EXCHANGE RATE MISALIGNMENT AND ECONOMIC GROWTH

Justin Dubas, Texas Lutheran University

ABSTRACT

This paper explores how exchange rate misalignment may impact economic growth and development. Using PDOLS estimation to arrive at a measure of misalignment and employing standard growth regressions, a number of interesting results emerge. This paper finds that exchange rate misalignment has asymmetric effects. Specifically, overvaluation significantly hurts growth while undervaluation has the opposite effect (though statistically insignificant). Misalignment affects developed and developing countries differently in that developing countries are more sensitive to the growth effects of misalignment. Finally, the persistence of misalignment matters. Continuing misalignment of either variety are harmful for growth. This suggests that it is not a viable strategy for a country to intentionally undervalue a currency with the aim of improving the competitiveness of the export sector. In the end, it seems clear that a country needs to limit misalignment and maintain an exchange rate that is closely in line with the equilibrium rate. **JEL Classifications**: F31, F33, F43

INTRODUCTION

There have been a number of studies that attempt to test the relationship between exchange rate misalignment and economic performance (usually growth). Edwards provided the seminal work and, based on his model, found a significant negative relationship between economic growth and overvaluation (1988). Ghura and Grennes use a number of measures of misalignment and come to the same conclusion as do Cavallo et al (1993;1990). Collins and Razin adapted Edwards's original model and also found a significant negative impact, but discovered it was only significant among countries with 'very high' degrees of overvaluation (1997). It seems that there is a consensus regarding the negative effects of overvaluation on growth. This paper is organized into four sections: a background section that outlines the theoretical channels through which misalignment impacts goods and financial markets, a section detailing the estimation and methodology of this study, a section containing the results, and a concluding section.

BACKGROUND

Goods Markets

The most obvious effect of real exchange rate overvaluation is a loss in the external competitiveness of export-producing firms. As a currency becomes overvalued, it is increasingly difficult to sell products in foreign markets in an open economy (Dornbusch 1988, Collins & Razin 1997). This is especially problematic when an export firm is a price taker and constrained by world prices which is often the case for developing countries that rely on exports of non-differentiated primary products. Profit margins tend to fall and the financial health of these firms are compromised with overvaluation. A number of authors find misalignment disproportionately affects agricultural sectors (Cho et al. 2001, Pick & Vollrath 1994, World Bank 1984).

This channel also impacts exporters of manufactured goods. However, overvaluation may not hurt the export industry as much since manufacturing firms may have some price setting ability and may have access to now-less expensive intermediate inputs from abroad. The empirical work, though, is clear and suggests that manufactured exports are hurt more than they are helped. Nabli and Varoudakis find that for the Middle East and Northern Africa region (MENA), real exchange rate (RER) overvaluation reduced the ratio of manufactured exports to GDP 18 percent per year on average (Nabli & Varoudakis 2002, p.10). With fewer profits to be made in the export sector, firms may withhold on investment projects (due to a lower rate of return), or even cut back production. After a period of sustained misalignment, disinvestment will result (Dornbusch 1988, Williamson 1985). When the situation is severe, in that misalignment is persistent or very large, entire firms or even industries may disappear. A number of papers find statistical support for this contention (Ghura & Grennes 1993, Bleaney & Greenaway 2001, Hasnat 1999, Kemme & Teng 2000).

Investment will also be affected by uncertainty caused by misalignment. Investment decisions are based on price signals and when these become distorted (due to misalignment) resources are allocated inefficiently (Nabli & Varoudakis 2002, Domac & Shabsigh 1999). Or when firms recognize the RER as misaligned but do not know the correct RER, the uncertainty also tends to affect investment (Kemme & Teng 2000). This will not only affect domestic firms but also multinational firms negatively (Collins & Razin 1997, Dornbusch 1988). Productive capacity may substantially fall, with recovery usually quite slow (Dornbusch 1988). Capital accumulation, a major impetus for growth, is therefore strongly affected by misalignment.

Overvaluation may slow growth through its impact on import-competing firms as well. With the overvalued currency, it is cheaper to purchase intermediate inputs from foreign firms than from domestic import-competing firms (Dornbusch 1988). The goods market can be severely disrupted by real exchange rate misalignment through its impact on export and import-competing firms, both in manufacturing and agricultural sectors.

Financial Markets

As outlined in the above, the economy is often disrupted during a period of sustained misalignment (especially overvaluation). Adjustment eventually occurs, often in the context of a currency, balance of payments and/or a financial crisis (Dornbusch 1988, p. 93-94). This subsection outlines the literature on misalignment and crisis.

A number of studies have found that currency crisis is often linked to real exchange rate misalignment (Frankel & Rose 1996, Goldfjan & Valdes 1998, Kaminsky et al. 1998, Cuaresma & Slacik 2009, Esquivel & Larrain 1998). Typically, the mechanism involves a speculative attack on a fixed currency that is perceived as misaligned. This creates not only pressure for a currency crisis, but also a financial crisis at large. With overvaluation, capital flight takes place, as domestic currency and other assets are sold at the official parity as economic agents speculate on the duration of the overvaluation (Dornbusch 1988, Domac & Shabsigh 1999). If monetary authorities defend the exchange rate, they do so with higher interest rates which can dampen growth through its impact on investment.

When the adjustment does not come in the time frame expected by those hoarding foreign assets (such as dollars), speculators will realize large losses (Dornbusch 1988). If such behavior is widespread, as it often is, many are at risk of going bankrupt and may be unable to pay the loans. Of course banks then have difficulty with heightened loan exposure, particularly if they also took part in speculating. When the public views this as significant, depositors may worry about their funds and a bank run ensues, thus increasing the chance of financial crisis.

Aside from speculation, there are other mechanisms as well that lead from misalignment to financial crisis. Firms in export sectors add fragility to the banking sector when they incorrectly perceive the overvaluation to be temporary and attempt to finance the slowdown instead of cutting production (Williamson 1985). If the misalignment is long lasting, firms are left with excess capacity and debt difficulties. Bankruptcy becomes a possibility and as many firms face these difficulties, banks may be put at risk as well as their bad loan exposure increases (Williamson 1985).

If on the other hand the currency is devalued/depreciates quickly instead of being defended by monetary authorities, there is still a significant risk of financial crisis, especially in developing countries where borrowing is typically denominated in foreign currency (Chang & Velasco 2000). This creates the possibility that the currency crisis turns into a banking crisis as balance sheets are affected. The value of a firm's liabilities increase and they are now more likely to face serious financial problems (1).

All of these contribute to an environment that is marked by uncertainty, higher interest rates (through either defending an exchange rate or through country risk premium), firm failures (export sector and otherwise) and bank failures as real debt increases (Domac and Shabsigh 1999, Dornbusch 1988). The resulting financial instability (or perception of instability) may inhibit future investment through interest rate volatility (Cavallo et al. 1990, p. 62; Kemme and Teng 2000). These all contribute to slow and/or negative economic growth, both in the present and possibly into the future.

ESTIMATION: ECONOMIC GROWTH AND MISALIGNMENT

Though there have been a few studies on the subject of exchange rate misalignment and economic growth, the studies are generally limited in the number of countries included as well as in the estimation of exchange rate misalignment. This study makes use of a significantly larger sample of countries and a longer time period, and takes advantage of the power of panel dynamic OLS (PDOLS) regression techniques to generate a measure of misalignment. The results from a study with these attributes should bring forth a clearer picture of the impact exchange rate misalignment may have on economic growth.

Measuring Misalignment

The most widely utilized approach to measure real exchange rate misalignment has been the Purchasing Power Parity (PPP) method, due in part to its simplicity. Other techniques that have been used include the trade equations-elasticities estimation and general-equilibrium modeling (FEERs, BEER, NATREX) (2). This paper uses a panel dynamic OLS (PDOLS) methodology. It does not address the specific cause of misalignment, but instead captures movements away from the long run equilibrium as implied by changes in the permanent components of the fundamental determinants. The approach does not explicitly run the fundamentals through a filter (such as Hodrick-Prescott filter, Beveridge-Nelson decomposition), but does so implicitly with the use of PDOLS estimation techniques.

To arrive at a measure for real effective exchange rate misalignment, the real effective exchange rate is defined as:

$$REER = \prod_{i=1}^{m} \frac{(E_{fc1})^{\omega_{id}} \times WPI_{g5}}{CPI_1} \quad (1)$$

where $i=1,2,...m$ is the number of trading partners of the home country, E_{fc1} is units of the foreign currency per unit of domestic currency of country *1*, WPI_{g5} is a weighted average of the wholesale price index of the G-5 countries (United States, Germany, France, United Kingdom and Japan) (3), and CPI_1 is the consumer price index for country *1*. ω_{id} is the trade weight for each trading partner, and $\sum_{i=1}^{m} \omega = 1$. An increase in the *REER* indicates a currency appreciation.

Utilizing the literature on determinants of exchange rates, this paper follows Dubas (2009) and estimates misalignment for each country *i* at each time period *t* as:

$$\ln REER_{it} = \alpha_i + \psi_t + \beta_1 \ln OPEN_{it} + \beta_2 \ln PROD_{it} + \beta_3 \ln TOT_{it} + \beta_4 \ln GOVCONS_{it} + \beta_5 \ln EXCR_{it} + \beta_6 \ln KFLOW_{it} + \mu_{it} \quad (2)$$

(2)

where α_i is a dummy variable for each country *i*, ψ_t is a dummy variable for a common time trend *t*, and μ_{it} is the error term.

To take advantage of the power of PDOLS, the two-step procedure is as follows: The first step consists of regressing one lead, one lag, and level of the difference of each independent variable as well as the individual intercept on each variable used in the analysis (both right hand and left hand variables from equation (2)). In so doing, the estimated residuals in each regression are used as estimates for *lnREER, lnOPEN, lnPROD, lnTOT, lnGOVCONS, lnEXCR,* and *KFLOW*, denoted with a *tilde*.

These are then used in the second step to estimate a cointegrating relationship. The estimation consists of the following regression:

$$\ln \widetilde{REER}_{it} = \propto_i + \psi_t + \beta_1 \ln \widetilde{OPEN}_{it} + \beta_2 \ln \widetilde{PROD}_{it} + \beta_3 \ln \widetilde{TOT}_{it} + \beta_4 \ln \widetilde{GOVCONS}_{it} + \beta_5 \ln \widetilde{EXCR}_{it} + \beta_6 \widetilde{KFLOW}_{it} + \varepsilon_{it} \quad (3)$$

Essentially, the estimation has captured the long run relationship of the real effective exchange rate and its determinants. The degree of misalignment is the equilibrium error, ε_{it} (4).

Misalignment and Growth

The use of regression analysis to explore economic growth has become fairly standard following the seminal work of Barro and Lee (1994). The approach here follows Barro and Lee (1994) and employs variables often used in the empirical growth literature in a panel data setting (5). Data sources and definitions are included in the Data Appendix. The dependent variable in these regressions is real GDP per capita growth (GDP_GR) taken from the World Bank's *World Development Indicators [WDI]*. The independent variables begin with population growth rates (POP_GR), also taken from WDI. A lower population growth rate stems from the decision of households to have fewer children. If this is the case, there is greater potential savings, and thus a higher potential growth rate (Barro 1995). Investment as a percent of GDP (INV_GDP, computed from WDI data) also enters with an expected positive sign as investment adds to the capital stock available within a country. Openness (OPEN, proxied as [imports +exports]/GDP from WDI data) has been argued as one way to increase growth potential, and one would expect a positive sign here

as well. A change in the terms of trade (DTT, 'Exports as a capacity to import' from WDI data) is thought to be exogenous for developing countries. The expected sign here is positive in that an improvement in the terms of trade should yield higher domestic income. A measure of political risk/civil liberties (CL, taken from Freedom House Country Rankings) is also included to proxy for instability and rule of law. Secondary education (SEC, taken from WDI and linearly interpolated to obtain annual observations) attainment rates are included as a proxy for human capital development. Of course, the expected sign here is positive since higher education levels should yield higher productivity in workers. Government consumption as a percent of GDP (GOVCON_1, taken from WDI data and lagged one period in the analysis to avoid endogeneity problems) is also used as an explanatory variable and is usually associated with a negative sign due to the crowding out effect seen in empirical results.

The final explanatory variable to be used then is that of misalignment (MIS, obtained by estimation above). Based on the literature review, misalignment in general is undesirable in that resources are misallocated, suggesting a negative relationship between misalignment and growth. Furthermore, theory suggests that overvaluation is more detrimental than undervaluation.

With a cross section of 102 countries (listed in Table 1) and annual data spanning 32 years (1971-2002), there are a number of possible econometric techniques that are used to estimate misalignment. The studies in misalignment and growth thus far have looked at this in a pooled OLS setting. However, this may not be the most appropriate estimation. If there is heterogeneity between individual countries

Table 1
Country List

Angola	Denmark	Kazakhstan	Romania
Argentina	Dominican Republic	Korea	Russia
Australia	Ecuador	Kuwait	Saudi Arabia
Austria	Egypt	Latvia	Senegal
Azerbaijan	El Salvador	Lithuania	Singapore
Bahamas	Estonia	Malaysia	Slovak Republic
Bahrain	Fiji	Malta	Slovenia
Barbados	Finland	Mauritania	South Africa
Belarus	France	Mauritius	Spain
Belgium	Gabon	Mexico	Sri Lanka
Bolivia	Germany	Morocco	Swaziland
Bosnia & Herzegovina	Ghana	Namibia	Sweden
Botswana	Greece	Netherlands	Switzerland
Brazil	Guatemala	New Zealand	Syria
Cameroon	Honduras	Nigeria	Thailand
Canada	Hungary	Norway	Trinidad and Tobago
Chile	Iceland	Oman	Tunisia
China	India	Pakistan	Turkey

China: Hong Kong	Indonesia	Panama	Ukraine
Colombia	Iran	Papua New Guinea	United Kingdom
Congo	Ireland	Paraguay	United States
Costa Rica	Israel	Peru	Uruguay
Cote d'Ivoire	Italy	Philippines	Venezuela, RB
Croatia	Jamaica	Poland	Vietnam
Cyprus	Japan	Portugal	Zimbabwe
Czech Republic	Jordan		

in the sample or heterogeneity over time, pooled OLS is biased (Hsiao 1986). To test this, the R-squared from a pooled OLS regression was compared to that of the LSDV (Least Squares Dummy Variable, or Fixed Effects (6)) model with (a) cross-sectional dummies, (b) time dummies and (c) both cross-sectional and time series dummies. In each case, the R-squared from the LSDV model was significantly higher (in relative terms) than under the pooled OLS, suggesting that pooled OLS is inappropriate. Also, a Breusch-Pagan Lagrangian multiplier test suggests panel effects are present, and thus rejects the use of pooled OLS as well. The remainder of the paper proceeds by relying on the estimation results of the LSDV model.

The baseline regression is given as:

$$GDP\_GR_{it} = \alpha_i + \theta_t + \beta_1 INV\_GDP_{it} + \beta_2 POP\_GR_{it} + \beta_3 GOVCON\_1_{it} + \beta_4 OPEN_{it} + \beta_5 DTT_{it} + \beta_6 GDP7 + \beta_7 CL_{it} + \beta_8 SEC_{it} + \beta_9 MIS_{it} + \varepsilon_{it} \quad (4)$$

RESULTS: EXCHANGE RATE MISALIGNMENT AND ECONOMIC GROWTH

Baseline Regression Results

The results from the regression are presented in Table 2. Although the analysis rejects first-order serial correlation, there is evidence that the results display groupwise heteroskedasticity. The standard errors that are reported are panel corrected standard errors as proposed by Beck and Katz to eliminate such bias and obtain consistent estimations (1995).

When the baseline regression is estimated as in Equation 1, the results are generally as expected. The variables that enter in a statistically significant way are the terms of trade (DTT), investment (INV GDP), and secondary education levels (SEC). Terms of trade and investment are positive (as expected), but the level of secondary education had an unexpected negative sign.

This is significant only at the 10% level, though, and it may reflect conditional convergence. Population growth, government consumption and openness were all statistically insignificant.

Most importantly, however, the misalignment indicator (MIS) suggests that growth is not hampered by exchange rate misalignment. The coefficient suggests misalignment is harmful (the coefficient is -0.036), but insignificant. This is not consistent with the previous work done on the subject, all of which suggests there is a significant negative impact.

When comparing the results of developed countries versus developing, the insignificance of the misalignment remains. But, the signs are different for these groups of countries. While overall misalignment has a negative sign for developing countries, it is positive for developed countries (though insignificant). It suggests that there are asymmetric effects of misalignment in that the potential negative impact of misalignment on developing countries far outweighs the potential positive impact while the opposite is true for developed countries. For the developing countries, this could be the case if an overvalued currency yields less expensive intermediate inputs but effectively restricts exports to the rest of the world, or if an undervalued currency yields the converse—more expensive intermediate inputs but a much more competitive export sector.

Table 2

Exchange Rate Misalignment and Growth

Variable	All Countries	Developed Countries	Developing Countries
INV_GDP	0.256***	0.268***	0.281***
	(0.039)	(0.060)	(0.045)
POP_GR	-0.269	0.172	-0.408
	(0.318)	(0.370)	(0.425)
GOVCON_1	0.003	-0.064	0.001
	(0.021)	(0.075)	(0.021)
OPEN	-0.014	0.122***	-0.043
	(0.029)	(0.041)	(0.032)
DTT	0.084***	0.024	0.092***
	(0.016)	(0.027)	(0.018)
CL	-0.076	-0.102	-0.039
	(0.199)	(0.293)	(0.221)
SEC	-0.044*	0.013	-0.079**
	(0.023)	(0.021)	(0.035)

MIS	-0.036	0.044	-.057
	(0.038)	(0.041)	(0.046)
Constant	-1.475	-6.656	0.854
N	760	225	535
R^2	0.395	0.540	0.420

Notes: Standard errors are in parentheses. Significance levels are denoted by ***: 1%, **: 5%, *: 10%

Overvaluation versus undervaluation

Clearly, these asymmetric effects need to be investigated further. The previous results make sense in that theory suggests misalignment has both positive and negative impacts, and these may be in effect cancelling each other out. So the regression was split into 2 samples, one in which all observations of MIS were overvalued, and another in which only undervaluation is investigated. Here the asymmetric nature of misalignment emerges.

When all countries are again included, the control variables have the same signs as before, and those that were significant previously are still significant while those that were insignificant remain insignificant. The results for overvaluation are presented in Table 3, while the results for undervaluation are in Table 4. In Table 3, the explanatory variable of interest (overvaluation) is the major change. The results suggest that overvaluation indeed hurts economic growth for all countries. The coefficient is strongly negative (-.171) and significant at the 1% level. The interpretation is that a 10% increase in overvaluation hurts economic growth by about 1.7% in any given year.

If the sample only includes cases of undervaluation, the coefficient associated with the misalignment indicator is in fact positive. A 10% increase in undervaluation leads to an increase in growth of 0.9%. However, this estimate is not statistically significant at standard levels (7). This is an interesting finding that needs further exploration. There may be asymmetries in the degree of undervaluation (as noted by Collins and Razin who found that countries with 'high' but not 'very high' degrees of undervaluation experienced higher economic growth (1997, p.18)). Though statistically insignificant, it leaves open the possibility that undervaluation is economically meaningful or may be helpful in some circumstances.

As can be seen from comparing the results of over- and undervaluation on developing versus developing countries, the costs/benefits of maintaining a misaligned exchange rate are different. For developed countries, the coefficient on overvaluation is -.041 while undervaluation has a coefficient of .056. Developing countries, on the other hand, the estimates are -.157 and .110. The differences in magnitude aside, the upside is greater than the downside for developed countries, while the opposite is true of developing countries.

Table 3

Overvaluation and Growth

Variable	All Countries	Developed Countries	Developing Countries
INV_GDP	0.230***	0.368***	0.269***
	(0.060)	(0.082)	(0.072)
POP_GR	-1.231	-2.038***	-1.176
	(0.586)	(0.634)	(0.789)
GOVCON_1	0.001	0.103	-0.009
	(0.026)	(0.093)	(0.027)
OPEN	-0.052	0.153**	-0.075
	(0.044)	(0.074)	(0.048)
DTT	0.059**	0.091**	0.061**
	(0.025)	(0.037)	(0.025)
CL	0.239	0.220	0.353
	(0.319)	(0.362)	(0.374)
SEC	-0.015	0.033	-0.045
	(0.031)	(0.028)	(0.052)
MIS	-0.171***	-0.041	-0.157**
	(0.066)	(0.075)	(0.081)
Constant	-0.150	-18.200	5.513
N	347	105	242
R^2	0.503	0.612	0.544

Notes: Standard errors are in parentheses. Significance levels are denoted by ***: 1%, **: 5%, *: 10%

Table 4

Undervaluation and Growth

Variable	All Countries	Developed Countries	Developing Countries
INV_GDP	0.280***	0.291***	0.276***
	(0.043)	(0.069)	(0.051)
POP_GR	0.470	0.870**	0.182
	(0.310)	(0.416)	(0.417)
GOVCON_1	-0.033	-0.287***	-0.037
	(0.026)	(0.093)	(0.027)
OPEN	0.009	0.097*	-0.014
	(0.036)	(0.057)	(0.041)
DTT	0.110***	-0.026	0.129***
	(0.017)	(0.038)	(0.018)
CL	-0.194	0.195	-0.214
	(0.229)	(0.527)	(0.246)

SEC	-0.043	0.001	-0.064
	(0.028)	(0.025)	(0.039)
MIS	0.101	0.056	0.110
	(0.066)	(0.049)	(0.093)
Constant	-7.661	-7.972	-5.613
N	413	120	293
R^2	0.529	0.747	0.536

Notes: Standard errors are in parentheses. Significance levels are denoted by ***: 1%, **: 5%, *: 10%

Persistent misalignment

With careful control of exchange rates, the results thus far suggest that it may be warranted to maintain an undervalued exchange rate to foster a competitive export sector to expand economic growth. However, a deeper look at misalignment suggests this is not a viable strategy (8).

If a currency is overvalued in year *t-1*, growth in year *t* is not affected (although the sign is positive). This may be due to a movement back towards the equilibrium rate. But, for a country with an *undervalued* currency in year *t-1*, growth in year *t* is in fact adversely affected. This is statistically significant and relatively large in magnitude. In fact, the coefficient is nearly as negative (-.143) as the coefficient associated with the original overvaluation (-.171). This is shown in Table 5.

When exchange rates are overvalued in both year *t* and *t-1*, the effects of persistent overvaluation are quite drastic. Table 6 shows that if overvaluation remains for at least two years, the continued overvaluation has a major impact on growth. In fact, the coefficient associated with misalignment in year *t* if there is overvaluation in both years is -1.792. The sign and the magnitude suggest that it is important for policy makers to limit misalignment.

Table 5

Previous Period Misalignment (*t-1*)and Growth

Variable	Overvaluation in *t-1*	Undervaluation in *t-1*
INV_GDP	0.262***	0.247***
	(0.051)	(0.064)
POP_GR	0.241	-1.068**
	(0.458)	(0.449)
GOVCON_1	0.037	-0.009
	(0.024)	(0.032)
OPEN	-0.044	-0.110**
	(0.037)	(0.052)
DTT	0.101***	0.095***
	(0.021)	(0.019)
CL	-0.359	-0.251
	(0.282)	(0.277)

SEC	-0.072**	-0.022
	(0.029)	(0.036)
MIS *t-1*	0.063	-0.192***
	(0.059)	(0.052)
Constant	0.537	5.113
N	350	415
R^2	0.535	0.555

Notes: Standard errors are in parentheses. Significance levels are denoted by ***: 1%, **: 5%, *: 10%

Table 6

Persistent Misalignment (Period *t, t-1*) and Growth

Variable	Overvaluation in *t-1, t*	Undervaluation in *t-1, t*
INV_GDP	-0.102	0.219***
	(0.125)	(0.081)
POP_GR	2.032*	0.457
	(1.053)	(1.005)
GOVCON_1	-0.445***	-0.056
	(0.092)	(0.047)
OPEN	0.103	0.001
	(0.106)	(0.072)
DTT	0.023	0.060**
	(0.053)	(0.028)
CL	2.568**	-0.662
	(1.066)	(0.419)

SEC	-0.120	-0.082
	(0.073)	(0.071)
MIS *t-1*	0.370	-0.263**
	(0.250)	(0.119)
MIS *t*	-1.792***	-0.045
	(0.273)	(0.244)
Constant	-24.631	5.018
N	82	135
R^2	0.905	0.791

Notes: Standard errors are in parentheses. Significance levels are denoted by ***: 1%, **: 5%, *: 10%

If an exchange rate is undervalued for an extended period of time (in this case, two years), the signs both become negative. The coefficient is significant for the undervaluation in period *t* at -.263. It is not significant for year *t*, but the sign is the opposite of what would be expected if continued undervaluation could help the export sector.

CONCLUSION

Overvaluation can seriously affect the growth prospects of a developing country. The impact is significant, especially if overvaluation is persistent. Undervaluation is typically viewed more favorably, but the data suggests this may not be the case. In fact, undervaluation is insignificant in a particular year, but future growth is adversely affected. There is no strategy then to manipulate exchange rates to create a competitive export sector (in the case of undervaluation) or to obtain cheaper intermediate inputs for production (overvaluation). Ultimately, policy makers must make a concerted effort to keep the exchange rate reasonably close to that what the fundamentals would suggest.

REFERENCES

Barro, R. (1995). Inflation and Economic Growth. *Bank of England Quarterly Bulletin*, 1-11.

Barro, R. & Lee, J.W. (1994). Sources of Economic Growth. *Carnegie-Rochester Conference Series on Public Policy*, 40, 1-46.

Beck N. & Katz, J. (1995). What to Do (and Not to Do) with Time-Series Cross-Section Data. *American Political Science Review*, 89, 634-647.

Bleaney, M. & Greenaway, D. (2001). The Impact of Terms of Trade and Real Exchange Rate Volatility on Investment and Growth in sub-Saharan Africa. *Journal of Development Economics*, 65, 491-500.

Cavallo, D., Cottani J., & Khan, M.S. (1990). Real Exchange Rate Behavior and Economic Performance in LDCs. *Economic Development and Cultural Change*, 39(1), 61-76.

Chang, R. & Velasco, A. (2000). Financial Fragility and the Exchange Rate Regime. *Journal of Economic Theory*, 92(1), 1-34.

Cho, G., Sheldon, I. & McCorriston, S. (2001). Exchange Rate Misalignment and Agricultural Trade. *Ohio State University Working Paper*, AEDE-WP-0011-01.

Collins, S. & Razin, O. (1997). Real Exchange Rate Misalignments and Growth. *NBER Working Paper Series*, WP 6174.

Cuaresma, J.C. & Slacik, T. (2009). On the determinants of currency crises: The role of model uncertainty. *Journal of Macroeconomics*, 31(4), 621-632.

Domac, I. & Shabsigh, G. (1999). Real Exchange Rate Behavior and Economic Growth: Evidence from Egypt, Jordan, Morocco, and Tunisia. *IMF Working Paper*, WP/99/40.

Dornbusch, R. (1988). *Overvaluation and Trade Balance*. In: Dornbusch R, Helmers FL (Eds), The Open Economy: Tools for Policymakers in Developing Countries. Washington D.C.: Oxford University Press (pp.80-107).

Dubas, J.M. (2009). The Importance of the Exchange Rate Regime in Limiting Misalignment.

World Development, 37(10), 1612-1622.

Edwards, S. (1988). Exchange Rate Misalignment in Developing Countries. *World Bank Occasional Paper Series*. Baltimore, MD: The Johns Hopkins University Press, Occasional Paper 2.

Esquivel, G. & Larrain, F. (1998) Explaining Currency Crises. *John F. Kennedy Faculty Research WP Series*, R98-07.

Frankel, J. & Rose, A. (1996). Currency Crashes in Emerging Markets: An Empirical Treatment. *NBER Working Paper Series*, WP 5437.

Ghura, D. & Grennes, T. (1993). The Real Exchange Rate and Macroeconomic Performance in Sub-Saharan Africa. *Journal of Development Economics*, 42, 155-174.

Goldfajn, I. & Valdes, R.O. (1998). Are currency crises predictable? *European Economic Review*, 42, 873-885.

Hasnat, B. (1999). Exchange Rate Misalignment and Foreign Direct Investment. *Atlantic Economic Journal*, 27(2), 235.

Hsiao, C. (1986). *Analysis of Panel Data*. Econometric Society Monographs (No. 11), Great Britain: Cambridge University Press.

Kaminsky, G., Lizondo, S. & Reinhart, C.M. (1998). Leading Indicators of Currency Crises. *IMF Staff Papers*, 45(1).

Kemme, D. & Teng, W. (2000). Determinants of the Real Exchange Rate, Misalignment and Implications for Growth in Poland. *Economic Systems*, 24(2), 171-205.

MacDonald, R. & Vieira, F. (2010). A Panel Data Investigation of Real Exchange Rate Misalignment and Growth. *CESifo Working Paper Series*, WP 3061.

Nabli, M. & Veganzones-Varoudakis, M.A. (2002). Exchange Rate Regime and Competitiveness of Manufactured Exports: The Case of MENA Countries. *World Bank Working Paper: Middle East and North Africa Country Series*, WP 27.

Pick, D. & Vollrath, T. (1994). Real Exchange Rate Misalignment and Agricultural Export Performance in Developing Countries. *Economic Development and Cultural Change*, 42(3), 555-571.

Rodrik, D. (2008) The Real Exchange Rate and Economic Growth. *Brookings Papers on Economic Activity*, 2, 365-412.

Shatz, H. & Tarr, D. (2000). Exchange Rate Overvaluation and Trade Protection: Lessons From Experience. *World Bank Working Paper*, WP 2289.

Toulaboe, D. (2006). Real Exchange Rate Misalignment and Economic Growth in Developing Countries, *Southwestern Economic Review*, 33(1), 57-72.

Williamson, J. (1985). *The Exchange Rate System*. Washington D.C.: Institute for International Economics.

World Bank (1984). *Toward Sustained Development in sub-Saharan Africa*. Washington D.C.: World Bank.

ENDNOTES

1. Liability dollarization will also affect central governments, which can then also induce a fiscal crisis.
2. For more details on these alternative approaches, refer to Dubas (2009).
3. Following the suggestion of Harberger (2004), these are weighted according to their relative importance in the Special Drawing Right (SDR) currency used by the IMF. Using WPI is well-established in the literature as a proxy for the price of tradable goods. See Baffes, Elbadawi and O'Connell (1999), Hinkle and Nsengiyumva (1999).
4. For more specifics on LSDV versus pooled OLS and PDOLS, as well as unit root tests and cointegration tests, refer to Dubas 2009.

5. It is not the intent to revisit the appropriateness and robustness of the control variables used, but rather to use them as a baseline from which to estimate the impact misalignment may have on growth.
6. Hausman specification tests suggest a fixed effects model is preferred to a random effects model given the data.
7. The *p*-value is .130, suggesting it is significant only at the 15% level.
8. The sample size is not sufficient to look at persistent over- and undervaluation as well as developed versus developing countries

DATA APPENDIX

GDP per capita Growth (GDP_GR): GDP per capita data is from the World Bank's *World Development Indicators (WDI)*. Growth rates are computed from this data.

Population Growth (POP_GR): Population data taken from WDI. Growth rates computed from this data.

Investment to GDP (INV_GDP): Investment derived by using GDP (current local currency units [LCU]) minus external balance on goods and services minus final consumption expenditure [I=GDP-NX-C]. This is expressed as a ratio to GDP. All data is from WDI.

Openness (OPEN). Measured as (Exports + Imports)/GDP, measured in constant local currency units. All data is from the WDI.

Change in Terms of Trade (DTT): Data taken from WDI listing of 'Exports as a Capacity to Import'. Data is then differenced to obtain rate of change.

Civil Liberties (CL): Measure of civil liberties, ranked from 1 (most civil liberties) to 7 (least). Data from Freedom House Country Rankings.

Secondary Education (SEC): Measured as the percentage of the population that has completed secondary education. Data is generally reported in WDI every five years, which was linearly interpolated to obtain annual observations.

Government Consumption (GOVCONS_1). Government consumption expressed as a percentage of GDP, lagged one period to prevent endogeneity problems. Data is from the WDI.

Misalignment (MIS): Obtained by PDOLS estimation as outlined in Dubas 2009.