argentina, after the devaluation of 2001-2, the conversion of a fiscal surplus into a fiscal deficit took only one year, whereas for Mexico, an effective fiscal response came three years after the December 1994 devaluation. This is a working hypothesis.

5. UNDERVALUATION, INVESTMENT, AND EXTERNAL SECTOR IN THE LONG-RUN

According to the standard theory, an undervalued currency can have positive effects on the level of investment and on the trade balance (see Rodrik 2008 and Razmi et al. 2009), so this section seeks to assess the effects (if any) of the *RER* (measured according to the standard methodology based on equation 3) on the level of investment with respect to GDP (I/GDP) and the trade balance of goods (X/M) for the different clusters of developed and developing countries defined above mainly for the period 1981-2010. Using a series of panel data regression models with six different samples, I use the following two econometric specifications (equation 11 & 12) in order to test the aforementioned effects:

$$\ln \frac{I}{GDP} = \gamma_1 + \gamma_2 Growth + \gamma_3 \text{Ln } rxr + f_i + f_t + u_i \quad (11)$$

$$\ln \frac{X}{M} = \theta_1 + \theta_2 \ln GDP^* + \theta_3 \ln GDP + \theta_4 \text{Ln } rxr + f_i + f_t + e_i \quad (12)$$

Equations 11 and 12 depict two two-way FE models where the dependent variable in equation 11 is the rate of investment as a percentage of the GDP, growth is the economic growth rate and *RER* is my calculated index of real exchange rate, f_i is a country specific effect, f_t is a time specific effect, and u_i is an error term. In equation 12, the dependent variable is the trade balance of goods, GDP^* is the world GDP which we incorporated in order to calculate an external demand effect, GDP is the national gross domestic product, and e_i is an error term. We first refer to the method to calculate the estimates of equation 11 and its results. We subsequently do the same for equation 12.

From the results showed in Table 4 above, we know that the *RER* has a direct impact on the rate of economic growth (*growth*), so the estimates of equation 11 would be biased and thus misleading. In order to avoid this collinearity problem, we decided to apply a Two-Stage Least Square (2SLS) method using two regressions to estimate equation 11:

$$Growth = \epsilon_1 + \epsilon_2 \text{Ln } rxr + f_i + f_t + u_i^* \quad (11A)$$

$$\ln \frac{I}{GDP} = \vartheta_1 + \vartheta_2 u_i^* + \vartheta_3 \text{Ln } rxr + f_i + f_t + u_i^{**} \quad (11B)$$

Equation 11A 'cleans' or discounts the effect of the *RER* on economic growth, so the variable u_i^* in equation 11B (error term in equation 11A) represents economic growth without the effect of the *RER* on it. Hence the parameter ϑ_2 measures the accelerator effect of economic growth (demand growth) over the rate of investment, whereas the parameter ϑ_3 measures the effect of *RER* on the rate of total investment. The estimated results for equation 11B (using Eviews 9) are shown in table 6.

Table 6: Undervaluation and Investment Rate by Economic Region

	ϑ_2	ϑ_3	Adj R-Square	FE	Period
All Countries (96)	0.011 [10]	0.14 [7.2]	0.51	1w, C	1982-2010
Developed (25)	0.008 [3.9]	-0.137 [-4.2]	0.55	1w, C	1982-2010
Developing (71)	0.014 [9.3]	0.11 [4.1]	0.49	1w, C	1982-2010
Africa (35)	0.014 [5.5]	0.22 [4.7]	0.44	1w, C	1982-2010
Asia (18)	0.012 [5.4]	-0.11 [-2.3]	0.55	1w, C	1983-2010
L.A. (20)	0.012 [5.1]	0.09 [2.7]	0.47	2w	1982-2010

Note: The numbers in brackets stand for the t-statistic.

The estimated results in Table 6 indicate that all the economies in our six different samples have a positive accelerator effect, as the parameter ϑ_2 is positive for all of them. However we can see that the accelerator effect of demand on the investment rate on average is much higher in developing economies (0.014*100=1.4%) than in developed economies (0.008*100=0.8%)[9]. Note that Africa is the region with the highest value for this parameter (0.014). Asia and Latin American economies have similar accelerator effects (0.012).

With regard to the effect of the *RER* on the investment rate (ϑ_3), the first thing to note is that the *RER* has a negative elasticity-effect on the investment rate for developed countries but a positive elasticity-effect on the investment rate for developing countries on average, which means that an increase (decrease) in the level of undervaluation (overvaluation) tends to increase (decrease) the investment rate in developing countries, whereas undervaluation (overvaluation) tends to decrease (increase) the investment rate in developed countries (similar conclusions are reported also by Razmi et al., 2009). African and Latin American countries show a positive elasticity-effect of the *RER* on the investment rate, although the elasticity-effect of the former (0.22) more than doubles the effect on the latter (0.09). However, it is worth mentioning that the final effect on the rate of investment would hinge on the degree of over-under/valuation of the currency.

The effect of the *RER* on the investment rate in the case of Asian economies appears to be negative, which we believe could be due to two reasons: (*i*) the sample of Asian economies is a mix of developed (6) and developing (12) countries, so it is likely that this result is been driving by the former set of countries rather than the latter; and (*ii*) it is also likely that *RER* undervaluation only is capable of enhancing the level of FDI (as we could see with the results in Table 5) but not necessarily the total rate of investment (I/GDP). In any case, the average result for this sample of Asian countries is that overvaluation of the *RER* tends to increase the total investment rate, whereas undervaluation of the *RER* tends to decrease the total investment rate.

[9] The parameter for growth is a semielasticity, as it was calculated from a log-linear regression, for that reason we multiply it by 100.

Table 7: Marshall-Lerner Condition by World Economic Region

	θ_2	θ_3	θ_4	Adj R-Square	FE	Period
All Countries (96)	-0.13 [-2.83]	0.12 [3.36]	0.14 [5.68]	0.75	1w, C	1981-2010
Developed (25)	-0.13 [-2.74]	0.15 [3.73]	0.11 [3.34]	0.86	1w, C	1986-2010
Developing (71)	-0.208 [-3.3]	0.15 [3.2]	0.189 [6.16]	0.73	1w, C	1981-2010
Africa (35)	-0.57 [-4.92]	0.40 [4.55]	0.13 [2.29]	0.73	1w, C	1984-2010
Asia (18)	0.405 [4.75]	-0.09 [-2]	0.25 [5.30]	0.80	1w, C	1981-2010
L.A. (20)	0.46 [3.07]	-0.71 [5.9]	0.312 [6.2]	0.83	1w, C	1984-2010

Note: The numbers in brackets stand for the t-statistic.

The estimated results from equation 12 in Table 7, where all the estimated parameters are elasticities, show that the Marshall-Lerner (M-L) condition is fulfilled by these clusters of developed and developing countries as the parameter (elasticity) θ_4 is positive for all of them, which means that a real devaluation tends to improve the trade balance (of goods). These results also indicate that in the medium-to-long term a real devaluation has stronger expansionary demand effects in developing countries than in developed countries. For instance, a 10% real devaluation would improve the trade balance in 1.89% (=0.189*10%) in developing countries, whereas a similar real devaluation would only improve the trade balance in 1.1% (=0.11*10%) in developed countries.

By economic region, Latin American countries show the highest response (elasticity) of a real devaluation to the trade balance of goods (0.312). For the Asian countries this same response (elasticity) was also considerably high (0.25), and for the African countries this response was a little lower (0.13) but higher than the developed countries (0.11). However, as I pointed out before, the final effect on the trade balance would depend on the degree of over-under/valuation of the currency as well as the maintained period of the under-over/valuation of the currency. Connecting these results in Table 7 with the results obtained in section III, we can conclude that the Latin American countries have not taken full advantage of this high response of the trade balance to the change of the real exchange rate. One observes a persistent tendency towards real exchange rate appreciation in Latin America. The opposite is true for African economies countries but especially for the case of the Asian countries, as these latter economies have managed to maintain more periods of currency undervaluation (see Figure 3).

With regard to the parameter θ_3 in Table 7, which measures the effect of the changes in GDP on the trade balance of goods, my results show that for the whole sample of countries (96), the sample of developed countries (25), the sample of developing countries (71), and the sample of African countries (35), an increase in the GDP tends to improve the trade balance of goods. This result is especially true for the African economies as they reported the highest elasticity (0.40) for the relationship between the GDP and the trade balance of goods, which indicates that an important part of the domestic production is exported to other countries.

For the cases of the Asian and Latin American countries, the parameter θ_3 turned out to be negative. However, the magnitude of the difference in this parameter θ_3 between both regions indicates that Latin American countries, on average, suffer a serious structural trade deficit when income increases. For instance, an increase in 3% in the GDP leads to an increase

in the trade deficit in the Asian countries of -0.27% (=3%*-0.09), whereas the same increase in the GDP leads to an increase in the trade deficit in the Latin American countries of -2.13% (=3%*-0.71).

The parameter θ_2 in Table 7, which measures the effect of the external demand on the trade balance of goods for our sample of countries, indicates that only the Latin American and Asian countries, on average, have been able to improve their trade balance (of goods) when the world GDP increases. The results also indicate that the other set of countries have a negative relationship between their trade balance (of goods) and the world GDP.

6. CONCLUDING REMARKS

Based on my own reformulation of Rodrik's (2008) undervaluation index "based on standard theory" using the PWT 7.1, this paper presents evidence of different long-run patterns in the relationship between the real exchange rate and income per capita for developed and developing countries. With these differences between countries in mind, we subsequently estimated different Balassa-Samuelson effects between countries. We calculated possibly better estimations of real exchange rate under/over-valuations.

This paper also finds, like other previous research, that real exchange rate undervaluation tends to enhance, although with different degrees and intensity, economic growth (GDP and GDP per capita) in the medium-to-long run for developed and developing countries for the periods 1960-1981 and 1982-2010. The only exception for this positive relationship was our sample of African countries for the period 1960-1981. By and large, the real exchange rate has not been neutral in stimulating economic growth in the long-run.

Using the Stock Flow Consistent approach and my own index of undervaluation for the period 1990-2010, we could conclude that in the short-run, on average, the sample of Asian economies see positive and larger effects of an undervalued currency on economic growth. The calculated multipliers show that an undervalued currency in our sample of Asian countries boost aggregate demand via a higher level of exports over imports, which is connected or explained by an increasing difference between total investment and national total savings, that is, increasing levels of foreign investment, mainly FDI. Although the Latin American countries also see a similar chain of effects, the average multiplier effects for this region were weak in comparison to those obtained for the Asian economies. The estimated multiplier effects for developed countries suggest that an undervalued currency also has week effects on economic growth. Due to the lack of data, we could not undertake a short-run analysis for our sample of African countries.

Another important finding from our short run analysis is that periods of exchange rate undervaluation are associated with negative changes in the participation of total wages in the GDP, that is, real devaluation tends to be regressive in all the economic areas analyzed in this paper, but specially in the small sample of developed economies, in the sample for African countries, and to a lesser extent, in Latin American and Asian countries.

Based on a visual inspection of the main components of the aggregate demand with respect to GDP, the growth rate, and the wage-share, we can observe that strong currency devaluations in developing countries are contractionary and regressive (see Figures 5-9 in the appendix). That is, despite the increasing stimulus of the level of exports over imports and the

level of investment over national savings, which are associated with the devaluation of the currency, the level of output tends to fall considerably, and with it, the participation of total wages in the GDP and the general level of consumption. Although in the medium-to-long-run, developing economies tend to improve their economic performance due to the positive effects of a devaluated currency on the level of investment and exports over imports (see the results in Table 6 and 7), for many developing countries a prolonged (permanent) currency devaluation tends to maintain lingering negative effects on the level of the wage-share, which despite the positive effect of the weakened currency on growth, could require many years to return to the pre-devaluation level of the wage share.

The bottom line of this paper is that the real exchange rate is a double-edged sword. On the one hand, an undervalued currency could improve international competitiveness in the short-to-medium term but could decrease the wage-share over time. Conversely, an overvalued currency could improve the wage-share in the short-to-medium term, but reduce the general level of competitiveness through time. Therefore, if a country wishes to improve its international competitiveness without significantly affecting its national distribution of income, it should take efforts to increase its international competitiveness through the development of new technologies and more differentiated products. Of course, such countries should also seek lower production costs. In the absence of a strong national bourgeoisie, the response could come from a vigorous public sector capable of developing relevant and dynamic economic sectors.

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APPENDIX

Figure 5: Currency Valuation and Economic Growth

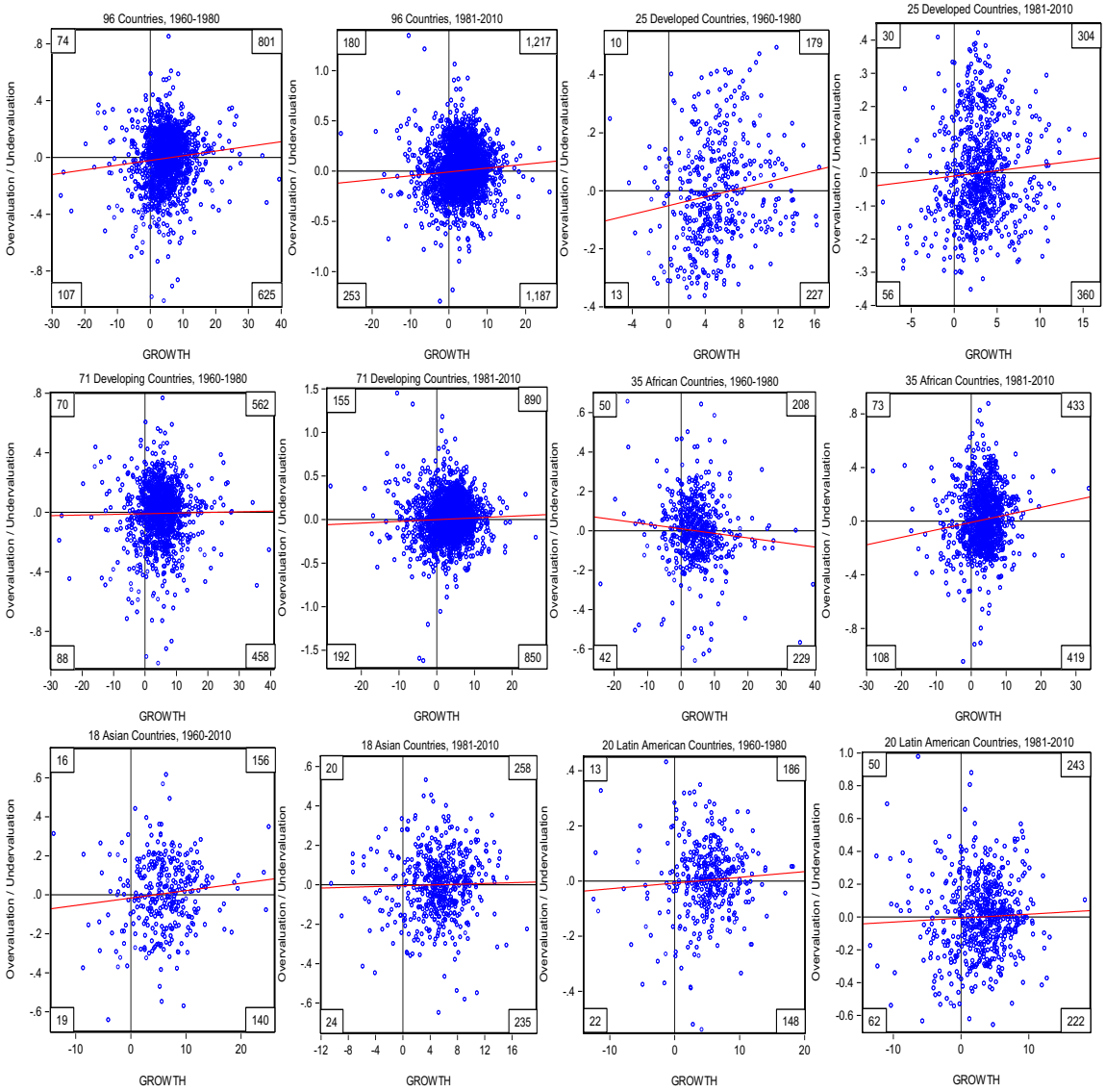


Figure 6: Undervaluation and Effective Demand: Developed Countries

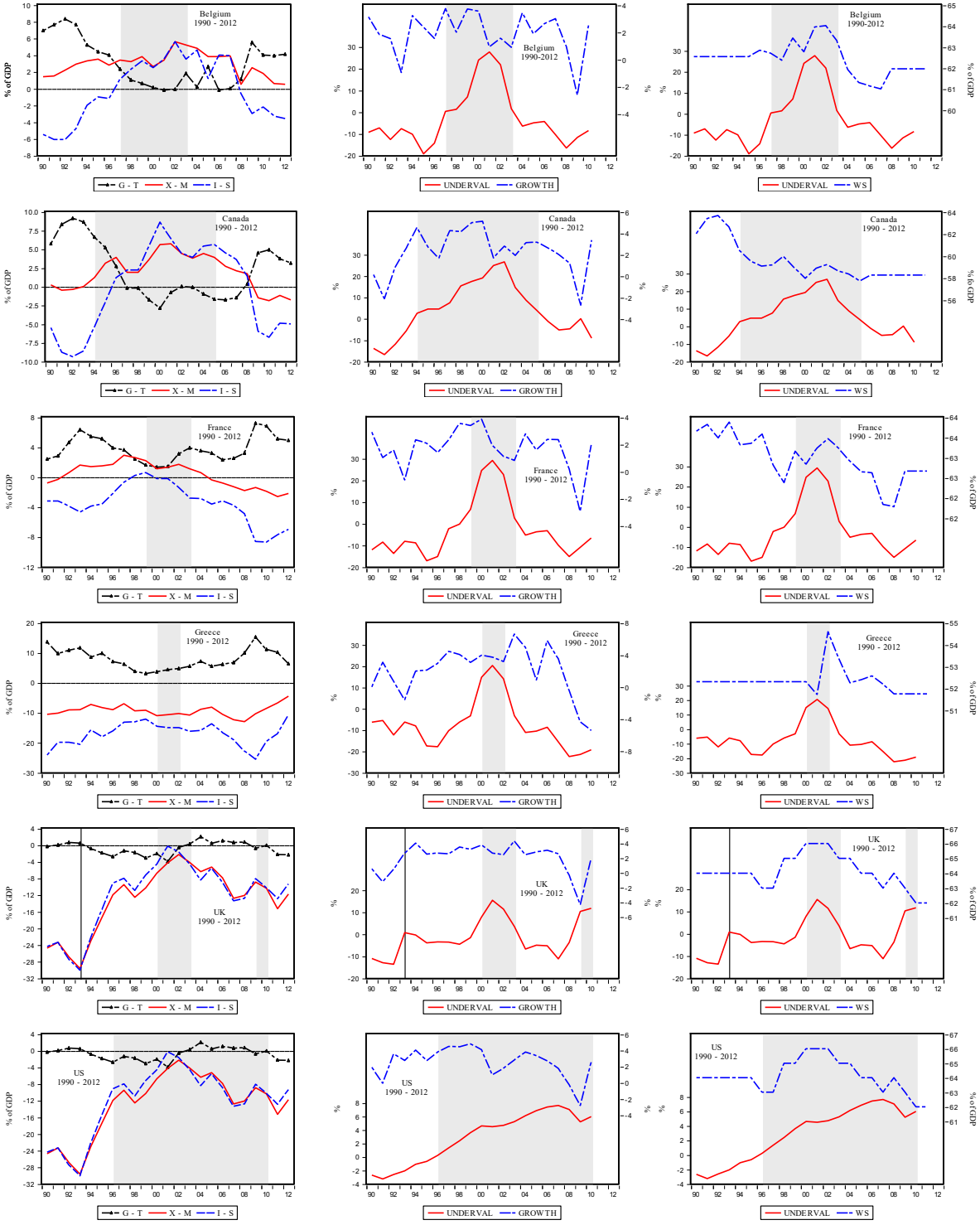


Figure 7: Undervaluation and Effective Demand: African Countries

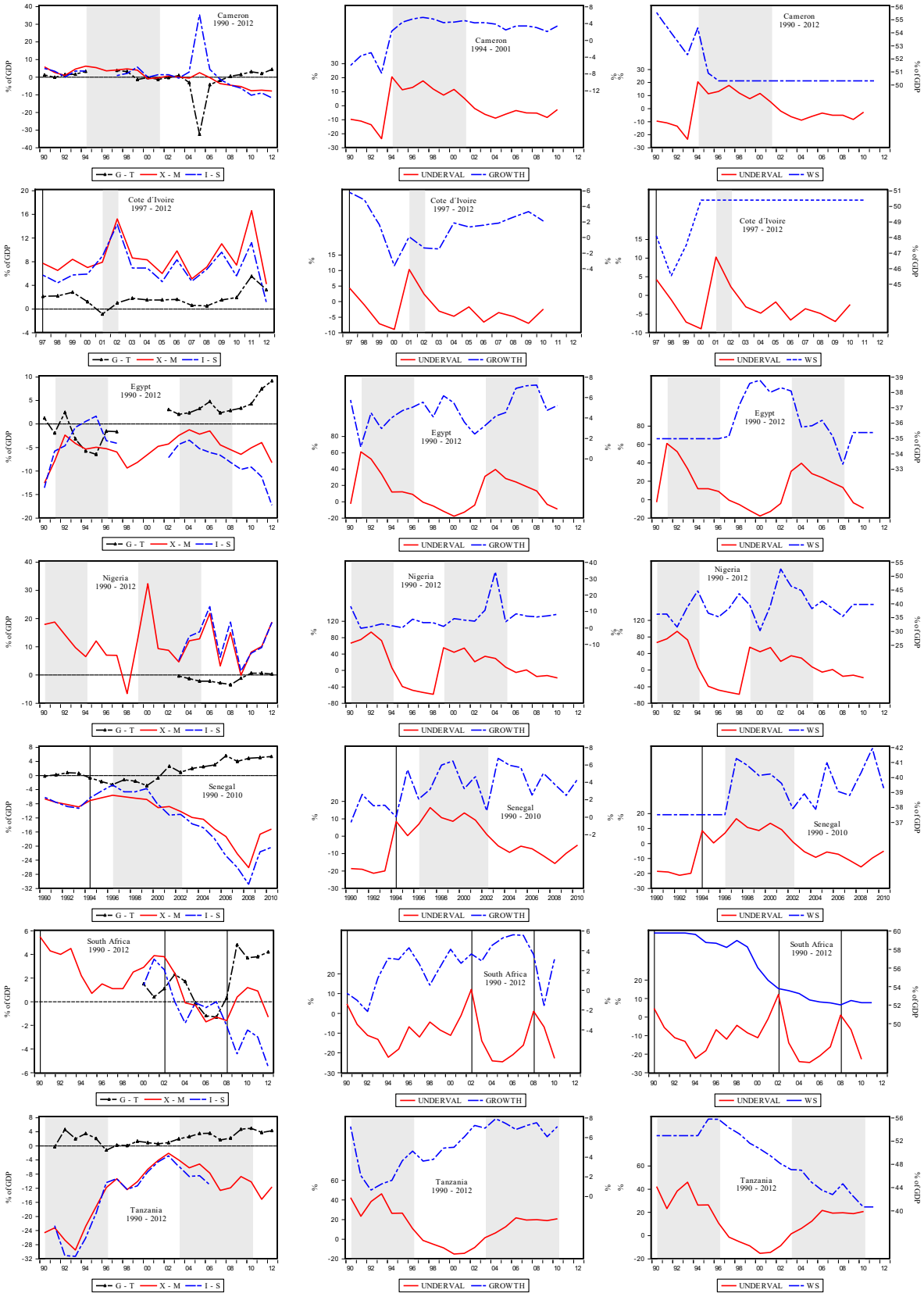
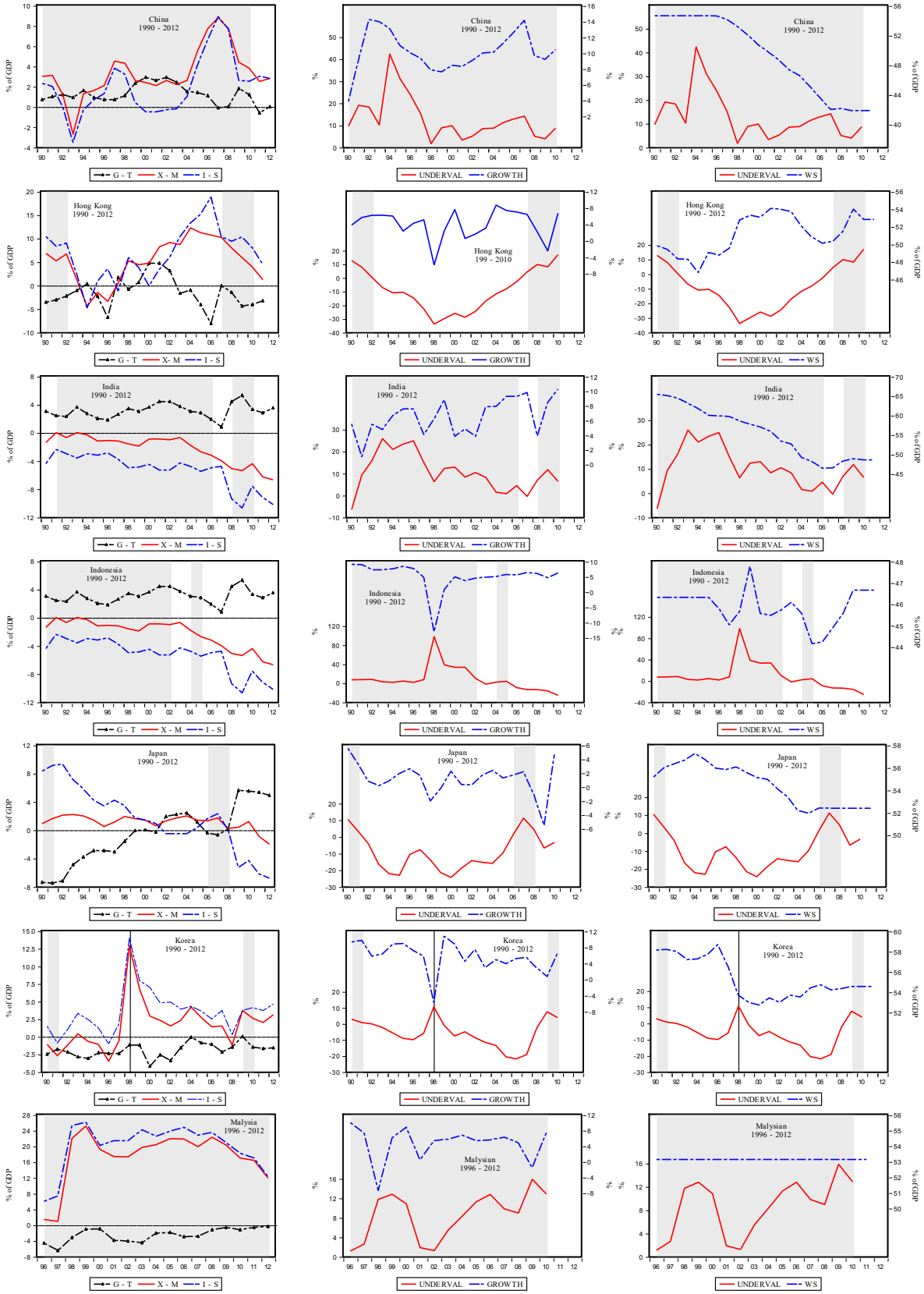


Figure 8: Undervaluation and Effective Demand: Asian Countries



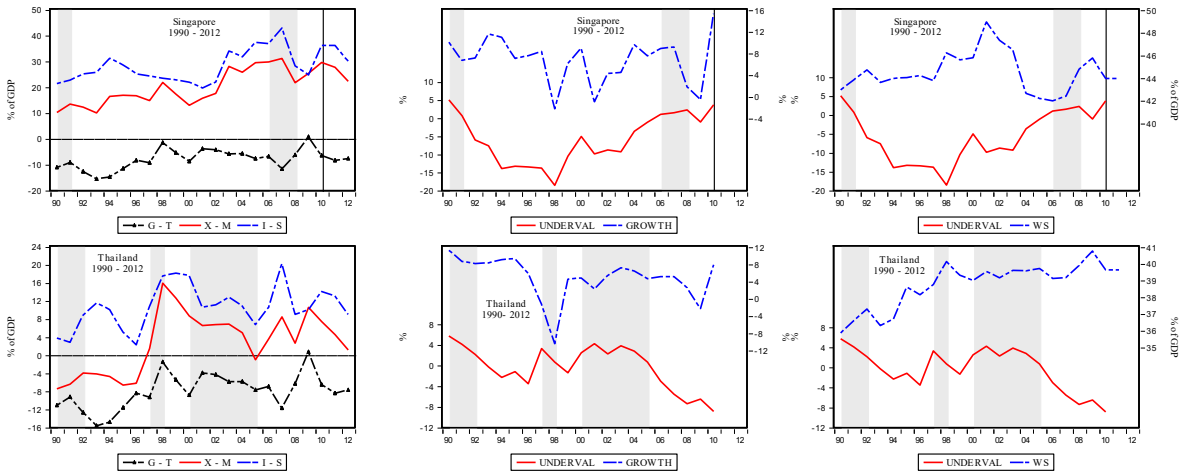
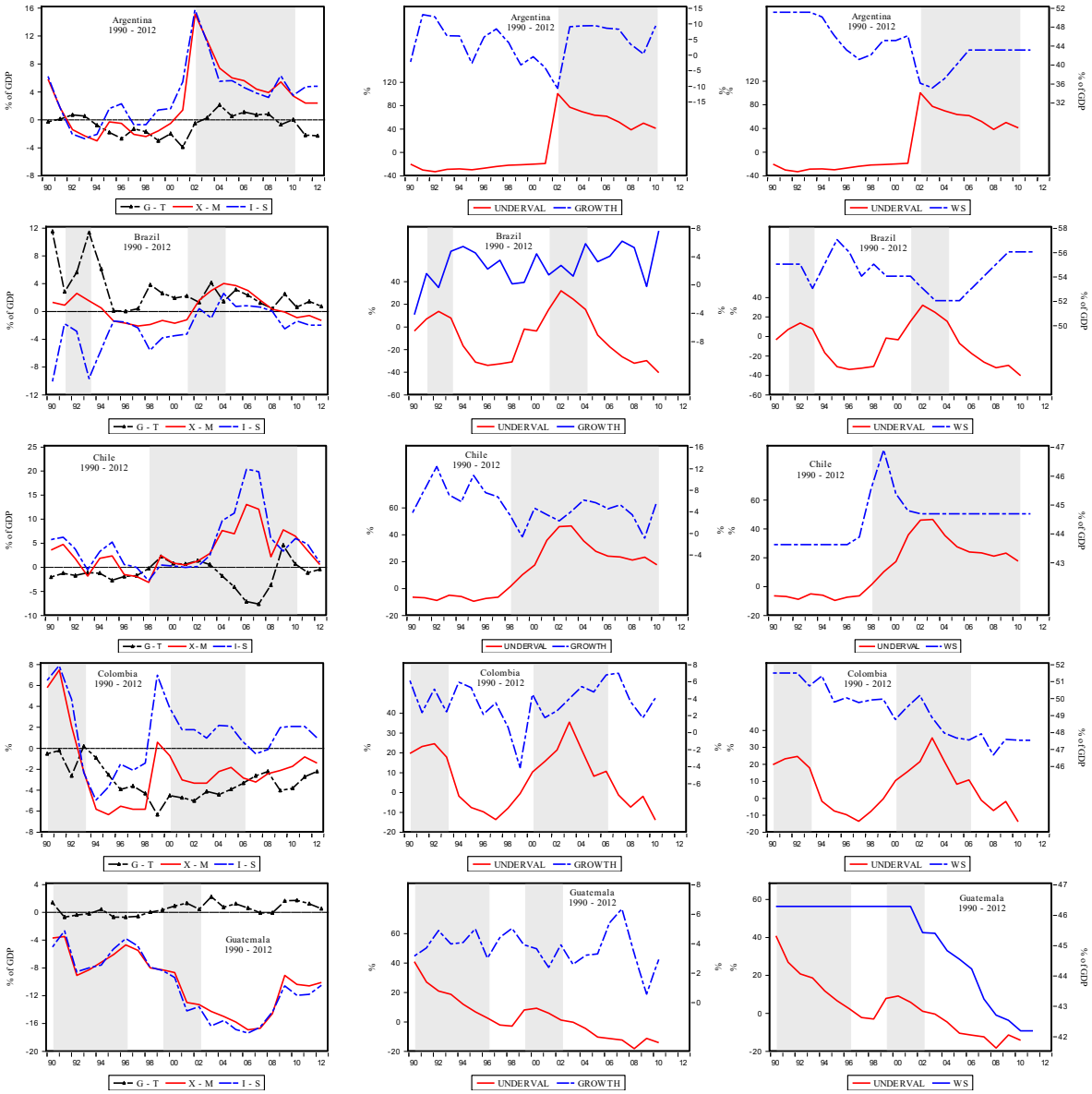


Figure 9: Undervaluation and Effective Demand: Latin American Countries



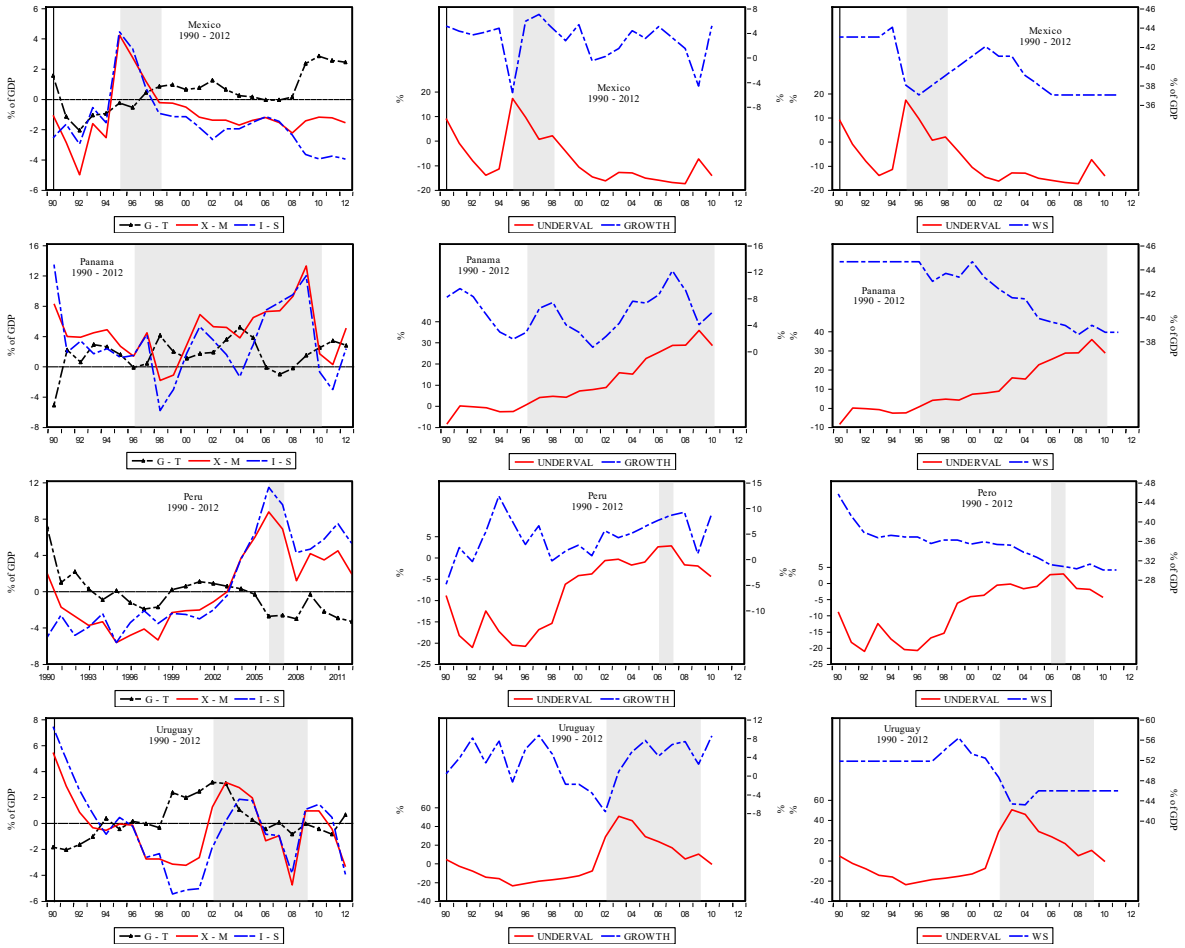


Table 8: Developed Countries

Australia (AUS)	Finland (FIN)	Israel (ISR)	New Zealand (NZL)	Sweden (SWE)
Austria (AUT)	France (FRA)	Italy (ITA)	Norway (NOR)	Switzerland (CHE)
Belgium (BEL)	Greece (GRC)	Japan (JPN)	Portugal (PRT)	Taiwan (TWN)
Canada (CAN)	Hong Kong (HKG)	Korea (KOR)	Singapore (SGP)	U. K. (GBR)
Denmark (DNK)	Ireland (IRL)	Netherlands (NLD)	Spain (Spain)	USA (USA)

Table 9: Developing Countries

Algeria	Costa Rica	India	Nepal	Syria
Argentina	Cote d`Ivoire	Indonesia	Nicaragua	Tanzania
Bangladesh	Dominican Rep.	Jamaica	Niger	Thailand
Benin	Ecuador	Jordan	Nigeria	Togo
Bolivia	Egypt	Kenya	Pakistan	Trinidad &Tobago
Botswana	El Salvador	Madagascar	Panama	Tunisia
Brazil	Ethiopia	Malawi	Papua New Guinea	Turkey
Burkina Faso	Gabon	Malaysia	Paraguay	Uganda
Burundi	Gambia, The	Mali	Peru	Uruguay
Cameroon	Ghana	Mauritania	Philippines	Venezuela
Cent'l Africa R.	Guatemala	Mauritius	Romania	Zambia
Chile	Guinea	Mexico	Senegal	
China	Guinea-Bissau	Morocco	Sierra Leone	
Colombia	Haiti	Mozambique	South Africa	
Congo, R of	Honduras	Namibia	Sri Lanka	

Table 10: African Countries

Algeria	Congo, R of	Guinea	Mauritius	Sierra Leone
Benin	Cote d`Ivoire	Guinea-Bissau	Morocco	South Africa
Botswana	Egypt	Kenya	Mozambique	Tanzania
Burkina Faso	Ethiopia	Madagascar	Namibia	Togo
Burundi	Gabon	Malawi	Niger	Tunisia
Cameroon	Gambia, The	Mali	Nigeria	Uganda
Cent'l Africa R.	Ghana	Mauritania	Senegal	Zambia

Table 11: Asian Countries

Bangladesh	Indonesia	Nepal	Singapore	Thailand
China	Japan	Pakistan	Sri Lanka	Turkey
Hong Kong	Korea	Papua New Guinea	Syria	
India	Malaysia	Philippines	Taiwan	

Table 12: Latin American Countries

Argentina	Colombia	El Salvador	Jamaica	Paraguay
Bolivia	Costa Rica	Guatemala	Mexico	Peru
Brazil	Dominican Rep.	Haiti	Nicaragua	Uruguay
Chile	Ecuador	Honduras	Panama	Venezuela

The statistical sources to construct the macro-balances were the following:

World Bank, World Development Indicators (http://data.worldbank.org/data-catalog/world-development-indicators)

International Monetary Fund, World Economic Outlook (Database) (https://www.imf.org/external/pubs/ft/weo/2016/01/weodata/index.aspx)