

2. Exchange Rate Regimes in Sub-Saharan Africa: Experiences and Lessons

As elsewhere, exchange rate regimes in sub-Saharan African countries vary greatly, and have evolved over time. Recent IMF work on exchange rate regimes suggests that there is no single prescription, and that the appropriate regime for a country depends on the macroeconomic challenges facing the country and its particular circumstances (see Ghosh, Ostry, and Tsangarides 2010). The exchange rate regime in turn has bearing on economic outcomes, but alongside other macroeconomic policies as well as the strength and depth of institutions.

This chapter considers what bearing exchange rate regimes have had on several important macroeconomic variables in sub-Saharan African countries. Specifically, we consider the effects exchange rate regimes have had on inflation, output growth, and output growth volatility outturns, relative to other emerging market and developing economies. Relatedly, we also examine the influence exchange rate regimes have had on fiscal outcomes. And based on the findings, we discuss policy requirements to strengthen macroeconomic performance.

The main findings are as follows:

- For analytical purposes and in keeping with the literature, we classify exchange rate regimes into three groups: pegs, intermediates, and floats. As in other regions, there is considerable variation in regimes across sub-Saharan Africa and over time. One distinguishing feature relative to other developing regions is the higher prevalence of pegs: nearly 60 percent of countries in sub-Saharan Africa had a peg in 2014 compared with 47 percent in other emerging market and developing economies. Over time, as in other emerging market and developing economies, some countries with

more flexible regimes tended to move toward less flexible arrangements—on an operational or de facto basis, though not always on a de jure basis, which tracks what countries announce their regime to be—particularly after the 2008 global financial crisis. For sub-Saharan African countries, this appears to reflect the tendency among many commodity exporters to lean against nominal appreciations in the face of significant foreign exchange inflows when commodity prices are high.

- Consistent with the monetary discipline and policy credibility that pegs provide, sub-Saharan African countries with pegged regimes have had lower inflation than their peers with floats or intermediate regimes. The lower-inflation benefit associated with exchange rate pegs has been greatest for the countries where the central bank de jure commits to and de facto maintains parity against an anchor currency.
- Growth performance has been mixed across regimes and over time. Our findings include the following:
 - Prior to 2000, there was not much of a per capita growth differential among countries with various types of regimes. But since around 2000, countries with more flexible exchange rate arrangements in sub-Saharan Africa have enjoyed 1–2 percentage points higher annual output per capita growth rates than pegs. Such a growth differential is not evident in other developing economies.
 - What explains this growth differential in sub-Saharan Africa? By and large, it seems attributable to some countries with pegs having had less competitive real exchange rate positions relative to countries with floating and intermediate regimes. It appears that in countries with pegs, various structural factors have kept domestic production costs and inflation higher relative to their anchor currencies,

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notwithstanding their lower inflation compared with countries with floating or intermediate regimes.

- Exposure to international capital flows among frontier market countries with de jure intermediate regimes combined with limited exchange rate adjustments appears to have led to greater output volatility compared with countries with floats.
- Floaters and peggers in sub-Saharan Africa have been associated with lower fiscal deficits than countries with intermediate regimes. For the floaters, this is consistent with the notion that fiscal indiscipline has an immediate cost in terms of exchange rate depreciations and higher inflation. For peggers, the need to subordinate macroeconomic policies to support the peg looks to have instilled more fiscal discipline. In recent years, intermediate regimes and to some extent floats in sub-Saharan Africa have been associated with less fiscal discipline than pegs, partly because of the increased availability of foreign financing that helped finance larger fiscal deficits while sustaining the exchange rate regimes. Despite this, these regimes have not been associated with a faster pace of debt accumulation than pegged regimes, which suggests that the strong growth performance of these countries helped keep debt-to-GDP ratios in check.
- The policy implications of the foregoing, particularly at the current conjuncture, are twofold:
 - For countries with less flexible exchange rate regimes, the onus is on (1) maintaining fiscal discipline and building buffers and (2) aggressive pursuit of structural reforms to improve competitiveness and facilitate economic diversification, even at times when growth is buoyant. This is all the more important given the weaker growth outcomes in countries with pegs at least since around 2000. Particularly at this juncture when low commodity prices have sharply reduced export earnings and fiscal revenues in a number of countries

with pegged regimes, it is imperative to implement growth-friendly fiscal adjustment and improve the efficiency of government spending, as well as undertake comprehensive structural reforms to reduce production costs and facilitate economic diversification.

- Countries with more flexible regimes have experienced higher inflation, and, in the case of countries with intermediate regimes, fiscal discipline has been weaker. This calls for putting in place domestic monetary policy frameworks with a strong mandate on price stability that can support the more flexible exchange rate regime. Under the current external pressures from low commodity prices and tighter external financing conditions, growth-friendly fiscal adjustment can help contain inflationary pressures associated with exchange rate depreciations.

EVOLUTION OF EXCHANGE RATE REGIMES IN SUB-SAHARAN AFRICA

This section examines the evolution of exchange rate regimes in sub-Saharan African economies since 1980. We begin by describing broad trends in exchange rate regimes based on a three-way categorization of *pegged*, *intermediate*, and *floating* exchange rate regimes using the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) database.¹ The *pegged* exchange rate regime category comprises hard pegs (countries with a currency board or countries without a separate legal tender, including monetary unions) and conventional single-currency pegs; the *intermediate* category comprises basket pegs, pegs within bands, crawling pegs, and floats with rule-based or discretionary intervention (managed floats); and the *floating* category comprises the independent floats.

¹ The empirical analysis in this chapter relies on an extended data set of IMF exchange rate classifications obtained following the methodology in Ghosh, Qureshi, and Tsangarides 2014, using the latest available AREAER data set which ends in 2014.

We also distinguish between de jure and de facto exchange rate classifications. The de jure classification reflects what the authorities declare the exchange rate regime to be in the AREAER. By contrast, the de facto classification seeks to categorize the regime according to the behavior of the exchange rate or the behavior of the central bank based on statistical methods alongside qualitative judgment drawing on IMF country team analyses and consultations with the respective central banks.² Three main points can be discerned in the evolution of sub-Saharan African countries' exchange rate regimes over the past three decades or so.

Pegged Regimes Dominate

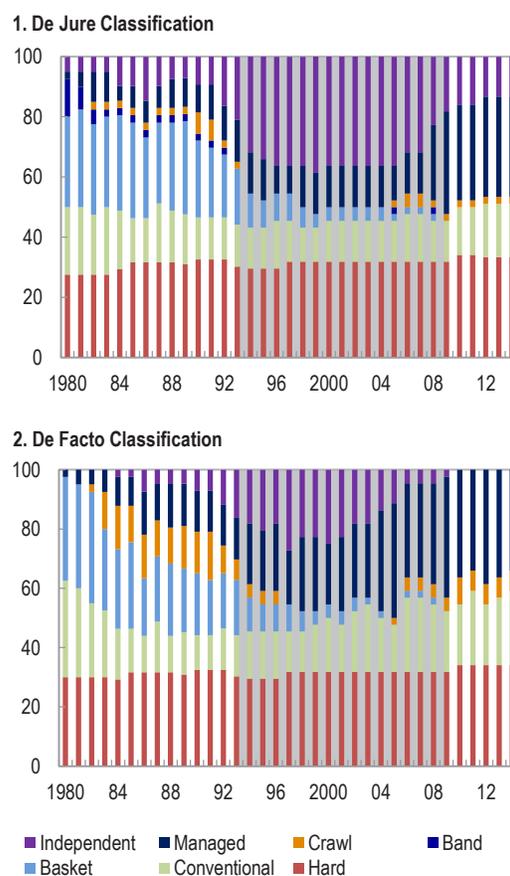
More than half of all sub-Saharan African countries peg their exchange rate (Figure 2.1). Hard pegs have been the dominant category among the sub-Saharan African pegs due to the CFA-franc zone. Conventional pegs have gained some ground, especially for the de facto classification (for example, São Tomé and Príncipe adopted a de facto peg to the euro in 2010). Among countries with pegs, the euro is the most popular anchor currency, followed by the U.S. dollar. Pegged regimes have been very resilient in sub-Saharan Africa, with more than 99 percent of all hard pegs and 87 percent of conventional pegs persisting from one year to the next. Countries in other exchange rate classifications are more likely to move to a different group over time.

Other aspects of exchange rate regimes in sub-Saharan Africa include the following:

- The prevalence of pegged exchange rate regimes is similar among countries that export extractive commodities (energy and metals) and those that do not. About 60 percent of commodity exporters peg to the euro—a share that is in

line with nonextractive sub-Saharan African countries. All these countries are, however, part of the CFA franc zone, for which the peg was determined long before most countries in the zone became exporters of extractive commodities. Some countries outside of the zone that are reliant upon commodity exports (Angola and the Democratic Republic of the Congo) have been (de facto) pegging their currency to the U.S. dollar—at least until 2014—as do Guinea and Zimbabwe

Figure 2.1. Sub-Saharan Africa: de Jure and de Facto Exchange Rate Regime Classifications, 1980–2014



Sources: IMF, Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) database; and IMF staff estimates.

Note: Based on a fine classification with seven categories (1) hard pegs (exchange arrangement with no separate legal tender and currency board arrangements); (2) conventional pegs (to a single currency); (3) basket pegs; (4) pegged exchange rates within horizontal bands; (5) crawling pegs or band; (6) managed floats with no predetermined path for the exchange rate; and (7) independently floating arrangement. The shaded area represents the period during which countries moved to either a peg or to a float.

² De facto exchange rate classifications, including the one used here, are subject to a number of limitations. For example, in the absence of shocks to the economy, exchange rate movements could be limited and could, therefore, imply a more rigid exchange rate classification than is actually being implemented. The de facto AREAER classification partly addresses this issue because it also takes into consideration the authorities policy intentions.

(which is dollarized).³ This may reflect that commodities are invoiced in dollars and the U.S. dollar's status as an international currency.

- Frontier market economies in sub-Saharan Africa are less likely to peg.⁴ Among these economies, pegs are only observed in about 20 to 30 percent of all cases, while intermediate exchange rate arrangements are more common.

Transitioning Away from Independent Floats

The evolution of exchange rate regimes in sub-Saharan Africa exhibits significant transitions that have recently been characterized by a move away from independent floats. During the mid-1990s to the mid-2000s, exchange rate regimes tended to be “bipolar”—that is, sub-Saharan African countries were moving to either a peg or to a float, thereby “hollowing out” the group of intermediate exchange rate regimes (see shaded part of Figure 2.1). During 1995–2008, about 45 and 35 percent of the countries were classified as pegs or floats, respectively, with intermediates accounting for about 20 percent.

This trend has reversed following the 2008 global financial crisis. The number of sub-Saharan African countries with an independently floating currency declined over time, while the proportion of intermediate regimes increased. In the aftermath of the global financial crisis, no fewer than eight sub-Saharan African countries (Burundi, Democratic Republic of Congo, Ghana, Guinea, Liberia, Mozambique, Rwanda, Zambia) moved away from de jure floats to adopt less flexible exchange rate regimes. In 1996, 16 countries in the region were operating a de jure independent floating exchange rate regime, and eight countries were operating a de facto independent float. By 2014, not a single sub-Saharan African country was listed as a de facto independent floater where interventions are

³ Liberia is highly dollarized (with the U.S. dollar enjoying legal tender status), but its local currency, the Liberian dollar, floats against the U.S. dollar.

⁴ We define frontier market economies as those countries that do not have emerging market status (as South Africa does), but that have issued an international sovereign bond and/or are typically featured in investment bank reports, including Angola, Cameroon, Côte d'Ivoire, Ethiopia, Gabon, Ghana, Kenya, Mauritius, Mozambique, Namibia, Nigeria, Rwanda, Senegal, Tanzania, Uganda, and Zambia.

exceptional and aim to address disorderly market conditions. However, it should be noted that South Africa's and Uganda's exchange rate regimes are de facto floating, and intervention has been rare in the past several years.⁵

Overall, the trend toward less flexible exchange rate regimes may reflect high commodity prices and the relative abundance of “liquidity searching for yield” amid unconventional monetary policies implemented in advanced economies following the global financial crisis. The resulting strength in current and capital accounts enabled many sub-Saharan African countries to lean against appreciation pressures and effect a welcome (re) building of reserves and buffers. This was associated with a higher degree of exchange rate stability. The tendency to move toward more de facto fixity was particularly prevalent among some of sub-Saharan Africa's extractive commodity exporters as oil and metal prices rose at the turn of the century (for example, Angola, the Democratic Republic of the Congo, Nigeria, and Zambia).

Words Don't Always Match Deeds

There is significant divergence between de jure and de facto classifications. This divergence between de jure commitments and de facto behavior nearly always reflects cases where the central bank intervenes but does not commit to the parity—making them de jure, but not de facto, floaters (Figure 2.1 and Table 2.1). At the other end of the spectrum (pegged regimes), the consensus between de jure commitments and the de facto regime is high: in 97 percent of cases where the exchange rate regime is classified as pegged de jure, it is also pegged de facto.

Overall, developments in sub-Saharan Africa broadly mirror developments observed for the combined sample of emerging market and developing economies (Figure 2.2). Pegs are still dominant, with the strategy of pegging the exchange rate gaining popularity since the late 1990s. However, while other emerging market and developing economies also show an uptick in the number of transitions in the aftermath of the global

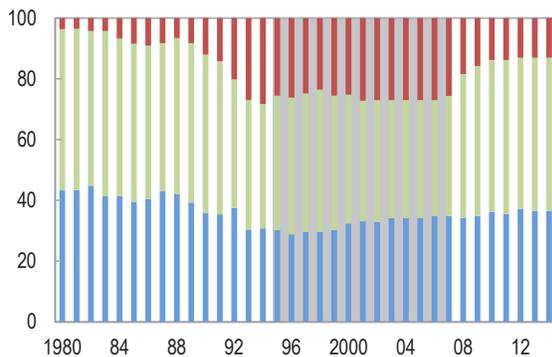
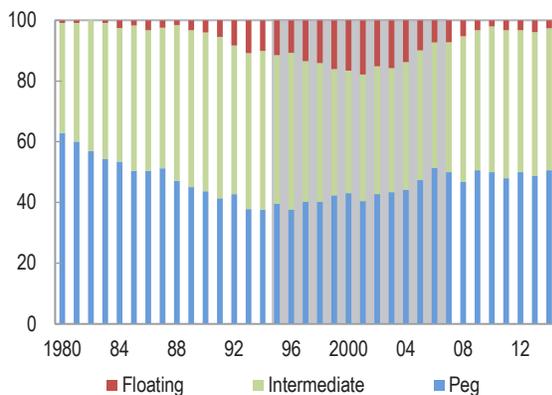
⁵ The findings of the estimations later in the chapter are robust to reclassifying South Africa and Uganda as independent floats.

Table 2.1. Sub-Saharan Africa: Distribution of de Jure and de Facto Exchange Rate Regime Classifications, 1980–2014

De Facto classification	De Jure classification		
	Peg	Intermediate	Floating
Peg	686	52	20
Intermediate	6	413	185
Floating	13	9	119
Total	705	474	324
Percentage consensus	97.3	87.1	36.7

Sources: IMF, Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) database; and IMF staff estimates.

Note: The table describes the distribution of de jure and de facto classifications. The percentage consensus shows the percentage of observations where the de jure and de facto classifications coincide.

Figure 2.2. Emerging Market and Developing Economies: de Jure and de Facto Exchange Rate Regime Classifications, 1980–2014**1. De Jure Classification****2. De Facto Classification**

Sources: IMF, Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) database; and IMF staff estimates.

Note: Based on an aggregated three-way classification (pegs, intermediate, and floating) where pegs comprise hard pegs (countries with a currency board or countries without a separate legal tender, including monetary unions) and conventional single-currency pegs; intermediates comprise basket pegs, crawling pegs, pegs within bands, and managed floats with no predetermined path for the exchange rate; floats include the independently floating arrangements. The shaded area represents the period during which countries moved to either a peg or to a float.

financial crisis, and on balance transitioned to less flexible exchange rate regimes, individual country moves have not always been to a less flexible regime (which was the case for sub-Saharan Africa). Finally, the de facto classifications diverge significantly from the de jure classifications for the broader emerging market and developing economy sample. Similarly to the sub-Saharan Africa sample, in 98 percent of cases where the exchange rate is de jure pegged it is also de facto pegged, while in only 35 percent of cases where the exchange rate de jure floats does it also de facto float.

The distinction between de facto and de jure captures differences in “deeds versus words.” While the implication may be that the de facto classification is more useful (since deeds presumably count for more than words), the de jure classification captures the central bank’s commitment (for example, to a peg), and, as the policy credibility literature stresses, such commitments can affect expectations and economic outcomes. Therefore, de jure and de facto classifications inform us on different aspects of the exchange rate regime—and both are useful to capture the stated and implemented policies of the central bank. The analysis in the rest of the chapter is, therefore, performed using both classifications. Results based on the de facto classification are systematically reported, with key differences from the findings using the de jure classification highlighted.

MACROECONOMIC PERFORMANCE UNDER ALTERNATIVE REGIMES

Although exchange rate policy is just one facet of a country’s overall set of macroeconomic policies, an appropriate exchange rate regime can help a country meet particular macroeconomic goals.⁶ This section conducts a comprehensive empirical analysis of how the exchange rate regime affects macroeconomic performance, particularly inflation, average growth, and output volatility in the region.

⁶ The empirical literature offers no consensus on the effect of exchange rate regimes on economic performance (see Ghosh, Gulde, and Wolf 2003; Levy-Yeyati and Sturzenegger 2003; and Reinhart and Rogoff 2004).

Inflation Performance

The strongest implications in the theoretical literature on the effects of the nominal exchange rate regime concern the behavior of nominal variables such as price inflation. Policy credibility models suggest that pegged exchange rates should be associated with lower inflation because they instill monetary discipline (implying a lower rate of money growth) and engender confidence in the currency (implying lower inflation expectations, higher money demand, and therefore lower inflation for a given rate of money growth (see Barro and Gordon 1983)). Under such models, pegging the exchange rate provides a pre-commitment device, allowing the central bank to import the credibility of the anchor currency.

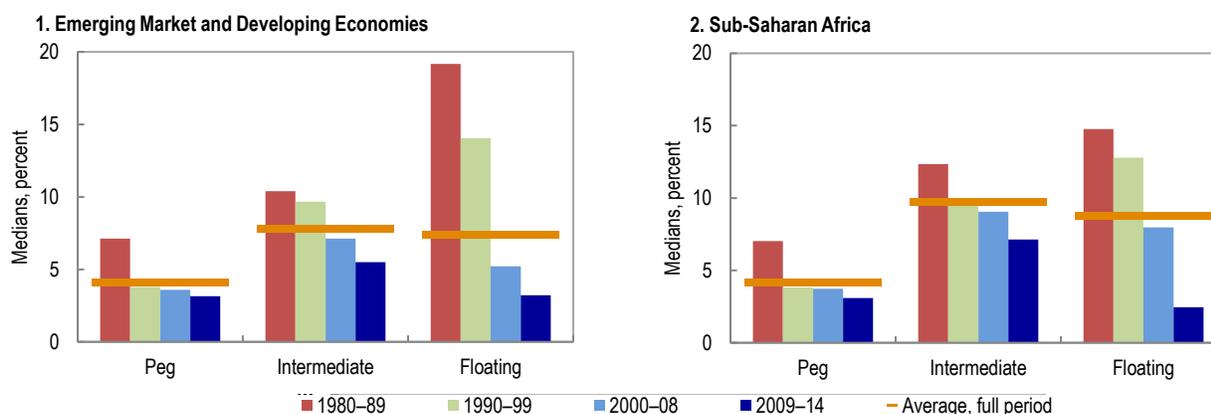
Inflation is consistently lower among sub-Saharan African countries with pegs (Figure 2.3). Over the full period of analysis, the median country with a pegged exchange rate regime in the region has lower inflation than floats or intermediates, by about 5–6 percentage points. This implies that inflation in pegs is half as much as in nonpegs. Similar conclusions broadly hold when examining subperiods (such as 1980–89, 1990–99, and 2000–08). Even during the general disinflationary period since the late 1990s, pegs in sub-Saharan Africa have, on average, continued to exhibit considerably lower inflation than intermediates and floats. Pegs are also associated with lower inflation in the broader sample of emerging market

and developing economies: on average, countries with pegged regimes have about 4 percentage points lower inflation compared with floats (and 3.5 percentage points lower compared with intermediates).

To investigate the relationship between inflation and exchange rate regimes controlling for potential determinants, we follow the approach in Ghosh, Gulde, and Wolf 2003, and Ghosh, Ostry and Tsangarides 2011. In particular, we undertake a regression analysis of the relationship between inflation and the exchange rate regimes (with the floating regime as the reference or base category), controlling for other factors that are likely to determine inflation, namely, the growth in broad money, real GDP growth, trade openness, central bank independence (proxied by the central bank governor turnover rate), the fiscal balance, and terms-of-trade shocks. The regression estimations take into account the direct “confidence” effect of exchange rate regimes reducing inflation for a given rate of money growth and the indirect “disciplining” effect of the regime from a lower rate of money growth. Details about the specification and the empirical methodology are provided in Annex 2.1.

Inflation is also found to be lower under pegs in the regression analysis. For sub-Saharan African countries, the direct (or confidence) effect, of a de facto peg is 5 percentage points lower inflation than it would be under a floating exchange rate regime,

Figure 2.3. Selected Samples: Inflation Performance



Sources: IMF, Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) database; and IMF, World Economic Outlook database. Note: Median estimates over indicated sample periods for the de facto classification. Inflation is transformed as $\ln(1 + \text{inflation})$.

while the total effect, including through lower money growth (the discipline effect), becomes 5.8 percentage points, after controlling for all of the other determinants of inflation (Figure 2.4). Under the de jure classification, the association between low inflation and regime is slightly stronger for de jure pegs than for de facto pegs, with inflation 7.2 percentage points lower in pegs than floats. This reflects the fact that the formal commitment to maintain the parity under a de jure peg is costly to break and leads to better inflation performance. Similarly, dropping the de facto pegged observations that are not classified as de jure

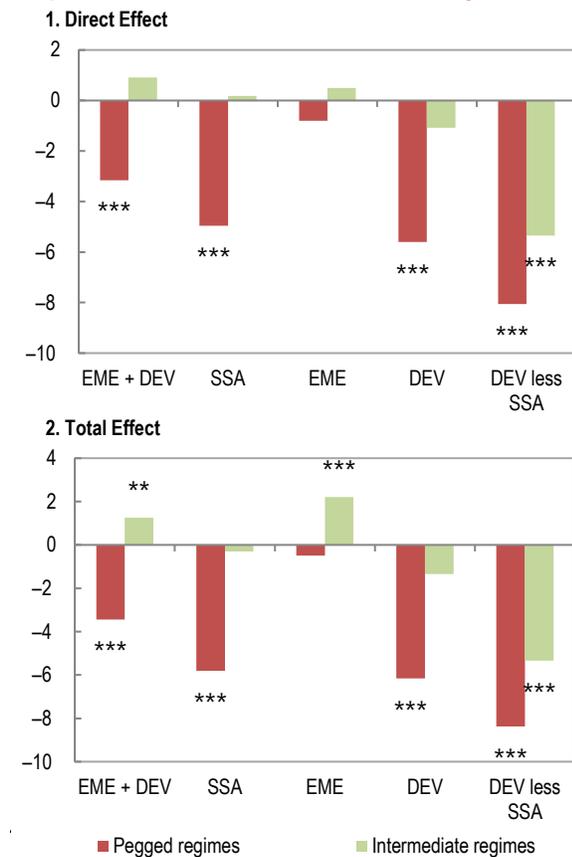
pegs, the direct (or confidence) effect of a de facto peg for the sub-Saharan Africa sample becomes 5.2 percentage points, while the total effect, including through the impact on money growth, becomes 6.1 percentage points (compared with 5.0 and 5.8, respectively, in the baseline). Conversely, de jure intermediate regimes in sub-Saharan Africa are not associated with lower inflation when compared with floats.

Findings for sub-Saharan Africa are generally consistent with the findings for the broader emerging market and developing economies sample, with the exception of de jure intermediate regimes that are also associated with lower inflation than floats (but the effect is smaller compared with de jure pegs in that sample). However, the effect is positive (and significant) under the de facto classification—implying higher inflation than under a float. In addition, the effect of de facto pegs in sub-Saharan Africa is almost twice as large compared with the broader emerging market and developing economies sample, underscoring the importance for keeping the commitment to a peg. In other words, de facto pegs in which the central bank is also making a formal commitment are indeed associated with lower inflation than floating regimes, particularly in sub-Saharan Africa.⁷

The results suggest that pegging the exchange rate has been useful for sub-Saharan African countries to achieve and maintain relatively low inflation. These findings hold strongly, even after a series of robustness tests and alternative specifications.

- Restricting the sample to observations where inflation is below 10 percent per year does not alter the basic picture; even then, pegged exchange rate regimes are associated with lower inflation than floating regimes in sub-Saharan Africa, supporting the notion that the exchange rate regime has an effect even for periods with low inflation. Alternatively, restricting

Figure 2.4. Selected Samples: Estimated Inflation Differential Compared with Floats Based on Baseline Inflation Regressions



Source: IMF staff estimates.

Note: The bars show the inflation differential relative to floating regimes conditioning on a range of other variables, based on the de facto classification. See Annex 2.1 for further details. EME + DEV = emerging market and developing economies; SSA = sub-Saharan Africa; EME = emerging markets; DEV = developing economies; DEV less SSA = developing economies excluding SSA. The total effect includes the direct effect of exchange rate regime on inflation, plus the indirect effect through money growth. *, **, and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

⁷ There is growing cross-country evidence in the literature that inflation and income inequality are positively related (even when controlling for other factors, such as the overall level of development) with the direction of causality going from inflation to inequality (Albanesi 2007). While our analysis did not explore the association between inflation and inequality directly, our findings of lower inflation under pegs may suggest another benefit of lower inflation, that is, lower inequality.

the analysis to the period 1990–2014 (thus excluding the 1980s, when inflation rates were higher on average) also preserves the results.

- Excluding cases in which countries must float because they are in a state of economic and financial collapse—in other words, freely collapsing regimes—does not overturn the finding of lower inflation under pegged regimes: excluding those cases, pegs in sub-Saharan Africa continue to be associated with 6 percentage points lower inflation than floats.
- Although hard pegs tend to have the lowest inflation rates among pegged exchange rate regimes, they are not solely responsible for the better inflation performance of the pegged regimes in sub-Saharan Africa. Indeed, dropping the CFA franc zone countries from the sub-Saharan Africa sample still leaves an inflation differential of 3–4 percentage points in favor of pegs.
- If countries that have good inflation performance are also more inclined (or able) to peg their exchange rate, then the estimated effects of the regime may be biased (see Annex 2.1 for more details). Yet taking account of regime endogeneity using a simultaneous equation framework actually strengthens the findings; across the various samples, pegs are associated with significantly lower inflation than intermediate or floating regimes.

Growth Performance

Per capita output growth performance in sub-Saharan Africa among countries with different types of exchange rate regimes has varied over time (Figure 2.5). In particular, three stylized facts are worthy of note. First, there was limited differentiation in growth outcomes between countries with pegs and countries with more flexible regimes in the 1980s and 1990s. Second, since around 2000, however, per capita growth performance among countries with pegs has been 1 to 2 percentage points lower than in countries with intermediate and floating regimes, primarily owing to weaker growth among the CFA franc zone countries. And third, among some of the CFA franc

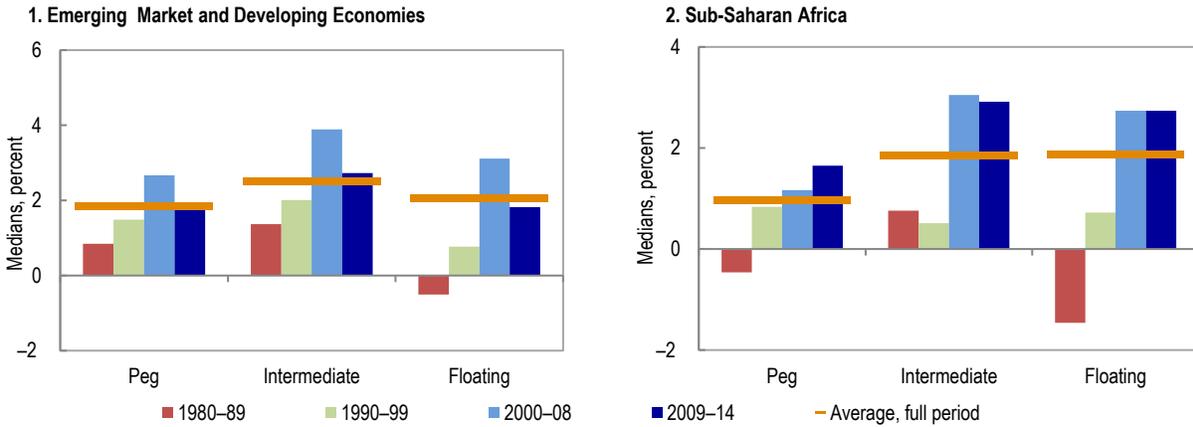
zone countries, there has been significant variation in growth outcomes, and overall, these countries' median growth was better than in the rest of sub-Saharan Africa in the 1960s and 1970s (by some 0.5 to 1.0 percentage point).

While the theoretical literature linking the nominal exchange rate regime to long-term growth is less developed, there are several possible channels. One is through the regime's impact on trade openness and low inflation—both of which are generally associated with higher growth in the empirical literature. The exchange rate regime may also affect growth volatility; if nominal or real exchange rate volatility is detrimental to growth, then floating regimes may be associated with lower growth. There is also some evidence on the importance of a competitive real exchange rate for fostering growth; if pegged exchange rates are more susceptible to overvaluation because of higher inflation than the anchor currency, it is likely to hurt competitiveness and lower growth.

To examine whether the exchange rate regime is linked to growth performance and through which channels, we investigate how these variables (which are potential channels) differ across exchange rate regimes. Five such channels are considered, namely, competitiveness (defined as the deviation of the real exchange rate from purchasing power parity, adjusted for per capita income), real and nominal volatility, inflation, and trade openness, which are shown to differ systematically by exchange rate regime (Figure 2.6). We find that pegged regimes are associated with lower real exchange rate volatility, lower inflation, and greater trade openness relative to floating regimes but also that their real exchange rate positions are less competitive; intermediate regimes have more competitive real exchange rate positions and price volatility, and greater trade openness relative to floating regimes.⁸

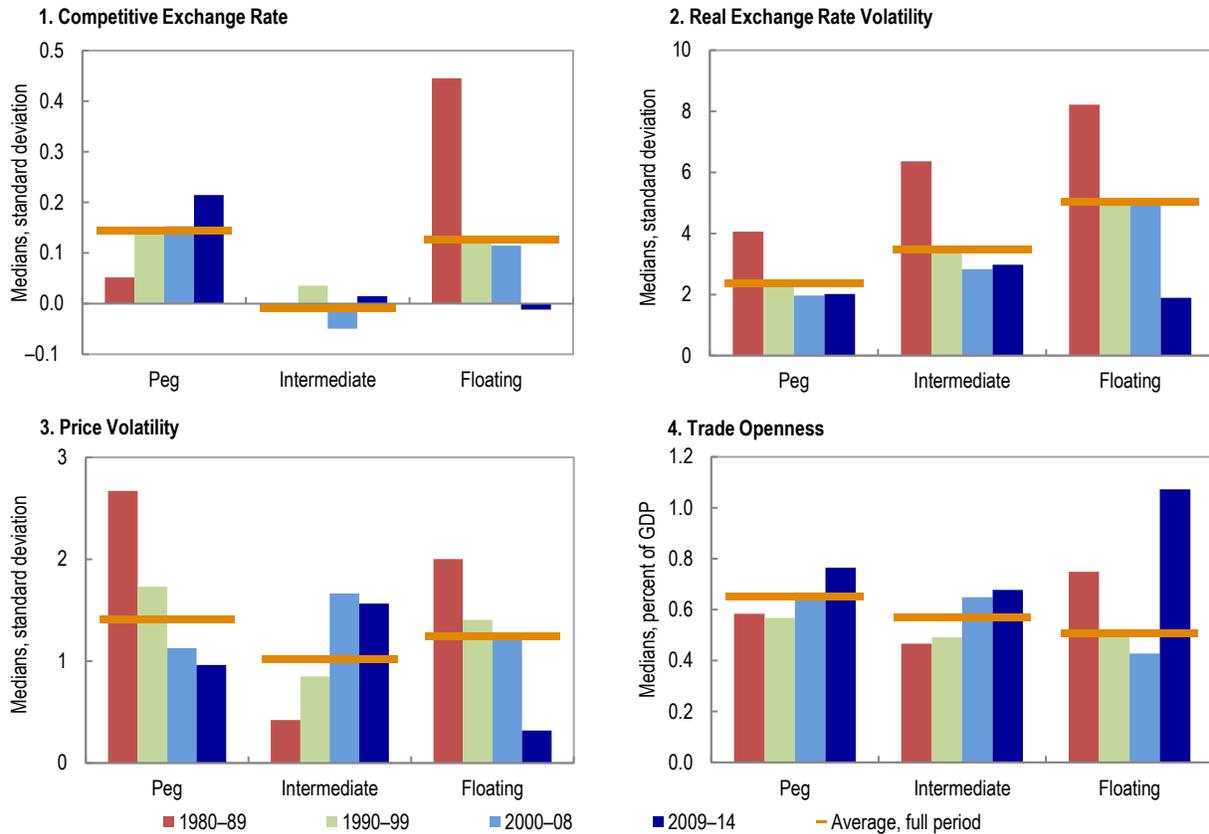
⁸ These results are based on unconditional associations between the channel and the regime. In addition, regressions of each of these channels (overvaluation, real exchange rate and price volatility, inflation, and trade openness) on the exchange rate regime dummies, while controlling for all other variables in the growth regression, confirm the unconditional associations (see Table 2 in Annex 2.1).

Figure 2.5. Selected Samples: Per Capita GDP Growth Performance



Sources: IMF, Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) database; and IMF, World Economic Outlook database. Note: Median estimates over indicated sample periods for the de facto classification.

Figure 2.6. Sub-Saharan Africa: Indirect Channels of Transmission of Exchange Rate Regime to Growth



Sources: IMF, Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) database; and IMF, World Economic Outlook database. Note: Median estimates over indicated sample periods for the de facto classification. The variable capturing the competitiveness of the exchange rate is defined as the deviation of the real exchange rate from purchasing power parity, adjusted for per capita income, where higher positive values indicate less competitive real exchange rates. Volatility measured as standard deviation of monthly growth rates. Trade openness is measured as the sum of exports and imports as a percent of GDP.

Since the channel variables differ systematically across regimes, we investigate growth regressions that also take into account the indirect effect that the exchange rate regimes have on growth through these channels. Specifically, we estimate the relationship between per capita output growth and the exchange rate regime, taking into account these various channel variables (competitiveness, real and nominal volatility, inflation, and trade openness) and controlling for other growth determinants, namely, initial income, investment ratio, population growth, human capital (proxied by average years of schooling), the fiscal balance, and government expenditure as a fraction of output. The key findings for sub-Saharan Africa are as follows:⁹

- Countries with pegs are associated with lower per capita growth directly of about 2.3 percentage points per year compared with floats (Figure 2.7). Taking into account the indirect effects of the regime operating through the various channels, per capita growth under pegs is lower by about 1.6 percentage points relative to floats. Overall, for pegs in sub-Saharan Africa, the net effect of various offsetting factors on per capita growth is negative: while the lower inflation and real exchange rate volatility promote growth, the less competitive real exchange rate hurts competitiveness and impedes growth. Pegs in the region have less competitive exchange rates primarily because inflation rates have been higher compared with their anchor currencies.¹⁰

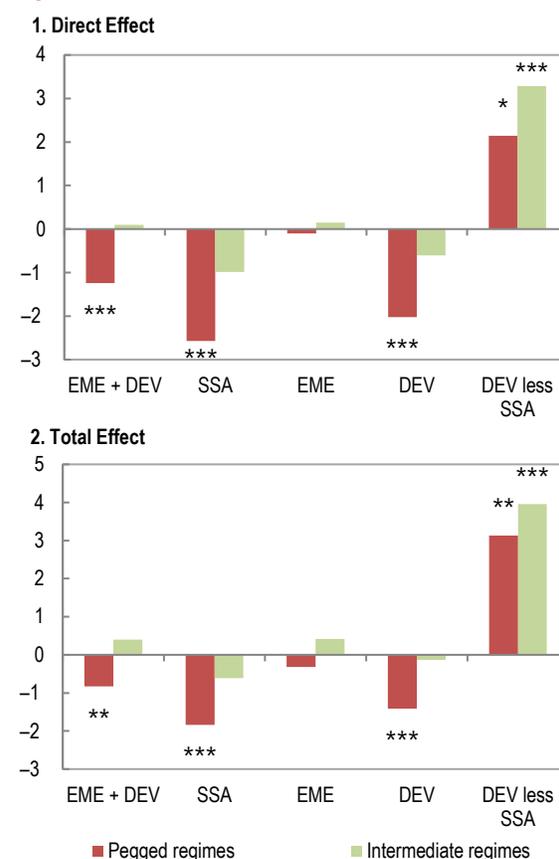
⁹ The findings are robust to alternative specifications, including considering the possibility that the choice of regime is endogenous to the country's growth performance; excluding freely collapsing regimes; and limiting the sample to the consensus classification, that is, when de jure and de facto agree. In addition, we alter the specification to include proxies for capital flows and capital account openness, geographical characteristics (such as percentage of land in geographical tropics and an indicator variable for landlocked countries), as well as variables to proxy for institutions, conflict, and colonial ties. Results remain unchanged.

¹⁰ All other things equal, the maintenance of long-standing pegs along with the move to greater exchange rate fixity in other sub-Saharan African countries since the global financial crisis helped these countries to (re)build reserves and buffers when commodity prices firmed and external financing became more abundantly available and may have contributed to keeping the inflation differential in these countries lower than it would have been.

For sub-Saharan African countries with intermediate regimes, per capita growth is higher than pegs and about the same as floats (mainly on account of more competitive exchange rates than pegged regimes).

- Similar results are obtained when we examine per capita output growth rates over a five-year horizon. Pegs are associated with about 2 percentage points lower per capita growth per year for sub-Saharan Africa (and about 1 percentage point in the broader emerging market and developing economy sample).

Figure 2.7. Selected Samples: Estimated per Capita Growth Differential Compared with Floats Based on Baseline Output Growth Regressions



Source: IMF staff estimates.

Note: The bars show differences in performance relative to floating regimes conditioning on a range of other variables, based on the de facto classification. See Annex 2.1 for further details. EME + DEV = emerging market and developing economies; SSA = sub-Saharan Africa; EME = emerging markets; DEV = developing economies; DEV less SSA = developing economies excluding SSA. The total effect includes the direct effect of exchange rate regime on growth, plus the indirect effect through the channels. *, **, and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

What drives the finding that countries with pegs have lower output growth than floats in sub-Saharan Africa? Looking at the unconditional median growth plots in Figure 2.5, median per capita growth in pegs was about 0.9 percent during 1980–2014, substantially lower than that of intermediates and floats (2 and 1.8 percent, respectively). This growth differential between pegs and floats was even more pronounced in the later period, 1998–2014, when pegs had about 1–2 percentage points lower per capita growth than nonpegs—driven by the fact that countries with intermediate and floating exchange rate arrangements, such as Botswana, Ghana, Mauritius, Nigeria, and Tanzania, averaged per capita output growth rates of 3 percent or more during 1998–2014.

These observations are confirmed in the empirical analysis. First, as suggested by the evidence in the raw data we split the sample into two subperiods and rerun the analysis. Doing so, we find that the result that pegs are associated with lower growth is driven by the second subperiod (1998–2014); pegs are *not* associated with lower growth than floats in the first subperiod (1980–97). Second, the growth difference of pegs compared with floats disappears when hard pegs are excluded from the sample. Looking at the channels through which the exchange rate regimes affect growth shows that during the second subperiod pegs, and in particular hard pegs, were associated with less competitive (more overvalued) real exchange rates and higher relative price volatility relative to floats, which both hurt growth.¹¹ This effect outweighs the positive effect of lower inflation, lower real exchange rate volatility, and greater trade openness on pegs' growth relative to floats. In addition, over the second subperiod, floats have benefited from more improved terms of trade relative to pegs, which, holding other things constant, helped raise growth

¹¹ The fraction of pegs in the sample with overvaluation exceeding 10 percent rose from 46 percent in the first subperiod to 65 percent in the second subperiod.

in floats more than pegs.¹² These observations underscore the importance for countries with pegged regimes to not only implement macroeconomic policies that help keep inflation at or below the levels of trading partners, but also to redouble efforts to improve competitiveness through better business climates and infrastructure quality.

For the broader samples of emerging market and developing economies, results are similar, with pegs associated with lower per capita growth than floats. For these samples, the effect of a peg is to lower per capita growth by about 1 to 1.5 percentage points, while intermediates' growth performance is no different from that of floats. In addition, no difference is found between the growth performance of sub-Saharan African countries with *de facto* peg and intermediate regimes compared with these regimes in other emerging market and developing economies.

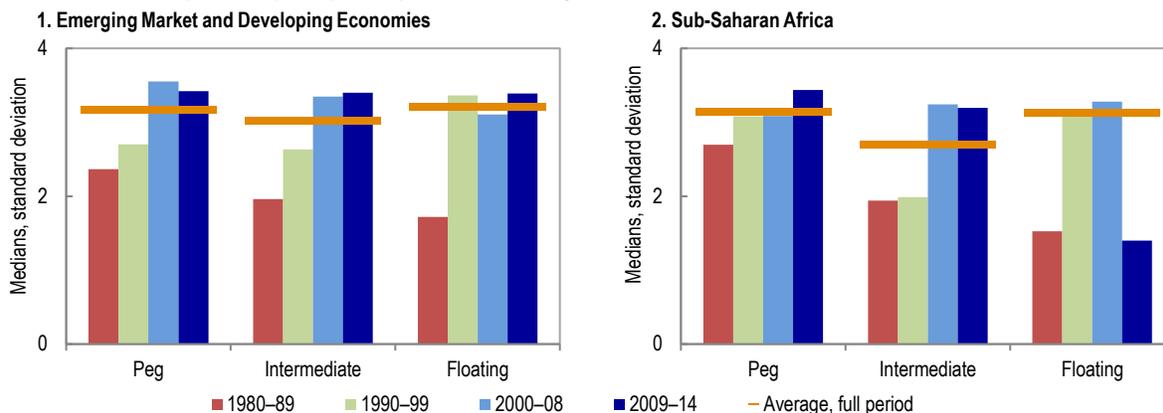
Growth Volatility

Beyond average growth performance, the volatility of real per capita output growth may be of interest. Relatedly, the nature and magnitude of shocks facing the economy is an important consideration in choosing an exchange rate regime. Theory suggests that real external shocks such as those to terms of trade are better accommodated with flexible exchange rate regimes; a fixed exchange rate regime may be more suitable when the economy faces nominal shocks, such as those originating from fluctuations in money demand. Accordingly, the relative importance of real and nominal shocks would be an important factor in determining which exchange rate regime would serve a country better.

We begin by examining the volatility of output relative to its long-term trend for different exchange rate regimes (Figure 2.8). Overall differences

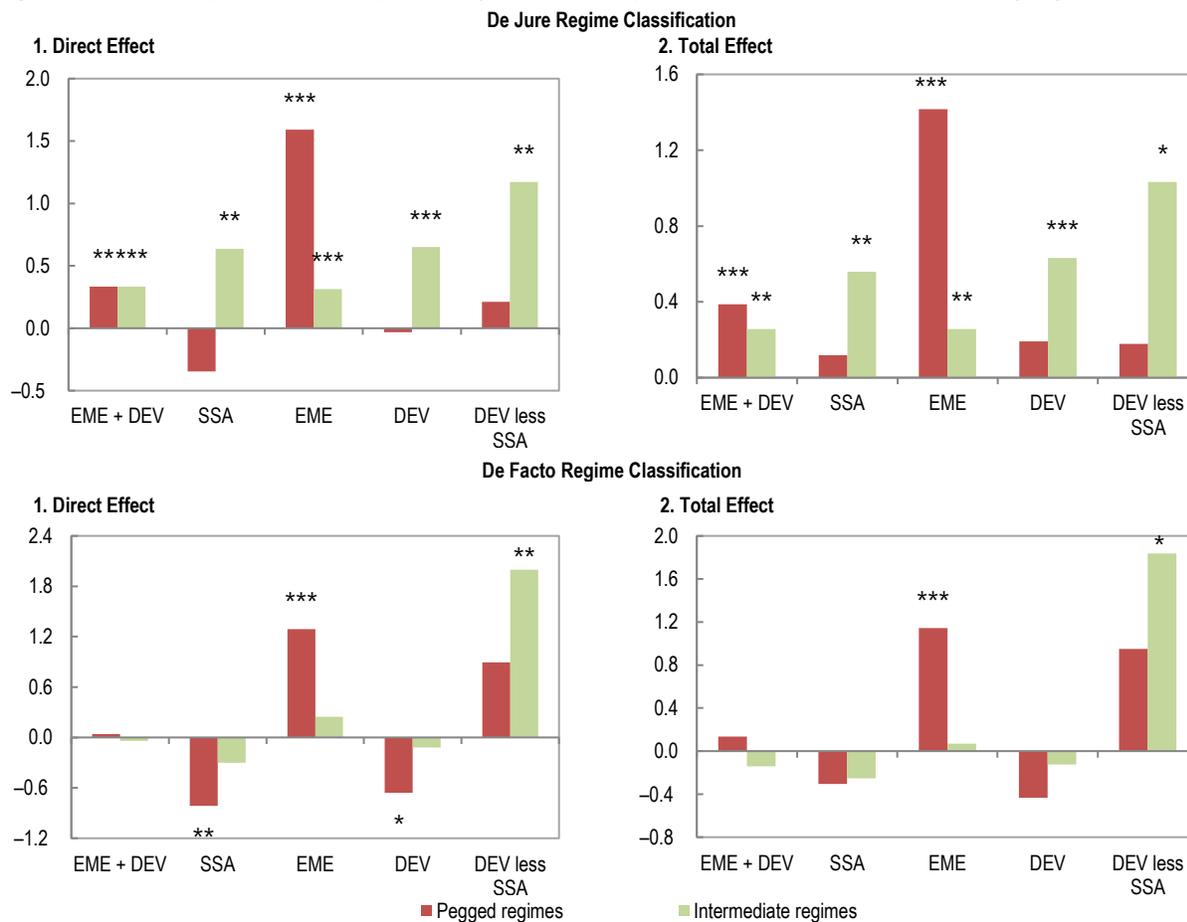
¹² In addition, we evaluate the importance of each of the growth determinants in our analysis by identifying the variable's effect on growth when the variable in question increases from its sample median value to the 75th percentile (holding all others constant). Results suggest that in addition to initial income (which captures convergence effects) and proxies for physical and human capital, the channels we formally explore in the specification (particularly, competitiveness and trade openness) as well as terms-of-trade growth are important contributors in explaining growth.

Figure 2.8. Selected Samples: Real per Capita Output Growth Volatility



Sources: IMF, Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) database; and IMF, World Economic Outlook database.
 Note: Median estimates over indicated sample periods for the de facto classification. Volatility defined as three-year centered standard deviation of output relative to its long-term trend.

Figure 2.9. Selected Samples: Estimated Output Volatility Differential Compared with Floats Based on Baseline Volatility Regressions



Source: IMF staff estimates.

Note: The bars show differences in output volatility relative to floating regimes conditioning on a range of other variables. See Annex 2.1 for further details. EME + DEV = emerging market and developing economies; SSA = sub-Saharan Africa; EME = emerging markets; DEV = developing economies; DEV less SSA = developing economies excluding SSA. The total effect includes the direct effect of exchange rate regime on growth volatility, plus the indirect effect through the channels. *, **, and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

between exchange rate regimes are very small, and no strong patterns can be identified; generally, there is some evidence of lower output volatility under floating regimes for sub-Saharan Africa and the broader sample.¹³

The main findings from an output growth volatility regression analysis that follows a similar specification as Rogoff and others 2003 and that uses the same determinants as in the growth section suggest the following:

- Sub-Saharan African countries with de jure intermediate regimes (but not de facto intermediates) tend to have higher output volatility compared with floats (Figure 2.9). This is possibly related to the greater exposure of many of the frontier markets in this group to international capital flows coupled with less scope for exchange rate adjustments to absorb shocks. Countries with pegged exchange rate regimes have not been associated with more output volatility than countries with floats, possibly because of their more limited direct exposure to cross-border capital flows.
- Commodity exporters' output volatility was, overall, about half a percentage point higher than in other countries, primarily driven by the later period of the sample. There is no differentiation among commodity exporters with pegs or intermediates. However, both effects are reduced or disappear altogether when the consensus sample is considered or the post-global financial crisis period is excluded (see also Figure 2.8).
- For the emerging market and developing economies sample, countries with both de jure pegs and intermediates experience higher output volatility than floats: compared with a float, the standard deviation of output growth increases by 0.3 percentage point under a de jure peg or intermediate. These results (which are more robust than those in the sub-Saharan Africa sample) are primarily driven by the emerging market economies sample, where

both de jure and de facto pegs are associated with higher output volatility (while only de jure intermediates are associated with higher output volatility).

We further augment the specification to include proxies of nominal and real shocks, namely, the volatility of the terms of trade and the volatility of the fiscal balance as real shocks, and the volatility of broad money velocity as a nominal shock. While each of these variables contributes significantly to the volatility of output growth, controlling for these shocks does not change the results—intermediate regimes are associated with higher output volatility.

EXCHANGE RATE REGIMES AND FISCAL DISCIPLINE

Since exchange rate arrangements are only part of the overall macroeconomic policy package, a relevant question is how the exchange rate regime affects the scope for monetary and fiscal policies. In terms of monetary policy, the “impossible trinity” implies that a country cannot have a pegged exchange rate, an open capital account, and an independent monetary policy at the same time.¹⁴ In terms of fiscal policy, it is well known that a peg will not be sustainable when the government is money-financing the fiscal deficit, or if fiscal policy dynamics over time lead to price developments that are not consistent with the exchange rate peg. The analysis in this section focuses on the extent to which different regimes have been associated with different fiscal outcomes in sub-Saharan Africa. This can inform how policies should be calibrated to make the exchange rate regimes “work” in the face of the current low international commodity prices and tightening external financing conditions.

There is an extensive debate in the literature on which exchange rate arrangement implies more fiscal discipline. Empirical evidence from the literature is not conclusive either (Annex 2.2):

¹³ Results using the three-year centered standard deviation of output growth are similar and, therefore, not reported.

¹⁴ We do not investigate the implications of the exchange rate regime for monetary policy in this chapter. Empirically, Ghosh, Ostry, and Tsangarides (2010) find that pegged exchange rate regimes seem to constrain the ability of monetary policy to react to domestic macroeconomic conditions considerably more than either intermediate or floating regimes do.

- One view is that pegged exchange rate regimes induce fiscal discipline because lax fiscal policies can lead to a depletion of foreign reserves or excessive buildup of public debt that can ultimately result in a collapse of the peg (such as Vuletin 2013). Lax fiscal policy can also lead to higher domestic inflation, often resulting in real appreciation and a higher current account deficit.
- Another view is that flexible exchange rate regimes provide more discipline by forcing the cost of fiscal profligacy to be paid immediately (Tornell and Velasco 2000). Lax fiscal policies have political costs in terms of inflation under both regimes, but under flexible regimes, these costs manifest themselves immediately through the inflationary impact of increased spending and concomitant exchange rate depreciation.

The question therefore is, how important is the exchange rate regime as a fiscal disciplining device in practice? In terms of medians, overall balances, and primary fiscal balances (which exclude interest payments to abstract from the effects of past fiscal policy decisions) show that floating exchange rate regimes are associated with the most fiscal discipline in sub-Saharan Africa (Figure 2.10).¹⁵

Beyond the average size of the deficit, does the exchange rate regime hold implications for the conduct of fiscal policy? To answer this question our empirical methodology follows previous research (such as Vuletin 2013) to examine the relationship between the overall fiscal balance—and, alternatively, the primary fiscal balance—and the exchange rate regime, controlling for key determinants. Variables that control for the position in the global and country-specific business cycles are also included in the estimations. In line with the literature, this allows capture of the independent disciplining effect of the exchange rate regimes.

¹⁵ While it may be useful to also investigate nonresource fiscal balances (which exclude potentially volatile fiscal revenues), comprehensive and consistent data are not available to carry out such analysis. In any case, sub-Saharan Africa's commodity exporters are dispersed across the regimes. Also, the regression estimations reported later in this section are robust to dropping the oil exporters from the sample.

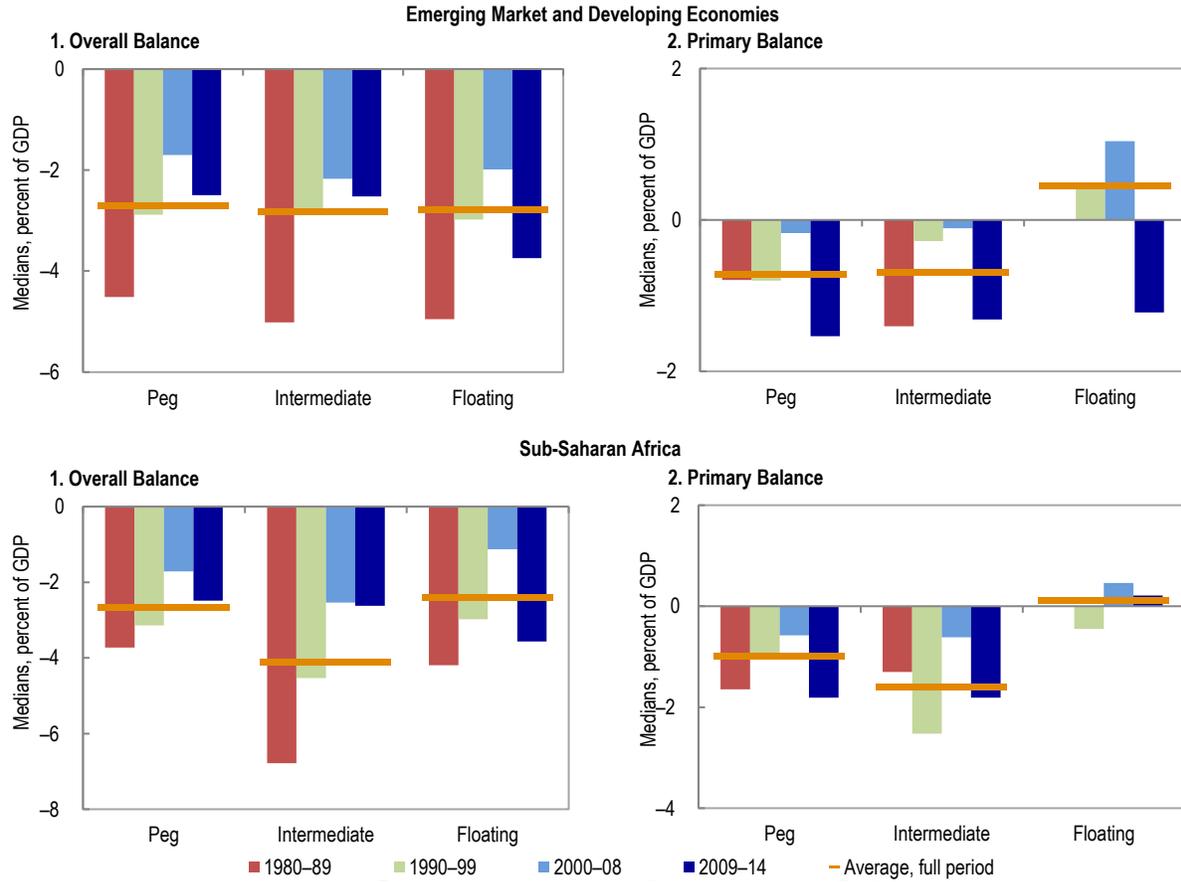
Annex 2.2 discusses the empirical methodology and specification used for the fiscal discipline investigation in more detail.

The main findings of the empirical analysis are as follows:

- For the full sample of emerging market and developing economies, extreme exchange rate regimes (hard pegs and independent floats) are more strongly associated with fiscal discipline (Figure 2.11). The findings are based on a regression of the relationship between the disaggregated classification of consensus exchange rate regimes and overall fiscal balance. Exchange rate classifications range from 1 (hard peg) to 7 (independent float). This allows for greater differentiation in the effects of regimes on fiscal balances. The regression also includes a square term to capture the possibility of a nonlinear relationship between exchange rate regimes and fiscal discipline. These results are preserved when the primary fiscal balance is used as an indicator of fiscal discipline.
- In sub-Saharan African countries, unlike in other emerging market and developing economies, intermediate regimes are strongly associated with weaker (overall and primary) fiscal balances than hard pegs or pure floats.¹⁶ Intermediate exchange rate regimes in the region are associated with, on average, 2 percentage points of GDP weaker (primary and overall) fiscal balances relative to floats. This difference is slightly smaller with respect to pegs (Figure 2.11). While floats are generally associated with more discipline in both sub-Saharan Africa and the broader sample of countries, only the sub-Saharan African pegs help to instill more fiscal discipline. This result is partly driven by the fact that pegs in the region are mostly hard pegs (about 60 percent of all pegs). The CFA zone limits fiscal policy expansion because of reduced scope

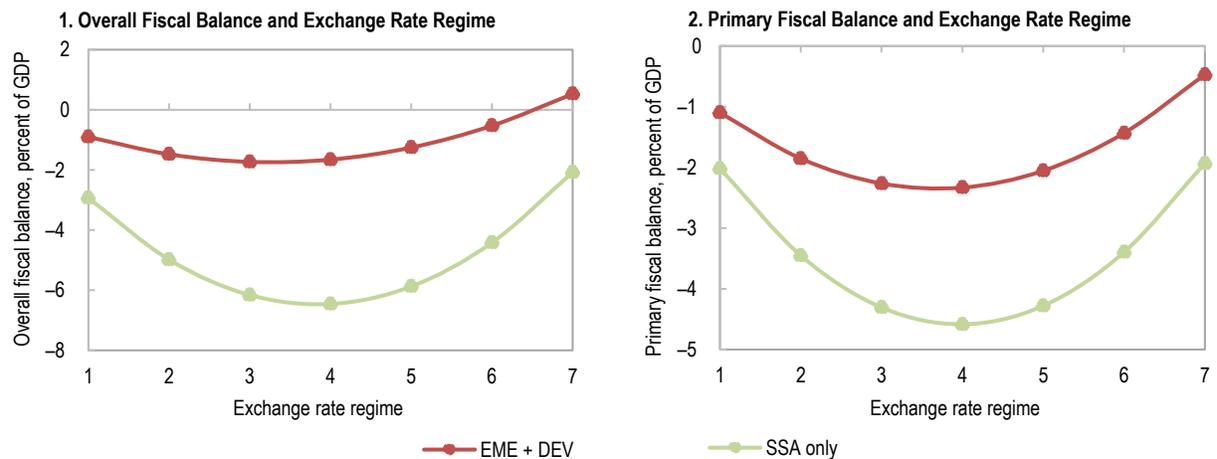
¹⁶ In fact, when only the non-sub-Saharan Africa sample is considered, the association between fiscal discipline and exchange rate regimes is rather linear, suggesting that more flexible regimes have a stronger relationship with fiscal discipline.

Figure 2.10. Various Samples: Fiscal Performance



Sources: IMF, Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) database; and IMF, World Economic Outlook database. Note: Median estimates over indicated sample periods for the de facto classification.

Figure 2.11. Exchange Rate Regimes and Fiscal Performance



Source: IMF staff estimates.

Note: The lines show the estimated effect of exchange rate regimes on fiscal balances, for emerging market and developing economies (EME + DEV) and sub-Saharan African (SSA) countries, conditioning on a range of other variables. The disaggregated exchange rate regime classification and the consensus sample (that is, observations where the de jure and de facto classifications agree) are used. See Annex 2.2 for further details.

for seigniorage, deficit financing, and debt monetization, and member states' fiscal policies are guided by "convergence criteria" to help keep inflation low and sustain the peg.

- Is the association between exchange rate regimes and fiscal discipline changing? While the results for the 1980–2000 subperiod preserve the finding that floats are associated with more fiscal discipline, pegs appear to be associated with more fiscal discipline since 2001. By contrast, the finding that sub-Saharan African countries with intermediate regimes exhibit the least fiscal discipline (including after controlling for the economic cycle) mainly appears in the second subperiod. The shift in the findings for the sub-Saharan African region is predominantly driven by two major developments: first, the boom in commodity prices since the 2000s led to a considerable improvement in the fiscal position of sub-Saharan African commodity exporters that maintained their (hard) peg regimes (more than 2 percentage points of GDP improvement).¹⁷ Second, the reduction in debt levels brought about by the Heavily Indebted Poor Countries/Multilateral Debt Relief Initiative and easy global financial conditions for most of the 2000s allowed many sub-Saharan African countries with relatively more flexible exchange rate regimes to run larger deficits financed by Eurobonds, syndicated loans, and new borrowing from nontraditional donors (May 2013 *Regional Economic Outlook: Sub-Saharan Africa*). Indeed, more than half of the sub-Saharan African countries with intermediate regimes have accessed international markets and become "frontier market economies."

- Fiscal discipline can also be assessed through the pace of public debt accumulation and, over time, sustainability of debt levels. When using the change in the debt-to-GDP ratio as the measure of fiscal discipline, the evidence suggests that there have been no substantial differences in the pace of debt buildup among the three types of regimes in sub-Saharan Africa. This contrasts with the finding from the full sample of emerging market and developing economies where flexible regimes have been associated with slower accumulation of debt than the other regimes. However, to the extent that debt-financed fiscal expansions lead to sustained higher growth, debt levels may not be rising as rapidly as would otherwise be the case. This might explain why intermediate regimes in sub-Saharan Africa have not been associated with a faster pace of debt accumulation than pegged regimes, despite weaker fiscal balances.
- The findings reported here are robust to different regression specifications as well as different measures of fiscal discipline (Annex 2.2). Replacing the exchange rate regime dummies with their lagged values, which can help mitigate reverse causality concerns that fiscal performance may influence the regime, do not alter the findings.¹⁸ Also, using the fiscal balance defined in percent of trend GDP as in Vuletin 2013, the de jure and the de facto regime classifications, respectively, and more aggregated regime classifications based on three categories (pegs, intermediate, and float) do not change the results for sub-Saharan Africa.

¹⁷ In contrast to sub-Saharan Africa, non-sub-Saharan African commodity exporters have moved to a relatively more flexible regime (from median regime of 3 in first subperiod (1980–2000) to median regime of 6 in the second subperiod of 2001–14). The average fiscal position improved by nearly 3 percentage points for non-sub-Saharan African commodity exporters.

¹⁸ Reverse causality concerns can arise if, for example, countries with weaker institutions, which are more prone to fiscal slippages, tend to have fixed exchange rates.

POLICY CONSIDERATIONS AND CONCLUDING REMARKS

Sub-Saharan African countries' exchange rate regimes cover a broad spectrum and have evolved over time. While pegged regimes remain the most persistent and dominant in the region, intermediate regimes have gained importance as several countries have moved away from floats, particularly after the global financial crisis.

This chapter highlights the differences in outcomes across regimes with regard to achieving low inflation, sustained high growth, and low output growth volatility. It also shows that exchange rate regimes have been associated with different degrees of fiscal discipline.

- **Pegs**—Sub-Saharan African countries with pegged exchange rate regimes have had the best inflation performance with little apparent cost in terms of higher output volatility, presumably because of their low exposure to international capital markets. The lower inflation stems from stronger monetary discipline and greater policy credibility under a pegged exchange rate regime, where the peg serves as a nominal anchor for monetary policy. The evidence also suggests that pegs have provided a disciplining device for fiscal policy to sustain the exchange rate regime. However, the growth performance of countries with pegged regimes has, on average, been weaker than of countries with nonpegged regimes during the second half of the sample period (2000–14). This said, sub-Saharan Africa's peggers' growth experience has been quite varied, with several countries that were able to maintain competitiveness able to enjoy periods of strong growth (Box 2.1).
- **Intermediates and floats**—Sub-Saharan African countries with intermediate regimes and floats have, on average, enjoyed higher growth relative to countries with pegs, but this has come at a cost of higher inflation and, for (de jure) intermediate regimes, greater output volatility. Fiscal positions also tended to be weaker particularly during the 2001–14 period,

which was characterized by easier external liquidity conditions and market access for many of these countries. But the seemingly weaker fiscal discipline has not translated into sustained higher levels of debt relative to the size of the economy.

Given these findings, how can sub-Saharan African countries maximize the benefits offered by each regime?¹⁹ In addition, the sharp fall in international commodity prices and tightening of external financing conditions pose significant challenges to many sub-Saharan African commodity exporters where the reduction in export earnings has led to a depletion of foreign exchange reserves and fiscal buffers.²⁰ In that context, the following policy recommendations apply:

- Countries operating under pegs have been able to anchor inflation thanks to their stable nominal anchor for monetary policy. In such cases, fiscal and structural policies must bear the burden of adjustment. More specifically, strengthening growth performance under pegs requires priority to be given to policies that address competitiveness concerns from poor business climate, low investment efficiency, and social and infrastructure gaps (see, for example, Chapter 2 of the October 2015 *Regional Economic Outlook: Sub-Saharan Africa*.²¹) In addition, growth-friendly fiscal adjustment in the face of the recent commodity price shock remains essential to sustain the pegged regimes.

¹⁹ The analysis in this chapter offers useful insights on some particular aspects of the role of exchange rate regime, namely macroeconomic performance and fiscal discipline. A comprehensive analysis of the role of the exchange rate regime needs to also examine its effects on other aspects including susceptibility to crises, resilience to shocks, external adjustment, trade integration, and cross-border capital flows—also in the context of the overall international monetary system.

²⁰ Indeed, faced with sustained pressure on their currencies, and with limited options to tap external borrowing, some highly exposed commodity exporters with long-standing pegs or stabilized regimes are allowing the exchange rate to adjust and, in some cases, are choosing to move to greater exchange rate flexibility (see Box 2.2 on Nigeria's experience).

²¹ Addressing structural obstacles to competitiveness (including less deep financial markets and more cumbersome legal procedures) remains key to longer-term growth and regional integration in the CFA zone (see also IMF 2008).

- Countries with more flexible exchange rate regimes tend to experience higher growth but also higher inflation and, in the case of de jure intermediate regimes, higher output volatility. To make the best of their exchange rate regime, these countries need to strengthen their domestic monetary policy framework to ensure that its objectives are squarely centered around a price stability mandate, and that the central bank is given sufficient independence to implement that mandate (IMF 2015). Moreover, an exchange rate adjustment in response to prevailing external pressures—which can help dampen output volatility—needs to be accompanied by appropriate fiscal and monetary policies to help sustain the new more depreciated level of the exchange rate by containing upward pressure on inflation and “locking in” the real depreciation brought about by the adjustment to the nominal exchange rate. Indeed, tighter external financing conditions coupled with exchange rate adjustment will make it harder to sustain the more expansionary fiscal policies that were implemented by the sub-Saharan African countries with intermediate regimes during the 2001–14 period.

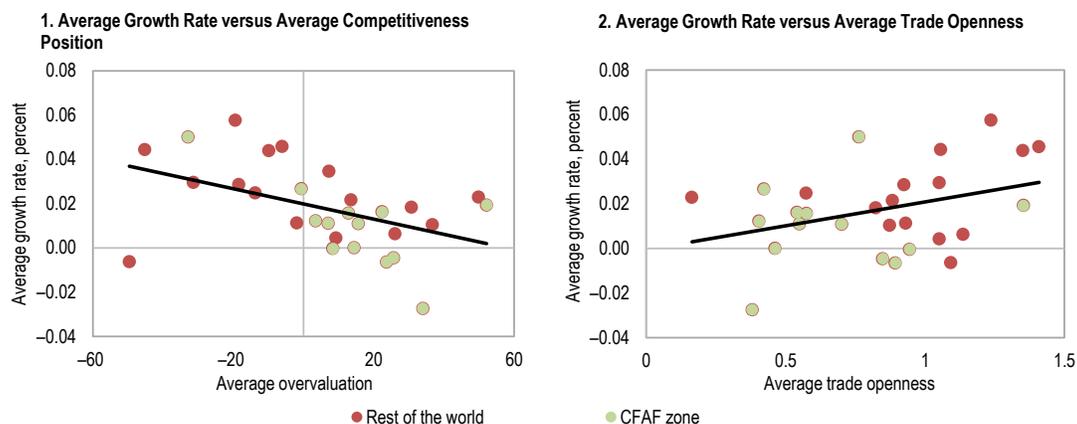
Box 2.1. Achieving Sustained Growth in Pegged Regimes: Lessons from across the Globe

The chapter's findings point to sub-Saharan African countries with pegged exchange rate regimes having generally had slower growth since around 2000. But there is ample evidence of rapid growth with pegs both within sub-Saharan Africa and beyond.

Over the course of their hard peg to the euro (or preceding currencies), countries like Bosnia and Herzegovina, Bulgaria, Estonia, and Lithuania for example registered average real GDP per capita growth rates between 4 and 6 percent per year.¹ Similarly, real GDP per capita in Hong Kong SAR has grown at an average annual rate of more than 3.5 percent since 1983, while maintaining a currency board with the U.S. dollar. Within sub-Saharan Africa, several countries with pegs have registered real per capita growth rates close to or above 2 percent per year for fairly sizable periods (for example, during 2000–14 Burkina Faso grew at an annual rate of 2.7 percent, Chad at 5 percent, and the Republic of Congo at 1.9 percent) and even higher growth rates for shorter durations (such as the ongoing growth surge in Côte d'Ivoire).

Following the strong indications that weak competitiveness may have contributed to slower growth among peggers, we reviewed to what extent growth outcomes correlate with the competitiveness positions of countries with hard pegs within and outside sub-Saharan Africa. By and large, the results suggest that the countries with stronger competitiveness positions grew faster (Figure 2.1.1.). Countries that were more open to trade also recorded higher growth rates (Figure 2.1.2). Although the correlations shown here do not control for other potential variables that could also affect growth, they buttress the evidence in the rest of the chapter of the need to enhance competitiveness through reforms to contain the domestic costs of production and improve business climates (IMF 2016a, 2016b).

Figure 2.1.1. Correlation of Average Growth Rates with Measures of Competitiveness and Trade Openness, 1980–2014



Source: IMF staff estimates.

Note: Averages are calculated over the 2000–14-period or the subsample of years during which the respective country operated a hard peg. The sub-Saharan African sample includes all CFA franc zone countries, with the exception of Equatorial Guinea, which is a clear outlier along the overvaluation dimension (+69 percent). This group is augmented by all countries (with the required data) that had a hard peg in place during (a subsample of) our 2000–14 sample period. The list of countries consists of Antigua and Barbuda, Argentina, Bosnia and Herzegovina, Brunei Darussalam, Bulgaria, Hong Kong SAR, Djibouti, Ecuador, Estonia, Grenada, Lithuania, Montenegro, Panama, St Kitts and Nevis, St Lucia, and St Vincent and the Grenadines. The variable capturing the competitiveness of the exchange rate is defined as the deviation of the real exchange rate from purchasing power parity, adjusted for per capita income, where higher positive values indicate less competitive real exchange rates. Trade openness is measured as the sum of exports and imports as a percent of GDP.

¹ Bosnia and Herzegovina and Bulgaria have had hard pegs since 1997 (first with the Deutsche mark, then with the euro), Estonia since 1992 (first with the Deutsche mark, then with the euro), and Lithuania since 1994 (first with the U.S. dollar until 2002, then with the euro).

Box 2.2. The Evolution of Nigeria's Foreign Exchange Arrangements, 2006–16

Over the past 10 years, as the country faced varying external and domestic economic conditions, Nigeria's de facto exchange arrangement evolved from a managed float to a stabilized one. In June, against the backdrop of a contraction in the first quarter of 2016 and with reserves at an 11-year low, the authorities announced the adoption of a “purely market-driven system,” but the initial implementation is facing challenges.

Nigeria implemented a major reform of monetary and exchange rate policy in early 2006. The Central Bank of Nigeria (CBN) introduced the wholesale Dutch auction system (DAS) on February 20, 2006, to facilitate price discovery and to promote transparency and efficiency in the provision of foreign exchange (FX) by the CBN, the largest single FX supplier. Meanwhile other segments of the FX markets, interbank FX market (IFEM), and as the cash segment of the FX market, the Bureau de Change (BDC), were allowed to gradually develop.

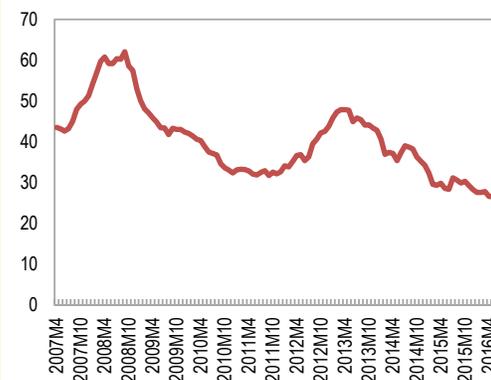
In mid-2013, a wedge emerged between the official exchange rate—which continued to be tightly managed—and the BDC rate as the “taper tantrum,” as well as domestic factors, affected the supply and demand for foreign exchange and put pressure on the naira.¹ Nigeria had received significant capital inflows in the aftermath of the global financial crisis. Following the taper tantrum, the CBN managed the resulting pressure on the exchange rate through interventions, which kept the official exchange rate stable but at the cost of a decline in gross international reserves. Moreover, limits on foreign exchange sales by the CBN to the BDC segment (introduced in fall 2013 as part of the CBN's anti-money-laundering measures) contributed to the spread between the official and the BDC rates increasing from less than 1 percent to about 5 percent by the end of 2013.

In response to the well-documented slide in international oil prices since mid-2014, two step devaluations were effected, for a cumulative 27 percent, but from March 2015 on, the official exchange rate was kept mostly fixed until the IFEM was liberalized in June 2016. With oil prices falling steeply beginning in mid-2014, the CBN effected a first devaluation of 8 percent in November 2014. It was supported by a tightening of monetary and fiscal policy and led to a narrowing of exchange rate spreads. However, the further decline in oil prices put renewed pressure on the naira. The second devaluation of 18 percent (to N197/U.S. dollar) took place in February 2015 when the CBN closed the DAS window

This box was prepared by Mika Saito.

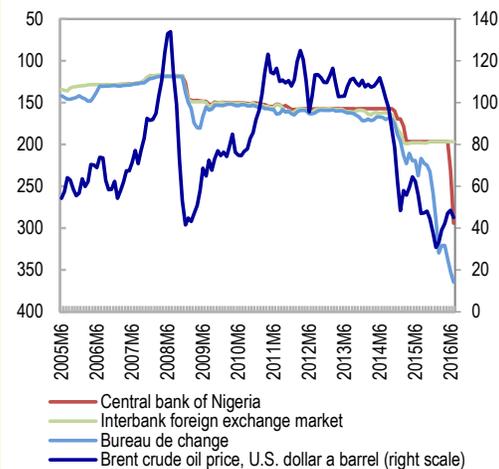
¹ Taper tantrum refers to the May 2013 announcement by the U.S. Federal Reserve System that its unconventional monetary policy support would be scaled back over time, which caused a change in investor sentiment that triggered a reversal of capital flows.

Figure 2.2.1. Nigeria: Central Bank Reserves, 2007–16
(Billions, U.S. dollars)



Sources: Central Bank of Nigeria; and IMF staff estimates.

Figure 2.2.2. Nigeria: Exchange Rates, 2005–16
(Naira per U.S. dollar)



Sources: Central Bank of Nigeria; and IMF staff estimates.

(Box 2.2 continued)

and started selling FX directly in the IFEM only to meet “legitimate” demand (such as, what can be backed by import bills). This change resulted in a significant decline in the size of transactions in the IFEM—which had developed significantly by this point—as FX traders were no longer able to take long or short positions. No market making also meant that the rate at which the CBN intervened in the IFEM became the de facto pegged rate. For the next 16 months, the CBN supplied the IFEM at about N197/U.S. dollar—until June 20, 2016, when the CBN liberalized the IFEM where newly appointed primary dealers could take limited positions.

The shortage of foreign exchange from mid-2015 contributed to a sharp slowdown in economic activity. As central bank international reserves continued to fall, foreign exchange sales were restricted and credit lines cut back or stopped. The prohibition to access foreign exchange at the Nigerian foreign exchange markets for the payment of imports of 40 categories of items, introduced in June 2015, disrupted economic activities further. The absence of a coherent policy response, compounded by political uncertainty, affected confidence, reduced investment, and increased net capital outflows, contributing to the widening of the spread to 30 percent by end-2015. In January 2016, the CBN announced that it would no longer sell foreign exchange to the BDC segment, widening the spread even further. With more foreign exchange transactions being conducted at the sharply depreciated BDC rate, inflationary pressure picked up significantly.

On June 20, 2016, the IFEM was liberalized, but trading volumes have remained low and the spread to BDC substantial. The CBN released revised guidelines for the operation of the Nigerian IFEM, which is expected to be market-driven and with the CBN role limited to periodic interventions. Available hedging products were expanded to moderate volatility in the market, but restrictions on access to foreign exchange for prohibited items have remained. Initial market reaction has been positive, but trading volumes have been low (from a lack of foreign exchange supplies and lack of means for price discovery) and exchange rate spreads have remained, although significantly narrowed from 80 percent to about 25–30 percent.

REFERENCES

- Albanesi, Stefania. 2007. "Inflation and Inequality." *Journal of Monetary Economics* 54 4: 1088–114.
- Barro, Robert, and David Gordon. 1983. "Rules, Discretion, and Reputation in a Model of Monetary Policy." *Journal of Monetary Economics* 12 1: 101–21.
- Duttagupta, Rupa, and Guillermo Tolosa. 2007. "Fiscal Discipline and Exchange Rate Arrangements: Evidence from the Caribbean." *Emerging Markets Finance and Trade* 43 6: 87–112.
- Ghosh, Atish R., Anne-Marie Gulde, and Holger C. Wolf. 2000. "Currency Boards: More than a Quick Fix?" *Economic Policy* (October).
- Ghosh, Atish R., Anne-Marie Gulde, and Holger C. Wolf. 2003. *Exchange Rate Regimes: Choices and Consequences*. Cambridge, Massachusetts: 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, International Monetary Fund, Washington, DC.
- Ghosh, Atish R., Mahvash S. Qureshi, and Charalambos G. Tsangarides. 2014. "On the Value of Words: Inflation and Fixed Exchange Rate Regimes." *IMF Economic Review* 62 2: 288–322.
- International Monetary Fund (IMF). 2008. *The CFA Franc Zone: Common Currency, Uncommon Challenges*. Washington, DC.
- . 2015. "Evolving Monetary Policy Frameworks in Low-Income and Other Developing Countries." Staff Report, Washington, DC.
- . 2016a. "Central African Economic and Monetary Community: Staff Report on the Common Policies of Member Countries." IMF Country Report 16/277, Washington, DC.
- . 2016b. "West African Economic and Monetary Union: Staff Report on the Common Policies of Member Countries." IMF Country Report 16/96, Washington, DC.
- Kim, Woochan. 2003. "Does Capital Account Liberalization Discipline Budget Deficit?" *Review of International Economics* 115: 830–44.
- Levy-Yeyati, Eduardo, and Federico Sturzenegger. 2003. "To Float or to Trail: Evidence on the Impact of Exchange Rate Regimes." *American Economic Review* 93: 1173–93.
- Reinhart, Carmen, and Kenneth Rogoff. 2004. "The Modern History of Exchange Rate Arrangements: A Reinterpretation." *Quarterly Journal of Economics* 119 1: 1–48.
- Rogoff, Kenneth, Aasim M. Husain, Ashoka Mody, Robin Brooks, and Nienke Oomes. 2003. "Evolution and Performance of Exchange Rate Regimes." IMF Working Paper 03/243, International Monetary Fund, Washington, DC.
- Tornell, Aaron, and Andres Velasco. 2000. "Fixed versus Flexible Exchange Rates: Which Provides More Fiscal Discipline?" *Journal of Monetary Economics* 45 2: 399–436.
- Vuletin, Guillermo. 2013. "Exchange Rate Regimes and Fiscal Discipline: The Role of Capital Controls." *Economic Enquiry* 51 4: 2096–109.

Annex 2.1. Empirical Specification and Estimation for Inflation, Growth, and Growth Volatility

We estimate the relationship between inflation and exchange rate regimes, controlling for other factors that are likely to determine inflation:

$$\pi_{it} = \beta_0 + \beta_1 X_{it} + \beta_{peg} Peg_{it} + \beta_{int} Int_{it} + \beta_{Mon} \Delta m_{it} + v_t + \varepsilon_{it} \quad (1)$$

in which π_{it} is the inflation rate for country i at time t ;¹ Peg and Int are dummy variables for pegged and intermediate exchange rate regimes, respectively (with the floating regime as the excluded category); Δm is the growth in broad money; X includes the other likely determinants of inflation performance (real GDP growth, trade openness, central bank independence (proxied by the central bank governor turnover rate), fiscal balance, and terms-of-trade shocks);² v are year effects to capture the effect of shocks over time that are common to all countries; and ε is a random error term.

In equation (1)—which constitutes our benchmark inflation specification—the estimates of β_{peg} and β_{int} are the *direct* effects of exchange rate regimes on inflation that are obtained after controlling for all other possible determinants. However, as money growth itself may vary systematically by regime, the exchange rate regime could also affect inflation *indirectly* through its effect on money growth:

$$\Delta m_{it} = \alpha_0 + \alpha_1 X_{it} + \alpha_{peg} Peg_{it} + \alpha_{int} Int_{it} + v_t + \eta_{it} \quad (2)$$

Taking into account the possibility that money growth is endogenous to the exchange rate regime as in equation (2), we also estimate the total *effect* of pegs and intermediate regimes, which considers both the direct and indirect effects. Specifically, the total effect of pegs (γ_{peg}) is given by $\beta_{peg} + \beta_{Mon} \alpha_{peg}$, and that of intermediate regimes (γ_{int}) is given by $\beta_{int} + \beta_{Mon} \alpha_{int}$.

Similarly, we estimate the relationship between growth and exchange rate regimes using potential determinants. Thus a higher investment ratio, more human capital (average years of schooling), greater trade openness, and a stronger fiscal balance tend to raise growth, while population growth, a larger share of government (expenditure as a fraction of output), inflation, price volatility, real exchange rate volatility, an overvalued real exchange rate, and lower initial income convergence term are all associated with lower growth.³ Similarly to the inflation regressions, we consider the *direct* effect of the exchange rate regime on growth (obtained after controlling for all other possible determinants) and the *indirect* effects of the exchange rate regime through its effect on each of these possible channels.

¹ To reduce the effect of hyperinflation observations, the inflation rate is transformed to $\pi/(1+\pi)$.

² Specifically, real GDP growth and trade openness are expected to lower inflation by raising money demand and increasing the costs of monetary expansions, respectively; central bank independence (lower turnover rate) is likely to be associated with lower inflation; the fiscal deficit—with direct monetization or increased aggregate demand pressures—is expected to increase inflation; and the effect of terms-of-trade shocks is likely to depend on how the aggregate supply and cost structure of the economy is affected (see, for example, Ghosh, Gulde, and Wolf 2003; and Rogoff and others 2003).

³ Price volatility is measured as the monthly standard deviation of the growth of the consumer price index relative to trading partners; real exchange rate volatility is measured as the monthly standard deviation of the growth of the trade-weighted real exchange rate; real exchange rate competitiveness is measured as the deviation of the price level (in international prices) from its predicted value based on per capita income; the income convergence term is per capita income in 1980, expressed in international prices.

The baseline regressions for inflation, growth, and growth volatility are estimated using ordinary least squares with annual fixed effects and robust standard errors.⁴ We also attempt to address regime endogeneity. If countries that have good inflation performance—perhaps because of strong national consensus on the need for price stability—are also more inclined (or able) to peg their exchange rate, then the estimated effects of the regime may be upward biased. To address this, we employ a simultaneous equation framework that allows explicitly for endogeneity of the regime. A probit is estimated on the decision to peg the exchange rate, and the predicted value from the probit is then used in the second-stage regression.⁵

⁴ We do not include country fixed effects as that would imply identifying the effect of exchange rate regimes solely through the time variation of the regime (so that, even if pegged exchange rates were associated with lower inflation, but no country changed its regime over time, no effect would be identified). Country fixed effects are considered in the robustness analysis. Recognizing the possible endogeneity between the control variables and inflation and/or growth, we estimate all regressions using instrumental variables. For the inflation analysis we use lagged values for real GDP growth, fiscal balance, and money growth as instruments; for the growth analysis, we instrument inflation, fiscal balance, government spending, investment, and trade openness. Finally, to prevent “contamination” across regimes the empirical analysis excludes the year of, and the year following, a change in exchange rate regime.

⁵ The probit and the “second-stage” regression are actually estimated simultaneously to allow for the appropriate correction of the standard errors, including the cross-equation correlation. The literature on regime choice suggests that smaller countries with geographically concentrated exports are more likely to adopt a peg (but there is no reason to believe that this would otherwise affect inflation). These variables (population size and the geographic concentration ratio of the country’s top-three exports) enter the regime choice probit significantly and with the expected signs but are excluded from the second-stage inflation regression.

Annex Table 2.1.1. Inflation Regression: Baseline¹

	De Jure classification				De Facto classification			
	Direct effect		Total effect ²		Direct effect		Total effect ²	
	coefficient	<i>t</i> -statistics	coefficient	<i>t</i> -statistics	coefficient	<i>t</i> -statistics	coefficient	<i>t</i> -statistics
Emerging market and developing economies								
Constant	0.003	0.2	0.003	0.2	0.092	13.5 ***	0.092	13.5 ***
Pegged regimes	-0.042	-9.9 ***	-0.080	-11.2 ***	-0.032	-6.1 ***	-0.034	-6.5 ***
Intermediate regimes	-0.002	-0.4	-0.015	-3.1 ***	0.009	1.0	0.013	2.4 **
Money growth	0.382	5.6 ***	0.382	5.6 ***	0.093	4.3 ***	0.093	4.3 ***
GDP growth	-0.736	-5.1 ***	-0.736	-5.1 ***	-0.599	-4.5 ***	-0.599	-4.5 ***
Openness	-0.013	-3.2 ***	-0.013	-3.2 ***	-0.008	-2.1 **	-0.008	-2.1 **
Central bank turnover rate	0.035	4.2 ***	0.035	4.2 ***	0.038	4.6 ***	0.038	4.6 ***
Terms-of-trade growth	0.001	0.1	0.001	0.1	0.009	0.6	0.009	0.6
Fiscal balance (percent of GDP)	-0.409	-2.2 **	-0.409	-2.2 **	0.395	5.3 ***	0.395	5.3 ***
Number of observations, <i>R</i> -squared	2,248	0.42	2,248	0.42	2,093	0.40	2,093	0.40
Sub-Saharan Africa								
Constant	0.044	4.3 ***	0.044	4.3 ***	0.078	5.9 ***	0.078	5.9 ***
Pegged regimes	-0.052	-8.0 ***	-0.072	-10.5 ***	-0.050	-4.3 ***	-0.058	-5.4 ***
Intermediate regimes	0.006	0.7	-0.001	-0.1	0.002	0.2	-0.003	-0.3
Money growth	0.165	5.8 ***	0.165	5.8 ***	0.068	4.6 ***	0.068	4.6 ***
GDP growth	-0.365	-1.5	-0.365	-1.5	-0.272	-1.0	-0.272	-1.0
Openness	0.012	2.0 **	0.012	2.0 **	0.014	2.4 **	0.014	2.4 **
Central bank turnover rate	0.017	1.1	0.017	1.1	0.021	1.4	0.021	1.4
Terms-of-trade growth	0.011	0.7	0.011	0.7	0.008	0.5	0.008	0.5
Fiscal balance (percent of GDP)	0.744	1.8 *	0.744	1.8 *	0.123	1.4	0.123	1.4
Number of observations, <i>R</i> -squared	830	0.47	830	0.47	793	0.38	793	0.38
Emerging markets								
Constant	0.049	6.0 ***	0.049	6.0 ***	0.047	5.8 ***	0.047	5.8 ***
Pegged regimes	-0.003	-0.3	-0.038	-3.8 ***	-0.008	-1.1	-0.005	-0.7
Intermediate regimes	-0.000	-0.1	-0.020	-3.9 ***	0.005	1.0	0.022	4.5 ***
Number of observations, <i>R</i> -squared	904	0.62	904	0.62	796	0.62	796	0.62
Developing economies								
Constant	0.049	3.3 ***	0.049	3.3 ***	0.113	10.3 ***	0.113	10.3 ***
Pegged regimes	-0.048	-9.4 ***	-0.076	-12.1 ***	-0.056	-6.1 ***	-0.062	-7.0 ***
Intermediate regimes	-0.001	-0.1	-0.009	-1.5	-0.011	-1.2	-0.014	-1.5
Number of observations, <i>R</i> -squared	1,344	0.41	1,344	0.41	1,297	0.34	1,297	0.34
Developing economies less SSA								
Constant	0.004	0.2	0.004	0.2	0.181	13.0 ***	0.181	13.0 ***
Pegged regimes	-0.054	-7.6 ***	-0.086	-9.8 ***	-0.081	-6.7 ***	-0.084	-7.2 ***
Intermediate regimes	-0.025	-3.1 ***	-0.021	-2.8 ***	-0.053	-4.5 ***	-0.053	-4.5 ***
Number of observations, <i>R</i> -squared	514	0.49	514	0.49	514	0.49	514	0.49

Source: IMF staff estimates.

¹ Regression of inflation (decimal fraction, per year) on regime dummy variables and other control variables. Estimates obtained from instrumental variable estimation controlling for the endogeneity of real GDP growth, fiscal balance, and money growth, where lagged values are used as instruments. All specifications include time effects. *t*-statistics based on robust standard errors. Negative coefficient on pegged or intermediate exchange rate regime dummies indicates lower inflation under that regime relative to inflation under floating exchange rate regimes (the omitted category). *, **, and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

² Direct effect of exchange rate regime on inflation, plus indirect effect through money growth.

Annex Table 2.1.2. Indirect Effects of Regime on Output Growth¹

	De Jure		De Facto	
	Peg	Intermediate	Peg	Intermediate
Emerging market and developing economies				
Less competitive exchange rate	0.117 ***	-0.083 ***	0.064 ***	-0.096 ***
Real exchange rate volatility	-0.855 ***	0.469 **	-1.382 ***	-0.961 ***
Price volatility	0.600 ***	-0.174 **	0.401 ***	-0.111
Inflation	-0.048 ***	-0.027 **	-0.011	0.025 ***
Trade openness	0.311 ***	0.075 ***	0.325 ***	0.110 ***
Sub-Saharan Africa				
Less competitive exchange rate	0.108 ***	-0.034	0.048	-0.088 *
Real exchange rate volatility	-0.836	1.348 **	-0.580	-0.289
Price volatility	0.705 ***	-0.651 ***	0.636 **	-0.232
Inflation	-0.057 ***	-0.002	-0.052 ***	0.007
Trade openness	0.395 ***	0.028	0.358 ***	0.021

Source: IMF staff estimates.

Note: Higher value indicates less competitive (more overvalued) real exchange rate. Volatility measured as standard deviation of monthly growth rates.

¹ Relative to floating regimes; includes other controls from growth regression.

Annex Table 2.1.3. Growth Regression: Baseline¹

	De Jure classification				De Facto classification			
	Direct effect		Total effect ²		Direct effect		Total effect ²	
	coefficient	t-statistics	coefficient	t-statistics	coefficient	t-statistics	coefficient	t-statistics
Emerging market and developing economies								
Constant	0.001	0.0	0.046	1.8 *	0.017	0.7	0.040	1.5
Pegged regimes	-0.013	-4.2 ***	-0.007	-2.5 **	-0.012	-3.4 ***	-0.008	-2.4 **
Intermediate regimes	0.003	1.3	0.006	2.8 ***	0.001	0.3	0.004	1.3
Initial per capita income	-0.010	-5.9 ***	-0.010	-5.9 ***	-0.009	-5.4 ***	-0.009	-5.4 ***
Population growth (percent per year)	-0.031	-4.3 ***	-0.031	-4.3 ***	-0.026	-3.8 ***	-0.026	-3.8 ***
Average years schooling (years)	0.002	3.5 ***	0.002	3.5 ***	0.003	4.7 ***	0.003	4.7 ***
Terms-of-trade growth	0.022	2.5 **	0.022	2.5 **	0.019	2.1 **	0.019	2.1 **
Real exchange rate vol. (percent per year)	-0.001	-2.2 **	-0.001	-2.2 **	-0.001	-1.6	-0.001	-1.6
Price volatility (percent per year)	-0.001	-0.6	-0.001	-0.6	-0.000	-0.0	-0.000	-0.0
Competitiveness	-0.008	-1.9 *	-0.008	-1.9 *	-0.012	-2.8 ***	-0.012	-2.8 ***
Investment (percent of GDP)	0.008	2.2 **	0.008	2.2 **	0.010	2.9 ***	0.010	2.9 ***
Inflation (percent per year)	-0.042	-3.1 ***	-0.042	-3.1 ***	-0.052	-4.3 ***	-0.052	-4.3 ***
Fiscal balance (percent of GDP)	-0.248	-2.1 **	-0.248	-2.1 **	-0.050	-0.8	-0.050	-0.8
Government spending (percent of GDP)	-0.005	-1.6	-0.005	-1.6	-0.005	-1.6	-0.005	-1.6
Trade openness	0.010	3.6 ***	0.010	3.6 ***	0.005	1.9 *	0.005	1.9 *
Number of observations, R-squared	1,726	0.25	1,726	0.25	1,585	0.23	1,585	0.23
Sub-Saharan Africa								
Constant	0.070	1.5	0.080	1.7 *	0.064	1.4	0.062	1.3
Pegged regimes	-0.020	-4.0 ***	-0.014	-3.4 ***	-0.026	-4.5 ***	-0.018	-3.2 ***
Intermediate regimes	-0.001	-0.2	0.002	0.3	-0.010	-1.6	-0.006	-1.1
Initial per capita income	-0.010	-2.9 ***	-0.010	-2.9 ***	-0.010	-2.8 ***	-0.010	-2.8 ***
Population growth (percent per year)	-0.007	-0.4	-0.007	-0.4	-0.005	-0.3	-0.005	-0.3
Average years schooling (years)	0.001	0.8	0.001	0.8	0.002	1.4	0.002	1.4
Terms-of-trade growth	0.017	1.5	0.017	1.5	0.016	1.3	0.016	1.3
Real exchange rate vol. (percent per year)	0.000	0.5	0.000	0.5	0.000	0.4	0.000	0.4
Price volatility (percent per year)	0.000	0.3	0.000	0.3	0.001	0.4	0.001	0.4
Competitiveness	-0.008	-1.0	-0.008	-1.0	-0.010	-1.1	-0.010	-1.1
Investment (percent of GDP)	0.004	0.7	0.004	0.7	0.003	0.6	0.003	0.6
Inflation (percent per year)	-0.015	-0.3	-0.015	-0.3	-0.012	-0.3	-0.012	-0.3
Fiscal balance (percent of GDP)	-0.638	-1.4	-0.638	-1.4	-0.108	-1.1	-0.108	-1.1
Government spending (percent of GDP)	-0.001	-0.1	-0.001	-0.1	-0.001	-0.2	-0.001	-0.2
Trade openness	0.017	3.0 ***	0.017	3.0 ***	0.016	2.9 ***	0.016	2.9 ***
Number of observations, R-squared	597	0.23	597	0.23	597	0.24	597	0.24
Emerging markets								
Constant	0.014	0.4	0.078	1.7 *	0.065	1.6	0.140	2.6 ***
Pegged regimes	-0.002	-0.4	-0.004	-0.6	-0.001	-0.2	-0.003	-0.6
Intermediate regimes	0.006	2.3 **	0.008	3.1 ***	0.002	0.4	0.004	1.1
Number of observations, R-squared	849	0.38	849	0.38	741	0.37	741	0.37
Developing economies								
Constant	0.022	0.7	0.046	1.6	0.032	1.1	0.042	1.5
Pegged regimes	-0.020	-5.2 ***	-0.012	-3.5 ***	-0.020	-3.8 ***	-0.014	-2.8 ***
Intermediate regimes	-0.004	-1.0	0.002	0.5	-0.006	-1.1	-0.001	-0.3
Number of observations, R-squared	877	0.18	877	0.18	844	0.17	844	0.17
Developing economies less SSA								
Constant	0.027	0.5	0.045	1.0	0.009	0.2	0.020	0.4
Pegged regimes	-0.029	-2.5 **	-0.022	-1.9 *	0.021	1.7 *	0.031	2.3 **
Intermediate regimes	-0.013	-1.3	-0.014	-1.4	0.033	2.8 ***	0.040	3.1 ***
Number of observations, R-squared	280	0.32	280	0.32	265	0.30	265	0.30

Source: IMF staff estimates.

¹ Regression of real GDP per capita growth rate on regime dummy variables, and other control variables. Estimates obtained from instrumental variable estimation controlling for the endogeneity of investment, inflation, fiscal balance, government spending, and trade openness where lagged values are used as instruments. All specifications include time effects. *t*-statistics based on robust standard errors. Negative coefficient on pegged or intermediate exchange rate regime dummies indicates lower growth under that regime relative to growth under floating exchange rate regimes (the omitted category). *, **, and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

² Direct effect of exchange rate regime on growth, plus indirect effect through competitiveness, real exchange rate volatility, inflation, price volatility, and openness.

Annex Table 2.1.4. Growth Volatility Regression¹

	De Jure classification				De Facto classification			
	Direct effect		Total effect ²		Direct effect		Total effect ²	
	coefficient	<i>t</i> -statistics	coefficient	<i>t</i> -statistics	coefficient	<i>t</i> -statistics	coefficient	<i>t</i> -statistics
Emerging market and developing economies								
Constant	-0.033	-2.9 ***	0.012	-2.2 **	-0.041	-3.5 ***	-0.027	-2.3 **
Pegged regimes	0.003	2.2 **	0.001	2.8 ***	0.000	0.2	0.001	0.7
Intermediate regimes	0.003	3.1 ***	0.001	2.5 **	-0.000	-0.2	-0.001	-0.9
Initial per capita income	0.004	4.9 ***	0.001	4.9 ***	0.004	5.1 ***	0.004	5.1 ***
Population growth (percent per year)	-0.008	-2.4 **	0.004	-2.4 **	-0.010	-3.0 ***	-0.010	-3.0 ***
Average years schooling (years)	-0.001	-2.3 **	0.000	-2.3 **	-0.001	-3.1 ***	-0.001	-3.1 ***
Terms-of-trade growth	0.000	0.1	0.005	0.1	-0.000	-0.1	-0.000	-0.1
Real exchange rate vol. (percent per year)	0.000	2.7 ***	0.000	2.7 ***	0.000	2.4 **	0.000	2.4 **
Price volatility (percent per year)	0.002	3.4 ***	0.000	3.4 ***	0.001	2.5 **	0.001	2.5 **
Competitiveness	0.003	1.8 *	0.002	1.8 *	0.004	2.0 **	0.004	2.0 **
Investment (percent of GDP)	-0.006	-2.7 ***	0.002	-2.7 ***	-0.007	-3.1 ***	-0.007	-3.1 ***
Inflation (percent per year)	0.003	0.6	0.005	0.6	0.003	0.8	0.003	0.8
Fiscal balance (percent of GDP)	0.012	0.2	0.057	0.2	-0.039	-1.2	-0.039	-1.2
Government spending (percent of GDP)	0.001	0.8	0.001	0.8	-0.000	-0.1	-0.000	-0.1
Trade openness	0.003	1.7 *	0.002	1.7 *	0.004	2.7 ***	0.004	2.7 ***
Number of observations, <i>R</i> -squared	1,721	0.28		0.28	1,581	0.29	1,581	0.29
Sub-Saharan Africa								
Constant	-0.041	-1.8 *	0.020	-1.8 *	-0.034	-1.5	-0.032	-1.5
Pegged regimes	-0.003	-1.4	0.002	0.6	-0.008	-2.1 **	-0.003	-0.9
Intermediate regimes	0.006	2.5 **	0.002	2.4 **	-0.003	-0.8	-0.003	-0.7
Initial per capita income	0.003	1.5	0.002	1.5	0.002	1.0	0.002	1.0
Population growth (percent per year)	-0.014	-1.8 *	0.007	-1.8 *	-0.013	-1.7 *	-0.013	-1.7 *
Average years schooling (years)	-0.003	-3.6 ***	0.001	-3.6 ***	-0.002	-3.0 ***	-0.002	-3.0 ***
Terms-of-trade growth	0.007	1.3	0.005	1.3	0.006	1.1	0.006	1.1
Real exchange rate vol. (percent per year)	-0.000	-1.5	0.000	-1.5	-0.000	-1.1	-0.000	-1.1
Price volatility (percent per year)	0.002	3.1 ***	0.001	3.1 ***	0.002	2.8 ***	0.002	2.8 ***
Competitiveness	0.003	1.0	0.003	1.0	0.003	1.0	0.003	1.0
Investment (percent of GDP)	-0.008	-2.4 **	0.003	-2.4 **	-0.008	-2.4 **	-0.008	-2.4 **
Inflation (percent per year)	-0.003	-0.2	0.018	-0.2	-0.006	-0.5	-0.006	-0.5
Fiscal balance (percent of GDP)	-0.159	-0.8	0.211	-0.8	-0.050	-1.1	-0.050	-1.1
Government spending (percent of GDP)	-0.005	-2.1 **	0.002	-2.1 **	-0.005	-2.3 **	-0.005	-2.3 **
Trade openness	0.006	2.0 *	0.003	2.0 *	0.007	2.1 **	0.007	2.1 **
Number of observations, <i>R</i> -squared	596	0.37		0.37	578	0.36	578	0.36
Emerging markets								
Constant	-0.036	-2.3 **	0.018	-3.1 ***	-0.073	-4.0 ***	-0.080	-3.9 ***
Pegged regimes	0.016	5.8 ***	0.003	5.1 ***	0.013	4.9 ***	0.011	4.6 ***
Intermediate regimes	0.003	2.7 ***	0.001	2.2 **	0.002	1.4	0.001	0.4
Number of observations, <i>R</i> -squared	842	0.46		0.46	734	0.47	734	0.47
Developing economies								
Constant	-0.025	-1.7 *	0.013	-1.0	-0.029	-2.0 **	-0.014	-1.1
Pegged regimes	-0.000	-0.2	0.002	1.1	-0.007	-1.8 *	-0.004	-1.3
Intermediate regimes	0.007	3.1 ***	0.002	3.4 ***	-0.001	-0.3	-0.001	-0.4
Number of observations, <i>R</i> -squared	879	0.30		0.30	847	0.30	847	0.30
Developing economies less SSA								
Constant	0.048	1.8 *	0.022	4.2 ***	0.050	1.9 *	0.084	3.7 ***
Pegged regimes	0.002	0.3	0.006	0.3	0.009	0.9	0.010	0.9
Intermediate regimes	0.012	2.0 **	0.006	1.8 *	0.020	2.2 **	0.018	1.9 *
Number of observations, <i>R</i> -squared	283	0.48		0.48	269	0.51	269	0.51

Source: IMF staff estimates.

¹ Regression of the three-year centered standard deviation of the Hedrick-Prescott-filtered real GDP on regime dummy variables, and other control variables. Estimates obtained from instrumental variable estimation controlling for the endogeneity of investment, inflation, fiscal balance, government spending, and trade openness where lagged values are used as instruments. All specifications include time effects. *t*-statistics based on robust standard errors. Negative coefficient on pegged or intermediate exchange rate regime dummies indicates lower growth volatility under that regime relative to growth volatility under floating exchange rate regimes (the omitted category). *, **, and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

² Direct effect of exchange rate regime on volatility, plus indirect effect through competitiveness, real exchange rate volatility, inflation, price volatility, and openness.

Annex 2.2. Empirical Specification and Estimation for Fiscal Discipline

This annex explores links between exchange rate regimes and fiscal policy discipline. The analysis primarily focuses on sub-Saharan African countries, though a broad sample of emerging market and developing economies is also considered for comparison. The dynamics of exchange rate regimes in sub-Saharan Africa discussed in the chapter, particularly the CFA zone arrangements that are stable and broadly exogenous to fiscal policy, provide an excellent case to study the fiscal performance across exchange rate regimes among countries otherwise at similar levels of development.

However, there is no consensus on how to define fiscal discipline. In general, a government is considered as fiscally disciplined if its fiscal policy and its public debt are sustainable. Thus, indicators of overall fiscal balance and primary fiscal balance (to exclude interest payments that are the effects of past fiscal policy decisions) are used for assessing fiscal discipline. We estimated the relationship between these indicators of fiscal discipline (FD) and exchange rate regimes (ERR), controlling for other factors that are likely to impact fiscal discipline (X_i), which are drawn from past research (for example, Tornell and Velasco 2000, and Vuletin 2013).

$$FD_{it} = \alpha_0 + \beta_1 ERR_{it} + \beta_2 \Delta TOT_{it} + \beta_4 ERR_{it} * \Delta TOT_{it} + \delta X_{it} + \varepsilon_{it} \quad (1)$$

Key control variables include economic cycles and shocks (terms-of-trade shocks, economic growth in trading partners, and election cycles are used as proxies), level of income per capita to capture level of development, and strength of fiscal institutions and a measure of past fiscal policies—initial debt level and related debt relief. It is expected that terms-of-trade shocks (ΔTOT) are likely to have a differential impact on fiscal position depending on the type of exchange rate regime. Therefore, the interaction of terms-of-trade shocks with the exchange rate regimes ($ERR * \Delta TOT$) is included to capture potential differential regime effects.

Past empirical work is not conclusive on the links between fiscal discipline and exchange rate regimes. For example, Ghosh, Gulde, and Wolf 2000 conclude that currency board arrangements are associated with smaller fiscal deficits than regular pegs. Kim 2003 also finds that fixed regimes have a stronger disciplinary effect on fiscal policy, especially when the capital account is liberalized. In contrast, Tornell and Velasco 2000 conclude that countries in the CFA zone were slow in undertaking fiscal adjustment during the 1980s compared with other sub-Saharan African countries operating under flexible exchange rate regimes. Duttagupta and Tolosa 2007 find that hard and conventional pegs are associated with worse fiscal balances compared with more flexible regimes. Similarly, Vuletin 2013 concludes that flexible regimes are more disciplinary than fixed regimes, while the dual (a combination of fixed and flexible) exchange rate system has the worst disciplinary effect.

The empirical results for overall fiscal balance and primary fiscal balance indicators are reported in Table 2.2.1.¹ Both (overall and primary) fiscal balances are measured as ratios to GDP, though an overall balance-to-trend-GDP measure was also used to test robustness. In the baseline (models 1–4), exchange rate regimes are treated as continuous variables with values ranging from 1 (hard peg) to 7 (independent float). Moreover, only observations with regime consensus (that is, when de facto regime is the same as the de jure) are included; but we tested for other classifications (de jure and de facto, separately) and formulation (for example using three broad regime categories: pegs, intermediate, and float). The baseline findings are robust to these changes in specifications (see Table 2.2.1). The findings are also robust to alternative specifications (not shown in Table 2.2.1) where we (1) use the lagged exchange rate regimes as explanatory variables in the regressions in place of current exchange rate regimes (which helps mitigate the possibility that the fiscal performance may influence the choice of regime and lead to reverse causality); and (2) add trade openness as a control variable in the regressions to capture that countries that are more open typically experience larger and more frequent external shocks, which can translate into higher fiscal deficits.

¹ The analysis is based on an annual data set covering 1980–2014. As in the rest of the analysis in this chapter, to prevent contamination across regimes, we exclude the year of, and the year following a change in exchange rate regime. In models with aggregate regimes, the “pegs” are treated as the baseline exchange rate regime, and the reported dummy variables (for intermediate and floating groups) capture their impact on fiscal discipline relative to the pegs.

Annex Table 2.2.1. Regressions of the Relationship Between Various Fiscal Discipline Indicators and Exchange Rate Regimes

Variables	(1) Overall balance (% of GDP)		(2) Primary balance (% of GDP)		(3) Change in debt-to-GDP ratio		(4) SSA		(5) SSA		(6) OB % of trend GDP		(7) SSA		(8) Various measures of exchange rate regimes		(9) SSA only: Overall balance (% of GDP)		(10) SSA only: Overall balance (% of GDP)		(11) SSA only: Overall balance (% of GDP)		(12) SSA only: Overall balance (% of GDP)		
	All ¹	SSA	All ¹	SSA	All ¹	SSA	All ¹	SSA	All ¹	SSA	All ¹	SSA	All ¹	SSA	All ¹	SSA	All ¹	SSA	All ¹	SSA	All ¹	SSA	All ¹	SSA	
Consensus exchange rate regime (fine) ²	-1.066 *	-3.370 ***	-1.271 **	-2.306 ***	-0.992	1.126	-0.982	1.126	(0.991)	(1.931)	(0.991)	(1.931)	-2.830 ***	-2.830 ***	-2.830 ***	-2.830 ***	-2.830 ***	-2.830 ***	-2.830 ***	-2.830 ***	-2.830 ***	-2.830 ***	-2.830 ***	-2.830 ***	-2.830 ***
	(0.639)	(0.957)	(0.571)	(0.873)	(0.389)	(1.931)	(0.389)	(1.931)	(0.991)	(1.931)	(0.991)	(1.931)	(0.873)	(0.873)	(0.873)	(0.873)	(0.873)	(0.873)	(0.873)	(0.873)	(0.873)	(0.873)	(0.873)	(0.873)	(0.873)
Consensus exchange rate regime squared (fine) ²	0.163 **	0.439 ***	0.172 **	0.290 ***	-2.316 *	-2.316 *	-2.316 *	-2.316 *	-2.316 *	-2.316 *	-2.316 *	-2.316 *	0.371 ***	0.371 ***	0.371 ***	0.371 ***	0.371 ***	0.371 ***	0.371 ***	0.371 ***	0.371 ***	0.371 ***	0.371 ***	0.371 ***	
	(0.080)	(0.123)	(0.073)	(0.111)	(1.297)	(1.920)	(1.297)	(1.920)	(1.297)	(1.920)	(1.297)	(1.920)	(0.114)	(0.114)	(0.114)	(0.114)	(0.114)	(0.114)	(0.114)	(0.114)	(0.114)	(0.114)	(0.114)	(0.114)	(0.114)
De facto exchange rate regime (fine) ²																									
De facto exchange rate regime squared (fine) ²																									
De jure exchange rate regime (fine) ²																									
De jure exchange rate regime squared (fine) ²																									
Consensus intermediate ERR (dummy) ³																									
Consensus floating ERR (dummy) ³																									
Commodity TOT shock	-0.366 ***	-0.339 ***	-0.481 ***	-0.424 ***	0.483 **	0.705 **	0.483 **	0.705 **	0.483 **	0.705 **	0.483 **	0.705 **	-0.348 ***	-0.348 ***	-0.348 ***	-0.348 ***	-0.348 ***	-0.348 ***	-0.348 ***	-0.348 ***	-0.348 ***	-0.348 ***	-0.348 ***	-0.348 ***	
	(0.054)	(0.027)	(0.075)	(0.071)	(0.192)	(0.312)	(0.192)	(0.312)	(0.192)	(0.312)	(0.192)	(0.312)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)	
CTOT shock * intermediate ERR dummy	0.244 ***	0.188	0.077	0.077	0.116	0.345	0.116	0.345	0.116	0.345	0.116	0.345	0.191 *	0.191 *	0.191 *	0.191 *	0.191 *	0.191 *	0.191 *	0.191 *	0.191 *	0.191 *	0.191 *	0.191 *	
	(0.076)	(0.136)	(0.099)	(0.068)	(0.273)	(0.506)	(0.273)	(0.506)	(0.273)	(0.506)	(0.273)	(0.506)	(0.099)	(0.099)	(0.099)	(0.099)	(0.099)	(0.099)	(0.099)	(0.099)	(0.099)	(0.099)	(0.099)	(0.099)	
CTOT shock * float ERR dummy	0.210 ***	0.238 ***	0.304 ***	0.304 ***	-1.420	-3.038 ***	-1.420	-3.038 ***	-1.420	-3.038 ***	-1.420	-3.038 ***	0.182 **	0.182 **	0.182 **	0.182 **	0.182 **	0.182 **	0.182 **	0.182 **	0.182 **	0.182 **	0.182 **	0.182 **	
	(0.068)	(0.070)	(0.097)	(0.108)	(1.148)	(2.180)	(1.148)	(2.180)	(1.148)	(2.180)	(1.148)	(2.180)	(0.075)	(0.075)	(0.075)	(0.075)	(0.075)	(0.075)	(0.075)	(0.075)	(0.075)	(0.075)	(0.075)	(0.075)	
Growth in trading partners	0.270 ***	0.397 ***	0.167	0.563 ***	-0.602 ***	-0.298	-0.602 ***	-0.298	-0.602 ***	-0.298	-0.602 ***	-0.298	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	
	(0.089)	(0.122)	(0.104)	(0.147)	(0.184)	(0.408)	(0.184)	(0.408)	(0.184)	(0.408)	(0.184)	(0.408)	(0.097)	(0.097)	(0.097)	(0.097)	(0.097)	(0.097)	(0.097)	(0.097)	(0.097)	(0.097)	(0.097)	(0.097)	
Initial level of public debt (% of GDP)	-0.021 ***	-0.016 **	0.97 ***	1.531 ***	0.643 *	1.487	0.643 *	1.487	0.643 *	1.487	0.643 *	1.487	-0.017 **	-0.017 **	-0.017 **	-0.017 **	-0.017 **	-0.017 **	-0.017 **	-0.017 **	-0.017 **	-0.017 **	-0.017 **	-0.017 **	
	(0.008)	(0.007)	(0.270)	(0.412)	(0.389)	(1.059)	(0.389)	(1.059)	(0.389)	(1.059)	(0.389)	(1.059)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	
Three-year lagged GDP per capita (log)	1.239 ***	0.744 *	0.97 ***	1.531 ***	0.643 *	1.487	0.643 *	1.487	0.643 *	1.487	0.643 *	1.487	0.919 **	0.919 **	0.919 **	0.919 **	0.919 **	0.919 **	0.919 **	0.919 **	0.919 **	0.919 **	0.919 **	0.919 **	
	(0.328)	(0.443)	(0.270)	(0.412)	(0.389)	(1.059)	(0.389)	(1.059)	(0.389)	(1.059)	(0.389)	(1.059)	(0.427)	(0.427)	(0.427)	(0.427)	(0.427)	(0.427)	(0.427)	(0.427)	(0.427)	(0.427)	(0.427)	(0.427)	
HIPC completion point dummy	3.287 **	3.097 **	1.787	1.672	-20.433 ***	-22.003 ***	-20.433 ***	-22.003 ***	-20.433 ***	-22.003 ***	-20.433 ***	-22.003 ***	3.121 **	3.121 **	3.121 **	3.121 **	3.121 **	3.121 **	3.121 **	3.121 **	3.121 **	3.121 **	3.121 **	3.121 **	
	(1.329)	(1.453)	(1.271)	(1.282)	(5.020)	(5.366)	(5.020)	(5.366)	(5.020)	(5.366)	(5.020)	(5.366)	(1.447)	(1.447)	(1.447)	(1.447)	(1.447)	(1.447)	(1.447)	(1.447)	(1.447)	(1.447)	(1.447)	(1.447)	
Election cycle dummy	-0.422 **	-0.616	-0.549 **	-0.698	-2.691	-9.640	-2.691	-9.640	-2.691	-9.640	-2.691	-9.640	-0.667 *	-0.667 *	-0.667 *	-0.667 *	-0.667 *	-0.667 *	-0.667 *	-0.667 *	-0.667 *	-0.667 *	-0.667 *	-0.667 *	
	(0.214)	(0.406)	(0.230)	(0.471)	(3.421)	(8.045)	(3.421)	(8.045)	(3.421)	(8.045)	(3.421)	(8.045)	(0.395)	(0.395)	(0.395)	(0.395)	(0.395)	(0.395)	(0.395)	(0.395)	(0.395)	(0.395)	(0.395)	(0.395)	
Constant	-11.600 ***	-5.037	-7.285 ***	-10.918 ***	-2.691	-9.640	-2.691	-9.640	-2.691	-9.640	-2.691	-9.640	-6.904 **	-6.904 **	-6.904 **	-6.904 **	-6.904 **	-6.904 **	-6.904 **	-6.904 **	-6.904 **	-6.904 **	-6.904 **	-6.904 **	
	(2.621)	(3.447)	(2.027)	(3.029)	(3.421)	(8.045)	(3.421)	(8.045)	(3.421)	(8.045)	(3.421)	(8.045)	(3.281)	(3.281)	(3.281)	(3.281)	(3.281)	(3.281)	(3.281)	(3.281)	(3.281)	(3.281)	(3.281)	(3.281)	
Number of observations	2,161	797	1,612	536	2,321	814	2,321	814	2,321	814	2,321	814	995	995	995	995	995	995	995	995	995	995	995	995	
Number of countries	119	37	117	36	120	37	120	37	120	37	120	37	37	37	37	37	37	37	37	37	37	37	37	37	

Source: IMF staff estimates.

¹ The sample "All" includes emerging market and developing economies; period covered is 1982–2014, except when specified.

² "fine" refers to a fine classification with seven categories (1) hard pegs (exchange arrangement with no separate legal tender and currency board arrangements); (2) conventional pegs (to a single currency); (3) basket pegs; (4) pegged exchange rates within horizontal bands; (5) crawling pegs or band; (6) managed floats with no predetermined path for the exchange rate; and (7) independently floating arrangement. The shaded area represents the period during which countries moved to either a peg or to a float.

³ Three broad categories of exchange rate regimes (ERRs) are considered: pegged (categories 1 and 2), floating (category 7) and all other regimes classified as intermediate.

Note: Regression of overall and primary fiscal balance on regime dummy variables and other control variables. All specifications include time effects. *t*-statistics based on robust standard errors. *, **, and *** indicate significance at the 10, 5, and 1 percent levels, respectively. CTOT = commodity terms-of-trade; ERR = exchange rate regime; HIPC = heavily indebted poor country; OB = overall balance; TOT = terms-of-trade.