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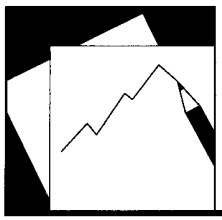

IMF Working Paper

The Relationship between the Foreign Exchange Regime and Macroeconomic Performance in Eastern Africa

Prepared by Janet G. Stotsky, Manuk Ghazanchyan, Olumuyiwa Adedeji, and Nils Maehle

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Abstract

This study examines the relationship between the foreign exchange regime and macroeconomic performance in Eastern Africa. The study focuses on seven countries, five of which decisively liberalized their foreign exchange regimes. The study assesses the relationship between (i) growth and various determinants, including the exchange regime, the real exchange rate, and current account liberalization; and (ii) inflation and various determinants, including lagged inflation, the nominal exchange rate, the exchange regime, and liberalization. We find that in our sample, for the determinants of growth, investment and the real exchange rate are significant determinants but not the exchange regime or liberalization; and for inflation, the lagged inflation rate, nominal exchange rate, and the de facto regime are significant. Exchange rate pass-through is limited.

JEL Classification Numbers: E60, F30, F41, F43

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I. INTRODUCTION

Most Eastern African countries have notably improved their macroeconomic performance in recent years, as reflected in higher average growth, generally moderate and stable inflation, and the accumulation of ample international reserve coverage. Key contributing factors to this improved performance were the reforms that these countries undertook to strengthen macroeconomic stability, and to liberalize their foreign exchange regimes. In the past, the foreign exchange regimes of many of these countries shared features of illiberal regimes once found commonly in Latin America and elsewhere, and were characterized by administrative controls over foreign exchange allocation and current account transactions. Persistently weak external accounts and overvalued exchange rates led to extensive foreign exchange rationing and sizeable black market premiums.

This study focuses on assessing the recent growth and inflation experience of Eastern African countries and looks specifically at the role of foreign exchange liberalization in influencing the outcomes for these key macroeconomic variables. The countries in this study are Ethiopia, Kenya, Malawi, Mozambique, Tanzania, Uganda, and Zambia, which share key characteristics in that they are low-income, primarily agriculturally-based economies. At the same time, they also possess important differences, including their institutional frameworks. While the majority of these countries have succeeded in sustaining growth and stable inflation and five of the seven have decisively liberalized their foreign exchange regimes, a few still lag behind.[2]

Section 2 studies empirically the relationship between growth and characteristics of the economy, including the foreign exchange regime and exchange rate. We find that investment is the most robust contributor to growth. Section 3 studies empirically the relationship between inflation and characteristics of the economy, and measures the degree of pass-through of exchange rate changes to domestic prices.

[2] See Maehle, Teferra, and Khachatryan (forthcoming, 2012) for a case-study analysis of foreign exchange regime liberalization in Eastern Africa.

II. Foreign Exchange Regimes and Economic Growth

A. Introduction

The record on economic growth is central to assessing macroeconomic performance. For developing countries, the foreign exchange regime and real exchange rate may play a crucial role in determining growth. This study examines empirically the recent growth experience of selected countries in Eastern Africa. The specific value added is threefold: it models explicitly those Eastern African countries that went through a shared experience of reform; it specifically includes indicators of the exchange rate regime and current account liberalization in the empirical methodology; and it models real exchange rates, making use of the equilibrium exchange rate concept.

Our study finds no robust relationship between the choice of the foreign exchange regime and growth (both overall and non-agricultural growth) in our sample, a finding that is generally in accord with previous studies on developing countries.[3] We find that there is a positive correlation between the more flexible foreign exchange regimes and growth. However, the relationship is not generally statistically significant, when controlling for other determinants of growth. The current account liberalization variable also is not significant in our sample, when controlling for other determinants of growth. On the other hand, the real effective exchange rate is significant in some specifications. The evidence suggests that a more appreciated exchange rate is bad for non-agricultural growth and some more limited evidence suggests that overvaluation, specifically, is harmful. We find a robust causality from investment to growth, with an increase of one percentage point in the share of investment in GDP increasing growth per capita by about one-third of a percentage point, thus leading to the important conclusion that whatever the varied reform experience, countries should create conditions that are conducive for investment to raise growth. This does not imply that the foreign exchange regime does not matter, but only that the overall package of reforms is key. Government consumption share in GDP has a significantly negative effect on overall, but not non-agricultural, growth.

Section B reviews the literature. Section C describes the data and presents a descriptive analysis. Sections D and E present our results and Section F provides the overall results of the growth analysis.

B. Literature Review

A number of comprehensive studies have examined the determinants of growth (Aghion and Howitt, 2009; the Commission on Growth and Development, 2008; and Barro and Sala-i-Martin, 2004).[4] Empirical modeling has found a robust relationship between

[3] We study the impact of foreign exchange regime on overall and non-agricultural GDP growth separately because of the distinct role that non-agricultural GDP growth may play in economies that are based on a dominant agricultural sector (about 40 percent of the economy on average in the period of our sample).

[4] Agenor and Montiel (1996) bring in an explicit development macroeconomic dimension.

investment (both human and non-human) and growth. Drawing upon an augmented Solow model of growth, Mankiw, Romer, and Weil (1992) find that investment, education, and population growth play a significant role in explaining cross-country growth. Levine and Renelt (1992) find that investment share of GDP is the most robust determinant of growth.

A growing body of literature tries to explain the African growth experience, and why African growth has improved in the last few decades. Some recent studies include Guerguil and others (2011), Johnson, Ostry, and Subramanian (2007), and Patillo, Gupta, and Carey (2006), which point to Africa's recent improved growth performance. Sub-Saharan African countries have made progress in sustaining macroeconomic stability and liberalizing foreign exchange regimes but still face challenges to improve institutions, reduce regulatory barriers, strengthen human capital and health, and avoid overvalued exchange rates.

Rose (2011), Klein and Shambaugh (2010), and Ghosh, Gulde, and Wolf (2002) survey key ideas that form the background to this study of foreign exchange regimes. Monetary neutrality suggests that the nominal exchange rate regime should have no bearing on long-run economic growth. On the other hand, the exchange rate regime influences how countries adjust to real and nominal shocks and hence it may have a bearing on growth. It is generally considered advantageous for countries that experience significant real shocks to use floating exchange rates, which allow relative price adjustment to take place through adjustments of the nominal exchange rate. It is generally considered advantageous for countries experiencing mostly financial shocks to adopt fixed exchange regimes. A range of other considerations are relevant to this discussion, including the transparency and credibility of the central bank, the incentives of different regimes for fiscal discipline, and various microeconomic arguments related to the workings of the foreign exchange market.

Theoretically, the choice of regime may influence growth through its indirect effect on investment, productivity, and international trade. Uncertainty is a key consideration in this indirect chain. A pegged exchange rate regime may increase confidence and reduce uncertainty and transaction costs, thus boosting investment, productivity, and trade, while uncertainty about exchange rates, under floating regimes, may create a damper to investment. However, if a peg is not credible or leads to overvaluation and black market premiums, as was observed in these Eastern African countries, then it may lead to lower investment, productivity, and trade, and hence weaker growth and competitiveness. Countries with more developed financial markets may be better able to contain exchange rate volatility associated with a flexible exchange rate, and thus are able to achieve the benefits of flexible rates in terms of enhancing the ability to adjust to real shocks without sacrificing the stability that a credible peg may entail.

Rose, Kyaw and de Vita (2011), Klein and Shambaugh, Ghosh Ostry, and Tsangarides (2010), and Harms and Kreschmann (2009) add to empirical work on the relationship between foreign exchange regime and growth.[5] De Vita and Kyaw use a panel of

[5] Petreski (2009) surveys the literature as well.

developing countries, over the 1981–2004 period, to study this relationship. They distinguish de facto and de jure regimes. They find that after controlling for the monetary policy framework, the regime has no significant effect on growth. Similarly, Rose, Klein and Shambaugh, and Ghosh, Ostry, and Tsangarides reach the same conclusion, with respect to developing countries (see also Husain, Mody, and Rogoff, 2005; Rogoff and others, 2004; and Ghosh and others, 1997). Harms and Kreschmann, using a sample of developing countries, find some benefit from less flexible regimes, but this result disappears after high inflation periods are eliminated from the sample. In contrast, Levy-Yeyati and Sturzenegger (2003) come to the conclusion that less flexible regimes are associated with slower growth, as well as greater output volatility. Miles (2006) introduces a measure of the black market premium, into the standard regression setup, and finds that this eliminates the effect of the exchange regime. In sum, the preponderance of empirical work suggests that the regime does not have a significant effect on growth, in developing countries, once other variables are taken into account, but this finding is not uniform and some studies have found that more flexible regimes are better for growth.

These studies have not generally explored another important dimension of the foreign exchange regime, the degree to which the country has liberalized its current account. Liberalization may on its own exert an effect on growth by creating an atmosphere that is more conducive to development of trade and export-oriented industry. It may sometimes be difficult to ascertain whether a country has liberalized its current account, because there are many aspects to this determination and there may also be substantial gaps between the laws and regulations and practices, as with the exchange rate regime. The best measure of liberalization on a de jure basis is whether the country has accepted Article VIII status of the IMF's Articles of Agreement and the de facto adherence is something that IMF country teams assess in conjunction with the authorities of each country.

Finally, the real effective exchange rate is a key component of macroeconomic policy. There is strong evidence that overvaluation is bad for growth and some more limited evidence that undervaluation may be beneficial for growth. Johnson, Ostry, and Subramanian (2007), Rodrik (2008), and Berg and Miao (2010) cover these issues in depth, in the developing country and specifically, African context.

C. Data and Descriptive Analysis

C.1. Data

The sample for our study covers annual observations for seven East African countries over the period 1990–2010.[6] While the sample of only seven countries over 20 years is small and non-random, our intention is to focus on these countries that shared the liberalization experience and hence we do not argue that these results would necessarily generalize.

[6] See Appendix A for a description of the data and summary statistics.

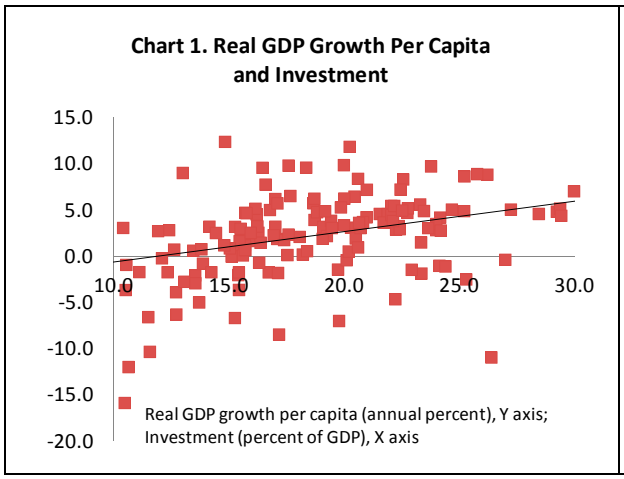
In constructing our measure of regime, this study distinguishes between de jure and de facto foreign exchange regimes, as indicated in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER). The de jure classification reflects the officially announced exchange rate regime and the de facto classification, the actual policies in place at that time (IMF, 1999). Because the IMF adopted the de facto exchange rate regime classification only in 1999, we used our own methodology to create the de facto classification going back to 1990, following Bubula and Ötker-Robe (2002). We mapped the IMF classifications into three regimes (i.e., pegged, intermediate, and floating).[7] The de jure and de facto classifications are positively correlated, in our sample, with a correlation coefficient of 0.65. We observe, in our sample, that pegged regimes hardly appear after the early 1990s and that there is some "fear of floating" (Calvo and Reinhart, 2002), especially in later years in the sample, where a number of de jure floating regimes are characterized as de facto intermediate regimes. Several other approaches rely on economic outcome data to distinguish de jure from de facto regimes. Levy-Yeyati and Sturzenegger (2005) use data on changes in nominal exchange rates, the volatility of these changes, and the volatility of international reserves, with cluster techniques, to group countries into de facto regimes. Reinhart and Rogoff (2004) rely on exchange rate movements and black market data, which were not available for our sample. Similarly, we use the AREAER source to measure current account liberalization on a de facto basis.

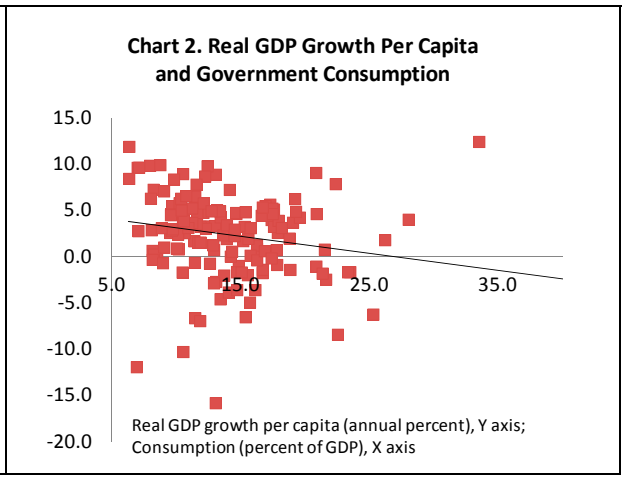
For our study, we find that Tanzania and Uganda are the countries that have made most use of floating exchange rates under both de jure and de facto regimes, with Mozambique and Zambia also having considerable experience with a floating regime. Ethiopia and Kenya have had the most experience in running intermediate regimes while Malawi and Kenya have the most inconsistencies between de jure and de facto exchange rate regimes. Malawi is also somewhat in the middle between floating and pegged regimes—neither seriously floating, nor pegging, but mainly having some sort of stabilized arrangements. Ethiopia is the only country which has had no recent experience with a floating regime, except on a de jure basis in 1996.

C.2. Descriptive analysis

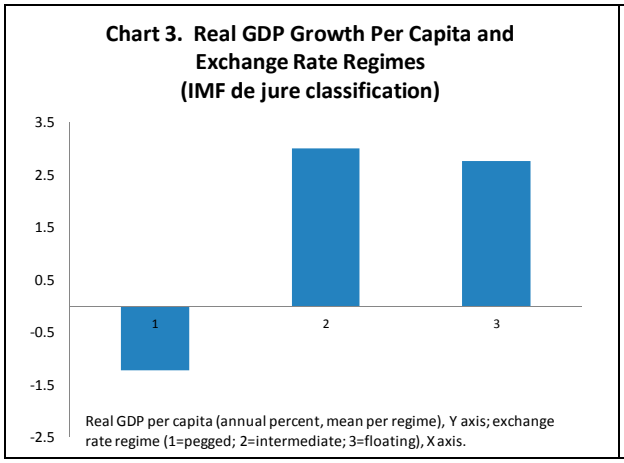
We first analyze the relationship between our variables of interest and growth, with the help of some simple scatter plots. We have plotted investment and consumption shares in GDP against real GDP per capita (Charts 1 and 2). There is a strong direct association between investment and growth, while there is weaker evidence of an inverse association between government consumption and growth.

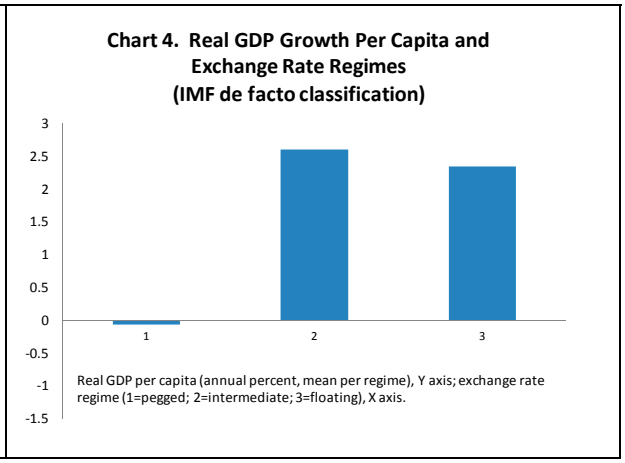
[7] See Appendix B for the methodology of exchange regime classifications.





We have also plotted the mean real GDP growth per capita against the different exchange rate regimes, in both the de jure and de facto settings (Charts 3 and 4). As can be seen, there is an obvious positive correlation between the more flexible exchange rate regimes and growth. Moreover, intermediate regimes are associated with higher growth than either of the other regimes. In the next section we seek to determine whether this positive association holds in the presence of other factors.





D. Empirical Specification

D.1. The set-up

Our results are based on estimating the following equation:[8]

$$Growth_{i,t} = \alpha X_{i,t} + \beta R_{i,t} + \sigma_i + \gamma_i + \varepsilon_{i,t} \qquad (1)$$

In equation (1), Growth $_{i,t}$ is the growth rate of real GDP per capita (rgdpgpc), and the growth rate of non-agricultural real GDP per capita (rgdpgpc_nagr) of country i in year t; $X_{i,t}$ is a vector of explanatory variables, described below; $R_{i,t}$ is a vector of foreign exchange regime dummies, where

[8] We use annual data because data with a higher frequency are not available for key variables.

the coefficients represent the performance of flexible foreign exchange regimes relative to a pegged regime, which is the omitted category; σ_i are country specific effects; γ_t are time specific effects; $\varepsilon_{i,t}$ are error terms; and α and β are parameters to be estimated. We run our estimations for pooled ordinary least squares (OLS), cross sectional fixed effects and time and cross sectional fixed effects models.[9]

For the explanatory variables, we draw upon the rich empirical literature in this field, keeping in mind the limitations of the data available in these countries, especially regarding human resource variables. Hence, we use investment in GDP as a measure of factor inputs, and we expect that a larger share of investment would increase growth. We use lagged investment in our analysis, following some previous studies. We also use government consumption in GDP as an explanatory variable, which we expect would have an ambiguous effect on growth for the following reasons. From a demand perspective, higher government spending may stimulate growth but, if excessive, may lead to higher inflation rather than growth. From a supply perspective, spending on investments, either physical or human capital, may induce higher growth. However, wasteful spending, such as on excessive compensation to civil servants, might lead to lower growth.

Following the open economy variants of the literature, the real exchange rate is expected to be a key determinant of growth, hence in this initial analysis, we use the change in the real effective exchange rate as an explanatory variable, though its effect is uncertain. Countries that are growing more rapidly tend to experience exchange rate appreciation. Hence an appreciating real exchange rate may not necessarily reduce competitiveness. Unfortunately, we have no good measures of productivity. In some analyses, relative per capita income is used as a measure of productivity, but we have some doubts about its value in the East African context, where a large part of activity is subsistence farming. Hence, we simply use the real exchange rate and undertake further analysis, as described later in the paper. We would expect an appreciation of the real effective exchange rate to have a negative effect on growth and a depreciation, a positive effect. With regard to the variables characterizing the foreign exchange regime, we would expect that a liberalized current account would raise growth, if it leads to greater trade and more certain access to foreign currency, thus improving business conditions. Our priors are that a more flexible exchange rate regime should be beneficial for small open economies that are buffeted by real shocks. But these countries may also benefit from a fixed exchange rate given that central bank credibility may be weak, as countries have emerged from regimes where fiscal dominance was pervasive.

For the independent variables, investment (Inv) and government consumption (Govc) shares in GDP are taken from national accounts data and the change in the real effective exchange rate (ΔREER) is measured as US dollars per national currency. Current account liberalization (Liberalization) is taken from AREAER data, where 1 indicates a liberalized current account, on a de facto basis, where the constrained regime is the omitted category. The exchange rate regime dummies for intermediate and floating de facto (Intdefacto and Flexdefacto) and de jure regimes (Intdejure and Flexdejure) are used to measure the impact of the regime on

[9] We used STATA programming language in our research, and the following program codes: OLS (regress, robust); cross-sectional, fixed effects model (xtivreg2, fe bw (5)) and time and cross sectional, fixed effects model (xtivreg2…dum* (year), fe, bw (5), both corrected for arbitrary autocorrelation up to the 4th order) with the assumption of homoskedasticity.

growth, with the pegged exchange rate regime treated as the omitted regime. Alternatively, we design an index variable with (Inddejure) for de jure and (Inddefacto) for de facto specifications, respectively, where the pegged regime takes value 0, the intermediate, 1, and floating, 2. This variable constrains the effect of moving from pegged to intermediate to floating to be the same.

D.2. Robustness

Our preferred model is the time and cross sectional, fixed effects estimator.[10] [11] In our model we also assume that errors ($\varepsilon_{i,}$) are homoskedastic and we thus correct only for pure autocorrelation. We do not correct for possible heteroskedasticity owing to the small number of cross-sectional units. However, the dependent variable is already scaled, thus reducing the possibility of serious bias from this violation of the normal assumptions on the error term.

It would be interesting to assess the effect on growth of distortions in the foreign exchange regime as opposed to just the regime, itself, because of the profound macroeconomic imbalances that distorted regimes produced in these countries. However, given the data deficiencies, we could only construct measures that would have a sizeable measurement error. For instance, we could not devise an accurate and consistent way to measure the black market premium, without collecting for each country detailed informal exchange rate information that are not available in published sources. Similarly, observations where the de jure and de facto exchange regime classification differ might only reflect a gap between the law and practice but not necessarily a distortion, such as would result in rationing of foreign exchange or a black market premium. We thus do not draw any conclusions from our empirical work about the effect of distortions as opposed to regimes.

D.3. Results

We present our results in separate tables for specifications using as the dependent variable both overall real GDP and non-agricultural real GDP growth per capita. Within each table, we present results for specifications using both the regime dummies and the regime index. For each specification (pooled OLS, cross-sectional, fixed effects, time and cross sectional, fixed effects and time and cross sectional fixed effects corrected for endogeneity), the first column uses regime dummy variables from the IMF de jure classification and the second column uses the IMF de facto regime classification.

D.3.1. Overall real GDP growth per capita

[10] Our robustness checks on the feasibility of the OLS regressions showed that the fixed effects model is preferred to the pooled OLS regression model. The F-statistic (Durbin-Wu-Hausman) strongly rejects the null of consistency and full efficiency of OLS results compared to the fixed effects model. We also rejected the appropriateness of the random effects estimator with the standard Hausman test, and by also observing higher correlation of country level individual effects with the independent variables after running the fixed effects model.

[11] Our robustness tests soundly rejected the time invariance of our models, which means that the two-way, fixed effects model is the preferred one.

Table 1a presents the results for overall real GDP growth per capita and regime dummies. The signs of the control variables are broadly as expected (we concentrate on columns 5 and 6). The impact of lagged investment on growth is positive and significant. An increase of the investment share in nominal GDP by 1 percentage point (say, from 26 percent of GDP to 27 percent of GDP) will increase the rate of growth per capita by about one-third of a percentage point. The impact of government consumption share in GDP is negative and significantly negative. An increase of the government consumption share in GDP by 1 percentage point will decrease the rate of growth per capita by about 0.16 percentage points. The change in the real effective exchange rate is not significant. The dummy for liberalization is significant at the 5 percent level under the de jure exchange rate classification and at the 10 percent level under the de facto classification but only in the cross sectional fixed effects model (columns 3 and 4). In the same manner, under the de jure classification the flexible and intermediate regimes have a significantly positive effect on growth in both the OLS (columns 1 and 2) and cross sectional fixed effects models (columns 3 and 4). However, in the model with time dummies, as well, the exchange regime dummies cease to be significant (columns 5 and 6). Correcting for endogeneity of investment produces broadly similar results.[12] The exchange rate dummies, the liberalization dummy and the change of the real effective exchange rate are not significant.

We tried several variants on this basic specification. For instance, the inclusion of population growth and openness as explanatory variables did not change the basic results. Although we did find that initial income was strongly negative and significant, suggestive of some degree of convergence of income over time, this variable is time invariant and hence would need to be dropped in the specification that included country fixed effects, our preferred specification. Instead we ran an augmented equation with lagged income and found that lagged income had a negative and significant effect on growth, without significantly altering the conclusions of the analysis presented above.

[12] Rose (2011) in his survey finds few systematic differences between the higher income countries (measured by real GDP per capita) and their exchange rage regimes. Hence we do not formally assess endogeneity of the exchange rate regime.

Table 1a. Growth and the Exchange Rate Regime, 1990–2010

Dependent variable: growth in real GDP per capita						
	OLS		Cross sectional fixed effects [1]		Time and cross sectional fixed effects [1]	
	(1)	(2)	(3)	(4)	(5)	(6)
Inv (-1)	0.388***	0.422***	0.314***	0.310***	0.300*	0.282*
	(0.081)	(0.086)	(0.080)	(0.085)	(0.100)	(0.099)
Govc	-0.185**	-0.160	-0.235***	-0.211*	-0.161**	-0.175**
	(0.076)	(0.082)	(0.068)	(0.074)	(0.076)	(0.073)
ΔREER	-0.031	-0.012	-0.015	0.002	-0.035	-0.039
	(0.044)	(0.043)	(0.028)	(0.029)	(0.033)	(0.032)
Liberalization	-0.001	0.004	0.027**	0.034*	0.017	0.011
	(0.006)	(0.007)	(0.012)	(0.012)	(0.014)	(0.014)
Intdejure	0.043*		0.031**		0.003	
	(0.016)		(0.013)		(0.028)	
Flexdejure	0.046*		0.038*		0.011	
	(0.016)		(0.012)		(0.027)	
Intdefacto		0.009		0.014		-0.012
		(0.026)		(0.014)		(0.017)
Flexdefacto		0.006		0.009		-0.017
		(0.027)		(0.016)		(0.020)
Constant	-0.061**	-0.039				
	(0.027)	(0.039)				
Observations [2]	135	135	135	135	135	135
R-squared	0.336	0.265	0.332	0.286	0.483	0.483
RMSE	0.039	0.041	0.037	0.038	0.035	0.035

Source: Staff estimates.

Standard errors in parenthesis

* Significant at 10% level.

** Significant at 5% level.

*** Significant at 1% level.

[1] Cross-sectional and time-series dummy variables are not presented but the full set of results is available from the authors.

[2] The total number of observations is 147, but we lose six observations for lagged investment and another six observations for missing data on Mozambique on the REER to yield 135 observations.

Table 1b presents the results for overall real GDP growth per capita and regime indices, with the index variable used to measure the foreign exchange regime. The coefficients of the key investment and consumption variables have the same signs and significance as in the case with regime dummies. The dummy for liberalization is significant at the 5 percent level under both de jure and de facto regime classifications but again only in the cross sectional fixed effects model (columns 3 and 4). As before, in the model with time characteristics, the coefficients of the more flexible regimes are not significant under both the de jure and de facto regime classifications (columns 5 and 6).

Table 1b. Growth and the Exchange Regime, with Regime Index, 1990–2010

Dependent variable: growth in real GDP per capita						
	OLS		Cross sectional fixed effects [1]		Time and cross sectional fixed effects [1]	
	(1)	(2)	(3)	(4)	(5)	(6)
Inv (-1)	0.417***	0.428***	0.327***	0.323***	0.299*	0.279*
	(0.084)	(0.087)	(0.080)	(0.084)	(0.099)	(0.099)
Govc	-0.185**	-0.170**	-0.234***	-0.225*	-0.165**	-0.171**
	(0.074)	(0.078)	(0.069)	(0.073)	(0.072)	(0.073)
ΔREER	-0.022	-0.014	-0.010	-0.002	-0.037	-0.036
	(0.043)	(0.043)	(0.028)	(0.029)	(0.031)	(0.031)
Liberalization	0.002	0.005	0.032*	0.036*	0.017	0.012
	(0.006)	(0.006)	(0.011)	(0.012)	(0.014)	(0.014)
Inddejure	0.015**		0.015*		0.007	
	(0.006)		(0.006)		(0.009)	
Inddefacto		0.000		0.001		-0.007
		(0.008)		(0.007)		(0.009)
Constant	-0.049	-0.033				
	(0.025)	(0.031)				
Observations	135	135	135	135	135	135
R-squared	0.307	0.263	0.322	0.278	0.482	0.482
RMSE	0.039	0.041	0.037	0.038	0.035	0.035

Source: Staff estimates.

Standard errors in parenthesis

* Significant at 10% level.

** Significant at 5% level.

*** Significant at 1% level.

[1] Cross-sectional and time-series dummy variables are not presented, but the full set of results is available from the authors.

D.3.2. Non-agricultural real GDP growth per capita

Table 2a presents the results for non-agricultural real GDP growth per capita and regime dummies. The coefficient for lagged investment is still positive and significant; however the coefficient for government consumption is no longer significant. In addition, the liberalization variable is not significant in any specification. In contrast to the results for overall GDP growth, the appreciation of the real effective exchange rate has a negative and significant effect on non-agricultural growth. The coefficient implies that an appreciation of the exchange rate by 1 percent will reduce real GDP growth per capita by 0.2 percentage points. This may highlight the greater sensitivity of manufactured and other industries to the real exchange rate than agricultural production. The coefficients for the de jure intermediate and flexible regimes are negative and significant (column 5), which is consistent with the Levy-Yeyati and Sturzenegger results, though the regime dummies are not significant for the de facto specification (column 6).

Table 2a. Non-Agricultural Growth and the Exchange Regime, 1990–2010

Dependent variable: growth in real GDP (non agricultural) per capita						
	OLS		Cross sectional fixed effects [1]		Time and cross sectional fixed effects [1]	
	(1)	(2)	(3)	(4)	(5)	(6)
lnv (-1)	0.190	0.204	0.038	0.010	0.408**	0.394**
	(0.170)	(0.176)	(0.177)	(0.184)	(0.192)	(0.195)
Govc	0.059	0.139	0.167	0.229	0.200	0.071
	(0.223)	(0.252)	(0.152)	(0.159)	(0.146)	(0.145)
ΔREER	-0.144	-0.115	-0.116	-0.088	-0.211*	-0.270***
	(0.085)	(0.079)	(0.063)	(0.062)	(0.062)	(0.063)
Liberalization	0.001	0.003	0.023	0.028	-0.038	-0.018
	(0.013)	(0.013)	(0.026)	(0.025)	(0.027)	(0.028)
lntdejure	0.041		0.034		-0.136**	
	(0.037)		(0.030)		(0.053)	
Flexdejure	0.041		0.031		-0.131**	
	(0.036)		(0.028)		(0.052)	
lntdefacto		0.049		0.052		-0.005
		(0.042)		(0.031)		(0.033)
Flexdefacto		0.042		0.032		0.000
		(0.044)		(0.034)		(0.040)
Constant	-0.051	-0.071				
	(0.064)	(0.076)				
Observations	135	135	135	135	135	135
R-Squared	0.070	0.072	0.068	0.086	0.456	0.420
RMSE	0.082	0.081	0.081	0.081	0.068	0.070

Source: Staff estimates.

Standard errors in parenthesis

* Significant at 10% level.

** Significant at 5% level.

*** Significant at 1% level.

[1] Cross-sectional and time-series dummy variables are not presented but the full set of results is available from the authors.

Table 2b presents the results for non-agricultural real GDP growth per capita and the regime index. The results are similar to table 2a. However, the regime index is not significant.

Table 2b. Non-Agricultural Growth and the Exchange Regime, with Regime Index, 1990–2010

Dependent variable: growth in real GDP (non-agricultural) per capita						
	OLS		Cross sectional fixed effects [1]		Time and cross sectional fixed effects [1]	
	(1)	(2)	(3)	(4)	(5)	(6)
lnv (-1)	0.220	0.231	0.057	0.058	0.369	0.390**
	(0.175)	(0.181)	(0.177)	(0.181)	(0.194)	(0.195)
Govc	0.058	0.091	0.168	0.178	0.088	0.076
	(0.224)	(0.241)	(0.152)	(0.158)	(0.141)	(0.144)
ΔREER	-0.135	-0.126	-0.109	-0.103	-0.260***	-0.265***
	(0.083)	(0.083)	(0.062)	(0.062)	(0.061)	(0.061)
Liberalization	0.004	0.006	0.031	0.033	-0.023	-0.016
	(0.013)	(0.013)	(0.025)	(0.025)	(0.027)	(0.027)
lnddejure	0.012		0.010		-0.017	
	(0.013)		(0.012)		(0.017)	
lnddefacto		0.007		0.002		0.003
		(0.015)		(0.016)		(0.018)
Constant	-0.039	-0.037				
	(0.058)	(0.067)				
Observations	135	135	135	135	135	135
R-squared	0.060	0.054	0.062	0.057	0.426	0.420
RMSE	0.082	0.082	0.081	0.081	0.069	0.069

Source: Staff estimates.

Standard errors in parenthesis

* Significant at 10% level.

** Significant at 5% level.

*** Significant at 1% level.

[1] Cross-sectional and time-series dummy variables are not presented but the full set of results is available from the authors.

E. Alternative Specification

E.1. The set-up

We next explore, with alternative methodologies, the effect of a more appreciated real effective exchange rate on growth. Because exchange rates tend to appreciate as countries grow faster than their peers, a more appreciated exchange rate is not bad, per se, but only so, if it implies that the currency has become overvalued. We would expect overvaluation of the exchange rate to have a negative effect on growth as it would erode the external competitiveness of the country. Following Berg and Miao and Christiansen and others (2009), we estimate a Fundamental Equilibrium Exchange Rate (FEER) regression to construct a residual that provides a measure of overvaluation or undervaluation:[13]

$$REER_{i,t} = \alpha_0 + \alpha_1 y_{i,t} + \alpha_2 X_{i,t} + \alpha_t + \varepsilon_{i,t}^{FEER} \qquad (2)$$

In equation (2), $X_{i,t}$ denotes "fundamental" determinants of the equilibrium exchange rate, which include the terms of trade (taken as the natural log), government consumption share in GDP, investment share of GDP and the share of external trade in GDP, and real GDP per capita.[14] The residuals from this regression (the results are shown in Appendix C), $\varepsilon_{i,t}$ imply either undervaluation (negative residuals) or overvaluation (positive residuals).[15] We used the residuals from equation 2 (Residfeer) to replace the change in REER in our baseline regression (1). Following Berg and Miao, we also used these residuals to measure the deviation of the real exchange rate from an equilibrium concept. We split the sample into components for undervaluation and overvaluation. The dummy variable D_1 takes a value of 1 for negative residuals from the FEER regression. The variable D_1*Und represents undervaluation, which is constructed by multiplying the dummy variable for undervaluation by the negative residuals. The dummy variable D_2 takes a value of 1 for positive residuals from the FEER regression. The variable D_2*Over represents overvaluation, which is constructed by multiplying the dummy variable for overvaluation by the positive residuals.

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[13] In estimating the FEER equation, we assume that in the medium term countries are in equilibrium as described by the level of the fundamental variables used in the estimation. We note that many of the determinants of the FEER equation may be the same as determinants of growth, giving rise to an identification problem. However, we do not employ exactly the same determinants in our analysis.

[14] We have also estimated (2) by omitting the co-integration variable, real GDP per capita, and by exploring variations of standard variables used in these equations, such as the log of terms of trade, government consumption, aid, foreign direct investment, and openness as a share of GDP, and net foreign assets as a share of exports. Our results confirm the negative and significant coefficient on the overvaluation dummy.

[15] Note that our definition of the FEER residual differs from that in Berg and Miao as we rely on the IMF's definition of the exchange rate underlying the real effective exchange rate, i.e. U.S. dollars per national currency, while the authors use the definition of national currency per U.S. dollar relying on Penn World Tables. The implication of this is that the negative residuals from regression (2) would mean undervaluation in our study and overvaluation in Berg and Miao.

In a similar vein, we also constructed a measure of the residuals that removes the cyclical component of the REER series using the Hodrick-Prescott filter, and we label this residual series Residhp to distinguish it from the FEER residual. Next, we used these residuals to replace the change in REER in our baseline regression, as in the case of the FEER residuals. We applied the same technique described above to split the sample into components for undervaluation and overvaluation with negative residuals assigned to dummy variable D1, and positive residuals, to dummy variable D2. As before, the variables D_1*Und and D_2*Over would represent undervaluation and overvaluation, respectively.

E.2. Results

Table 3a presents the results for overall real GDP growth per capita and regime dummies where the exchange rate variable is replaced by the residual (Residfeer) from the FEER regression. We then also split the sample using D_1*Und and D_2*Over. We present the results using only our preferred specification of time and cross sectional fixed effects regression. Columns 1 and 2 replicate our earlier, preferred specification and the remaining columns present our results with these alternative approaches to capture effects on growth on the real exchange rate. The results are similar in many respects to the earlier results. Investment and consumption share of GDP are significant. As can be seen, the impact of the change in exchange rate on overall growth is still not significant even though it is now replaced with a measure of misalignment (the residual from the FEER regression). However, we do find that the impact of overvaluation on growth is significantly negative under the de facto regime classification. In particular, an overvaluation of the FEER by 1 percentage point would reduce the real GDP growth per capita by about 0.1 percent. Interestingly, when using the Hodrick-Prescott residuals, we find a significantly negative effect of the exchange rate misalignment on overall growth (with roughly the same overall significance and signs of the other explanatory variables). This is in line with our earlier findings of the impact of the changes in exchange rate on non-agricultural growth (Tables 2a and 2b). This specification thus confirms the theoretical conjecture that overvaluation in the real exchange rate has a negative impact on growth.[16]

[16] We also tested for endogeneity of the change in the real exchange rate and the two residual series, and found that, in a statistical sense, we cannot reject the hypothesis of exogeneity for any of these variables, even though the theory suggests that they might be endogenous in a growth equation.

Table 3a. Growth and the Exchange Regime, with FEER Residual, 1990–2010

Dependent variable: growth in real GDP per capita										
	Time and cross sectional fixed effects [1]									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
lnv (-1)	0.300*	0.282*	0.262**	0.234**	0.243**	0.202**	0.223**	0.200**	0.219**	0.189
	(0.100)	(0.099)	(0.102)	(0.100)	(0.104)	(0.099)	(0.099)	(0.095)	(0.102)	(0.099)
Govc	-0.161**	-0.175**	-0.152	-0.178**	-0.164**	-0.204**	-0.188**	-0.200*	-0.188**	-0.205*
	(0.076)	(0.073)	(0.079)	(0.079)	(0.080)	(0.079)	(0.075)	(0.072)	(0.075)	(0.073)
ΔREER	-0.035	-0.039								
	(0.033)	(0.032)								
Residfeer			-0.017	-0.018						
			(0.021)	(0.022)						
Residhp							-0.001*	-0.001*		
							(0.000)	(0.000)		
Liberalization	0.017	0.011	0.021	0.017	0.022	0.014	0.022	0.010	0.023	0.013
	(0.014)	(0.014)	(0.016)	(0.015)	(0.016)	(0.015)	(0.014)	(0.014)	(0.015)	(0.015)
lntdejure	0.003		-0.007		0.002		0.018		0.017	
	(0.028)		(0.027)		(0.028)		(0.027)		(0.029)	
Flexdejure	0.011		0.002		0.013		0.031		0.029	
	(0.027)		(0.027)		(0.028)		(0.028)		(0.029)	
lntdefacto		-0.012		-0.015		-0.030		-0.027		-0.028
		(0.017)		(0.017)		(0.019)		(0.017)		(0.017)
Flexdefacto		-0.017		-0.021		-0.036		-0.031		-0.032
		(0.020)		(0.021)		(0.022)		(0.020)		(0.020)
D_1*Und					0.044	0.055			-0.001	-0.001
					(0.044)	(0.043)			(0.001)	(0.001)
D_2*Over					-0.075	-0.096**			-0.001	-0.001**
					(0.043)	(0.045)			(0.000)	(0.000)
Observations [2]	135	135	135	135	135	135	136	136	136	136
R-squared	0.483	0.483	0.464	0.465	0.478	0.486	0.505	0.507	0.505	0.508
RMSE	0.035	0.035	0.036	0.036	0.036	0.035	0.034	0.034	0.035	0.035

Standard errors in parenthesis.

* Significant at 10% level.

** Significant at 5% level.

*** Significant at 1% level.

[1] Cross-sectional and time-series dummy variables are not presented but the full set of results is available from the authors.

[2] The total number of observations is 147, but we lose six observations for lagged investment and another five observations for missing data on Mozambique on the REER in columns 7 to 10 to yield 136 observations.

Table 3b presents the results for overall real GDP growth per capita and regime indices. The results do not vary much. However, we do not observe the significantly negative impact of overvaluation on growth owing to, perhaps, the loss of qualitative aspects of regime change when using the index.

Table 3b. Growth and the Exchange Regime, with FEER Residual and Regime Index, 1990–2010

Dependent variable: growth in real GDP per capita										
	Time and cross sectional fixed effects [1]									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
lnv (-1)	0.299*	0.279*	0.254**	0.235**	0.238**	0.212**	0.226**	0.205**	0.221**	0.198
	(0.099)	(0.099)	(0.100)	(0.100)	(0.102)	(0.101)	(0.097)	(0.097)	(0.101)	(0.101)
Govc	-0.165**	-0.171**	-0.162**	-0.171**	-0.171**	-0.181**	-0.183**	-0.185**	-0.185**	-0.188**
	(0.072)	(0.073)	(0.077)	(0.077)	(0.077)	(0.077)	(0.071)	(0.072)	(0.072)	(0.073)
ΔREER	-0.037	-0.036								
	(0.031)	(0.031)								
Residfeer			-0.017	-0.015						
			(0.021)	(0.021)						
Residhp							-0.001*	-0.001**		
							(0.000)	(0.000)		
Liberalization	0.017	0.012	0.023	0.017	0.023	0.015	0.022	0.013	0.023	0.015
	(0.014)	(0.014)	(0.016)	(0.015)	(0.016)	(0.015)	(0.014)	(0.014)	(0.015)	(0.015)
lnddejure	0.007		0.006		0.010		0.013		0.013	
	(0.009)		(0.009)		(0.009)		(0.009)		(0.009)	
lnddefacto		-0.007		-0.008		-0.011		-0.010		-0.010
		(0.009)		(0.009)		(0.009)		(0.009)		(0.009)
D_1*Und					0.046	0.046			-0.001	-0.001
					(0.044)	(0.043)			(0.001)	(0.001)
D_2*Over					-0.076	-0.072			-0.001	-0.001
					(0.042)	(0.041)			(0.000)	(0.000)
Observations	135	135	135	135	135	135	136	136	136	136
R-squared	0.482	0.482	0.462	0.464	0.478	0.479	0.505	0.500	0.505	0.500
RMSE	0.035	0.035	0.036	0.036	0.035	0.035	0.034	0.034	0.034	0.035

Source: IMF staff estimates.

Standard errors in parenthesis.

* Significant at 10% level.

** Significant at 5% level.

*** Significant at 1% level.

[1] Cross-sectional and time-series dummy variables are not presented but the full set of results are available from the authors.

[2] The total number of observations is 147, but we lose six observations for lagged investment and another five observations for missing data on Mozambique on the REER in columns 7 to 10 to yield 136 observations.

The results for non-agricultural growth reveal some parameter instability (Tables 4a and 4b). Investment share of GDP is not significant with the cross-sectional and time dummies. Instead the dejure regime variables for flexible regimes are negative and significant, a curious result.

Table 4a. Non-agricultural Growth and the Exchange Regime, with FEER Residual, 1990–2010

Dependent variable: growth in real GDP (non-agricultural) per capita										
	Time and cross sectional fixed effects [1]									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Inv (-1)	0.408**	0.394**	0.295	0.219	0.268	0.161	0.167	0.066	0.178	0.121
	(0.192)	(0.195)	(0.201)	(0.211)	(0.202)	(0.211)	(0.191)	(0.192)	(0.196)	(0.199)
Govc	0.200	0.071	0.340**	0.214	0.322**	0.167	0.189	0.046	0.190	0.067
	(0.146)	(0.145)	(0.157)	(0.168)	(0.158)	(0.168)	(0.144)	(0.144)	(0.145)	(0.145)
?REER	-0.211*	-0.270***								
	(0.062)	(0.063)								
Residfeer			0.005	0.014						
			(0.042)	(0.046)						
Residhp							-0.002***	-0.002***		
							(0.000)	(0.001)		
Liberalization	-0.038	-0.018	-0.044	-0.009	-0.042	-0.014	-0.024	-0.010	-0.027	-0.022
	(0.027)	(0.028)	(0.032)	(0.033)	(0.032)	(0.033)	(0.027)	(0.027)	(0.029)	(0.030)
Intdejure	-0.136**		-0.195***		-0.181*		-0.131**		-0.125**	
	(0.053)		(0.053)		(0.054)		(0.052)		(0.055)	
Flexdejure	-0.131**		-0.185***		-0.168*		-0.110**		-0.106	
	(0.052)		(0.053)		(0.055)		(0.052)		(0.055)	
Intdefacto		-0.005		0.025		-0.003		-0.030		-0.027
		(0.033)		(0.037)		(0.040)		(0.034)		(0.034)
Flexdefacto		0.000		0.023		-0.005		-0.020		-0.018
		(0.040)		(0.044)		(0.046)		(0.040)		(0.040)
D_1*Und					0.096	0.150			-0.002	-0.003*
					(0.087)	(0.092)			(0.001)	(0.001)
D_2*Over					-0.080	-0.128			-0.002**	-0.002**
					(0.082)	(0.095)			(0.001)	(0.001)
Observations	135	135	135	135	135	135	136	136	136	136
R-squared	0.456	0.420	0.398	0.321	0.407	0.341	0.472	0.443	0.473	0.449
RMSE	0.068	0.070	0.071	0.076	0.071	0.075	0.067	0.068	0.067	0.068

Source: Staff estimates.

Standard errors in parenthesis

* Significant at 10% level.

** Significant at 5% level.

*** Significant at 1% level.

[1] Cross-sectional and time-series dummy variables are not presented but the full set of results is available from the authors.

Table 4b. Non-agricultural Growth and the Exchange Regime, with FEER Residual and Regime Index, 1990–2010

Dependent variable: growth in real GDP (non-agricultural) per capita										
							Time and cross sectional fixed effects [1]			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Inv (-1)	0.369	0.390**	0.193	0.215	0.162	0.162	0.073	0.075	0.052	0.054
	(0.194)	(0.195)	(0.207)	(0.209)	(0.207)	(0.210)	(0.193)	(0.195)	(0.195)	(0.198)
Govc	0.088	0.076	0.210	0.191	0.194	0.169	0.072	0.072	0.049	0.051
	(0.141)	(0.144)	(0.160)	(0.163)	(0.159)	(0.162)	(0.141)	(0.144)	(0.145)	(0.147)
ΔREER	-0.260***	-0.265***								
	(0.061)	(0.061)								
Residfeer			0.010	0.005						
			(0.044)	(0.044)						
Residhp							-0.002***	-0.002***		
							(0.000)	(0.000)		
Liberalization	-0.023	-0.016	-0.021	-0.009	-0.020	-0.014	-0.005	-0.005	-0.001	-0.001
	(0.027)	(0.027)	(0.033)	(0.033)	(0.032)	(0.032)	(0.027)	(0.027)	(0.027)	(0.027)
Inddejure	-0.017		-0.024		-0.016		-0.001		0.001	
	(0.017)		(0.018)		(0.019)		(0.017)		(0.017)	
Inddefacto		0.003		0.005		-0.002		0.000		0.001
		(0.018)		(0.019)		(0.019)		(0.018)		(0.018)
D_1*Und					0.134	0.150			-0.001	-0.001
					(0.090)	(0.090)			(0.001)	(0.001)
D_2*Over					-0.106	-0.127			-0.002***	-0.002***
					(0.086)	(0.084)			(0.001)	(0.001)
Observations	135	135	135	135	135	135	136	136	136	136
R-squared	0.426	0.420	0.329	0.318	0.346	0.341	0.437	0.437	0.440	0.440
RMSE	0.069	0.069	0.075	0.076	0.074	0.075	0.068	0.068	0.069	0.069

Source: Staff estimates.

Standard errors in parenthesis

* Significant at 10% level.

** Significant at 5% level.

*** Significant at 1% level.

[1] Cross-sectional and time-series dummy variables are not presented but the full set of results is available from the authors.

F. Conclusions and Policy Implications

This section examines the relationship between the choice of exchange rate regime and economic growth. Using a panel dataset of seven countries in Eastern Africa, during 1990–2010, we find no robust evidence that the exchange rate regime or current account liberalization affects growth performance, after controlling for other variables. This result is robust to alternative specifications including the introduction of misalignment measures of the exchange rate into the equation. We find, however, that real exchange rate appreciation reduces non-agricultural growth. To ascertain the impact of overvaluation on growth, we introduce two misalignment measures into our equation (i) following Berg and Miao and (ii) by extracting the deviation of the REER with cyclical components removed. We confirm

that overvaluation is bad for overall growth, while the effect of undervaluation is not significant. We find a robust positive correlation between investment and growth. The investment share in GDP generally has a positive and significant effect on growth. With regard to government consumption share in GDP, we find that it has a negative and significant growth effect, though only in regressions with overall, and not non-agricultural, GDP. Our results suggest that countries should put in place a framework that allows for strong investment and avoid overvalued exchange rates to support growth, but that foreign exchange regime variables alone do not determine growth.

III. Foreign Exchange Regimes, Inflation Performance, and Exchange Rate Pass-Through

A. Introduction

Control of inflation is an important challenge for developing countries, especially in the Eastern African region, as these countries have moved away from fiscal dominance and towards more flexible exchange rate regimes. This section studies empirically two issues: (i) the relationship between inflation and the characteristics of the foreign exchange regime and other variables of interest; and (ii) the degree of pass-through of exchange rate changes to domestic prices.[17] As in the growth analysis, we distinguish the de jure and de facto exchange rate regimes in the analysis.

The literature lacks a conclusive position on whether and how the choice of foreign exchange regime influences inflation outcomes. Some studies argue that pegging a country's currency to a hard currency (with low inflation) could lower inflation. Pegging is seen as a way to anchor inflationary expectations and thus raises the political costs of expansionary monetary and fiscal policies (Obstfeld and Rogoff, 1995; Ghosh and others, 1997). Pegging the exchange rate may thus bring about greater monetary discipline and confidence in the domestic currency. Other studies argue that pegging a country's currency can raise inflation (Tornell and Velasco, 2000). In an intertemporal context, under a flexible exchange regime, expansionary fiscal policy would manifest itself in associated exchange-rate movements. Under a pegged regime, pressures could build, and inflation could emerge with greater vigor later on; thus macroeconomic discipline is neither automatic nor guaranteed. In practice, a flexible exchange rate regime can provide a greater incentive for consistent fiscal behavior and exert more policy restraint relative to a pegged regime.

Some empirical studies on the impact of exchange rate regimes on inflation, such as Ghosh and others (1997) and Ghosh, Gulde and Wolf (2003), using a de jure classification, find a strong statistical association between pegged exchange rate regimes and lower inflation.

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[17] More specifically, the exchange rate pass-through measures the responsiveness of the local currency prices of traded goods to changes in exchange rate. These changes in import prices can subsequently be passed on to producer and consumer prices, thereby affecting the general price levels in the economy. We focus, in this paper, on the impact of exchange rate movements on consumer price inflation.

Other studies, such as Levy-Yeyati and Sturzenegger (2001) and Rogoff and others (2004), using de facto classifications, find a much weaker association between pegging the exchange rate and lower inflation.

The degree of exchange-rate pass-through is an important contributor to macroeconomic deliberations for effective policy-making. Most countries today recognize the disruptive effects of high or rapidly rising inflation and the uneven impact of high inflation on the economy. In addition, maintaining a competitive or appropriate real exchange rate is normally a central goal of macroeconomic policy. Thus, the degree by which changes in the nominal exchange rate pass through to inflation and thus affects the adjustment of real exchange rates is an important empirical issue.

The degree of exchange rate pass-through depends importantly on accompanying fiscal and monetary policies (Taylor, 2000; Choudhri and Hakura, 2006; Devereux and Yetman, 2010). Exchange rate devaluations that are complemented by tight fiscal and monetary policies are generally more successful in limiting the inflationary effect of the devaluation and thus achieving a more depreciated real exchange rate. Market structure, which we do not address in this paper, also affects the degree of exchange rate pass-through, at least in the short term. For instance, firms may choose to absorb some price changes in reduced profit margins, rather than change prices.

Our results indicate that the foreign exchange regime, based on the de jure classification, does not seem to be important for inflation determination; while the de facto intermediate and flexible foreign exchange regimes exert a statistically significant negative effect on inflation. Exchange rate pass-through is found to be limited. We also find that a lower rate of money growth and fiscal deficit as a ratio of GDP lead to lower inflation. These are key results, as they suggest that devaluation of a currency, combined with fiscal consolidation and broad money growth restraint, support real adjustment of the exchange rate. We do not find a significant relationship between a liberalized current account and inflation.

The finding that the de jure exchange rate regime is not strongly related to inflation seems to suggest that policy commitment to a specific exchange rate regime is not what is critical for achieving lower inflation. The important factor is the actual exchange rate regime. In our sample, the pegged regimes may not have been credible, as they were not accompanied by appropriate monetary and fiscal policies, supporting Tornell and Velasco's position.

The remainder of this section is organized as follows. Section B reviews studies on the relationship between the foreign exchange regime and inflation. Section C reviews the studies on exchange rate pass through and how the foreign exchange regime can influence the degree of pass through. Section D provides our empirical results. Section E concludes.

B. Literature Review

B.1. Inflation and foreign exchange regime

A number of papers have analyzed the empirical relationship between the foreign exchange regime and inflation. We present a short review of key relevant empirical studies to guide our analysis of the impact of exchange rate regime on inflation and exchange rate pass-through. Our review of the literature points to lack of a definite position on the impact of exchange rate regime on inflation, as the results obtained were highly sensitive to sample selection, methods of estimation, and classification methods adopted.

A considerable body of research has studied the relationship between the choice of foreign exchange regime and inflation, with varying results that may reflect differences in samples, methods of estimations, methodologies for classifying regimes, and so on. We highlight several key studies.

Ghosh and others (1997) and Ghosh, Gulde, and Wolf (2003) examine inflation performance across different foreign exchange regimes, for a sample of developing and developed economies, using the de jure classification. They find that inflation was lower under pegged than under intermediate and floating regimes. However, for high-income countries, where credibility is gained by means other than the exchange regime, and for countries which had frequent changes in their exchange rate parities, where credibility may be low, the choice of the exchange rate regime had only a small marginal effect.

Levy-Yeyati and Sturzenegger (2001), using a large sample of developing and developed countries, find that the de facto foreign exchange regime is what matters for inflation performance. In addition, they find that the foreign exchange regime has no significant link with inflation in "industrial countries" and that in "non-industrial countries" where pegged exchange rate regimes seemed to deliver lower inflation, such benefit occurred only for "long" pegs (lasting five or more years).

Rogoff and others (2004) find that for countries that have relatively limited financial market development and relatively closed capital markets, pegged foreign exchange regimes appear to offer some measure of credibility, with the important proviso that monetary policy must be consistent in avoiding large and volatile parallel market premiums. They also point out that though, on average, the value of exchange rate flexibility was found to increase with financial maturity, the performance of any regime can be enhanced by consistent macroeconomic management.

Bleaney and Francisco (2007), using data from a large sample of developing countries, find that "hard peg" (de jure pegs combined with de facto pegs) arrangements tend to exert a negative effect on inflation in comparison to other regimes. De Grauw and Schnabl (2008), using a sample of 19 southeastern and central European countries, find that exchange rate

stability contributes significantly to low inflation rates, although that relationship disappears in a sub-sample analysis.

Ghosh, Qureshi, and Tsangarides (2011), focusing on a sample of emerging market and developing countries, find that a de jure peg that is not backed by a de facto peg will not deliver low inflation and a de facto peg that lacks the corresponding de jure status will likewise reap few of the low inflation benefits expected to be associated with pegging the exchange rate.

B.2. Exchange rate pass through

A review of the literature on exchange rate pass-through appears to suggest that the association between exchange rate changes and domestic prices at the consumer level depends significantly on the inflation environment and the market structure underpinning the pricing of commodities:

Taylor (2000) put forth the hypothesis that a low-inflation environment, associated with more credible monetary policies, tends to reduce exchange rate pass-through to domestic prices. He argues that exchange rate pass-through is primarily a function of the persistence of exchange rate and price shocks, which tend to be reduced in an environment where inflation is low and monetary policy is more credible. Choudhri and Hakura (2001) emphasize a channel similar to the one in Taylor (2000). In their model, a low-inflation regime reduces exchange rate pass-through because the expected effects of monetary shocks on current and future costs are lower. They also emphasize the importance of exchange rate regimes.

Engel (2002) discusses several factors that affect exchange rate pass-through, such as the degree of price flexibility, the importance of producer currency pricing versus local pricing, shipping costs, and the share of non-traded goods. Exchange rate pass-through may also depend on various structural features of commodity markets, such as pricing to market by imperfectly competitive firms. In this type of framework, pass-through will depend on different pricing strategies, such as whether firms practice producer currency pricing or local currency pricing. If prices are preset in the currency of the producer, then the home-country price of the foreign good will move one-for-one with changes in the nominal exchange rate; thus there is full pass-through. Consequently, exchange rate movements will lead to a change in the relative price of the goods, and this will lead to a change in consumers' demand for home, relative to foreign, goods. On the other hand, if a firm practices local currency pricing, then prices are preset in the local currency, anges in the nominal exch te will have no short-run effect on prices faced by consumers (Betts and Devereux, 1996; Engel, 2002). Thus, there is no pass-through in the short run. This is consistent with the findings that pass-through varies by industry (Campa and Goldberg, 2005).

The relationship between exchange rate pass-through and the inflation environment has also been examined empirically in a handful of studies. Using this approach on a large sample of countries (both industrialized and developing) over the post-Bretton Woods period, Choudhri and Hakura (2001) and Devereux and Yetman (2002) find that cross country differences in

estimated exchange rate pass-through coefficients can be explained by differences in inflation performance. In their cross-sectional analysis, Gagnon and Ihrig (2004) find a systematic relationship between estimated rates of pass-through and monetary policy in a sample of 20 industrialized countries over the period 1971 to 2000. They also examine the link between the pass-through coefficients and parameters estimated from Taylor-type monetary policy rules, but fail to find a robust relationship.

Recent empirical studies on exchange rate pass through have tended to focus on time-series analysis and developed and emerging economies (Bouakez and Rebei, 2008; Kohlscheen, 2010). Bouakez and Rebei (2008) find that pass-through to Canadian import prices has been rather stable, while pass-through to consumer prices has declined in recent years. Kohlscheen (2010) establishes that pass-through for emerging-market economies typically has been moderate, despite considerable nominal and real exchange rate volatilities.

From this review of the literature, we observe that the extent of pass-through to consumer prices seems to depend on the rate of pass-through to import prices, the share of imports in consumer price indexes, and the response of domestically produced goods to movements in the exchange rate. The extent and speed of pass-through is dependent upon a range of other factors, including expectations of the duration of the currency adjustment, the cost of adjusting prices, and the local demand conditions.

C. Descriptive Analysis

C.1. Descriptive Analysis

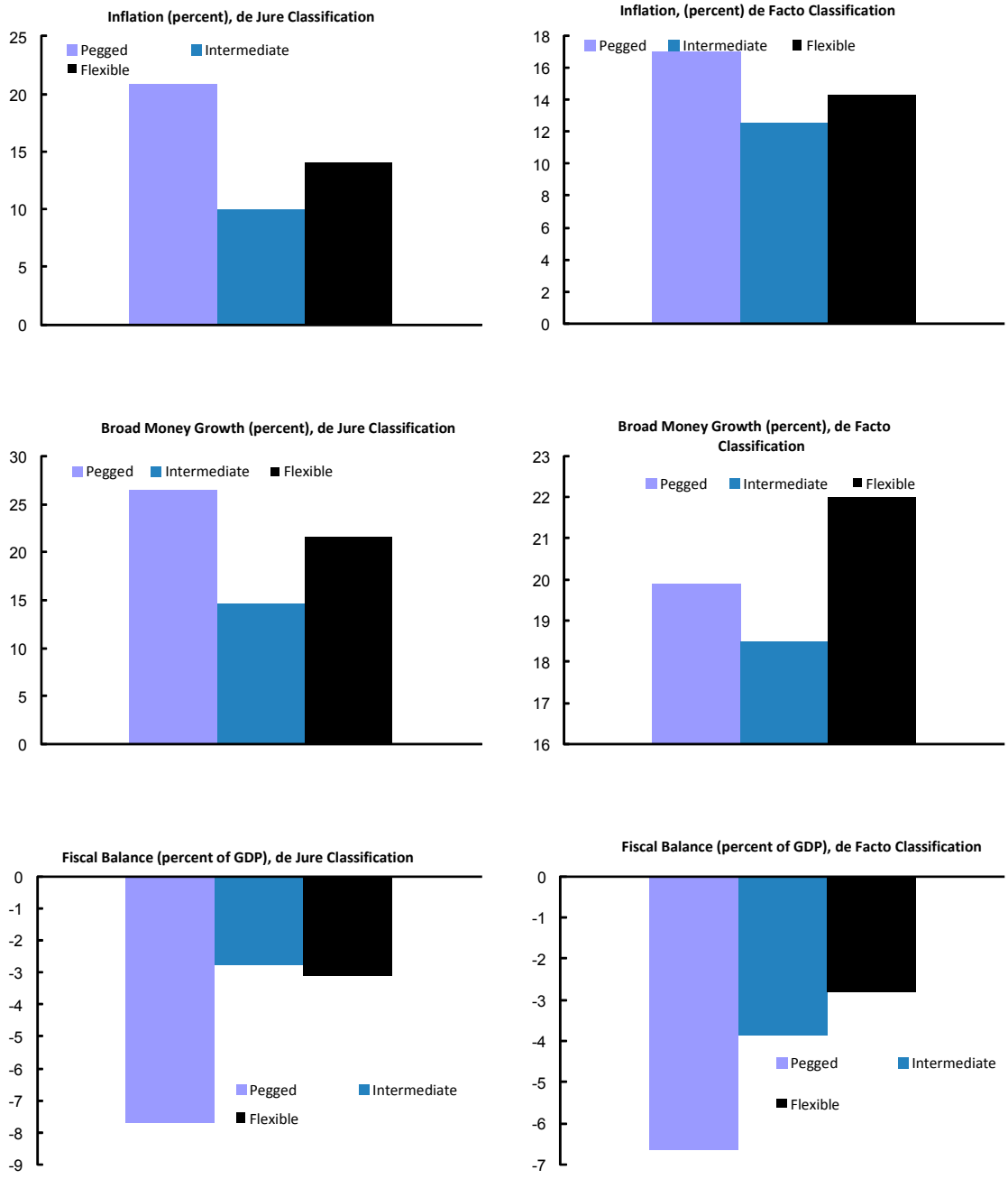
The sample for this descriptive section covers annual observations for the same Eastern African countries (that is, Ethiopia, Kenya, Malawi, Mozambique, Tanzania, Uganda and Zambia) over the period 1990–2010. Our descriptive analysis reveals the following: Inflation is systematically lower under both intermediate and flexible foreign exchange regimes compared with pegged exchange rates (Chart 5). Under the de jure classification, inflation averaged 14.1 percent for the flexible exchange rate regimes and about 10 percent for the intermediate compared with about 21 percent for the pegged exchange rate regimes. The pegged exchange rate regimes also had the highest inflation (17 percent) under the de facto classification, relative to 14.3 percent for flexible and 12.6 percent for intermediate regimes.

As shown in Chart 5 below, broad money growth under the pegged exchange regimes was higher than those of intermediate and flexible exchange rate regimes, especially under the de jure classification, possibly explaining the difference in inflation performance. Broad money growth under the de facto flexible classification had the highest average compared to both the pegged and intermediate regimes.

The pegged exchange rate regime had fiscal deficits as a ratio of GDP that were greater than those of flexible and intermediate regimes, supporting the notion that a pegged foreign

exchange regime, not backed by an appropriate fiscal stance, would not necessarily deliver lower inflation (Chart 5).

Chart 5. Inflation and Other Key Variables under Different Regimes

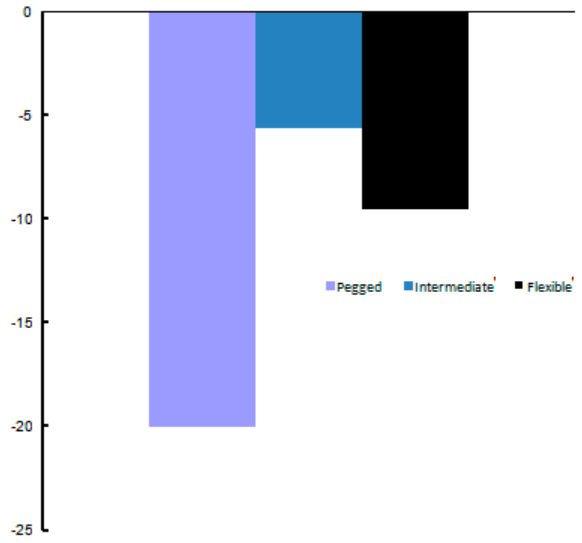


Sources: IMF, World Economic Outlook and Staff estimates.

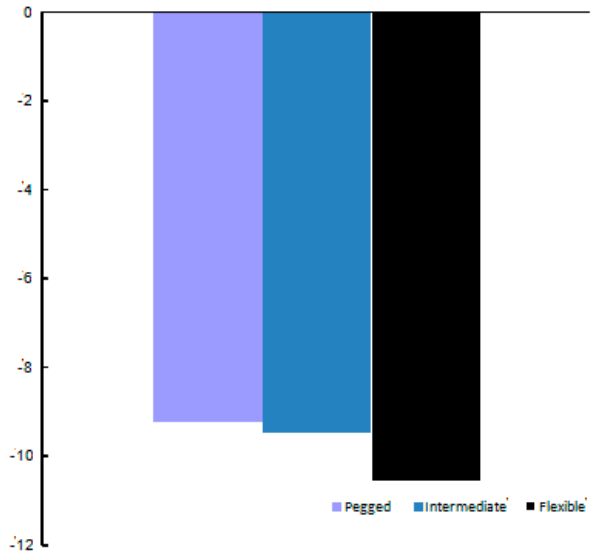
With the de jure classification, the average percentage change in the nominal effective exchange rate under pegged exchange rate regimes exceeded that of intermediate and flexible regimes. Based on the de facto classification, the average percentage change under the three exchange rate regimes was broadly similar, though the flexible exchange rate regime had the highest average percent change (Chart 6).

Chart 6. Nominal Effective Exchange Rate
(percent change)

Nominal Effective Exchange Rate, de Jure Classification



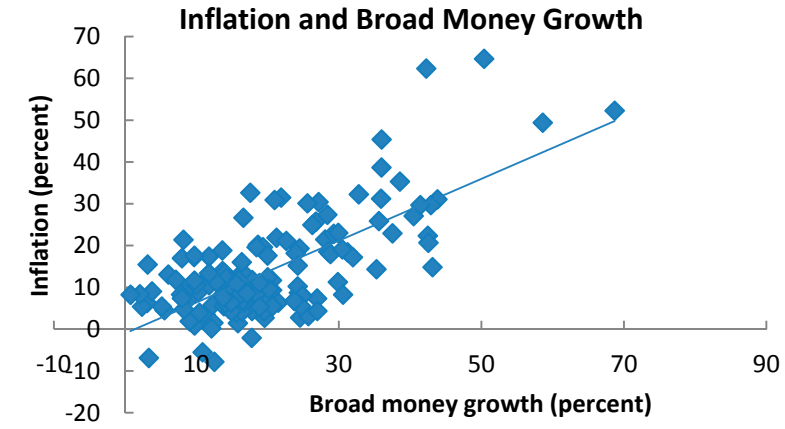
Nominal Effective Exchange Rate, de Facto Classification

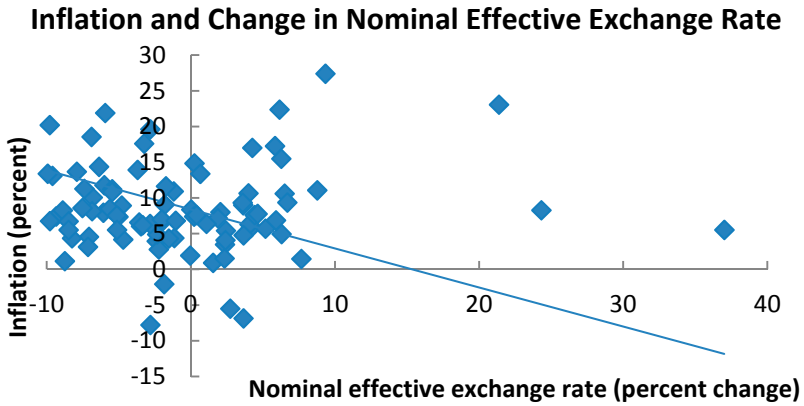


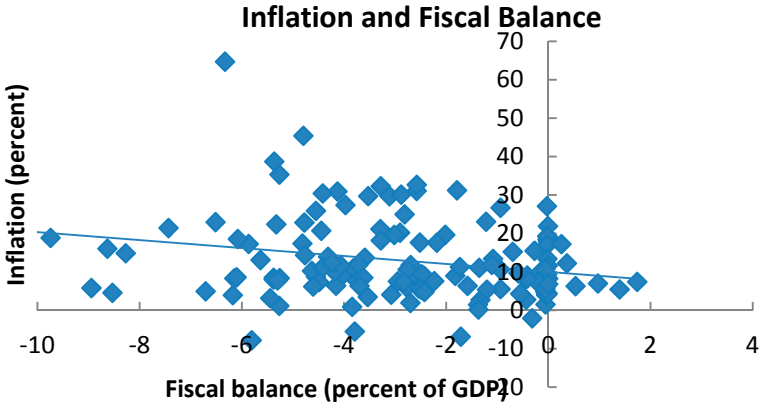
Source: IMF, World Economic Outlook and staff estimates.

Chart 7 shows that annual broad money growth and inflation moved in the same direction, while nominal exchange rate movements and fiscal deficits moved inversely to inflation. Increased broad money growth was associated with higher inflation; while nominal exchange rate appreciation and improvement in the fiscal position were associated with lower inflation.

Chart 7. Inflation and Key Macroeconomic Indicators







Source: IMF Staff estimates.

The next section formalizes this analysis.

D. Empirical Specification

We estimate the relationship, given in (3), between inflation and foreign exchange regime (i.e., pegged, flexible and intermediate), controlling for other factors that could potentially influence inflation:

$$\pi_{it} = \alpha_0 + \alpha_1 \pi_{it-1} + \alpha_2 \Delta m_{it} + \alpha_3 X_{it} + \alpha_4 \Delta NEER_{it} + Lib + \alpha_3 R_{it} + \mu_i + v_t + \varepsilon_{it} \qquad (3)$$

π_{it} is the inflation rate for country *i* at time *t*, π_{it-1} is lagged inflation rate which captures inflation persistence and the role of expectations ($\alpha < 1$) (we transform inflation to $\pi / (1+\pi)$ to reduce the impact of outliers, arising from hyper-inflation). Broad money growth (Δm) represents the growth in broad money and higher growth is expected to lead to higher inflation, consistent with the monetarist view of inflation (we apply the same transformation to broad money as to inflation). X captures other variables that could potentially affect inflation. Real GDP growth (Real GDP) is expected to have a negative correlation with inflation because a country with a higher growth rate of output tends to have a lower rate of inflation for a given rate of money growth. However, higher growth of output may have an ambiguous effect on inflation, depending on whether it reflects supply side or demand side factors. Fiscal balance as a share of GDP (Fiscal balance) is expected to have a positive correlation with inflation because higher deficits may be associated with greater monetization of the deficit and also aggregate demand pressures. The effect of changes in the terms of trade (Terms of trade) on inflation will depend on how the aggregate supply and cost structure of the economy is affected, thus it is ambiguous.

The change in the nominal effective exchange rate ($\Delta NEER$), whose coefficient measures exchange rate pass-through, where an increase represent an appreciation, is expected to have a negative correlation with inflation.[18] Liberalization of the current account (Liberalization), a dummy variable for countries that have liberalized their current account transactions, as in the growth analysis, is expected to reduce inflation because it gives countries the opportunity to take advantage of enhanced trade and investment flows. As in the earlier growth analysis, R captures the regime dummy variables. Flexdejure and Intdejure (likewise for de facto) represent flexible and intermediate exchange rate regimes respectively (with the pegged regime as the excluded category). The μ_i are the country-specific effects and v_t are year effects to capture the effects of shocks over time that are common to all countries (such as oil price shocks); and ε_{it} is a random error term.

[18] The nominal effective exchange rate is constructed in terms of unit of the composite foreign currency per local currency units. Therefore, this variable will take on a (positive (negative) value when the nominal exchange rate appreciates (depreciates).

E. Empirical Results

Estimating (3) requires the use of a technique that is suitable for dynamic panel data models, because the lagged dependent variable (π_{it-1}) would tend to be correlated with the disturbance term. Our initial econometric estimation uses pooled ordinary least squares (OLS). To correct for the bias introduced by country and time characteristics, we apply a cross-section, time-series fixed effects estimator and control for unobserved, country- and time-specific characteristics. We find fixed effects preferable to random effects.

Owing to the correlation between the lagged dependent variable and the error term, as shown by Nickell (1981), a dynamic panel data model with fixed effects generates estimates that are biased when the time dimension of the panel is small. To address this issue and to deal with the potential endogeneity of some of the explanatory variables, we also apply the system Generalized Method of Moments (GMM) estimator.[19] The system GMM estimator (Blundell and Bond, 1998) is more efficient in addressing misspecification issues than is the difference estimator of Arellano and Bond (1991). The system focuses on combining the dependent and explanatory variables into one-system regression in first differences and levels. The methodology also relies on the assumption that there is no second-order correlation in the first-differenced errors. Using this instrument matrix, Arellano and Bond (1991) derive a GMM estimator, as well as two specification tests for this estimator, that can be used to test the validity of the instruments: a test of second-order autocorrelation in the first-differenced residuals and a Sargan test of over-identifying restrictions. We, however, note that the use of system GMM requires a "short-time" period and "many cross-sections," which we lack. Hence we present the various estimates to demonstrate robustness of the results.

Table 5 shows the econometric results obtained from the use of pooled OLS and fixed effects (correcting for cross-sectional and time-effects). Across these three estimation techniques, the lagged inflation, broad money growth and change in nominal effective exchange rate are found on a consistent basis to be significant determinants of inflation. Real GDP growth does not exert a significant influence on growth in our sample of countries, after controlling for other variables. Fiscal balance is negative and significant, only with some of the fixed effects estimations (correcting for cross-sectional effects under both the de jure and de facto classifications and under the de facto classification with cross-sectional and time effects). Changes in the terms of trade are not significant. We do generally find that the de facto exchange rate regime is a significant determinant of inflation, with both intermediate and flexible regimes producing lower inflation relative to the pegged regime, but we do not find a significant relationship for the de jure classification. The only exception is where we apply the fixed effects (correcting for cross-section and time-effects) and both the intermediate and flexible exchange regimes produce higher inflation relative to the pegged exchange rate regime, an odd result. Liberalization of the current account has no significant effect on inflation in our sample of countries.

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[19] Not controlling for the endogeneity of these variables would likely result in inconsistent and biased estimates, as the econometric techniques based on the pooled ordinary least squares and fixed effects impose strict exogeneity assumptions of the independent variables.

Table 5. Inflation and the Exchange Rate Regime, 1990–2010 [1]

Dependent variable: inflation rate						
	OLS		Cross sectional fixed effects		Time and cross sectional effects	
	(1)	(2)	(3)	(4)	(5)	(6)
Inflation (-1)	0.453***	0.458***	0.452***	0.446***	0.358***	0.401***
	(0.076)	(0.074)	(0.060)	(0.059)	(0.067)	(0.070)
Money growth	0.208***	0.206***	0.214*	0.206*	0.157**	0.192**
	(0.059)	(0.057)	(0.065)	(0.062)	(0.073)	(0.079)
Real GDP	-0.070	-0.047	-0.040	-0.037	-0.086	-0.026
	(0.126)	(0.115)	(0.104)	(0.088)	(0.126)	(0.136)
ΔTerms of trade	0.055**	0.048	0.064	0.053	0.058	0.076**
	(0.027)	(0.028)	(0.029)	(0.028)	(0.033)	(0.035)
Fiscal balance	-0.313	-0.235	-0.348**	-0.284**	-0.211	-0.312*
	(0.167)	(0.168)	(0.132)	(0.113)	(0.138)	(0.141)
ΔNEER	-0.251***	-0.256***	-0.246***	-0.251***	-0.268***	-0.252***
	(0.045)	(0.041)	(0.049)	(0.046)	(0.044)	(0.047)
Liberalization	0.012	0.015	-0.000		0.039	0.034
	(0.009)	(0.009)	(0.020)		(0.020)	(0.022)
Intdejure	0.004		-0.007		0.154***	
	(0.022)		(0.017)		(0.038)	
Flexdejure	-0.003		0.021		0.139***	
	(0.021)		(0.023)		(0.038)	
Intdefacto		-0.045*		-0.049**		-0.027
		(0.016)		(0.013)		(0.024)
Flexdefacto		-0.050*		-0.055**		-0.023
		(0.017)		(0.016)		(0.030)
Constant	-0.006	0.036				
	(0.026)	(0.021)				
Observations [2]	140	140	140	140	140	140
R-squared	0.779	0.789	0.724	0.738	0.724	0.738
RMSE	0.056	0.054	0.057	0.055	0.057	0.055

Standard errors in parentheses

* Significant at 10% level.

* * Significant at 5% level.

* * * Significant at 1% level.

[1] Cross-sectional and time-series dummy variables are not presented but the full set of results is available from the authors.

[2] The total numberof observations is 147, but we lose seven observations due to the inclusion of lagged inflation as an explanatory variable.

We then apply the system GMM in view of the issues raised in applying pooled OLS and fixed effects techniques in a dynamic panel setting. We first test for the endogeneity of the independent variables. We are able to establish that both the broad money growth and change in nominal effective exchange rate are endogenous variables and the rest of the key macroeconomic variables are exogenous.[20] These results guide our application of system GMM in separating the variables into exogenous and endogenous variables.[21] Based on the Sargan test, we cannot reject the validity of the instrument, especially with de facto classification. The second specification test pertains to serial correlation of the residuals. The null hypothesis of no first-order serial correlation of the differenced residuals was rejected, whereas the null of no second-order serial correlation of the differenced residuals was not rejected. This suggests the orthogonality conditions hold.

The results from the application of system GMM, as presented in Table 6, are in line with the results from the use of the other econometric techniques in Table 5, pointing to the robustness of our results. The interpretation below follows from columns (1 and 2) of Table 6:

The coefficient on the lagged inflation rate is positive and highly significant in the inflation equation with a coefficient of about 0.5, indicating a high degree of inflation persistence, implying that the current inflation performance is strongly determined by that of the previous year.

A 1 percent increase in the annual rate of growth of broad money would tend to increase inflation by 0.2 percentage point in the same period. An improvement in the fiscal position by 1 percent of GDP would tend to reduce inflation by 0.3 percentage point under the specification with the de jure classification and a reduction of about 0.2 percentage point with the de facto classification.

The exchange rate pass-through is found to be limited, with a 1 percent appreciation (depreciation) of the nominal effective exchange rate decreasing (increasing) inflation by about 0.2 percentage points.[22] Our measure of the cumulative impact of exchange-rate movements on inflation equals (immediate- pass-through/1-coefficient on the lagged

[20] Based on the use of various econometric techniques, variables that are not found to be statistically significant are excluded from Table 5 so as to reduce the number of instruments and the challenge of having seven cross sectional units.

[21] Xtivreg2 routine provided in STATA enables us to test the exogeneity assumption of our regressors variables by the means of a C test distributed as a chi-square (r), where r is the number of suspect regressors for the C statistic to be sure that we can treat them as exogenous. Extending the list of possible exogenous variables (real GDP growth and fiscal balance), abstracting from the results from C test, does not change our main results.

[22] Saxena (2011) finds the estimate of exchange rate pass-through to consumer prices to be 0.49 for Sierra Leone, compared to 0.56 for the world and 0.23 for Africa.

inflation).[23] It is intended to capture the feedback effects resulting from the inclusion of the lagged dependent variable terms (i.e., the effects of an exchange rate change in period t will influence inflation over several periods subsequent to this as a result of these feedback effects). This estimate of long-run pass-through is estimated at 0.4 implying that a 1 percent depreciation of the nominal effective exchange rate will be associated cumulatively with higher inflation of 0.4 percentage point.

The de jure exchange rate regime does not seem to be important for inflation determination. The de facto exchange rate regime exerts a statistically significant negative effect on inflation, with inflation under the intermediate and flexible exchange rate regimes having lower inflation compared to the pegged exchange regime by about 5 percentage points on an annual basis.

[23] See Bailliu and Fujii (2004) for the same approach for arriving at the cumulative pass-through. Aside from many time-series studies that have included lagged inflation as one of the determinants of current inflation, Bailliu and Fujii (2004) also include lagged inflation in the inflation equation in a dynamic-panel model context. In our several estimations, we find the coefficient on lagged inflation to be significant.

Table 6. Inflation and the Exchange Rate Regime, Alternative Specification, 1990–2010

	Dependent variable: inflation rate	
	(1)	(2)
Inflation (-1)	0.479***	0.470***
	(0.044)	(0.048)
Money growth	0.191***	0.191***
	(0.059)	(0.060)
Fiscal balance	-0.305***	-0.179**
	(0.090)	(0.091)
ΔNEER	-0.233***	-0.242***
	(0.050)	(0.050)
Intdejure	0.010	
	(0.013)	
Flexdejure	0.002	
	(0.013)	
Intdefacto		-0.055***
		(0.013)
Flexdefacto		-0.056***
		(0.007)
Arellano-Bond test for AR (1)	0.034	0.032
Arellano-Bond test for AR (2)	0.186	0.190
Observation [1]	140	140
Sargan test	0.078	0.290
Hansen test	1.000	1.000

* Significant at 10% level.

* * Significant at 5% level.

* * * Significant at 1% level.

[1] The total numberof observations is 147, but we lose seven observations due to the inclusion of lagged inflation as an explanatory variable.

F. Conclusions and Policy Implications

This section has empirically examined the relationship between inflation and the characteristics of the foreign exchange regime and other key macroeconomic variables and the degree of pass-through of exchange rate changes to domestic prices. We find that lagged inflation, broad money growth and fiscal position are key macroeconomic determinants of inflation. What is important for inflation determination is not the declared exchange rate regime, but the actual exchange rate regime in place, with flexible and intermediate foreign exchange regimes producing lower inflation than the pegged exchange rate regime. While we found evidence of a significant relationship between exchange rate movements and inflation, there is no evidence for full pass-through, both in the short and long run. The findings of a significant relationship between broad money growth and inflation as well as fiscal position, suggests the complementary roles that both the monetary and fiscal policies can play in containing inflation and ensuring that a nominal devaluation leads to a real devaluation.

REFERENCES

Agenor, Pierre-Richard and Peter J. Montiel, 1996, *Development Macroeconomics* (Princeton, NJ: Princeton University Press).

Aghion, Philippe and Peter Howitt, 2009, *Economics of* Growth (Cambridge, MA: MIT Press).

Arellano, Manuel, and S. Bond, 1991, "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations," *Review of Economic Studies*, Vol. 58, No. 2, pp. 277–297.

Barro, Robert J. and Xavier Sala-i-Martin, 2004, *Economic Growth* (Cambridge, MA: MIT Press).

Bailliu, Jeannine and Eiji Fujii, 2004, "Exchange Rate Pass-Through and the Inflation Environment in Industrialized Countries: An Empirical Investigation," Bank of Canada, Working Paper No. 4–21 (Ottawa, Ontario: Bank of Canada).

Berg, Andrew and Yanliang Miao, "The Real Exchange Rate and Growth Revisited: The Washington Consensus Strikes Back?" IMF Working Paper No. 10/58 (Washington, D.C.: International Monetary Fund).

Betts, Caroline and Michael B. Devereux, 1996, "The Exchange Rate in a Model of Pricing-to-Market," *European Economic Review,* Vol. 40, No. 3–5, pp. 1007–21.

Blundell, Richard and Stephen Bond, 1998, "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models," *Journal of Econometrics*, Vol. 87, No. 1, pp. 111–143.

Bouakez, Hafedh and Nooman Rebei, 2008, "Has Exchange Rate Pass-Through Really Declined? Evidence from Canada," *Journal of International Economics*, Vol.75, No. 2, pp. 249–267.

Bubula, Andrea, and Inci Otker-Robe, 2002, "The Evolution of Exchange Rate Regimes Since 1990: Evidence from De Facto Policies," IMF Working Paper No. 02/155 (Washington, DC: International Monetary Fund).

Calvo, Guillermo A., and Carmen M. Reinhart, 2002, "Fear of Floating" *Quarterly Journal of Economics*, Vol. 117, No. 2, pp. 379–408.

Campa, Jose Manuel and Linda S. Goldberg, 2005, "Exchange Rate Pass-Through into Import Prices," *Review of Economics and Statistics,* Vol. 87, No. 4, pp. 679–690.

Choudhri, Ehsan U. and Dalia S. Hakura, 2006, "Exchange Rate Pass-Through to Domestic Prices: Does the Inflationary Environment Matter?" *Journal of International Monety and Finance*, Vol 25, No. 4, pp 614–639.

Christiansen, Lone, E., Alessandro Prati, Luca Antonio Ricci, and Thierry Tressel, 2009, "External Balance in Low Income Countries," IMF Working Paper No. 09/221 (Washington, D.C.: International Monetary Fund).

Commission on Growth and Development, 2008, *Growth Report: Strategies for Sustained Growth and Inclusive Development* (Washington, DC: World Bank).

De Grauwe, Paul and Gunther Schnabl, 2008, "Exchange Rate Stability, Inflation and Growth in (South) Eastern and Central Europe," *Review of Development Economics*, Vol.12, No. 3, pp. 530–549.

Devereux, Michael B. and James Yetman, 2010, "Price Adjustment and Exchange Rate Pass-Through," *Journal of International Money and Finance,* Vol. 21, No. 1, pp. 181–200.

De Vita, Glauco and Khine Sandar Kyaw, 2011, "Does the Choice of Exchange Rate Regime Affect the Economic Growth of Developing Countries," *Journal of Developing Areas,* Vol. 45, No. 1, pp. 135–53.

Engel, Charles, 2002, "The Responsiveness of Consumer Prices to Exchange Rates: A Synthesis of Some New Open Economy Macro Models," *Manchester School,* Vol. 70, pp. 1–15.

Gagnon, Joseph E. and Jane Ihrig, 2004, "Monetary Policy and Exchange Rate Pass-Through," *International Journal of Finance and Economics*, Vol. 9, No. 4, pp. 315–338/

Ghosh, Atish R., Anne-Marie Gulde, Jonathan D. Ostry, and Holger C. Wolfe, 1997, "Does the Nominal Exchange Regime Matter?" NBER Working Paper No. 5874 (Cambridge, MA: National Bureau of Economic Research).

Ghosh, Atish, R., Anne-Marie Gulde, and Holger C. Wolf, 2002, *Exchange Rate Regimes: Choices and Consequences* (Cambridge, MA: MIT Press).

Ghosh, Atish R., Jonathan D. Ostry, and Charalambos G. Tsangarides, 2010, "Exchange Rate Regimes and the Stability of the International Monetary System," IMF Occasional Paper 270 (Washington, D.C.: International Monetary Fund).

Ghosh, Atish R., Mahvash S. Qureshi, and Charalambos Tsangarides, 2011, "Words vs. Deeds: What Really Matters?" IMF Working Paper No. 11/112 (Washington, D.C.: International Monetary Fund).

Guerguil, Martine, Catherine McAuliffe, Hamid R. Davoodi, Maxwell Opoku-Afari, and Shiv Dixit, 2011, "The East African Community: Taking Off?" in *Regional Economic Outlook, Sub-Saharan Africa* (Washington, D.C.: International Monetary Fund), pp. 51–72.

Harms, Philipp and Marco Kreschmann, 2009, "Words, Deeds and Outcomes: A Survey on the Growth Effects of Exchange Rate Regimes," *Journal of Economic Surveys*, Vol. 23, No. 1, pp. 139–164.

Husain, Aasim M., Ashoka Mody, and Kenneth S. Rogoff, 2005, "Exchange Rate Regime Durability and Performance in Developing versus Advanced Economies," *Journal of Monetary Economics*, Vol. 52, No. 1, pp. 35–64.

IMF, 1999, "Exchange Rate Arrangements and Currency Convertibility: Developments and Issues," *World Economic and Financial Surveys* (Washington, DC: International Monetary Fund).

IMF, *Annual Report on Exchange Arrangements and Exchange Restrictions,* various editions, (Washington, D.C.: International Monetary Fund).

Johnson, Simon H., Jonathan D. Ostry, and Arvind Subramanian, 2007, "The Prospects for Sustained Growth in Africa: Benchmarking the Constraints," IMF Working Paper No. 7/52 (Washington, D.C.: International Monetary Fund).

Klein, Michael W. and Jay C. Shambaugh, 2010, *Exchange Rate Regimes in the Modern Era* (Cambridge, MA: MIT Press).

Kohlscheen, Emanuel, 2010, "Emerging Floaters: Pass-Throughs and (Some) New Commodity Currencies," *Journal of International Money and Finance,* Vol. 29, No. 9, pp. 1580–1595.

Levine, Ross and David Renelt, "A Sensitivity Analysis of Cross-Country Growth Regressions," *American Economic Review*, Vol. 82, No. 4, pp. 942–963.

Levy-Yeyati, Eduardo and Federico Sturzenegger, 2001, "Exchange Rate Regimes and Economic Performance," *IMF Staff Papers*, Vol. 47, pp. 62–98.

Levy-Yeyati, Eduardo and Federico Sturzenegger, 2003, "To Float or to Fix: Evidence on the Impact of Exchange Rate Regimes on Growth," *American Economic Review*, Vol. 93, No. 4, pp. 1173–1193.

Levy-Yeyati, Eduardo and Federico Sturzenegger, 2005, "Classifying Exchange Rate Regimes: Deeds vs. Words," *European Economic Review*, Vol. 49, No. 6, pp. 1603–1635.

Maehle, Nils, Haimanot Teferra, and Armine Khachatryan, forthcoming 2012, "Exchange Rate Liberalization in Selected Sub-Saharan African Countries: Successes, Failures, and Lessons," IMF Working Paper (Washington, D.C.: International Monetary Fund).

Mankiw, N. Gregory, David Romer, and David N. Weil, 1992, "A Contribution to the Empirics of Economic Growth," *Quarterly Journal of Economics*, Vol. 107, No. 2, pp. 407–437.

Miles, William, 2006, "To Float or Not to Float? Currency Regimes and Growth," *Journal of Economic Development*, Vol. 31, No. 2, pp. 91–105.

Nickell, Stephen J., 1981, "Biases in Dynamic Models with Fixed Effects," *Econometrica,* Vol. 49, No. 6, pp. 1417–26.

Obstfeld, Maurice and Kenneth Rogoff, 1995, "The Mirage of Fixed Exchange Rates," *Journal of Economic Perspectives*, Vol. 9, No. 4, pp. 73–96.

Pattillo, Catherine, Sanjeev Gupta, and Kevin Carey, 2006, *Sustaining and Accelerating Pro-Poor Growth in Africa* (Washington, D.C.: International Monetary Fund).

Petreski, Marjan, 2009, "Exchange-Rate Regime and Economic Growth: A Review of the Theoretical and Empirical Literature," *Economics,* Discussion Paper No. 2009–31.

Reinhart, Carmen M. and Kenneth S. Rogoff, 2004, "The Modern History of Exchange Rate Arrangements: A Reinterpretation," *Quarterly Journal of Economics,* Vol. 119, No. 1, pp. 1–48.

Rodrik, Dani, 2008, "The Real Exchange Rate and Economic Growth," *Brookings Papers on Economic Activity*, Vol. 2, pp. 365–412.

Rogoff, Kenneth S., Aasim M. Husain, Ashoka Mody, Robin J. Brooks, and Nienke Oomes, 2004, "Evolution and Performance of Exchange Rate Regimes," IMF Occasional Paper 229 (Washington, D.C.: International Monetary Fund).

Rose, Andrew K., 2011, "Exchange Rate Regimes in the Modern Era: Fixed, Floating, and Flaky," *Journal of Economic Literature*, Vol. 49, No. 3, pp. 652–672.

Saxena, Sweta C., 2011, "Exchange Rate Pass-Through to Inflation in Sierra Leone," *Africa Research Papers (internal IMF publication),* ARP/11/02.

Taylor, John B., 2000, "Low Inflation, Pass-Through, and Pricing Power of Firms," *European Economic Review,* Vol. 44, No. 7, pp. 1389–1408.

Tornell, Aaron and Andres Velasco, 2000, "Fixed Versus Flexible Exchange Rates: Which Provides More Fiscal Discipline?" *Journal of Monetary Economics*, Vol. 45, No. 2, pp. 399–436.

APPENDIX A

Table A1. Countries in the Sample, Definition of Variables and Sources

Countries in the sample:

Ethiopia
Kenya
Malawi
Mozambique
Tanzania
Uganda
Zambia

Definition of variables and sources

Variable	Description	Source
Dependent variables		
Inflation	Consumer price index, annual percentage change (percent).	International Monetary Fund, WEO
Rgdppcg	Real GDP growth per capita (percent)	International Monetary Fund, WEO
Rgdppcg_nagr	Nonagricultural Real GDP growth per capita (percent)	World Bank, World Development Indicators, IMF staff estimates
Independent variables		
Fiscal balance	Fiscal balance (general government net lending/borrowing, percent of GDP)	International Monetary Fund, WEO, country desk estimates.
Govc	Government consumption (percent of GDP).	International Monetary Fund, WEO
Inflation (-1)	Normalized (lagged) rate of inflation calculated as: (inflation/100)/(1+inflation/100).	International Monetary Fund, WEO
Inv (-1)	Lagged investment, gross fixed capital formation (percent of GDP)	International Monetary Fund, WEO
Money growth	Normalized growth rate of broad money calculated as Δmnorm=(Δm/100)/(1+Δm/100).	International Monetary Fund, WEO
ΔNEER	Change in nominal effective exchange rate (annual percent change).	International Monetary Fund, Information Notice System
Real GDP	Real GDP growth	International Monetary Fund, WEO
ΔREER	Change in REER (average yearly).	International Monetary Fund, Information Notice System
ΔTerms of trade	Change in terms of trade index (2000=100).	International Monetary Fund, WEO
Dummy variables		
Intdejure	Intermediate exchange rateime regime	International Monetary Fund, *Annual*

Variable	Description	Source
	dummy, de jure regime classification	*Report on Exchange Arrangements and Exchange Restrictions (AREAER).*
Flexdejure	Flexible exchange regime dummy, de jure regime classification	International Monetary Fund, AREAER
Intdefacto	Intermediate exchange regime dummy, de facto regime classification	International Monetary Fund AREAER and Bubula and Ötker-Robe (2002).
Flexdefacto	Flexible exchange regime dummy, de facto regime classification	International Monetary Fund, AREAER and Bubula and Ötker-Robe (2002).
Dejureind	An index variable, where 0 is pegged, 1 is intermediate and 2 is floating) for de jure regime classification.	
Defactoind	An index variable, where 0 is pegged, 1 is intermediate and 2 is floating) for de facto regime classification.	
Liberalization	Liberalization dummy constructed based on controls for current account transactions; a country is considered to have a liberalized regime (the dummy variable taking a value of 1 and 0 otherwise) if it has a liberalized current account.	International Monetary Fund, AREAER
D1	A dummy variable taking a value of 1 for negative residuals from the FEER regression.	
D2	A dummy variable taking a value of 1 for positive residuals from the FEER regression.	
(D1*Und)	Variable representing undervaluation.	
(D2*Over)	Variable representing overvaluation.	

Table A2. Descriptive Statistics for Full Sample, 1990–2010

Variable	Mean	Standard Deviation	Min	Max
Real GDP per capita growth (percent change)	0.023	0.046	-0.160	0.120
Investment (percent of GDP)	0.186	0.047	0.090	0.310
Government consumption (percent of GDP)	0.144	0.061	0.060	0.620
Real effective exchange rate (percent change)	-0.004	0.124	-0.489	0.444
Terms of Trade (normalized)	-0.003	0.159	-0.588	0.607
Nominal effective exchange rate (normalized)	-0.099	0.155	-0.620	0.370
Real GDP growth (percent change)	0.047	0.049	-0.133	0.148
Broad money (percent change)	0.201	0.113	0.008	0.687
Inflation (CPI, annual percent)	0.138	0.119	-0.078	0.647
Fiscal balance (percent of GDP)	-0.037	0.060	-0.528	0.017

Table A3.1. Selected Variable Means by Exchange Regime, 1990–2010
(de Jure classification)

Regime classification	Pegged (22)	Intermediate (46)	Flexible (79)
Real GDP per capita growth (percent change)	-0.012	0.030	0.028
Investment (percent of GDP)	0.163	0.194	0.189
Government consumption (percent of GDP)	0.141	0.139	0.148
Real effective exchange rate (percent change)	-0.094	0.017	0.006
Terms of Trade (normalized)	-0.070	0.030	-0.004
Nominal effective exchange rate (normalized)	-0.201	-0.057	-0.096
Real GDP growth (percent change)	0.045	0.047	0.047
Broad money (percent change)	0.265	0.146	0.214
Inflation (CPI, annual percent)	0.209	0.099	0.141
Fiscal balance (percent of GDP)	-0.077	-0.028	-0.031

Table A3.2. Selected Variable Means by Exchange Regime, 1990–2010
(de Facto classification)

Regime classification	Pegged (14)	Intermediate (72)	Flexible (61)
Real GDP per capita growth (percent change)	-0.001	0.026	0.023
Investment (percent of GDP)	0.157	0.191	0.188
Government consumption (percent of GDP)	0.210	0.140	0.134
Real effective exchange rate (percent change)	0.010	-0.012	0.002
Terms of Trade (normalized)	0.009	-0.005	-0.004
Nominal effective exchange rate (normalized)	-0.092	-0.095	-0.106
Real GDP growth (percent change)	0.038	0.048	0.048
Broad money (percent change)	0.199	0.185	0.220
Inflation (CPI, annual percent)	0.182	0.126	0.143
Fiscal balance (percent of GDP)	-0.066	-0.038	-0.028

APPENDIX B

Characterizing accurately the exchange rate regime is critical in assessing the relationship between exchange rate regimes and economic growth and inflation. In our empirical study we adopted two classification schemes:[24] The IMF de jure regime classification, based on the regime that governments claim to have in place, published by the IMF in its Annual Report on Exchange Rate Agreements and Exchange Restrictions (various issues) and the IMF de facto classification scheme that corrects for observed exchange rate behavior and countries' de facto policies, based on Bubula and Ötker-Robe (2002) and IMF's Annual Report on Exchange Rate Agreements and Exchange Restrictions. Thus, we complement the IMF de jure classification scheme with the de facto scheme for comparison.

The IMF de jure classification[25]

The IMF de jure classification is reported in either the issues of the *Annual Report on Exchange Rate Agreements and Exchange Restrictions* or in the *International Financial Statistics*. For the countries in our study, this original IMF de jure classification scheme is presented in Table B1. As can be seen, we further mapped the original classification into three (Floating, Intermediate, and Pegged) regime categories. This is done to draw a line in a continuum of different intermediate regimes ranging from fixed rates, hard and soft pegs, crawling or other stabilized arrangements, heavily or lightly managed floats, and free floating regimes.

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

[25] All classifications are at end of year.

Table B1. The IMF de Jure Regime Classifications and our Reclassification Strategy

	IMF	Reclassified
Pegged to the U.S. dollar	1	1
Pegged to a basket of currencies	2	1
Pegged to a weighted basket of currencies	3	1
Pegged to a trade weighted basket of currencies	4	1
Fixed in terms of the SDR	5	1
The weighted average of bids emerging from the auction is the official rate.	6	2
Managed floating	7	2
Managed floating with no preannounced path for the exchange rate	8	2
Other managed arrangement	9	2
Floating	10	3
Free floating	11	3
Independent floating	12	3

In tables B2.1 and B2.2, we show the original IMF de Jure classification distributed by years.

Table B2.1. The IMF de Jure Regime Classification

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Ethiopia	1	1	1	1	1	7	12	7	8	8	8
Kenya	2	2	2	12	12	12	12	7	8	8	8
Malawi	2	2	2	12	12	12	12	7	8	8	12
Mozambique	3	3	3	12	12	12	12	12	12	12	12
Tanzania	2	2	2	6	12	12	12	12	12	12	12
Uganda	4	4	4	12	12	12	12	12	12	12	12
Zambia	5	5	12	12	12	12	12	12	12	12	12

Table B2.2. The IMF de Jure Regime Classification (continued)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Ethiopia	8	8	8	8	8	8	7	9	7	7
Kenya	8	8	8	8	8	8	11	11	11	11
Malawi	12	12	12	12	8	8	8	10	10	10
Mozambique	12	12	8	8	8	8	7	7	10	10
Tanzania	12	12	12	12	12	8	11	11	11	11
Uganda	12	12	12	12	12	8	11	11	11	11
Zambia	8	8	8	8	8	8	11	11	10	10

Based on our allocation strategy shown in Table B1, we present the mapped versions of the IMF original de jure regime scheme in Tables B3.1 and B3.2.

Table B3.1. Reclassified Three Regime de Jure Classification

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Ethiopia	1	1	1	1	1	2	3	2	2	2	2
Kenya	1	1	1	3	3	3	3	2	2	2	2
Malawi	1	1	1	3	3	3	3	2	2	2	3
Mozambique	1	1	1	3	3	3	3	3	3	3	3
Tanzania	1	1	1	2	3	3	3	3	3	3	3
Uganda	1	1	1	3	3	3	3	3	3	3	3
Zambia	1	1	3	3	3	3	3	3	3	3	3

Table B3.2. Reclassified Three Regime de Jure Classification (continued)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Ethiopia	2	2	2	2	2	2	2	2	2	2
Kenya	2	2	2	2	2	2	3	3	3	3
Malawi	3	3	3	3	2	2	2	3	3	3
Mozambique	3	3	2	2	2	2	2	2	3	3
Tanzania	3	3	3	3	3	2	3	3	3	3
Uganda	3	3	3	3	3	2	3	3	3	3
Zambia	2	2	2	2	2	2	3	3	3	3

The IMF de facto classification

Regarding the IMF de facto classification, since 1999 the IMF moved from a purely de jure classification to a hybrid one, which combines information obtained through bilateral discussions with or provision of technical assistance to the country authorities and also from the IMF's judicial assumptions over the countries de facto policies and the observed behavior of the exchange rate within the existing exchange rate regime framework. This new methodology was applied by the IMF to the years after 1999 up to 2011, and the data is available through the yearly issues of Annual Report on Exchange Rate Agreements and Exchange Restrictions. To make a consistent database of de facto regimes, including the previous years, we have combined the IMF database on de facto regimes with Bubula and Ötker-Robe (2002). In this work, the authors backdated the IMF's improved classification methodology to 1990. This paper also adds to the IMF official classification more details on some regimes including the introduction of backward-and forward-looking crawling pegs and bands, and tightly managed floats. Thus, in

Table B4, we present both Bubula and Ötker-Robe and IMF regime classifications and our regrouping strategy. Unless the two classifications coincide, Bubula and Ötker-Robe definitions are used before 1999, while after 1999 (included) the IMF definitions are used.

Table B4. Bubula and Ötker-Robe and IMF de Facto Regime Classifications and our Reclassification Strategy

Bubula and Ötker-Robe	IMF (from 1999)	Original	Reclassified
Conventional fix peg to single currency	Other conventional fixed peg	4	1
Conventional fix peg to a basket		5	1
	Crawl-like arrangement	6	2
	Stabilized arrangement	7	2
Backward looking crawling peg		9	2
	Other managed arrangement	10	2
Tightly managed floating		11	2
Other managed floating	Managed floating	12	2
Independently floating	Floating	13	3

In Tables B5.1 and B5.2 we reclassify this combined classification scheme into our three regime scenario.[26] These later scenario of de facto classification is used throughout the study and in contrast with the de jure regime classifications presented in Tables B3.1 and B3.2.

Table B5.1. The Three Regime de Facto Classification

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Ethiopia	1	1	1	2	2	2	2	2	2	2	2
Kenya	1	1	1	2	2	2	2	2	2	2	2
Malawi	1	1	1	1	1	1	1	2	2	2	3
Mozambique	2	2	2	3	3	3	3	3	3	3	3
Tanzania	2	2	2	3	3	3	3	3	3	3	3
Uganda	2	2	3	3	3	3	3	3	3	3	3
Zambia	2	2	3	3	3	3	2	3	3	3	3

[26] Please see Bubula and Ötker-Robe (2002) for de facto classification for the years 1990–99.

Table B5.2. The Three Regime de Facto Classification (continued)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Ethiopia	2	2	2	2	2	2	1	2	2	2
Kenya	2	2	2	2	2	2	2	2	3	3
Malawi	3	3	3	3	2	2	2	2	2	2
Mozambique	3	3	2	2	2	2	2	2	3	3
Tanzania	3	3	3	3	3	2	2	2	3	3
Uganda	3	3	3	3	3	2	2	2	3	3
Zambia	2	2	2	2	2	2	2	3	3	3

Table B6 shows the regime distributions of both de jure and de facto observations. Floating regimes constitute about half of all the observations, while pegged regimes about 15 percent according to the official IMF de jure classification. Under the de facto categorization, there are even fewer pegged regimes, about 10 percent of total observations.

Table B6. Distribution of Regimes

	IMF (de Jure)	Percent in Total	IMF (de Facto)	Percent in Total
Regime				
Float	79	54	61	41
Intermediate	46	31	72	49
Pegged	22	15	14	10
Total	147	100	147	100

Among the countries in our sample presented in Tables B7 and B8, Tanzania and Uganda had most of the floating time periods, 20, 25 and 22, 26 percent of all floats, respectively under both de jure and de facto settings. Ethiopia is the only country which has had no experience in a floating regime, except on a de jure basis in 1996. Having said this, Ethiopia and Kenya have most of the experience in running managed arrangements. Mozambique and Zambia have had considerable experience in having a floating regime in place. Malawi is somewhat in the middle--neither seriously floating, nor pegging, but having some sort of stabilized arrangements most of the time. Note that there is a gap between de jure and de facto exchange rate regime in Malawi and Kenya.

Table B7. Distribution of de Jure Regimes by Country

	Floating	Intermediate	Pegged	Percent of Floats	Percent in Total
Ethiopia	1	15	5	5	1
Kenya	8	10	3	38	10
Malawi	12	6	3	57	15
Mozambique	12	6	3	57	15
Tanzania	16	2	3	76	20
Uganda	17	1	3	81	22
Zambia	13	6	2	62	16
Total	79	46	22		100

Table B8. Distribution of de Facto Regimes by Country

	Floating	Intermediate	Pegged	Percent of Floats	Percent in Total
Ethiopia	0	17	4	0	0
Kenya	2	16	3	10	3
Malawi	5	9	7	24	8
Mozambique	12	9	0	57	20
Tanzania	15	6	0	71	25
Uganda	16	5	0	76	26
Zambia	11	10	0	52	18
Total	61	72	14		100

Charts B1 and B2 depict the evolution of the exchange rate regimes in our sample of 7 countries ranging from 1990 to 2010 using both classification schemes. As shown in the top chart, the de jure classification shows an overall movement from pegged to floating regimes with the popularity of intermediate regimes fluctuating over time. In the bottom chart with de facto regimes, intermediate regimes are more common and the move towards floating regimes is not generalized.

Chart B1. Frequency Distribution of Exchange Rate Regimes, 1990–2010
(De jure classification)

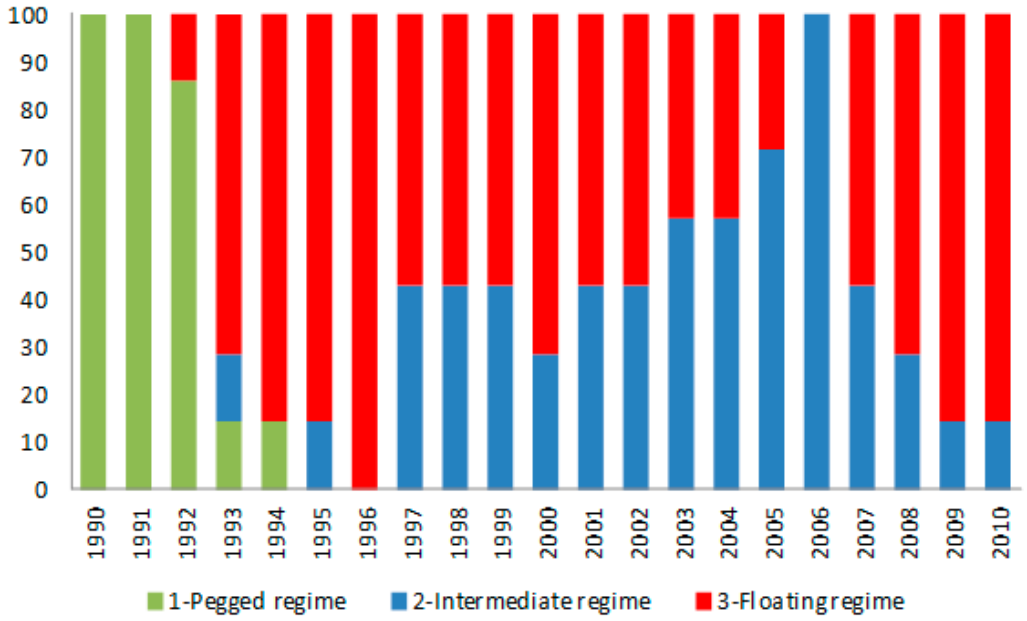
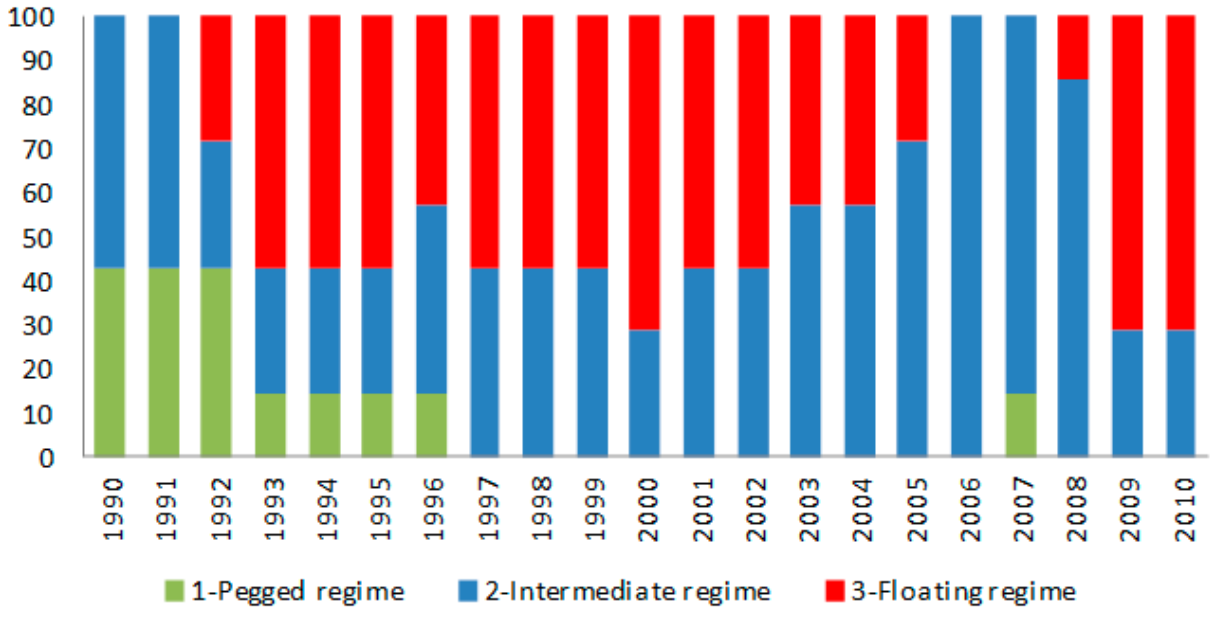


Chart B2. Frequency Distribution of Exchange Rate Regimes, 1990–2010
(De facto classification)



As became evident, there are differences between the two classification schemes, and our calculated correlation coefficient between the IMF de facto and de jure regime classifications is 0.65. The divergence is mostly concentrated in the gap between de jure pegged and de facto intermediate and floating regimes and de jure floating and de facto intermediate regimes. In this context, we also observe the "fear of floating" (Calvo and Reinhart, 2000).

This comparison reveals two important developments in our sample of countries: first, the proportion of de facto pegs that are de jure either intermediate or floating regimes has almost doubled since 1993 growing from about 15 to about 28 percent of cases in 2010, and second, the proportion of de facto pegs that are de jure an intermediate or floating regime has decreased over time, going down from an average of 25 percent of cases in the early 90s to none in 2010.

APPENDIX C

Table C1. The Exchange Rate Regression [1]

Dependent variable: Real exchange rate	
OLS with time dummies	
	(1)
Real GDP per capita	-0.018**
	(0.008)
Terms of trade	0.146**
	(0.064)
Government consumption	1.283***
	(0.328)
Openness	-0.015***
	(0.003)
Investment	-1.109
	(0.561)
Constant	4.629***
	(0.406)
Observations [2]	140
R-squared	0.326
RMSE	0.246

Source: IMF staff estimates.

Standard errors in parenthesis
* Significant at 10% level.
** Significant at 5% level.
*** Significant at 1% level.

[1] The real exchange rate, real GDP per capita, and terms of trade are expressed in logarithmic terms.

Openness, government consumption, and investment are expressed as a share of GDP.

[2] The total number of observations is 147, but we lose five observations for missing data on Mozambique on the REER and two obsetvations for missing data on Zambia for terms of trade, to yield 140 observations.