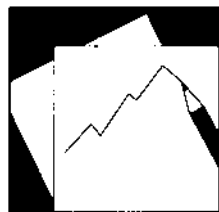


# Working Paper

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INTERNATIONAL MONETARY FUND



# IMF Working Paper

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## Madagascar: A Competitiveness and Exchange Rate Assessment

*Luc Eyraud*

**IMF Working Paper**

African Department

**Madagascar: A Competitiveness and Exchange Rate Assessment**

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**Abstract**

**This Working Paper should not be reported as representing the views of the IMF.**

The views expressed in it are those of the author and do not necessarily represent those of the IMF or IMF policy. Working Papers describe research in progress by the authors and are published to elicit comments and to further debate.

The purpose of this paper is to assess Madagascar's competitiveness in recent years, using both price and nonprice indicators and an exchange rate assessment of the currency. We estimate the distance between the equilibrium and the actual real exchange rates using three methods: the macroeconomic balance approach, the external sustainability approach, and the reduced-form equilibrium real exchange rate approach. These methods suggest that in the medium term the real exchange rate is only slightly overvalued. We also carry out a comparative analysis of nonprice indicators and find that Madagascar performs less favorably than its competitors on structural competitiveness.

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## I. INTRODUCTION

Over the last decade Madagascar's export performance has improved. Export volumes grew on average by 9 percent a year between 1998 and 2007, up from 5 percent during the previous decade, and Madagascar has markedly reduced its dependence on traditional exports. At the same time, Madagascar has also experienced several negative shocks likely to undermine its competitiveness: the political crisis of 2002, when shortages fueled domestic inflation; the termination of the Agreement on Textiles and Clothing in 2005, which removed the special regime benefiting textile products; and the surge in commodity prices in 2008, which increased the cost of intermediate inputs for exporters.

This paper analyzes the competitiveness of Madagascar from 1990 to 2008 giving special attention to recent years. We use several approaches to compare Madagascar with its main competitors, using price and nonprice indicators as well as an exchange rate assessment of the currency. To assess the distance between the actual and equilibrium exchange rates, we adopt two methodologies: the first—applied in two different versions, namely the macroeconomic balance approach and the external sustainability approach—estimates the adjustment necessary to close the gap between the actual current account and its sustainable level; the second—the reduced-form equilibrium exchange rate—directly estimates the equilibrium value of the ariary in terms of its fundamentals.

The paper applies several novel elements to this type of analysis. First, it estimates, with panel cointegration techniques, the equilibrium exchange rate of the countries belonging to the Southern African Development Community (SADC). Second, it discusses theoretical issues related to the choice of current account elasticity to the exchange rate. Third, it provides a comprehensive survey-based comparison of the structural competitiveness of Madagascar and Mauritius.

After analyzing the real exchange rate, market shares, and the structure of exports, the study finds that Madagascar's competitiveness has deteriorated since 2000. However, the exchange rate assessment partly moderates this finding by showing that the ariary is only slightly overvalued in a medium-term perspective.

In what follows, Section II analyzes Madagascar's export performance by examining market share and export structure. Section III describes the evolution of the real effective exchange rate. Section IV sets out the main results of the exchange rate assessment. Section V analyzes competitiveness using nonprice indicators. Section VI draws conclusions.

## II. EXPORT PERFORMANCE OF MADAGASCAR

Competitiveness can be difficult to define precisely. Usually, it is described as the ability and performance of a firm, a subsector, or a country to sell and supply goods and services in a given market. Based on this definition, competitiveness would thus cover almost every aspect of market performance, from product quality to innovation, from labor market rigidities to the cost of production factors. In recent years, new indicators of competitiveness have been formulated that rely on even broader definitions. For instance, the Global Competitiveness Indicator of the World Economic Forum (WEF) is based on twelve pillars of competitiveness that cover almost all of both macro- and microeconomics.<sup>2</sup>

This paper does not intend to provide a new and more focused definition of competitiveness. Rather, we approach competitiveness through its causes and consequences. This section analyzes the effects of competitiveness on export performance. Sections III, IV, and V will examine the price and nonprice determinants of competitiveness.

### A. Export Acceleration and Better Trade Specialization Since the 1990s

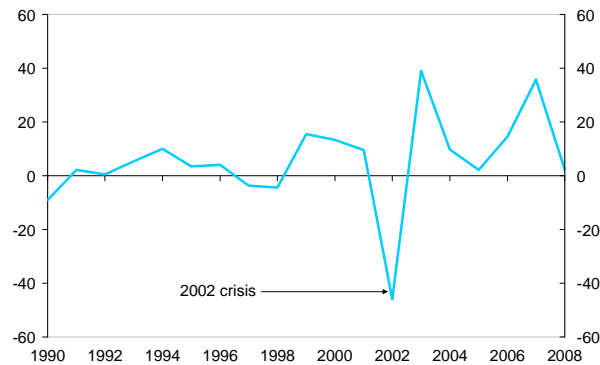
Since 1990 Madagascar's export performance has improved owing to an increase in export growth and improvement in its trade diversification.

1. Exports growth has increased since 1990, with the notable exception of 2002 when a political and economic crisis followed the disputed presidential election in December 2001. Export volume growth averaged 9 percent a year between 1998 and 2007, up from 5 percent in the previous decade (see Figure 1).

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<sup>2</sup> The WEF's competitiveness pillars are institutions, infrastructure, macroeconomic stability, health and primary education, higher education and training, goods market efficiency, labor market efficiency, financial market sophistication, technological readiness, market size, business sophistication, and innovation.

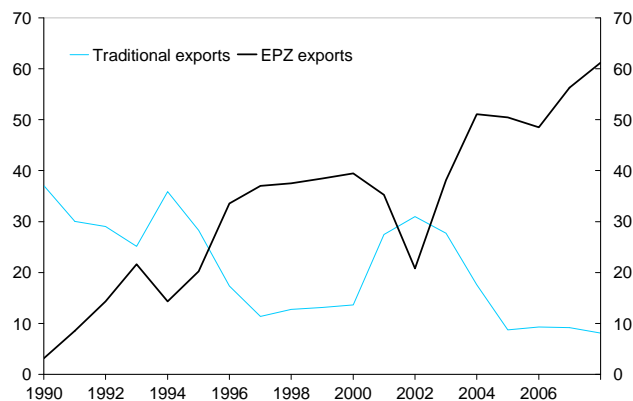
Figure 1: Growth in Export Volume  
(Percent)



Note: 2008 = provisional data.  
Source: World Economic Outlook.

2. At the sectoral level, the strength in aggregate exports has been mainly driven by manufacturing exports from the export processing zones (EPZs). EPZs are special areas established early in the 1990s near Antananarivo and Antsirabe where companies, mainly in the garment sector, enjoy tax holidays and exemptions from import duties and taxes. Though their contribution was negligible at first, exports from EPZs now represent over half the value of total exports ( Figure 2).
3. Madagascar has diversified towards nontraditional exports (Figure 2). The development of manufactured exports has reduced Madagascar's reliance on traditional agricultural exports (coffee, vanilla, cloves, and pepper). Trade specialization has improved as Madagascar reoriented its exports toward goods priced higher on international markets (historically agricultural prices have trended down).

Figure 2: Structure of Exports in Value  
(Percentage of total exports)



Note: Traditional exports = coffee, vanilla, cloves, pepper.  
Source: Madagascar authorities and author's estimates.

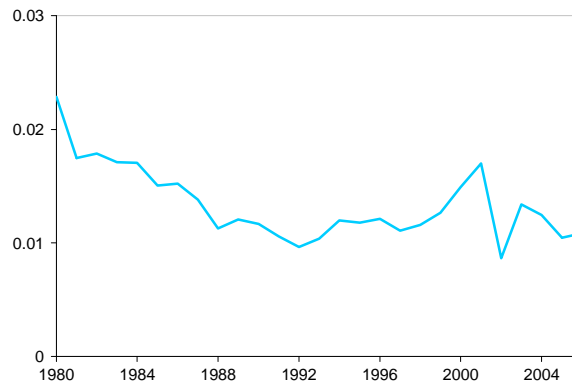


## B. Decline in Market Share Since the 1990s

Despite solid export growth during the last decade, Madagascar's market share has declined.

- Historically, Madagascar's market share has been stable in nominal terms (Figure 3). For long periods, it seems better to analyze the ratio of Madagascar's exports to world exports in nominal terms; real series can show a substantial bias when the base year (in this case, 2000) is too distant.

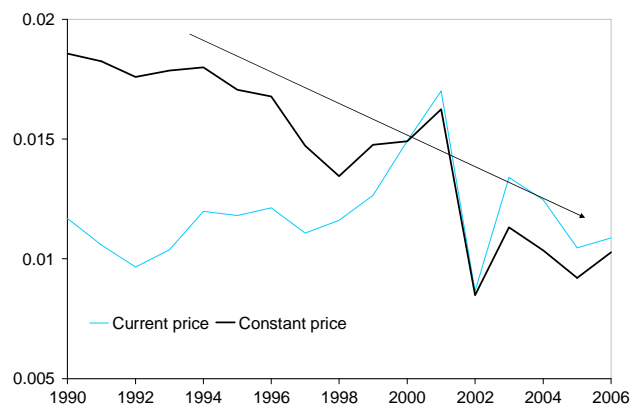
Figure 3: Nominal Market Share Since 1980  
(Percentage of world exports)



Source: World Development Indicators.

- For recent years, the comparison of nominal and real market shares is informative (Figure 4). The growth in export volume has been lower than in the rest of the world and Madagascar's market share has decreased in real terms. The fact that the nominal share is more stable over time suggests that the lower growth in volume was partly offset by higher growth of export prices in Madagascar.

Figure 4: Market Share in Nominal and Real Terms since 1990  
(Percentage of world exports)

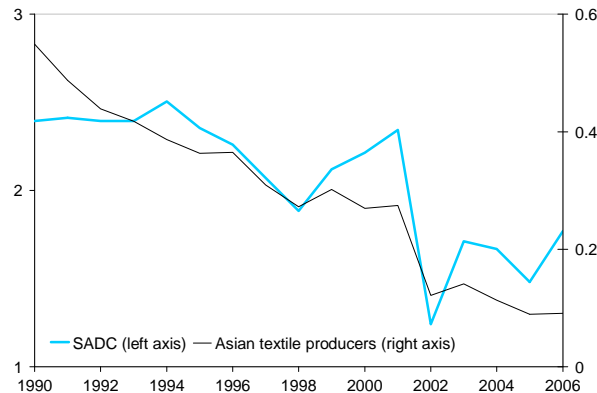


Note: Real data are in constant 2000 US\$

Source: World Development Indicators.

- It should be noted that computing the market share as a percentage of world exports can be misleading. This share may decrease even if a country's competitiveness remains stable, because exports from noncompetitor countries increase. To address this issue, we compute real shares relative to two subsets of competitors: the SADC countries and some Asian textile producers.<sup>3</sup> These alternative measures confirm that Madagascar's market share has declined since the beginning of the 1990s (Figure 5).

Figure 5: Real Market Share Relative to SADC and Asian Competitors  
(Percentage of competitors' exports)



Data are in constant 2000 US\$  
Source: World Development Indicators.

### III. PRICE COMPETITIVENESS: A DESCRIPTIVE ANALYSIS

The real effective exchange rate (REER) is the most popular indicator of price competitiveness. By measuring the prices of a country relative to its competitors in international markets, the REER constitutes an improvement over the nominal exchange rate because changes in competitiveness depend not only on exchange rate variations but also on cost and price trends. As a first approximation, an appreciation of the REER may be interpreted as a deterioration of competitiveness.

This indicator nevertheless has several shortcomings (which will be addressed in the next sections): competitiveness depends not only on the evolution of the REER but also on the distance from its equilibrium value (Section IV) and on nonprice factors (Section V).

<sup>3</sup> For each subset we divide Madagascar's export by the sum of its competitor's exports. To make the series comparable, we use data in 2000 constant US\$. The SADC aggregate comprises all SADC countries except Zimbabwe and Angola, for which data are not available. The Asian aggregate comprises Bangladesh, China, India, Indonesia, Pakistan, and Vietnam.

### A. Real Depreciation of the Ariary During the 1980s

A striking feature of the evolution of the REER over a long period is the very large depreciation of the ariary during the 1980s (see Figure 6). Although it was more volatile in the first half of the 1990s, it continued to trend down and reached a floor in 1995.

Figure 6: Real Effective Exchange Rate  
(Index, 2000=100)



Source: International Financial Statistics.

Accounting and economic factors offer some explanations to this phenomenon:

First, a simple accounting decomposition shows that the nominal depreciation of the effective exchange rate (by 70 percent between August 1980 and July 1987) more than offset the widening of the price differential between Madagascar and its competitors. Indeed, inflation remained high in the 1980s in Madagascar, averaging 19 percent a year; at the same time, it fell sharply in Madagascar's competitors (mainly industrialized countries in the REER methodology).<sup>4</sup>

<sup>4</sup> From a competitiveness point of view, the REER of the ariary (as measured by the IMF's *International Financial Statistics*) may overestimate the importance of industrialized countries. To weigh exchange rates and prices of Madagascar's competitors in the REER index, the IMF takes into account both bilateral trade and indirect competition between trading partners in third countries. As a result, industrialized countries represent 80 percent of Madagascar's competitors. The share of industrialized countries would be far lower if just the competition in third markets was considered (as is the case in the common definition of competitiveness). For instance, the weight of Asian countries in the REER is only 13 percent, which does not reflect the true level of competition with Madagascar.

Second, structural and macroeconomic factors affected the real exchange rate over the period<sup>5</sup>:

- Economic fundamentals exerted a downward pressure on the real exchange rate: (i) the external position declined in the 1980s and in the first half of the 1990s (Lane and Milesi-Ferretti, 2006); (ii) the terms of trade have steadily decreased since the mid-1980s; and (iii) Madagascar's productivity has lagged behind that of its trading partners.
- The country's macroeconomic policies during this period may also account for the real depreciation. Madagascar adopted IMF structural adjustment programs in the second half of the 1980s, involving a capital account and trade liberalization and a nominal depreciation under a crawling peg arrangement. Major reforms of 1994–95 (including the adoption of a floating exchange rate) may also have spurred the depreciation.

### **B. Real Appreciation of the Ariary since 2004**

Since the beginning of the 1990s the evolution of the exchange rate has been less clear-cut than it was in the 1980s. After hitting bottom in 1995 the ariary began to appreciate but this trend was unwound by the steep depreciation between 2002 and mid-2004.<sup>6</sup> Since June 2004 the ariary has appreciated by 65 percent in real terms.

Recent REER appreciation reflects the inflation differential between Madagascar and its trading partners, and to a lesser extent the upward trend of the nominal exchange rate:

- Higher inflation in Madagascar relative to its competitors has been the main driver of real appreciation.<sup>7</sup> Inflation averaged 10 percent a year from 1998 to 2008, peaking in 2005 (Figure 7). In 2002, shortages in the wake of the political crisis fueled domestic inflation, but the inflation peak in 2005 resulted from the sharp depreciation of the currency in 2004 (pass-through effect) and the near doubling of the prices of rice and oil products.

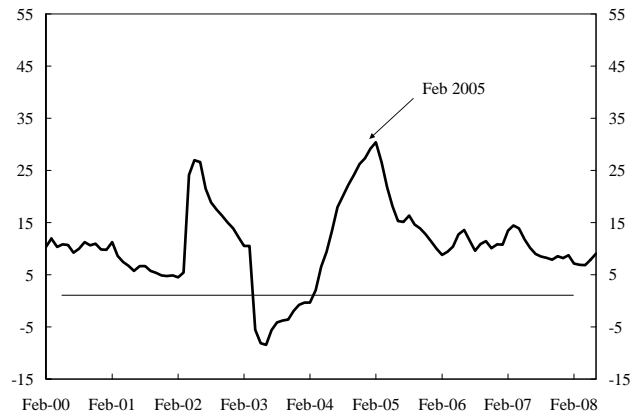
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<sup>5</sup> Non-economic factors also played a role at particular points in time. Madagascar has undergone periods of severe political instability, notably at the beginning of the 1990s and in 2002.

<sup>6</sup> In the first half of 2004, the ariary depreciated by about 50 percent against the euro because of (i) an acceleration of private imports in response to tax and tariff exemptions, and (ii) the impact of cyclones on vanilla and shellfish exports. Exchange rate volatility was exacerbated by erratic liquidity management in domestic money markets and structural weaknesses in the foreign exchange market, which were partly addressed by the introduction of an inter-bank foreign exchange market in July 2004.

<sup>7</sup> See footnote 4 for a caveat on the inflation differential measure in the IMF's *International Financial Statistics*.

Figure 7: Consumer Price Index  
(Year-over-year growth rate in percent)

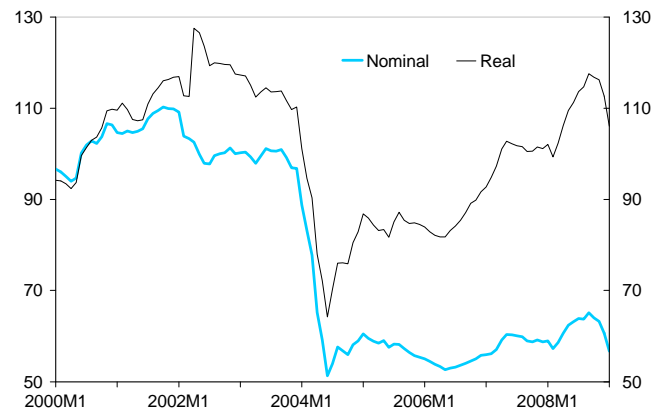


Note: Monthly data only available after Feb 2000.

Source: Malagasy authorities.

- The nominal exchange rate has moderately appreciated since mid-2004 (Figure 8). This reversal of the historical trend results from an improvement in the net external position of the country (successive debt relief initiatives occurred in 2004 and 2006) and large FDI inflows since 2006 into the mining sector to build new facilities.

Figure 8: Nominal and Real Effective Exchange Rates  
(Indexes, 2000=100)



Source: International Financial Statistics.

A comprehensive assessment of price competitiveness should also examine cost differentials. Due to a lack of data, it is not possible to compute a cost-based REER, but a few surveys, though too recent to provide an historical perspective, give indications on wage and nonwage costs. Madagascar benefits from extremely low labor costs. Cadot and Nasir (2001) report that the monthly wage for an unskilled textile machine operator is less than one-fourth the equivalent wage in Mauritius, about half that in China, and about 80 percent of the average wage in India. However, this advantage is partly eroded by lower relative productivity and

higher nonwage costs, such as those related to electricity, transportation, and communication (Table 1).

Table 1: Wage and Nonwage Costs in Madagascar and Comparator Countries

	Madagascar	Mauritius	China	India	Bangladesh	Pakistan	South Africa	
Wage cost <sup>8</sup>	• Monthly wage (\$)	65	220	150	75		255	
	• Daily production per worker	15		22	16		15	
	• Labor cost per shirt (\$)	0.21		0.26	0.18		0.65	
Nonwage costs <sup>9</sup>	• Shipping cost to Paris/New York (\$)	820/1350		400/1000				
	• Value lost due to electrical outages (%)	6.6	2.9	1.3	6.6	10.6	4.9	0.4
	• Business tax rate (%)	46.5	21.7	73.9	70.6	39.5	40.7	37.1
	• Cost of business startup (%)	22.7	5.3	8.4	74.6	46.2	14	7.1

Source: World Bank, Cadot and Nasir (2001).

#### IV. PRICE COMPETITIVENESS: EXCHANGE RATE ASSESSMENT

The REER, as an indicator of price competitiveness, is not always well interpreted. What affects competitiveness is less the evolution of the real exchange rate than the distance from its equilibrium value. A real appreciation can reflect an improvement in competitiveness when the appreciation is due to fundamental factors, such as productivity gains. An REER appreciation only compromises competitiveness if the actual REER is overvalued and departs significantly from its equilibrium value. Conversely, a real depreciation can undermine competitiveness if the equilibrium exchange rate depreciates concurrently and the actual exchange rate remains overvalued.

It is therefore necessary to supplement the descriptive analysis in Section III with an assessment of the gap between the actual and equilibrium exchange rates. This assessment is based on three methods advocated by the IMF's CGER methodology (Lee and al., 2008). Two methods—the macroeconomic balance (MB) approach and the external sustainability (ES) approach—measure the exchange rate adjustment necessary to close the gap between the medium-term current account and a norm. The third—the equilibrium REER (ER) approach—directly estimates the equilibrium exchange rate using an econometric equation relating the exchange rate to its fundamental determinants.

<sup>8</sup> Wage cost indicators in the garment industry: (1) Monthly machine operator wage in \$ (2001); (2) Number of shirts produced daily per worker (2001); (3) Labor cost per shirt in \$ with 26-day work month (2001).

<sup>9</sup> Nonwage cost indicators: (4) Shipping cost of children clothes to Paris/New York by air in \$ (2003); (5) Value lost due to electrical outages (% of sales) (2005); (6) Business tax rate (% of profit) (2007); (7) Cost of business start-up procedures (% of GNI per capita) (2007).

### A. The Macroeconomic Balance Approach

The MB approach measures the exchange rate adjustment necessary to shift the underlying current account (CA) toward its sustainable level when output is at its potential level. In other words, it measures how much the exchange rate should vary to restore the external balance, on the assumption of internal balance. The method consists of three steps:

- The first step estimates a target for the CA. This target, the “CA norm,” is the CA that is compatible with the fundamentals at their medium-term value.<sup>10</sup> The CA norm is computed from an econometric relation between the CA and its fundamentals, which are the determinants of saving and investment. The value of the fundamentals is drawn from the WEO database for 2013<sup>11</sup>.
- The norm is then compared to the “underlying CA,” which is the CA stripped out from temporary factors. Theoretically, the underlying CA would emerge at prevailing exchange rates if the country was producing at its potential output level. The CA forecast by the WEO for 2013 can be seen as a measure of the underlying CA. Indeed, the WEO projections are conditional on real exchange rates remaining unchanged and, for the final year in the five-year forecast horizon, assume that actual output equals potential output.
- Finally the CA elasticity to the real exchange rate is used to measure the exchange rate variation that would close the gap between the underlying CA and its target value. Computation of this elasticity is an essential step but relies on firm hypotheses that should be clarified (see the theoretical discussion in the Appendix).

To apply the MB approach to Madagascar, we use the results from a fixed-effect estimation carried out by Imam and Minoiu (2008) for a sample of 140 countries between 1980 and 2005. The following relation was estimated for Madagascar:

$$\left(\frac{CA}{GDP}\right)_{MDG,t} = -3.75 + 0.38 \times \left(\frac{FISC}{GDP}\right)_{MDG,t} + 0.02 \times \left(\frac{NFA}{GDP}\right)_{MDG,t} - 0.05 \times RELGDP_{MDG,t} - 0.09 \times GROWTH_{MDG,t} - 0.4 \times POP_{MDG,t}$$

where the fundamentals are the overall fiscal balance as a ratio of GDP; the net foreign assets (NFA) position (relative to GDP); relative per capita GDP, expressed as the deviation from

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<sup>10</sup> Adopting a medium-term perspective ensures that the output gap is zero, i.e., the internal balance condition is met.

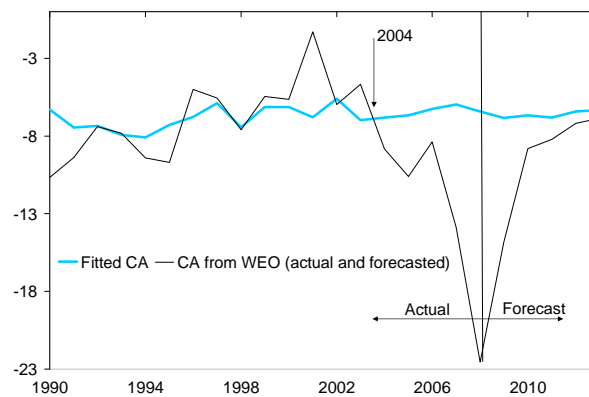
<sup>11</sup> The data used in section IV are drawn from the WEO database as at January 15, 2009.

US income,; per capita GDP growth; and population growth. The constant estimate is specific to Madagascar.

This analysis produces three results:

- Competitiveness started deteriorating in 2004, when the observed CA fell below the estimated CA, implying that the exchange rate has been overvalued since then.
- The CA norm, estimated at  $-6.3$  percent of GDP and the underlying CA at  $-6.9$  percent are very close (Figure 9)<sup>12</sup> After a serious deterioration in 2008,<sup>13</sup> the actual CA is expected to improve—mainly because the mining operations graduate from the construction to the production phase—and almost reach the estimated CA at the end of the forecast horizon.
- The gap between the norm and the underlying CA being very small, the overvaluation of the currency is also small. In a medium-term perspective the ariary seems to be only slightly overvalued by 1 percent (see Appendix for a discussion on the selected CA elasticity).

Figure 9: Results from the MB Method  
(Percent of GDP)



Source: WEO and author's estimates

## B. The External Sustainability Approach

The ES approach is very similar to the MB, and follows the same three-step methodology. The approaches differ only in the definition of the CA norm. In the ES, it is measured as the

<sup>12</sup> The CA norm is the CA estimated by the econometric equation for 2013; the underlying CA is the CA forecast by the WEO for 2013.

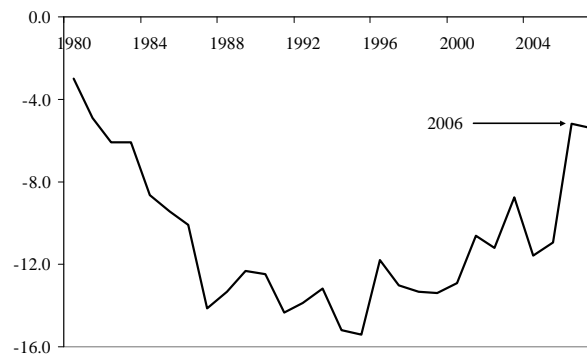
<sup>13</sup> Owing to a deceleration of exports and still strong imports for the mining sector.



CA that stabilizes the net external position (NEP) at a benchmark level, generally the last observation.<sup>14</sup>

Because no official data on NEP are available for Madagascar<sup>15</sup> we use the series computed by Lane and Milesi-Ferretti (2006). However, applying the ES method to the last available data of their NEP (in 2004) could be misleading because in 2006 MDRI debt relief significantly improved Madagascar's external position, and thereby the NEP-stabilizing CA. We choose to extend the external position series by cumulating the current accounts between 2005 and 2007 on the assumption that valuation effects offset each other. Finally, we compute the NEP-stabilizing CA for 2007 on the assumptions of potential growth of 6 percent and inflation of 8 percent a year (Figure 10).

Figure 10: NEP-Stabilizing CA  
(Percent of GDP)



Source: Lane and Milesi-Ferretti (2006), WEO, and author's estimates.

Using the ES approach the CA norm is estimated at  $-5.4$  percent. If the method had been applied to the NEP prevailing before MDRI relief, the norm would have been mistakenly estimated at double the value (in 2005 the stabilizing CA was  $-10.9$  percent). Given the elasticity of the current account to the exchange rate, a real depreciation of 3 percent would be necessary to close the gap between the underlying CA ( $-6.9$  percent in 2013) and the norm. The result does not differ significantly from the overvaluation estimated by the MB approach.

<sup>14</sup> The level of the CA that stabilizes the NEP/GDP ratio is calculated as  $\frac{g + \pi}{(1 + g)(1 + \pi)} \cdot b$  where  $g$  is the growth rate of real GDP,  $\pi$  is the inflation and  $b$  is the benchmark NEP/GDP level.

<sup>15</sup> The NEP should not be mistaken for the net foreign asset (NFA) position of the central bank, which is published data in Madagascar. The NFA covers only the short-term external position of the central bank; the NEP describes the external position of a country, covering all institutional sectors, all maturities, and all instruments. For example, in 2004 the NEP of Madagascar amounted to  $-91$  percent of GDP but the NFA position was  $+10$  percent.

### C. The Equilibrium Real Exchange Rate Approach

The ER approach estimates directly the equilibrium exchange rate. It differs from the other two methods, which estimate the distance from the equilibrium exchange rate but not its level.

The ER approach consists of three steps:

- A stable econometric relation is estimated between the REER and a set of fundamentals identified in the literature.
- The equilibrium exchange rate is computed as a function of the forecasted value of the fundamentals (drawn from the WEO forecasts for 2013).
- The magnitude of the adjustment is measured as the gap between the actual REER and this equilibrium value. (It is pointless to wonder if one should compare the equilibrium value to the current or to the forecasted REER because, by assumption, the REER is fixed over the forecast period in the WEO).

For low-income countries, results from single-equation estimations are less reliable because data are either of poor quality or totally absent. We estimate a model of the real exchange rate using panel data for the SADC countries for 1992–2007. The SADC includes Madagascar and many of its competitors<sup>16</sup>. The series being nonstationary, cointegration techniques are applied (see the Appendix for details on the estimation).

We find a long-term relationship among the following variables in log form: the REER, investment-to-GDP, NFA-to-GDP, and relative income per capita. Variables are statistically significant and have the expected sign. The investment ratio has a negative effect on the exchange rate, implying that investment purchases are primarily tradable goods. Coefficients are robust to different specifications or time periods.

$$\ln(REER)_{MDG,t} = 8.85 - 0.30 \times \ln\left(\frac{INV}{GDP}\right)_{MDG,t} + 0.52 \times \left(\frac{NFA}{GDP}\right)_{MDG,t} + 0.98 \times RELGDP_{MDG,t}$$

The fitted REER declines from the beginning of the 1990s to the last observed data (2007) as the investment ratio increases and relative income deteriorates. The exchange rate starts to be

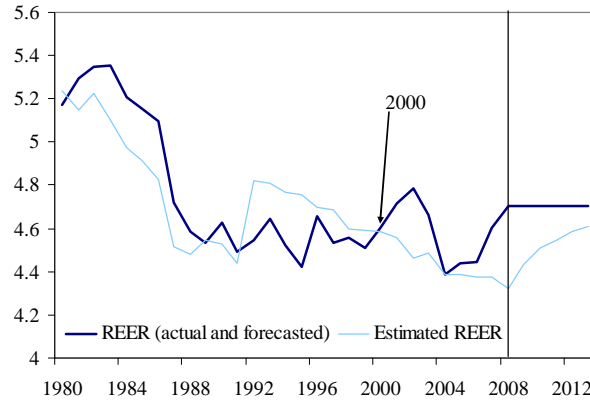
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<sup>16</sup> The SADC comprises the following: Angola, Botswana, the Democratic Republic of Congo, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, United Republic of Tanzania, Zambia, and Zimbabwe.

overvalued in 2000—earlier than predicted by the MB approach, which dates the beginning of the deterioration in 2004.

After 2007 the fitted REER picks up because (i) relative income is expected to improve (reflecting the catching-up process); (ii) the investment ratio will decrease (with the shift in mining from construction to production); and (iii) the NFA ratio will improve (along with the CA). At the end of the forecast period, the REER is found to be overvalued by 9 percent.

Figure 11: Actual and Estimated REER of the Ariary



Source: WEO and author's estimates.

To sum up our discussion on the exchange rate assessment, all three methods conclude that the ariary is slightly overvalued in the medium term (Table 2). The ER method produces the highest overvaluation estimate, though the percentage is low by historical standards. An 9 percent overvaluation at the end of the forecast horizon means that the real exchange rate is expected to depreciate by 9 percent over the next five years. Historical data give significantly higher numbers: since the beginning of the 1980s, the REER has grown on average 11 percent a year (in absolute terms).

Our main findings are therefore that in the medium term (i) the CA can be expected to move to a more sustainable level without the need for a significant real depreciation, and (ii) the overvaluation of the ariary can be expected to diminish over time because the equilibrium exchange rate will appreciate.

Table 2: Summary of the Results from the Three Methods

	Underlying CA (Percent of GDP)	CA Norm (Percent of GDP)	Exchange Rate Overvaluation (Percent)
Macro balance	-6.9	-6.3	1
External sustainability	-6.9	-5.4	3
Equilibrium REER			9

Source: Author's estimates.

## V. NONPRICE COMPETITIVENESS: A DESCRIPTIVE ANALYSIS

In addition to studying price competitiveness, a comparative analysis of nonprice indicators can be useful, though these indicators should be interpreted with caution for conceptual and practical reasons:

- At the firm level, the concept of nonprice (structural) competitiveness is relatively well defined. Firms can distinguish their products or services from those of competitors through promotional expenditures, quality of service, market research, etc. At the country level, the concept is more controversial. It is not well-grounded in theory and not sufficiently focused—almost any indicator of performance can relate to structural competitiveness. To address this issue and to limit the scope and size of our analysis, we will look at just two aspects of nonprice competitiveness: constraints on trade and on business (subsection V.2).
- Measuring and interpreting indicators of structural competitiveness also raises problems. First, selection and aggregation of the components of composite indicators are to some degree arbitrary. Second, interpreting indicators is often misleading because (i) variables may be imperfect proxies, especially when correlations depend on nonobserved variables (for instance, the number of schools only measures human capital accumulation if the teachers are well-trained); and (ii) economic agents often adapt and address the constraints by themselves (for instance, one should not conclude that the state of the electricity network in a country is not an issue if local firms buy power generators to bypass outage constraints).

### A. Assessment of Structural Competitiveness

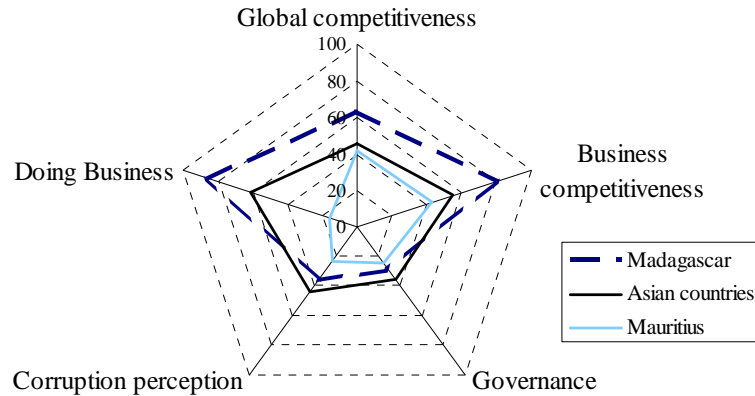
On several composite indicators of competitiveness, we find that Madagascar underperforms its competitors. We compare Madagascar with Mauritius and a set of Asian countries comprising the eight biggest textile producers (China, India, Bangladesh, Pakistan, Vietnam, Cambodia, Sri Lanka, and Indonesia). The comparison is based on the most popular composite indicators: (i) the Global Competitiveness Index and the Business Competitiveness Index of the World Economic Forum; (ii) the World Governance Indicators of the World Bank; (iii) the World Bank Doing Business Report indicators; and (iv) the Corruption Perception Index of Transparency International.

This comparison produces two results:

- Madagascar compares poorly to both Asian countries and Mauritius. This is especially true for the quality of the business environment (Doing Business and Business Competitiveness surveys). It compares more favorably to Asia on governance standards (World Governance and Corruption Perception surveys).

- Madagascar's lower performance than Mauritius, its traditional competitor, is worth noting: the World Bank ranks Mauritius at 24 out of 181 countries for ease of doing business and Madagascar at 144 ; the World Economic Forum ranks Mauritius at 60 out of 131 on global competitiveness and Madagascar at 118.

Figure 12: Composite Indicators of Competitiveness



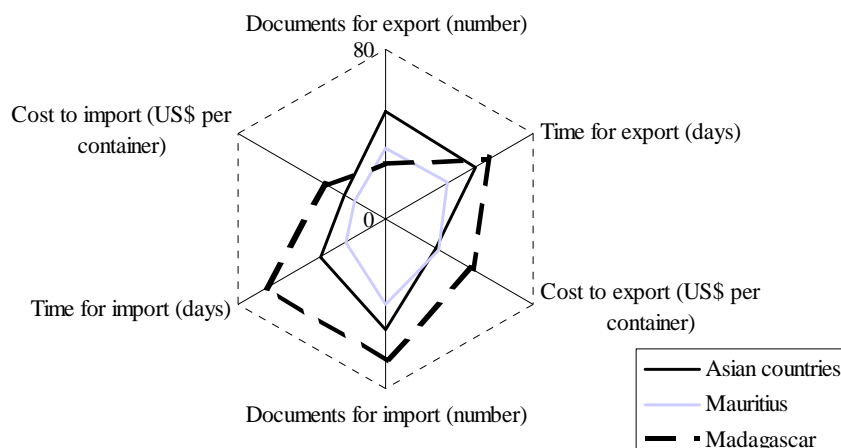
Note: Lines closer to the center indicate a better relative position.  
Sources: World Economic Forum, World Bank, Transparency International.

## B. Constraints on Trade and Business in Madagascar and Mauritius

The indicators noted above show that the business environment is less favorable in Madagascar than in its competitors. We now examine two surveys that address this issue more specifically.

We first consider a subindex of the Global Competitiveness Index, “trading across borders,” where Madagascar is outperformed by Mauritius and Asian competitors in almost every category.

Figure 13: Trading Across Borders Index



Note: Lines closer to the center indicate a better relative position.

Source: World Economic Forum.

Second, we consider the World Bank Doing Business and Enterprise surveys. Because both are extremely detailed, we limit our comparison to Mauritius as a benchmark. The comparison highlights several items for which the gap in performance is significant; these items are grouped into two areas where Madagascar might improve (Table 3):

- Madagascar's regulations seem to be less flexible, as illustrated by time spent getting licenses, the rigidity of the employment index, and time spent dealing with officials.
- Bank financing is less developed in Madagascar. The gap with Mauritius is particularly striking for the bank credit-to-GDP ratio and the percentage of firms using banks to finance investment.

Table 3: Comparison of Madagascar and Mauritius on World Bank Surveys

		Madagascar	Mauritius
Regulation	• Time required to build a warehouse (proxy for time dealing with licenses)	268	107
	• Rigidity of employment index (0 min-100 max)	63	23
	• Time dealing with officials (percent of management time)	20.8	9.6
Financing	• Public credit registry coverage (percent of adult population)	0.1	38.6
	• Domestic credit to the private sector (percent of GDP)	10.2	78
	• Domestic credit provided by the banking sector (percent of GDP)	9.7	111.1
	• Firms using banks to finance investment (percent of total firms)	13.0	36.3

Source: World Bank (2006,2007).

## **VI. CONCLUSIONS AND POLICY IMPLICATIONS**

Price competitiveness has deteriorated in Madagascar since 2000, as illustrated by the steady decline in its market share, the real appreciation of the ariary, and the widening of the gap between the actual and equilibrium exchange rates.

However, in the medium term, the ariary seems to be generally in line with its fundamental determinants. Our assessment of Madagascar's real exchange rate was based on three methods. Both the MB and the ES approaches indicate that the ariary is only slightly overvalued. The ER approach finds the ariary to be overvalued by 8 percent, which is low by historical standards.

Nonprice competitiveness raises more serious concerns. Madagascar underperforms its competitors on a large number of structural criteria. The quality of the business environment and especially the role of the banking sector need to be strengthened to improve export performance. Measures to address structural challenges, which are at the core of the Madagascar Action Plan for 2007-2012, are essential if the country is to become more competitive.

## APPENDIX

### 1. Computation of Current Account Elasticities

In this section we (i) compute CA elasticities to the real exchange rate under alternative assumptions, and (ii) apply the formulas to Madagascar.

#### Definitions

We assume two countries (domestic and foreign). Each country produces and exports a tradable good imported by the partner country. The following notions will be employed throughout:

$E$  = Nominal exchange rate (increase = nominal depreciation).

$R$  = Real exchange rate (increase = real appreciation).

$X$  = Export volume supplied by the domestic country and demanded by the foreign country. The price of export goods is  $P$  in domestic currency and  $P/E$  in foreign currency.

$M$  = Import volume demanded by the domestic country and supplied by the foreign country. The price of import goods is  $E.P^*$  in domestic currency and  $P^*$  in foreign currency.

We define four positive elasticities:

$$e_x \equiv \frac{dX^s}{dP} \frac{P}{X^s} = \text{export supply elasticity.}$$

$$\eta_x \equiv -\frac{dX^d}{d(P/E)} \frac{(P/E)}{X^d} = \text{export demand elasticity.}$$

$$e_M \equiv \frac{dM^s}{dP^*} \frac{P^*}{M^s} = \text{import supply elasticity.}$$

$$\eta_M \equiv -\frac{dM^d}{dEP^*} \frac{EP^*}{M^d} = \text{import demand elasticity.}$$

$BC = PX - EP^*M$  = trade balance of the domestic country in domestic currency.

$BC^* = \frac{BC}{E}$  = trade balance of the domestic country in foreign currency.

$s_x = \frac{PX}{Y}$  = domestic exports-to-domestic GDP (in nominal terms and domestic currency).

$s_M = \frac{PM}{Y}$  = domestic imports-to-domestic GDP (in nominal terms and domestic currency).



## Assumptions

We now identify three cases based on three different assumptions. We derive a CA elasticity formula in each case. Each assumption can be formulated in three equivalent ways (either on prices, on the pass through effect or on supply and demand elasticities).

Table 4: Assumptions Underlying the Three Cases

	Equivalent Assumptions On:		
	Prices	Pass Through (domestic point of view)	Elasticities
Mundell-Fleming	$P$ and $P^*$ fixed	Zero pass through on export prices. Full pass through on import prices.	$e_X$ and $e_M \rightarrow \infty$
Small country	$P/E$ and $P^*$ fixed	Full pass through on export and import prices.	$e_M$ and $\eta_X \rightarrow \infty$
Large country	$P$ and $EP^*$ fixed	Zero pass through on export and import prices	$e_X$ and $\eta_M \rightarrow \infty$

The following formulas are derived with respect to the real exchange rate. Caution is required when comparing them to other formulas (generally derived with respect to the nominal exchange rate or with different variable definitions<sup>17</sup>).

### Case 1: Mundell-Fleming<sup>18</sup>

We assume that the relative price of nontradable to tradable goods is constant in both countries and thus make no distinction between the real exchange rate and the terms of trade:  $R = \frac{P}{EP^*}$ .

$$\text{trade: } R = \frac{P}{EP^*}.$$

Given that (i) the response of exports and imports is given by demand elasticities (supply

elasticities being infinite), and (ii)  $\frac{dE}{E} \Big/ \frac{dR}{R} = -1$ , we have:

$$\frac{dX}{X} \Big/ \frac{dR}{R} = \frac{dX^d}{X^d} \Big/ \frac{dR}{R} = -\frac{dX^d}{X^d} \Big/ \frac{dE}{E} = \frac{dX^d}{X^d} \Big/ \frac{d(P/E)}{P/E} = -\eta_X < 0.$$

$$\text{and } \frac{dM}{M} \Big/ \frac{dR}{R} = \frac{dM^d}{M^d} \Big/ \frac{dR}{R} = -\frac{dM^d}{M^d} \Big/ \frac{dE}{E} = -\frac{dM^d}{M^d} \Big/ \frac{d(EP^*)}{EP^*} = \eta_M > 0.$$

<sup>17</sup> Export and import elasticities are sometimes defined with respect to the real exchange rate; the real exchange rate is sometimes defined as the ratio of foreign to domestic prices etc.

<sup>18</sup> The CGER methodology implicitly makes the Mundell-Fleming assumptions (see Lee and al., 2008 on page 7 or Isard and Faruqee, 2001 on page 32). The CGER defines the export and import elasticities with respect to the real exchange rate; this explains the difference in the sign of the export elasticity.

We differentiate the trade balance with respect to R and find:

$$dBC = PdX - MP^*dE - EP^*dM \Leftrightarrow \frac{dB}{Y} \Big/ \frac{dR}{R} = -s_X \cdot \eta_X - s_M (\eta_M - 1). \quad [1]$$

Note that the Marshall-Lerner condition can easily be recovered (under the assumption that the trade balance is at equilibrium i.e.  $s_M = s_X$ ):

$$\frac{dB}{Y} \Big/ \frac{dE}{E} = -(-s_X \cdot \eta_X - s_X (\eta_M - 1)) > 0 \Leftrightarrow \eta_X + \eta_M - 1 > 0.$$

### **Case 2: Small country**

In the small country case, the terms of trade  $P/EP^*$  are fixed by assumption. The real exchange rate moves along with the ratio of nontradable to tradable goods in the domestic country. We redefine the real exchange rate as follows<sup>19</sup>:

$$R = \frac{P_{NT}}{P_T} = \frac{P_{NT}}{\alpha \cdot P + (1 - \alpha) \cdot EP^*}.$$

Given that (i) the response of exports is given by the supply side (the elasticity of export demand being infinite), and (ii)  $\frac{dE}{E} \Big/ \frac{dR}{R} = -1$ , we have:

$$\frac{dX}{X} \Big/ \frac{dR}{R} = -\frac{dX^s}{X^s} \Big/ \frac{dE}{E} = -\frac{dX^s}{X^s} \Big/ \frac{dP}{P} = -e_X < 0.$$

$$\text{and } \frac{dM}{M} \Big/ \frac{dR}{R} = -\frac{dM^d}{M^d} \Big/ \frac{dE}{E} = -\frac{dM^d}{M^d} \Big/ \frac{d(EP^*)}{EP^*} = \eta_M > 0.$$

By differentiating the trade balance expressed in foreign currency, we find:

$$\begin{aligned} BC^* &= \frac{P}{E} X - P^* M \Leftrightarrow dBC^* = \frac{P}{E} dX - P^* dM \Leftrightarrow dBC = BC \cdot \frac{dE}{E} + P \cdot dX - P^* E \cdot dM \\ &\Leftrightarrow \frac{dBC}{Y} \Big/ \frac{dR}{R} = -s_X (e_X + 1) - s_M (\eta_M - 1). \quad [2] \end{aligned}$$

Two sub-cases are of particular interest:

(1) It has been shown that in many commodities exporters (especially oil exporters) the supply response is usually very small. In that case we add the assumption  $e_X = 0$ .

<sup>19</sup> Results are identical if we adopt the real exchange rate definition of the third case (see below).

(2) In some countries, imports by the manufacturing sector are complementary to domestic industrial production and the import elasticity is small. In that case we add the assumption  $\eta_M = 0$ .

### **Case 3: Large country**

In a large country, the terms of trade are fixed as well as the relative price of tradable goods. The real exchange rate moves along with the ratio of nontradable to tradable goods in the foreign country. We redefine the real exchange rate as follows:

$$R = \frac{P_{NT}}{P_T} \bigg/ \frac{P^*_{NT}}{P^*_T} = \frac{P_{NT}}{\alpha.P + (1-\alpha).EP^*} \bigg/ \frac{P^*_{NT}}{\beta.P/E + (1-\beta).P^*}.$$

Given that (i) the response of imports is given by the supply side (the elasticity of import demand is infinite), and (ii)  $\frac{dE}{E} \bigg/ \frac{dR}{R} = -1$ , we have:

$$\frac{dX}{X} \bigg/ \frac{dR}{R} = -\frac{dX^d}{X^d} \bigg/ \frac{dE}{E} = \frac{dX^d}{X^d} \bigg/ \frac{d(P/E)}{P/E} = -\eta_X < 0.$$

$$\text{and } \frac{dM}{M} \bigg/ \frac{dR}{R} = -\frac{dM^s}{M^s} \bigg/ \frac{dE}{E} = \frac{dM^s}{M^s} \bigg/ \frac{dP^*}{P^*} = e_M > 0.$$

By differentiating the trade balance with respect to R, we find:

$$dBC = PdX - EP^*dM \Leftrightarrow \frac{dBC}{Y} \bigg/ \frac{dR}{R} = -s_X \cdot \eta_X - s_M \cdot e_M. \quad [3]$$

Table 5: Current Account Elasticity Formulas

Mundell-Fleming		$-s_X \cdot \eta_X - s_M (\eta_M - 1)$
	Standard case	$-s_X (e_X + 1) - s_M (\eta_M - 1)$
Small country	Commodity exporter	$-s_X - s_M (\eta_M - 1)$
	Manufacturing importer	$-s_X (e_X + 1) + s_M$
Large country		$-s_X \cdot \eta_X - s_M \cdot e_M$

### **Application to Madagascar**

We estimate the current account elasticity in Madagascar by (i) using estimates from different sources for export and import elasticities, and (ii) using alternative formulas to compute the CA elasticity.

Table 6: Estimates of the Export and Import Elasticities

	Imports	Exports
IMF (CGER)	0.9	0.7
IMF (Tokarick)	1.3	0.9
World Bank	1.2	0.9
Marquez	0.8	0.6

Source: IMF, World Bank, Marquez (1990).

Table 7: Estimates of the Current Account Elasticity

	Mudell-Fleming	Small Country	Large Country	Average by Line
IMF (CGER)	-0.2	-0.5	-0.6	-0.4
IMF (Tokarick)	-0.4	-0.7	-0.8	-0.6
World Bank	-0.3	-0.6	-0.8	-0.6
Marquez	-0.1	-0.4	-0.6	-0.4
Average by column	-0.2	-0.5	-0.7	

Note:  $X/Y = 30\%$  and  $M/Y = 45\%$  in Madagascar.

Source: Author's calculations

For Madagascar we select a CA elasticity estimate of -0.5 (which is the small country estimate as well as the average of all elasticities of Table 7). It means that the real exchange rate has to depreciate by 2 percent to improve the current account by 1 percentage point of GDP.

## 2. Results of The Panel Estimation of The REER

We estimate a model of the real exchange rate using panel data for the 15 SADC countries for 1992–2007.

We search for a stable relationship among the following variables in log form: the REER, investment-to-GDP, public consumption-to-GDP, net income from the BoP-to-GDP, NFA-to-GDP, terms of trade, trade openness (defined as the ratio of exports and imports to GDP), the real interest rate, and relative income per capita (measured as a ratio to the US GDP per capita in 2000 US\$).

After a first series of tests and estimations, we limit our investigation to five variables that were found statistically significant in exchange rate equations: the REER, investment-to-GDP, NFA-to-GDP, trade openness, and relative income per capita.

- Variables are nonstationary over the period (see Table 8). The ratio of NFA to GDP is found stationary on row data but the result is not robust over alternative time periods or if the data are smoothed.

- We find a cointegration relation among the variables (especially when cointegration tests are applied to smoothed data, see Table 9).
- We estimate the cointegration relation with three alternative techniques: the fixed effect, the FMOLS and the DOLS estimators (see Table 10). With the DOLS (our preferred estimator), the openness coefficient is not significantly different from zero (this estimate varies a lot across specifications and it seems better not to include it).

Table 8: Panel Unit Root Tests  
(Im, Pesaran and Shin 2003)

		Statistic (Ztbar)	Significance Level	Conclusion
Row data	REER	0.60	0.72	I(1)
	I/Y	-0.52	0.30	I(1)
	NFA/Y	-2.07	0.02	I(0)
	RELGDP	2.00	0.98	I(1)
	(X+M)/Y	0.01	0.51	I(1)
Smoothed data (3 year moving average)	REER	3.60	1.00	I(1)
	I/Y	1.17	0.88	I(1)
	NFA/Y	-0.06	0.48	I(1)
	RELGDP	3.27	1.00	I(1)
	(X+M)/Y	3.05	1.00	I(1)

Note: Variables are tested in log form.

Source: Author's estimates.

Table 9: Panel Cointegration Tests  
(Pedroni 1997)

		Row data		Smoothed data (3 year moving average)	
		Statistic	Conclusion	Statistic	Conclusion
4 variables	Panel v-stat	0.37	No coint	-0.23	No coint
	Panel rho-stat	1.15	No coint	2.24	Coint
	Panel pp-stat	-1.46	No coint	0.78	No coint
	Panel adf-stat	-0.99	No coint	-1.27	No coint
	Group rho-stat	2.86	Coint	4.04	Coint
	Group pp-stat	-1.11	No coint	1.83	Coint
	Group adf-stat	-1.98	Coint	-2.77	Coint
5 variables	Panel v-stat	0.06	No coint	-0.96	No coint
	Panel rho-stat	2.05	Coint	2.94	Coint
	Panel pp-stat	-1.27	No coint	-0.24	No coint
	Panel adf-stat	-0.51	No coint	-2.74	Coint
	Group rho-stat	3.59	Coint	4.50	Coint
	Group pp-stat	-1.24	No coint	-0.01	No coint
	Group adf-stat	0.63	No coint	-3.53	Coint

Note: Variables are tested in log form.

Note: 4 variables = REER, I/Y, NFA/Y, RELGDP. 5 variables = previous and (X+M)/Y.

Source: Author's estimates.

Table 10: Panel Estimates

	Fixed Effects	FMOLS	<b>DOLS</b>
I/Y	-0.25 (-5.59)	-0.14 (-5.41)	<b>-0.30</b> <b>(-4.08)</b>
NFA/Y	0.48 (5.37)	0.29 (3.12)	<b>0.52</b> <b>(3.29)</b>
RELGDP	0.75 (5.70)	0.57 (4.25)	<b>0.98</b> <b>(5.74)</b>
(X+M)/Y	-0.06 (-2.34)	-0.33 (-9.41)	

Note: Estimations are made on raw data and incorporate individual constants.

Note: In bold = preferred estimates.

Source: Author's estimates.

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