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Exchange Rate Pass-Through in Sub-Saharan African Economies and its Determinants

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Abstract

This paper analyzes the exchange rate pass-through to domestic prices and its determinants in sub-Saharan African countries. It finds that the pass-through is incomplete. The pass-through is larger following a depreciation than after an appreciation of the local currency. The average elasticity is estimated at about 0.4. It is lower in countries with more flexible exchange rate regimes and in countries with a higher income. A low inflation environment, a prudent monetary policy, and a sustainable fiscal policy are associated with a lower pass-through. The degree of pass-through has declined in the SSA region since the mid-1990s following marked improvements in macroeconomic and political environments.

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I. INTRODUCTION

An important challenge to economic policy makers is the effect of exchange rate changes on inflation and economic activity. In case of a misalignment of the nominal exchange rate,[2] there is often a reluctance to allow the exchange rate to adjust for fear that the pass-through would create domestic disruptions and will offset the expected international competitiveness gains. A large price increase of imported goods from an exchange rate depreciation would spill over to the other sectors of the economy, raise the overall domestic production costs, and might lead to an inflationary spiral. Also, the rise in production costs would increase the price of export products in local currency and might lead to unchanged or even weakening international price competitiveness.

This study investigates the degree and speed of pass-through in sub-Saharan Africa (SSA) and suggests that it can be contained if a favorable macroeconomic environment is in place. This study starts by estimating the degree and speed of exchange rate pass-through to domestic prices. Then it identifies factors that underlie the differences of pass-through across countries and periods. The study is structured as follows. In section II, we review the major and most relevant studies on exchange rate pass-through and highlight the contributions of our study to the literature. In section III, we conduct empirical analyses and present the main results. Section IV concludes and provides some policy recommendations.

II. LITERATURE REVIEW

Considerable literature exists on exchange rate pass-through as an accurate understanding of the adjustment of domestic prices following changes in the exchange rate allows policy makers to formulate appropriate accompanying macroeconomic policies. A low exchange rate pass-through tends to permit a more independent monetary policy. On the one hand, during downward phases of the business cycle, monetary authorities would be less constrained to dampen exchange-rate-induced inflation and would have more room for countercyclical policies. On the other hand, when there are strong demand pressures, a low pass-through helps to contain inflation. Estimates of the pass-through can help guide exchange rate policy and provide insights into the degree of exchange rate flexibility that is appropriate considering the characteristics of the economy (Frankel et al., 2005; Ho and McCauley, 2003). Also, an understanding of the magnitude of the pass-through contributes to the design of the country's trade policy.

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[2] Reports on Article IV consultations conducted by the International Monetary Fund with its members show that the exchange rate is broadly in line with macroeconomic fundamentals in most sub-Saharan African (SSA) countries, but some cases of misalignments are mentioned. Such misalignments are often related to an overvaluation of the currency.

Various theoretical models were put forward to analyze the links between exchange rate and inflation, and the pass-through reflects the interaction of micro and macro phenomena. On the micro side, producers may maximize expected profits by fully reflecting the changes in the exchange rate into sales prices. This case will likely occur when the structure of the domestic economy is close to a monopoly or to imperfect competition. Obstfeld and Rogoff (1995) called this "producer currency pricing". However, in the case of more competitive markets, producers may need to bear a part of the exchange rate changes by reducing mark-ups to keep market share. This behavior is defined by Krugman (1987) as a "pricing to market". In the case where prices are sticky or rigid because of imperfect market mechanisms or administrative constraints, a phenomenon of "local currency pricing" persists. Also, if consumers maximize their utility by "flying from quality", that is consuming locally produced goods instead of imported ones, the degree of the overall pass-through might be attenuated. On the macro side, most recent studies utilize the framework of new open macroeconomics or new Keynesian models to establish the effects of exchange rate changes on inflation (Choi and Cook, 2008).[3]

Most empirical studies have focused on developed countries and have found a low and decreasing pass-through since the 1990s. Choudhri *et al.* (2002) find that domestic prices in non-U.S. G-7 countries increase by 0.2 percent after ten quarters following a one percent change in the exchange rate.[4] Taylor (2000) examines developments in the United States and shows that the declining pass-through since the late 1990s is mainly due to the low inflation environment achieved since that period. Takhtamanova (2008) supports Taylor's hypothesis for a set of fourteen OECD countries. However, Campa and Goldberg (2002) analyze micro-level prices of imported goods for a few selected industries in 25 OECD countries and assert that higher inflation is weakly associated with a large pass-through and that the types of products and their share in the country's import bundle are the most important determinant of pass-through.[5]

The emerging countries have attracted growing research interest in recent years, and studies on developing economies have slightly expanded. Frankel *et al.* (2005) carry out a cross-country analysis and find that developing countries have experienced a rapid downward trending pass-through since the 1990s, more so than did high income countries. Identified determinants of pass-through include income, trade openness, inflation environment, and exchange rate variability. Zorzi *et al.* (2007) assert that the elasticities of pass-through in emerging economies that could reach and maintain macroeconomic stability are not significantly different from those in developed countries. However, the degree of pass-through

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[3] See also Dornbusch (1987), Fisher (1989).

[4] Faruqee (2006) also finds a low pass-through in the Euro area, or a "Euro pricing".

[5] The market structure and mechanisms differ across products (i.e. sectors or industries), leading to higher pass-through for some products and lower for others.

is much larger in emerging economies with severe macroeconomic instability. Choudhri and Hakura (2001) study a sample of 71 countries, including emerging markets and developing economies, and confirm a strong correlation between the exchange rate pass-through and an inflationary environment.

To the best of our knowledge, there has not been any study yet covering the entire SSA region. Akofio-Sowah (2009) covers fifteen SSA countries and 12 Latin American countries and finds that the pass-through is incomplete and is dampened by a low inflation environment. In the SSA region, countries within the Common Market for Eastern and Southern Africa (COMESA) group have the highest inflation, and the exchange rate pass-through in those countries is 25 to 50 percent higher than that in the West African Monetary Zone (WAMZ), Common Monetary Area (CMA), the West African Economic and Monetary Union (WAEMU), and the Central African Economic and Monetary Community (CEMAC). A few studies focused on country-specific cases. Mwase (2006), analyzing the case of Tanzania, asserts that pass-through declined in the late 1990s despite the depreciation of the currency; this could be partly due to the implemented macroeconomic and structural reforms.

This study goes beyond the existing literature by examining the exchange rate pass-through in all SSA countries. It employs methodologies used elsewhere, through both a panel setting (considering SSA as one entity or region) and time series techniques (considering the SSA countries individually). It provides a more complete analysis by estimating the pass-through elasticities and investigating their determinants.

III. ANALYSIS

This analysis looks at developments in the exchange rate and inflation in SSA countries from 1985 to 2008.6 First, we present, as stylized facts, an overview of these developments. We then test the hypotheses of no pass-through and of complete pass-through in the SSA region using a panel setting. We also estimate elasticities of pass-through for each SSA country using normalized impulse responses, and look for determinants of the pass-through elasticities using cross-correlation coefficients. Finally, we investigate changes in the magnitude of pass-through in SSA.

A. Stylized Facts

The rates of changes of the consumer price index (CPI) are generally lower than those of the nominal effective exchange rate (NEER). Figures 1 to 3 show the quarterly median values of the two variables for all forty four SSA countries. When the median exchange rate depreciated by around 35 percent in 1994, median prices increased by about 9 percent. When the median depreciation rate was close to 5 percent in 1987, 1995, and between 2003 and 2007,

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[6] Reflecting data limitations, this analysis focuses on the pass-through to consumer prices, rather than import and export prices directly.

inflation was about 3 percent in the former two years and below 2 percent in the latter period.[7] The large change in the NEER and CPI in 1994 reflected the substantial devaluation of the CFA Franc and the induced price changes.[8]

This paper uses the de facto classification of exchange rate regimes as published by the IMF.[9] In order to get a sufficient degree of freedom for the empirical analysis, the SSA countries are aggregated in two groups "flexible" and "fixed", instead of using all intermediate classifications of exchange rate arrangements. In this paper, countries with "managed floating with no pre-determined path for the exchange rate" and with "independently floating" exchange rate are included in the countries with flexible exchange rate regimes; countries with "other conventional fixed peg arrangement" are included in countries with fixed regimes.[10]

Following exchange rate changes, the inflation rate seems higher in countries with fixed exchange regimes than in countries with flexible exchange regimes. Figures 4 and 5 show that, whereas the depreciation of over 40 percent in 1994 in fixed-regime countries led to a sharp price increase, no similarly large price changes could be noticed in countries with flexible regimes following exchange rate changes. Acknowledging that the two-group and one-year classification adopted in this paper has a limitation as it does not reflect changes of exchange rate regimes during the period studied, the findings of this paper need to be interpreted cautiously.[11]

Exchange rate pass-through seems to have declined since the mid-1990s. For the entire SSA region, between 1985 and 1994 the median exchange rate depreciated by about 10 percent and inflation rate was mostly above 2 percent. However, from the mid-1990s, the exchange rate depreciated faster, and inflation rate has mostly remained below 2 percent. This is particularly pronounced for countries with flexible regimes; where the depreciation of the exchange rate was generally similar before and after the mid-1990s, average inflation was about 5 percent during the first period and 3 percent during the second.

B. Zero versus Complete Pass-Through

We test the hypotheses of zero pass-through and of complete pass-through in the SSA region using panel techniques. We conduct panel unit root tests on the NEER and the CPI

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[7] Those periods had the largest exchange rate depreciation rates in SSA as a region.

[8] Data on CPI and NEER were taken from the database of the Institute of the International Monetary Fund.

[9] Annual Report on Exchange Arrangements and Exchange Restrictions, 2009, IMF; www.imfbookstore.org.

[10] There is no sub-Saharan African country under the other classifications, *i.e.* exchange arrangement with no separate legal tender, currency board arrangement, pegged exchange rate within horizontal bands, crawling peg, and crawling band.

[11] Alternative approaches could include classifications by Obstfeld and Rogoff (1995) and methodologies by Habermeier *et al.* (2001).

variables (Table 1). We employ various methodologies and model specifications to ensure the robustness of our analysis. The assessments of the stationarity of the NEER and the CPI in level form are mixed across methodologies. However, all methodologies and model specifications confirm that NEER and CPI are stationary in first difference form. Subsequently, we carry out panel cointegration tests to determine whether a long-run relationship exists between NEER and CPI (Table 2). We use the residual-based test by Pedroni (1999 and 2004). Results from the various model specifications and the panel statistics do not allow determining robustly the existence or non-existence of a cointegration. Considering the results of the panel unit root and the cointegration tests, we employ both panel Vector Auto-Regression (VAR) and panel Vector Error-Correction (VEC). We introduce two alternative lag lengths – one and two – in order to confirm the robustness of the results. We conduct coefficient restriction tests based on the four model specifications. To test the zero pass-through, we restrict the coefficients on the exchange rate variables to zero; and to test the complete pass-through, we restrict those coefficients to one (Table 3).[12]

The hypothesis of no pass-through is rejected for the SSA region. The individual coefficients of the exchange rate variables are highly statistically significant. The tests on joint coefficients restriction confirm that the zero pass-through hypotheses are rejected for all model specifications. Exchange rate changes are associated with price changes in the region. The hypothesis of "local currency pricing" does not hold in SSA.

Also, the hypothesis of complete pass-through is rejected for the SSA region. The hypothesis restricting to one the coefficients on exchange rate variables—in absolute terms—is rejected for the four model specifications. A depreciation of the local currency does not induce a CPI inflation of a similar magnitude. Although import price indices were not available to use in our analysis, the rejection of the complete pass-through hypothesis to CPI allows inferring that the hypothesis of "producer currency pricing" does not hold in SSA.

Therefore, the hypothesis of incomplete pass-through is confirmed in the SSA region. The international competitiveness gains from an exchange rate depreciation are not likely to be offset by the induced domestic inflation. Prices of export goods from the SSA countries (in foreign currency) would decrease, and price-competitiveness would strengthen.

The pass-through is more pronounced following a depreciation/devaluation than following an exchange rate appreciation. We employ a dummy variable for all periods of depreciation or devaluation of the domestic currency and find that the magnitude of pass-through is much larger during those periods from all model specifications (Table 4). Numerous studies have put forward that domestic prices respond more intensively to a depreciation of the local currency than to an appreciation. This is partly due to the importance

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[12] Tests on individual coefficients and on the sum of the coefficients led to similar conclusions.

of the ratchet effect in prices. Our estimates show that an appreciation of the local currency has almost no impact on domestic prices; the coefficients on the NEER variables without the dummy variable are mostly statistically insignificant.

C. Estimates of Pass-Through Elasticities

We estimate the elasticities of pass-through for each SSA country using normalized impulse responses. We construct a VAR for each country using quarterly data on CPI and on NEER.[13] The lag length is determined through Schwarz Bayesian information criteria and takes into account the sample size for each country. We employ the Cholesky decomposition and compute the accumulated impulse responses of each variable to shocks – innovations – to the other variable. Subsequently, we normalize the accumulated responses of one variable to shocks to the other variable by the accumulated responses of that variable to its own shocks.

Impulse responses from VAR provide more robust and accurate elasticities than coefficients from single equation models. The dynamic structure of the VAR allows the impulse responses to account for full effects of exchange rate shocks, instead of a one-round or one-time effect as in single equation models. Also, the Cholesky decomposition allows attributing shocks to a specific variable.

The normalized impulse responses offer more precise estimates of the elasticities. Normalizing the accumulated impulse responses of CPI to NEER shocks by the accumulated responses of CPI to its own shocks allows identifying the pure effects of NEER shocks. Moreover, the two variables are likely to be affected by changes in the same shocks such as nominal shocks (changes in foreign money), demand shocks (changes in fiscal policy), and supply shocks (drought, oil prices, etc.). The effects of shocks to other variables on CPI and NEER are eliminated through the normalization.

The dynamic elasticities of pass-through are estimated at about 0.4 on average for the SSA countries. The estimates of the elasticities corresponding to one, four, and eight quarters following a shock to the exchange rate are displayed in Table 5.[14] At the 4th quarter, the average of the normalized impulse responses is estimated at 0.406, and the median at 0.416 in absolute terms. The elasticities broadly stabilize in subsequent periods. About 50 percent of the impacts of the exchange rate shock occur within the first quarter. The average and the median of the dynamic elasticities are estimated at 0.19 in the first quarter; the estimates vary considerably across countries, ranging from almost nil to 0.59.

The results from the per-country estimates confirm the results from the region-based estimates that indicate an incomplete pass-through in sub-Saharan Africa. The time series analysis based on each SSA individual country finds that exchange rate changes significantly

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[13] The VAR-based approach assumes that there is no-cointegration, i.e. no long-run relationship, among the variables. To assess the robustness of our findings, we also conduct the analysis using a Vector Error Correction model, which assumes the existence of a cointegration between CPI and NEER. The results are broadly similar to that based on VAR.

[14] Some countries for which the data did not pass a set of model specification tests were dropped because the estimated elasticities might be misleading.

affect domestic prices. The average and the median dynamic elasticities indicate that the pass-through is not complete. Those findings are similar to that from the panel analysis based on SSA as a region. Also, those findings are in line with the stylized facts presented above.

D. Determinants of Pass-Through Elasticities

We try to identify factors that influence the degree of exchange rate pass-through to domestic prices.[15] The dynamic pass-through elasticities vary considerably across countries. We analyze whether the elasticity is influenced by the set of macroeconomic policies implemented domestically. It is important for policy makers to understand the determinants of pass-through in order to predict and/or attenuate changes in domestic prices.

On average, elasticities of pass-through are lower in countries with flexible exchange rate regimes than in fixed exchange rate regimes (Table 6). In countries with fixed regimes, the dynamic elasticities reach 0.23 in the first quarter and 0.46 in the fourth quarter. In countries with flexible regimes, the elasticities are estimated at 0.13 and 0.3, respectively for the two periods. The normalized accumulated impulse responses are about 35 percent lower in flexible regimes.[16] The differences are statistically significant. This seems to imply that in fixed regimes, economic agents consider that a change in the exchange rate is permanent and will have a permanent impact on their production costs. Therefore, they adjust selling prices rapidly. In contrast, in flexible regimes, economic agents seem to consider changes in the exchange rate as partially temporary. Hence, they do not adjust their selling prices immediately.[17]

Higher income countries show a lower exchange rate pass-through. The dynamic pass-through elasticities are highly correlated with income per capita levels in countries with flexible exchange rate regimes (Figure 6). Income per capita can be interpreted to reflect the size of the domestic market. Exporters to or importers/producers in a high income country seem to not fully increase their selling prices following currency depreciation, probably to preserve market share. A higher income level may lead to and reflect a higher degree of competition in the domestic market. In such a case, firms have limited "pricing power" preventing them from rapidly and intensively passing exchange rate changes through to domestic prices.

High-inflation environments are associated with a higher pass-through in countries with flexible exchange rate regimes (Figure 7). This finding can be explained through the behavior of economic agents—firms—based on staggered price setting in a monopolistic competition.

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[15] Data employed in this section were taken from the International Financial Statistics published by the International Monetary Fund, and the World Development Indicators and CPIA database published by the World Bank.

[16] An endogeneity issue remains to be addressed as the choice of an exchange rate arrangement can also be determined by degree and speed of the exchange rate pass-through.

[17] Krugman (1989) and Steel and King (2004) also find that a more flexible exchange rate regime is associated with a lower pass-through.

Firms set prices for several periods in advance and adjust the prices based on the expected costs for the periods ahead. If cost changes are expected to persist, firms adjust prices more rapidly and more intensively. Therefore, in a high-inflation environment, the additional inflation induced by the exchange rate changes is expected to persistently increase price levels and costs. Thus, the pass-through is higher.[18] The correlation between inflation regime and the degree of exchange rate pass-through is not statistically significant in countries with fixed exchange rate regimes. In those countries, firms do not expect inflation—and consequently costs—to persistently stay at a high level.

Prudent monetary policy seems to reduce the magnitude of pass-through. In countries with flexible exchange rate regimes, a large increase in broad money is associated with a large pass-through elasticity (Figure 8). Economic agents seem to consider that such an increase reflects an unstable monetary policy; in such an uncertain economic environment, firms appear unwilling to absorb or delay the effects of the exchange rate changes. Hence, pass-through elasticities are larger. In countries with fixed exchange rate regimes, the correlation between broad money changes and pass-through elasticities is not statistically significant. Firms seem to expect the monetary authority to take corrective actions and uncertainty regarding the economic environment is not as worrisome as in a flexible regimes.

Sustainable fiscal policies are associated with lower pass-through elasticities. In countries with flexible exchange rate regimes, smaller basic primary fiscal deficit (or a higher surplus) is associated with a lower degree of pass-through (Figure 9). Large fiscal deficits seem to be perceived by firms as increasing uncertainty, i.e. economic agents fear that the government will have to address accumulated fiscal deficits in the future through substantial increases in taxes or cuts in expenditures. The former weighs on the costs for firms, and the latter will contract the market; both measures will reduce profits. Expecting such a profit reduction in the future, firms would not delay or absorb the impacts of exchange rate changes in a given period but pass those changes through to domestic prices.

Overall "good" macroeconomic policy is associated with a low pass-through, particularly in countries with flexible exchange rate regimes. Using the Country Policy and Institutional Assessment (CPIA) as an indicator of the quality of macroeconomic management, a higher CPIA is associated with a smaller pass-through elasticity (Figure 10).[19] This analysis assesses whether monetary, exchange rate, and aggregate demand policies are conducive to sustained medium-term economic growth, in particular whether economic policies pursue price stability

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[18] Taylor (2000) developed a microeconomic model and an economy-wide model illustrating the favorable effect of a low-inflation environment on the pricing power of firms and thus on the exchange rate pass-through.

[19] The CPIA is an indicator developed by the World Bank to measure the quality of policy and institution, and to determine IDA allocations. The CPIA produces a score and a ranking for each country investigated. It is constructed from 16 criteria, including a criterion on the performance of macroeconomic management. The latter criterion is substantially based on IMF Article IV consultations with member countries.

objectives, focus on maintaining short and medium-term external balance, and avoid crowding out private investment. Good macroeconomic policy seems to strengthen firms' confidence and they might be more willing to partially bear cost increases from exchange rate changes, expecting continued profits in the medium term. This leads to a reduced pass-through of exchange rate movements to domestic prices.[20]

E. Shift in Pass-Through Elasticities

We also investigate shifts in pass-through elasticities in the SSA economies. As mentioned earlier, numerous studies have found that the magnitude of exchange rate pass-through has decreased since the 1990s in developed countries. Similar findings were also put forward in cross-country analyses of developing countries. The reduction in pass-through was often found to be more pronounced in developing countries.

The exchange rate pass-through appears to have decreased since the mid-1990s in SSA economies. We use a dynamic panel OLS and four alternative model specifications in order to assess the robustness of our finding. We employ both Auto-Regressive and Error Correction specifications to cover both cases of existence and non-existence of cointegration between price level and exchange rate, with alternative lag lengths of one and two quarters. We tried to introduce a dummy variable for various years, combined with the NEER variables. We found that the shift in the coefficients of the NEER variables were the most distinct and statistically significant in the mid-1990s, especially in 1997 (Table 7). The elasticities substantially decreased in all model specifications. The reduction in pass-through elasticities is estimated at about 50 percent.

The timing of the pass-through shift coincided with marked improvements in the economic and political environments in SSA (Figure 11). Since the mid-1990s the average annual inflation rate for the region fell to about 5 percent, whereas it oscillated around 10 percent in previous years. The overall fiscal deficit (excluding grants) improved from about 10 percent of GDP before mid-1990s to about 7 percent of GDP since then with the improvement particularly pronounced since the 2000s. The accumulation of foreign reserves accelerated since the mid-1990s. Countries' trade openness increased, with the share of exports and imports to GDP surpassing 60 percent since the mid-1990s and on a steep upward trend. In addition to the favorable macroeconomic developments, the political situation has also ameliorated since the mid-1990s. The indicator of political freedom—both the median and the average of polity score—indicates a sustained improvement since the mid-1990s. These economic and political developments appear to strengthen the confidence of economic agents in the business environment in SSA countries. Firms seem willing to bear some of the costs increases from exchange rate changes, expecting that the favorable business environment

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[20] Frankel *et al.* (2005) and Zorzi *et al.*(2007) found a link between macroeconomic environment and the exchange rate pass-through.

would allow continued profits in the medium term. Also, improvements in the business environment enhance competition in the domestic market and limit firms' pricing power, reducing exchange rate pass-through.[21]

IV. CONCLUSIONS

This study finds that the exchange rate pass-through to domestic prices in SSA countries is partial and incomplete. On average, a 10 percent depreciation of the local currency brings about a 4 percent increase of domestic prices. Half of the increase occurs within the first quarter following the exchange rate change, and the full impact generally takes place within four quarters.

The elasticity of pass-through decreased in SSA from the mid-1990s following improvements in political and macroeconomic environments. The magnitude of pass-through is estimated to have declined by about 50 percent since the mid-1990s. This decline was associated with stronger macroeconomic performance and a stabilizing political situation, which strengthened the confidence in the business environment and deepened competition.

Good macroeconomic policies seem to dampen the degree of exchange rate pass-through. As shown in this analysis, stronger performance on some important macroeconomic variables—income, inflation, broad money, and fiscal balance—are associated with lower pass-through. This is also reflected through the aggregated indicator of the quality of policies, namely the CPIA. To address the fear of pass-through and avoid large exchange rate-induced inflation, this study shows that SSA policy makers should improve the overall macroeconomic policies. This seems to be particularly important for countries with flexible exchange rate regimes.

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[21] The lower pass-through since the mid-1990s might have been partly caused also by other structural changes such as the declines in prices of imported goods due to higher productivity in producer countries or to shift of imports from more expensive countries to lower-cost countries, or rising distribution costs in the domestic price structure which increase domestic costs of imports in relation to import (producer) prices.

Table 1. Panel Unit Root Test

	Specifications	Levin, Lin & Chu	Im, Pesaran, Shin	Dickey Fuller	Phillips Perron
CPI Level	Constant	-6.579***	0.196	102.3	195.3***
	Trend	-8.34***	-2.23**	130.45***	125.8***
NEER Level	Constant	-8.03***	-2.88***	148.3***	231.9***
	Trend	-7.5***	-0.79	111.8**	85.7
CPI First Difference	Constant	-9.8***	-7.9***	228.2***	311.1***
	Trend	-7.2***	-5.1***	164.2***	288.1***
NEER First Difference	Constant	-11.5***	-9.8***	262.8***	363.8***
	Trend	-12.7***	-8.7***	233.5***	507.8***

Source: Author's calculations.
***(**) indicates significance level of 1%(5%).

Table 2. Panel Cointegration Test

	No trend		With trend	
	Stat.	Prob.1/	Stat.	Prob.1/
Panel v	2.30	0.01	7.52	0.00
Panel rho	-0.56	0.29	-0.23	0.41
Panel PP	-5.20	0.00	-10.90	0.00
Panel ADF	0.02	0.51	-4.61	0.00

Source: Author's calculations.
1/ A probability smaller than 0.10 indicates the existence of a cointegration.

Table 3. Zero vs. Complete Pass-Through Tests (Panel AR-EC) [1]

	AR-Lag 1	AR-Lag 2	EC-Lag 1	EC-Lag 2
Constant	0.032***	0.016**	0.017**	0.003
dlnCPI(-1)	0.461***	0.254***	0.267***	0.089**
dlnCPI(-2)		0.484***		0.370***
dlnNEER	-0.426***	-0.482***	-0.576***	-0.591***
dlnNEER(-1)	0.103***	0.262***	-0.038	0.114***
dlnNEER(-2)		0.124***		0.023
EC			-0.127***	-0.120***
Adj. R2	0.725	0.753	0.758	0.779
Long-Term ERPT	-0.599	-0.366	-0.838	-0.839
Ho: No pass-through	308.583	383.150	438.609	504.262
Chi-square (prob)	(0.000)	(0.000)	(0.000)	(0.000)
Ho: Complete pass-through	487.594	701.613	89.095	110.959
Chi-square (prob)	(0.000)	(0.000)	(0.000)	(0.000)

Source: Author's calculations.
***(**) indicates significance level of 1%(5%).
[1] This analysis uses both Auto-Regressive (AR) and Error Correction (EC) model specifications, and two alternative lag lengths for each specification.

Table 4. Appreciation vs. Depreciation Pass-Through

	AR-Lag1	AR-Lag2	EC-Lag1	EC-Lag2
Constant	0.020**	0.001	-0.004	-0.019**
dlnCPI(-1)	0.439***	0.234***	0.202***	0.037
dlnCPI(-2)		0.512***		0.379***
dlnNEER	0.059	0.053	0.155	0.131
dlnNEER*dum	-0.510***	-0.590***	-0.798***	-0.805***
dlnNEER(-1)	0.096	0.074	-0.052	-0.063
dlnNEER(-1)*dum	0.005	0.240***	-0.014	0.196***
dlnNEER(-2)		0.194***		0.063
dlnNEER(-2)*dum		-0.071		-0.046
EC			-0.147***	-0.136***
Adj. R2	0.731	0.765	0.773	0.796
LT-ERPT (depreciation)	-0.624	-0.393	-0.888	-0.897

Source: Author's calculations.
***(**) indicates significance level of 1%(5%).

Table 5. Dynamic Pass-Through Elasticities

	Quarter 1	Quarter 4	Quarter 8
Fixed regimes			
Angola	-0.101	-0.521	-0.607
Benin	-0.315	-0.442	-0.450
Burkina Faso	-0.163	-0.320	-0.327
Cameroon	-0.276	-0.548	-0.554
Cape Verde	0.076	-0.177	-0.156
Central African Rep.	-0.096	-0.403	-0.438
Chad	-0.316	-0.513	-0.525
Congo Rep.	-0.324	-0.506	-0.489
Côte d'Ivoire	-0.165	-0.312	-0.320
Equatorial Guinea	-0.218	-0.420	-0.398
Eritrea	-0.109	-0.185	-0.193
Ethiopia	-0.388	-0.905	-0.887
Gabon	-0.243	-0.531	-0.536
Guinea Bissau	-0.398	-0.735	-0.797
Mali	-0.590	-0.821	-0.865
Namibia	0.040	-0.208	-0.212
Niger	-0.271	-0.447	-0.445
Rwanda	-0.157	-0.219	-0.202
Senegal	-0.278	-0.479	-0.458
Seychelles	-0.328	-0.851	-1.161
Sierra Leone	-0.093	-0.091	-0.236
Togo	-0.298	-0.416	-0.405
Zimbabwe	-0.129	-3.064	-2.341
Flexible regimes			
Burundi	-0.238	-0.351	-0.370
Congo Dem. Rep.	-0.397	-0.484	-0.393
Gambia	-0.101	-0.257	-0.284
Ghana	-0.194	-0.546	-0.436
Guinea	-0.258	-0.452	-0.485
Madagascar	-0.031	-0.234	-0.248
Mauritius	0.024	-0.163	-0.162
Sao Tome & Principe	-0.091	-0.355	-0.436
South Africa	-0.019	-0.131	-0.160
Tanzania	-0.044	-0.187	-0.189
Zambia	-0.090	-0.200	-0.181
Average	-0.195	-0.406	-0.424
Median	-0.194	-0.416	-0.405

Source: Author's calculations.

Table 6. Pass-Through Elasticities in Fixed vs. Flexible Regimes

	Quarter 1	Quarter 4	Quarter 8
Fixed – Average	-0.228	-0.457	-0.485
Flexible – Average	-0.131	-0.306	-0.304
Anova F-stat	3.361	4.198	4.887
Probability	0.076	0.049	0.035

Source: Author's calculations.

Table 7. Pass-Through Shift in 1997 [1]

|	AR-Lag1	AR-Lag2	EC-Lag1	EC-Lag2
Constant	0.048***	0.033***	0.035***	0.019***
dlnCPI(-1)	0.305***	0.150***	0.197***	0.047
dlnCPI(-2)		0.398***		0.325***
dlnNEER	-0.471***	-0.513***	-0.559***	-0.579***
dlnNEER*dum	0.107**	0.098**	0.069	0.065
dlnNEER(-1)	-0.116***	0.089***	-0.187***	-0.014
dlnNEER(-1)*dum	0.324***	0.243***	0.286***	0.250***
dlnNEER(-2)		0.029		-0.016
dlnNEER(-2)*dum		0.051		0.015
EC			-0.091***	-0.089***
Adj. R^2	0.775	0.796	0.79	0.809
LT-ERPT (before 1997) 2/	-0.845	-0.874	-0.929	-0.969
LT-ERPT (after 1997) 2/	-0.224	-0.007	-0.487	-0.444

Source: Author's calculations.

***(**) indicates significance level of 1%(5%).

[1] This analysis uses both Auto-Regressive (AR) and Error Correction (EC) model specifications, and two alternative lag lengths for each specification.

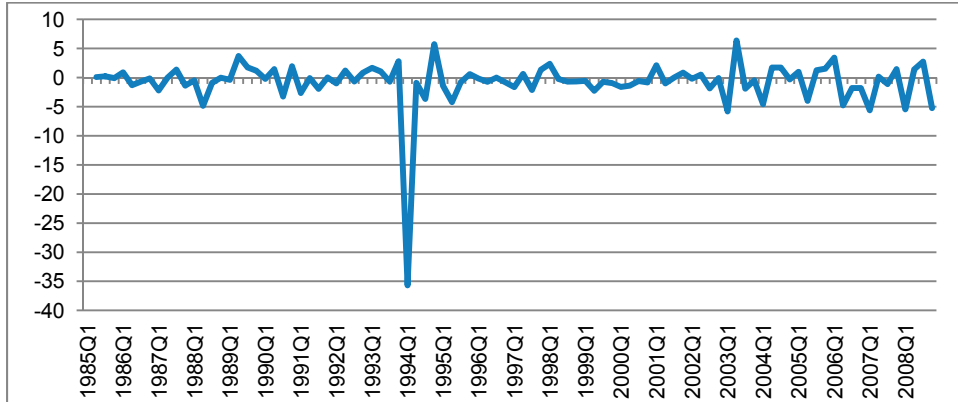[2] LT-ERPT refer to long run pass-through elasticities.

Figure 1. NEER Developments in SSA (Quarterly) [1]
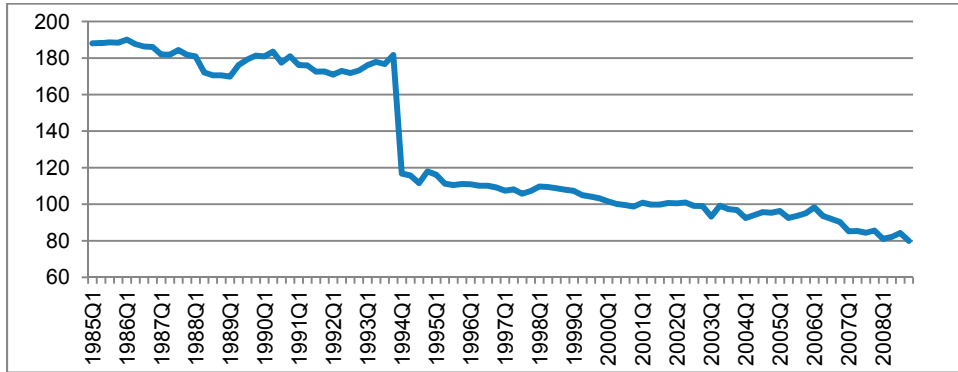
Source: IMF Institute Database.
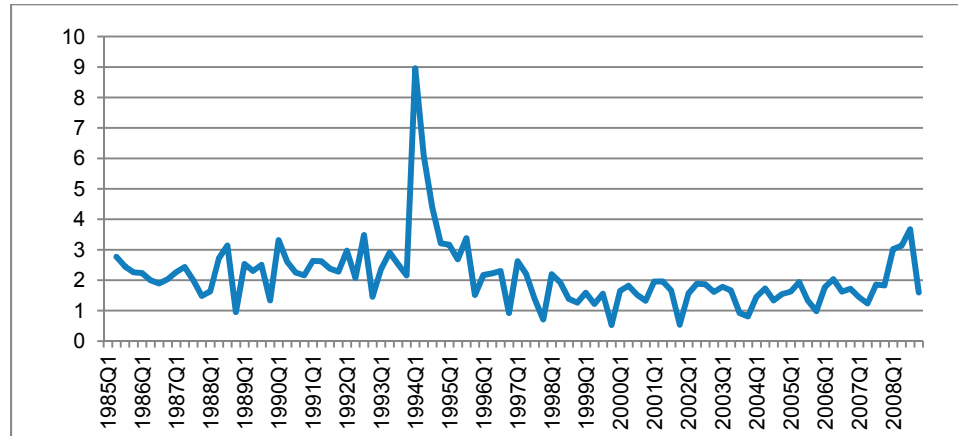[1] The NEER is an index number using base year 2000.

Figure 2. NEER Percentage Changes in SSA (Quarterly) [1]
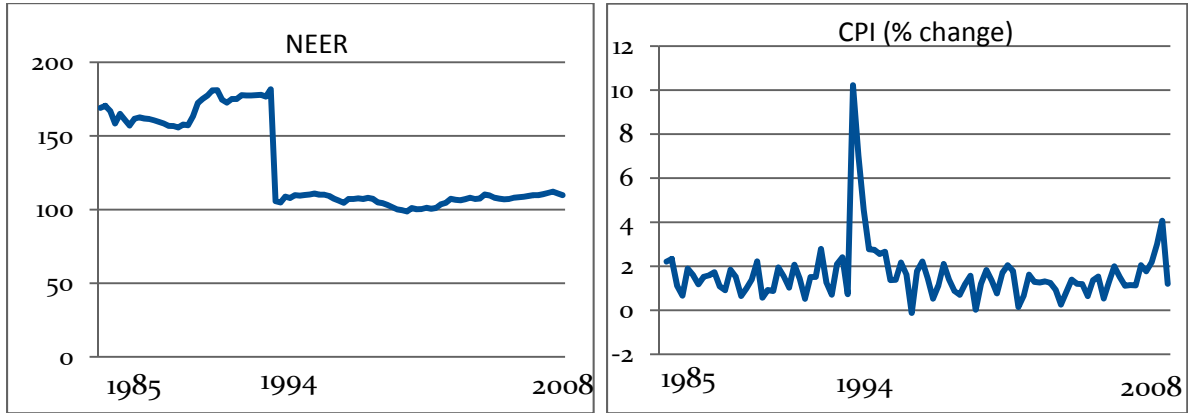

Source: IMF Institute Database.
[1] The NEER is an index number using base year 2000.

Figure 3. CPI Percentage Changes in SSA (Quarterly)
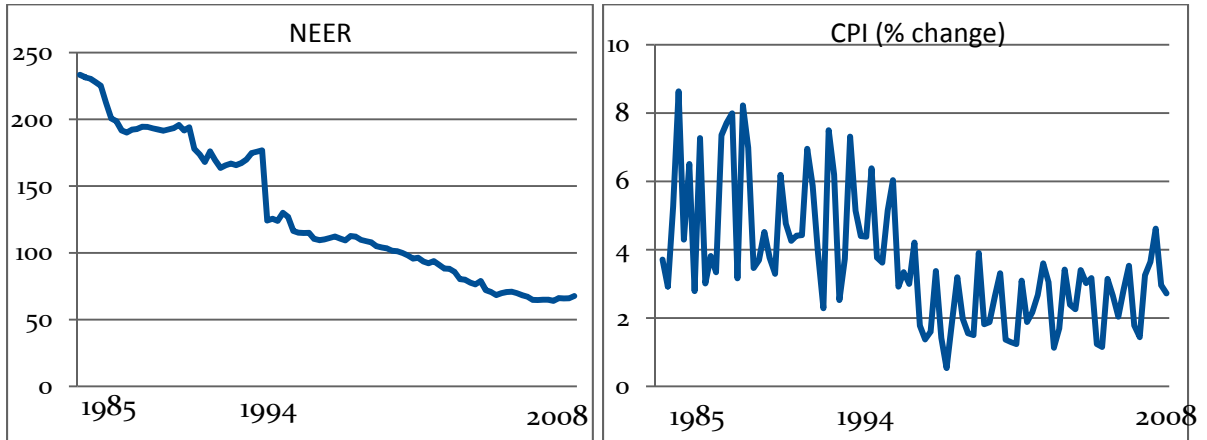

Source: IMF Institute Database.

Figure 4. NEER and CPI in Fixed Exchange Rate Regimes [1/]

Source: IMF Institute Database.
[1/] The NEER and CPI are index numbers using base year 2000.

Figure 5. NEER and CPI in Flexible Exchange Rate Regimes [1/]

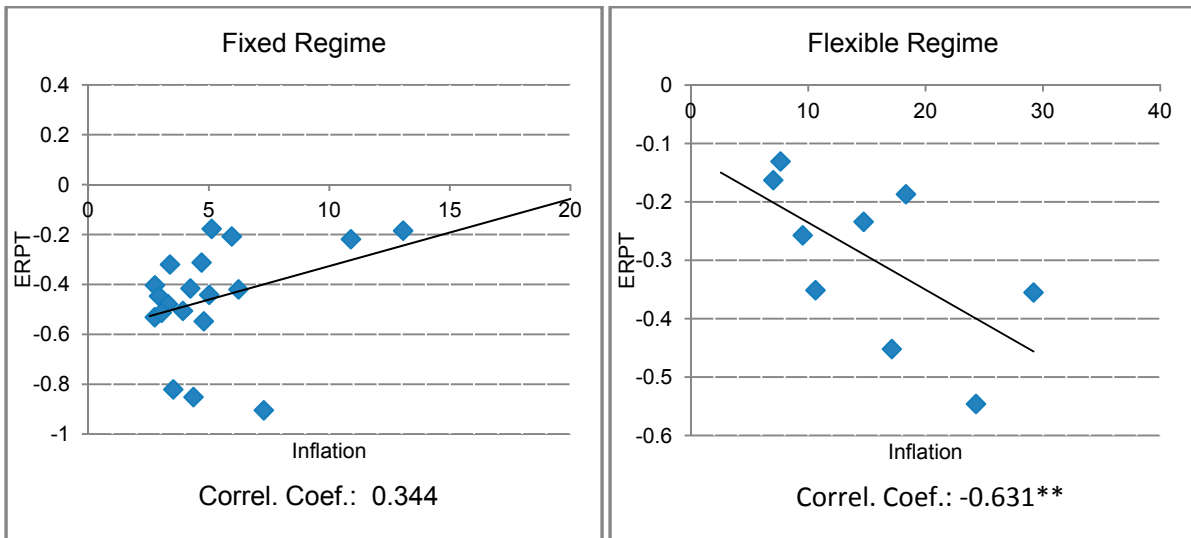Source: IMF Institute Database.
[1/] The NEER and CPI are index numbers using base year 2000.
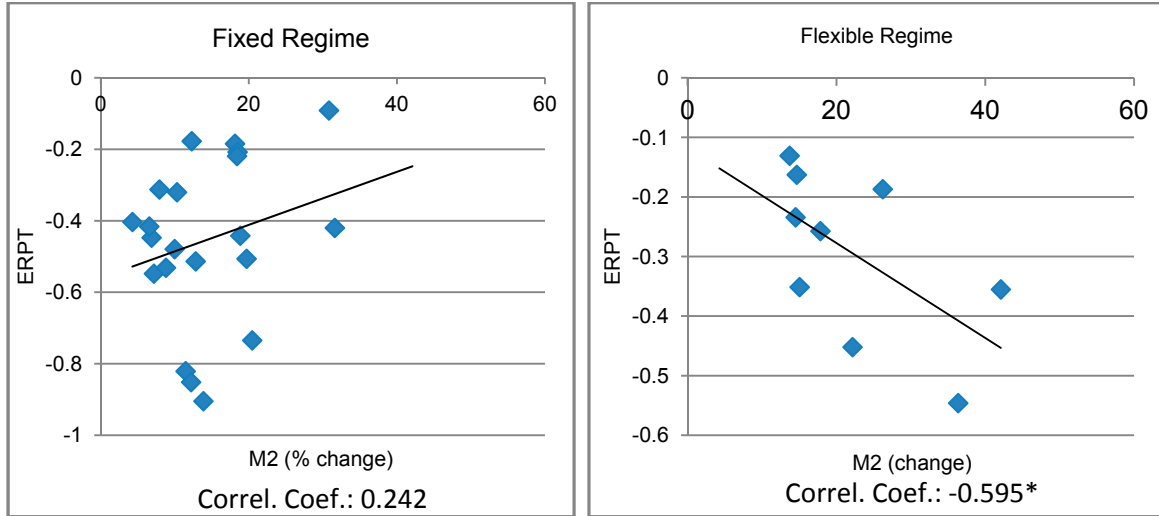
Figure 6. Income and Pass-Through Elasticities
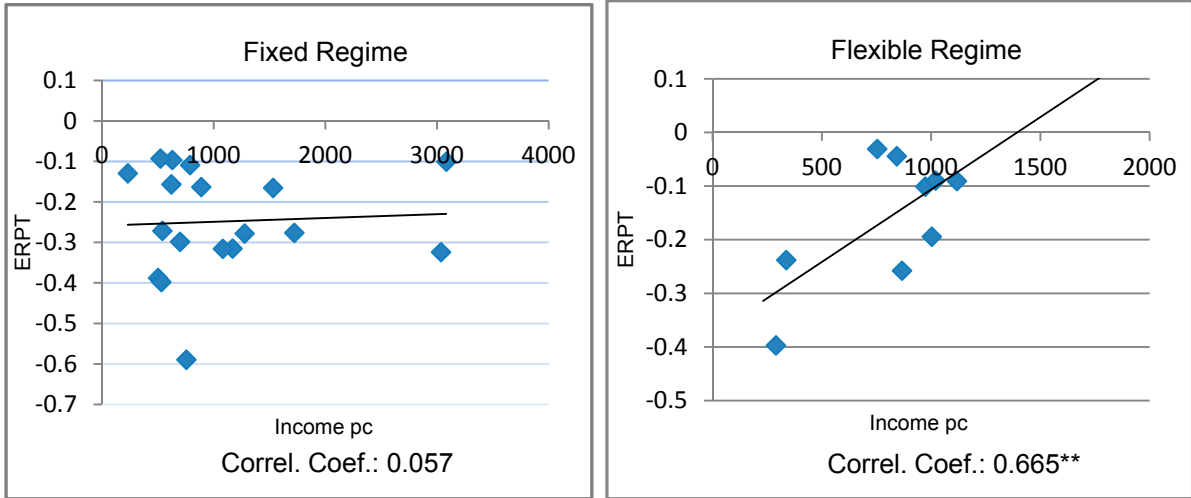
Source: Author's calculations.
Note: ** indicates significance level of 5%.

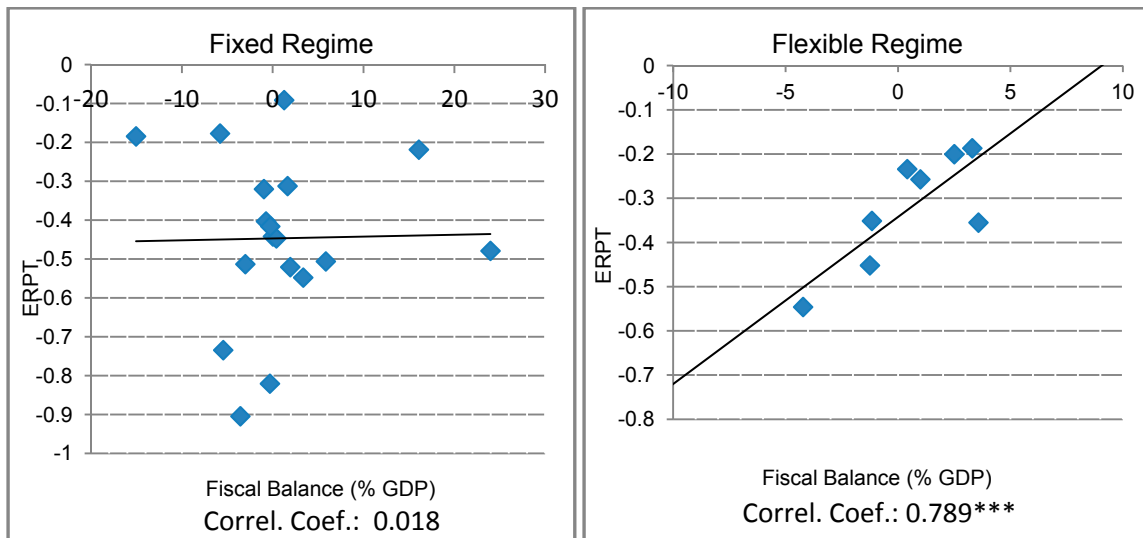**Figure 7. Inflation Environment and Pass-Through Elasticities**

Source: Author's calculations.
Note: ** indicates significance level of 5%.

Figure 8. Broad Money and Pass-Through Elasticities

Fixed Regime

M2 (% change)

Correl. Coef.: 0.242

Flexible Regime

M2 (change)

Correl. Coef.: -0.595*

Source: Author's calculations.
Note: * indicates significance level of 10%.

Figure 9. Fiscal Balance and Pass-Through Elasticities

Fixed Regime

Fiscal Balance (% GDP)

Correl. Coef.: 0.018

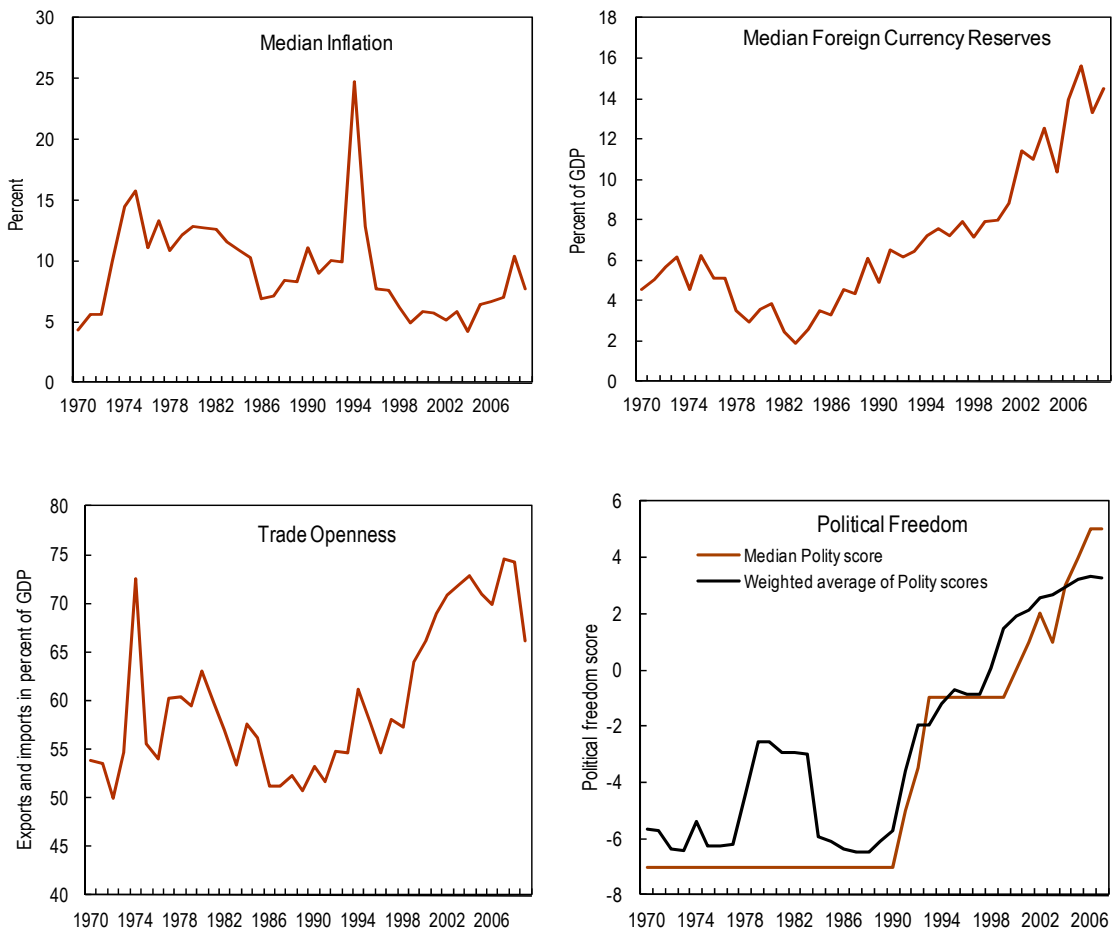Flexible Regime

Fiscal Balance (% GDP)

Correl. Coef.: 0.789***

Source: Author's calculations.
Note: *** indicates significance level of 1%.

Figure 10. CPIA Macro and Pass-Through Elasticities
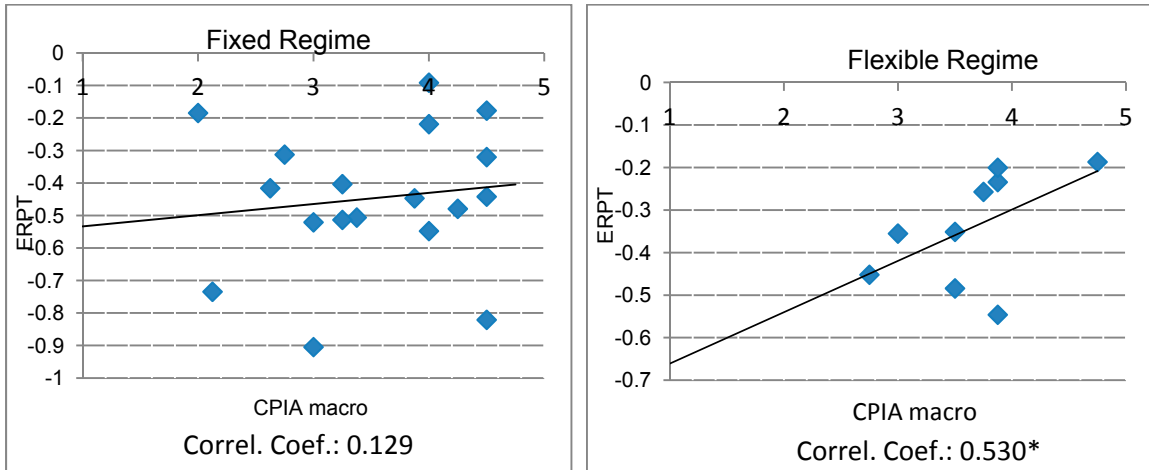
Source: Author's calculations.
Note: * indicates significance level of 10%.

Figure 11. Macroeconomic and Political Developments in SSA

Source: Regional Economic Outlook, Sub-Saharan Africa, October 2009, IMF.
www.imf.org/external/pubs/ft/reo/2009/AFR/eng/sreo1009.htm.

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