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# DEPARTMENT OF ECONOMICS

## Working Paper

**The Growth Effects of Openness to Trade and  
the Role of Institutions:  
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by

Mina Balamoune-Lutz and Léonce Ndikumana

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# The Growth Effects of Openness to Trade and the Role of Institutions: New Evidence from African Countries

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## **ABSTRACT**

In this paper, we explore the argument that one of the causes for the limited growth effects of trade openness in Africa may be the weakness of institutions. We also control for several major factors and, in particular, for export diversification, using a newly developed dataset on Africa. Results from Arellano-Bond GMM estimations on panel data from African countries show that institutions play an important role in enhancing the growth effects of trade. Moreover, we find that the joint effect of institutions and trade has a U-shape, suggesting that as openness to trade reaches high levels, institutions play a critical role in harnessing the trade-led engine of growth. The results from this paper are informative about the missing link between trade liberalization and growth in the case of African countries.

## **1. Introduction**

African countries have implemented a series of economic reforms, including trade liberalization, with the aim of boosting economic growth. The theoretical motivation for these reforms is that trade liberalization is expected to increase trade, which in turn raises the rate of economic growth. However, the empirical evidence from the large and growing literature on trade and growth remains mixed (Edwards 1998; Rodriguez and Rodrik 2001; Baliaoune 2002; Yanikaya 2003). Some studies suggest that trade liberalization is not associated with growth while others conclude that trade openness may even retard growth. For example, while Sachs and Warner (1997) argue that trade openness increases the speed of convergence, the evidence from the study by Baliaoune (2002) suggests that increased openness to trade has led to income divergence rather than convergence in African countries. In fact, Rodrik (2001) argues that, regarding trade openness and growth, “the only systematic relationship is that countries dismantle trade restrictions as they get richer.”

This paper contributes to this debate on the linkages between trade liberalization and growth in the case of African countries. The paper specifically explores the argument that one of the causes for the limited growth effects of trade liberalization may be the weakness of institutions. Indeed one strand of the literature on growth has argued for the primacy of institutions in economic development (Easterly and Levine 2003; Dollar and Kraay 2003; Rodrik et al. 2004). Of particular relevance for this study is the finding from empirical studies that institutions are crucial for the success of economic reforms in developing countries (Acemoglu et al. 2003; Dollar and Kraay 2003; Addison and Baliaoune-Lutz 2006). This evidence suggests that the failure of trade reforms to

promote trade and growth in African countries may be attributable to the poor quality of institutions. The results from the study by Addison and Balamoune-Lutz (2006) on North African countries show that the growth effects of economic reforms depend to a large extent on the quality of institutions.

This paper examines whether this finding can be generalized to all African countries. The paper estimates a growth model including measures of institutional quality and indicators of openness in addition to conventional correlates of growth. We also control for the effects of other major factors of growth. In particular, we control for the effects of export diversification, using a newly developed data set on African countries (Ben Hammouda et al 2006). The empirical analysis uses Arellano-Bond panel estimation techniques to uncover joint effects of trade liberalization and institutional quality on growth in African countries while controlling for potential bias due to endogeneity of some regressors including the lagged dependent variable.

The results from this paper are informative about the missing link between trade liberalization and growth in the case of African countries. The evidence indicates that, once we control for other factors, institutions have a robust and positive impact on growth. More importantly, institutions play an important role in enhancing the effectiveness of trade liberalization. These effects of institutions are non-monotonic and exhibit a U-shape pattern: at low levels of trade openness, the joint effect of institutions and trade liberalization on growth is negative. As trade openness reaches higher levels, better institutions appear to enhance the growth effects of openness. The results also confirm the role of other important factors of growth, especially positive effects of domestic investment and negative effects of ethnic fractionalization and economic

instability proxied by exchange rate variability. The results with the measure of concentration and diversification of exports are consistent with the recent history of the continent where oil-producers have dominated in terms of growth performance.

The remainder of the paper proceeds as follows. The next section provides a brief review of the empirical literature on trade liberalization and growth, as well as the role of institutions with an emphasis on evidence on African countries. Section 3 describes the empirical methodology and the data, and discusses the estimation results. Concluding remarks are provided in Section 4.

## **2. Growth, trade, and institutions: a brief literature review**

Standard theory predicts that trade liberalization should promote trade, which in turn fuels growth in the long run. Theory suggests that trade liberalization expands trade opportunities, improves efficiency of allocation of resources (towards the most efficient sectors), and accelerates technological development especially through liberalization of imports. It is expected that high-technology imports enhance domestic innovation, thus raising productivity and growth.

However, after decades of liberalization experiments in Africa and in developing countries in general, the evidence on the growth effects of trade liberalization remains mixed (Greenaway et al. 2002; Easterly and Levine 2003; Dollar and Kraay 2003; Rodrik et al. 2004). Various arguments have been advanced to explain the limited effects of trade liberalization on growth. In this review we only stress some of the possible reasons for the weak empirical evidence on the growth effects of trade openness.

From a methodological standpoint, the observed weak link between trade liberalization and growth may be attributed to measurement imperfections: the indicators used in empirical analysis may not capture the true essence of openness. Indeed, due to lack of data on indicators of trade openness as a policy, empirical studies (as this one does) resort to measures of trade outcomes, i.e., trade volume, as proxies for trade openness. It is assumed that positive trade outcomes are an indication of a policy environment that is at least not anti-trade. Moreover, a high trade volume indicates exposure to international markets with the associated benefits (e.g., technological transfer), which openness policies seek to achieve. Thus, to some extent trade outcomes do carry some indication of the effects of trade liberalization. Nonetheless, results from analyses using trade volume as a measure of trade openness have to be interpreted cautiously. Indeed, variations in the volume of trade do not always reflect actual government policies that promote or hinder trade. For instance, fluctuations in commodity prices result in changes in trade flows even in the absence of shifts in trade policy.

The weak empirical evidence on the link between trade liberalization and growth can also be due to problems of misspecification. In particular, the effects of trade liberalization may materialize only with a lag. In the short run, liberalization may have negative effects, especially by undermining domestic production because of competitive imports, retarding growth (Mukhopadhyay 1999). Hence, to the extent that these negative short-run effects and the expected delayed positive effects occur consecutively, growth would exhibit a J-curve type of response to trade openness (Greenaway et al. 2002). Therefore, empirical studies may yield inconclusive and even misleading results if these dynamic and counterbalancing effects are not fully taken into account.

Another explanation relates to the structure of trade. Whether a country benefits from trade liberalization or not in terms of growth depends on the composition of trade. Mazumdar (1996) hypothesized that the composition of trade determines the strength of the “engine of growth.” Indeed, Lewer and Van Den Berg (2003) find evidence supporting the view that countries that import capital goods and export consumer goods grow faster than those that export capital goods. The evidence suggests that African countries and developing countries in general would benefit from trade most by promoting exports of labor-intensive goods and services while encouraging imports of capital goods (Lopez 1991). This implies that the current export boom which is driven by capital-intensive sectors such as oil is not likely to generate growth that is sustainable, especially because of the low gains in employment creation and limited spillover effects on non-oil sectors.

To gain from trade liberalization, a country must have adequate industrial strategy that fosters economic diversification.<sup>1</sup> The failure of trade liberalization to promote trade expansion is partly attributable to the lack of effective national industrial policies to enhance diversification of the production and export base. The narrow export base has exposed African countries to the vagaries of international markets, resulting in high volatility of export proceeds and exchange rate instability (Bleaney and Greenaway 2001). Indeed, economic vulnerability has been shown to be one of the major factors that have prevented African countries from achieving high growth rates on the one hand, and sustaining high growth rates on the other (UNECA 2006; Fosu 2001; Guillaumont et al. 1999).

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<sup>1</sup> See Ben Hammouda et al. (2006) for detailed discussion of diversification regimes and trends in African countries.



The weak effects of trade liberalization on growth may thus be due to insufficient focus by policy makers on factors that make liberalization work. Unless accompanying policies are implemented to provide an environment that is conducive for trade, investment, productivity, and private sector activity in general, the effects of trade liberalization will be only marginal (UNCTAD 2005). The lack of effective accompanying policies to trade liberalization may explain weak growth gains from liberalization in various ways. In particular, due to ineffective investment promotion policies, the gains from trade expansion are not translated into economic diversification and growth. Moreover, inefficient management of foreign reserves may also prevent countries from benefiting from trade expansion. Indeed, foreign exchange proceeds are often stored into idle reserves instead of being absorbed into the economy and invested into productive activities. While African oil-exporting countries have experienced substantial trade account surpluses and high saving rates, this has not translated into commensurate increases in investment in non-oil sectors (UNECA 2006). This raises concerns about the sustainability of oil-led growth. Furthermore, the underdevelopment of African financial systems, which are characterized by pervasive inefficiencies in financial intermediation may also explain weak transmission from trade liberalization to growth. Indeed, even when countries experience expansion in trade, the resulting increases in savings do not stimulate investment due to inefficient financial intermediation.

Therefore, it appears that the broader institutional environment is key to the transmission from trade liberalization and trade expansion to growth. This suggests that weak institutions and an inadequate economic policy framework may be partially responsible for the weak growth gains from trade liberalization in African countries. However, the

empirical literature has thus far been unable to establish a robust role of institutions in the linkage between trade and trade liberalization on the one hand, and trade liberalization and growth on the other. Dollar and Kraay (2003) suggest that growth regressions including both institutions and trade may yield insignificant results for both trade and institutions due to the high correlation between the two determinants of growth. By taking into account this relationship, Dollar and Kraay (2003) find a significant joint effect of trade and institutions on growth in the long run but a larger role of trade alone on growth in the short run. This suggests that good institutions are critical for the ability of a country to generate long-run growth gains from trade liberalization. The results suggest that the weak growth benefits from trade liberalization in African countries may be due to inefficient institutions. This paper explores this hypothesis further while also paying attention to other non-institutional factors of growth.

### **3. Empirical analysis: methodology, data, and estimation results**

#### ***3.1 Model specification and estimation methodology***

We use panel data from 39 African countries covering the period 1975-2001. However, data are not available for the same period of time for all countries, thus the panel is unbalanced. The model to be estimated is the following:

$$y_{it} = \alpha y_{it-1} + \beta x_{it-1} + \gamma z_{it} + v_i + \varepsilon_{it}$$

Where  $y_{it}$  is the natural logarithm of per-capita real income in country  $i$  at time  $t$ ,  $x_{it}$  is a vector of predetermined and endogenous variables,  $z_{it}$  is a vector of exogenous variables, and  $\alpha$ ,  $\beta$ , and  $\gamma$  are parameters to be estimated. We assume that  $v_i$  and  $\varepsilon_{it}$  are independent over all time periods and for each country  $i$ . The term  $v_i$  represents country-specific

random effects which are independent and identically distributed over the countries, and  $\varepsilon_{it}$  is also independent and identically distributed.

We estimate the model using Arellano-Bond Generalized Method of Moments (GMM) estimator (Arellano and Bond 1991). Tests for autocorrelation and the validity of instruments (Sargan test) are presented along with the coefficient estimates in Tables 2-5.

The variables used in the empirical estimations are described in the next subsection.

### ***3.2 Description of the data***

The list of the countries included in the sample is given in Appendix A. The countries are selected based on data availability. We use data from the World Bank's World Development Indicators for income per-capita, openness (defined as the sum of exports and imports as a percentage of GDP, in log), domestic investment as a percentage of GDP (log), total reserves (log), credit to the private sector as a percentage of GDP (log), and adult literacy as a measure of human capital. Our measure of institutional quality is the Polity 2 variable from the Polity IV project. This variable is measured on a -10 to 10 scale, with higher values indicating better institutions. We also include data on indicators (indices) of export concentration (the ogive index) and diversification (the entropy index) from a newly developed dataset (Ben Hammouda et al. 2006). The first indicator, called the ogive index, measures the extent of export concentration, with higher values indicating higher concentration (lower diversification). The second indicator, called the entropy index, measures the extent of diversification in exports, with higher value implying higher diversification. Details on how these indices are calculated are given in Appendix B. We include dummy variables for Northern Africa (Algeria, Egypt, Morocco and Tunisia) and Southern Africa (Botswana, Lesotho, Mauritius, Namibia, South Africa,

Swaziland and Zimbabwe) to account for the fact that these subregions comprise more advanced economies, especially in terms of financial development and economic diversification. Information on ‘ethnic tensions’ is only available for the period 1982-1997. Thus regressions including this variable cover a shorter time span. Descriptive statistics for selected variables and periods are reported in Table 1.

We include domestic investment and human capital (proxied by literacy), which have been proved to be robust determinants of growth. Both variables are treated as endogenous. We provide a discussion of the rationale for the inclusion of the other variables in the next two paragraphs.

In many developing countries, export proceeds have not been well intermediated in the financial system. An underdeveloped financial system is unable to absorb sizeable foreign exchange inflows and minimize exchange rate instability. Furthermore, it is unable to allocate the resources into the most profitable activities. We therefore need to control for the role of financial development by including an indicator of financial development into the growth equation. This is beyond the fact that financial development has been demonstrated to affect long-run growth. We use domestic bank credit to the private sector as a measure of financial development. Given the possibility of two-way causation between growth and finance, the indicator of financial development is treated as endogenous.

High volatility of exports can retard growth through exchange rate instability. We control for this effect by adding an indicator of real exchange rate instability, measured as the

annual deviation (in absolute value) of the real exchange rate index from a time trend.

This variable is treated as exogenous.

Export booms (and aid inflows) have allowed many countries to accumulate substantial amounts of reserves. This is particularly evident for oil-rich countries during episodes of high oil prices. Excessive accumulation of reserves, however, may not help growth – they are sterile resources. We control for this effect by including reserves in the growth equation. We use the logarithm of total reserves (including gold). We treat this variable as exogenous.

The measures of export concentration and diversification are included in the model to explore whether, as theory predicts, diversification of exports (which indicates diversification of production) is associated with higher and more sustained growth. It is expected that a more diversified economy is able to withstand shocks to production and exports and thus minimize volatility of growth. We test this prediction in the case of African countries.

Finally, the model includes an indicator of ethnic fractionalization. We use the variable ‘ethnic tensions’ from the International Country Risk Guide (ICRG) database as a measure of ethnic fractionalization. This variable is measured on a 0-6 scale, with higher values implying lower ethnic tension. Ethnic tensions tend to be high in countries with high fractionalization. Several studies have shown that ethnic fractionalization or ethnic heterogeneity has a negative effect on growth. The effect could arise through the effects of ethnic tensions on private investment and public expenditure on education and health (Mauro 1995, Easterly and Levine 1997), or through increased incidence (and the

probability) of internal armed conflicts which destroy economic activity (Collier and Hoeffler 1998, Addison and Baliaoune-Lutz 2004). It has been shown that the effect of ethnic fractionalization may be nonlinear (Addison and Baliaoune-Lutz 2004). Thus, we consider a quadratic specification of the linkage between ethnic tensions and growth. The data on ethnic tensions start in 1982 and end in 1997. The variable ‘ethnic tensions’ is treated as predetermined.

### ***3.3 Discussion of the results***

We use the Arellano-Bond GMM estimation technique with income per-capita (in log) as the dependent variable. We treat the variables ‘literacy’, ‘institutional quality’ and ‘openness to international trade’ (and their interactions) as endogenous. In all regressions, the results of the Sargan test of over-identifying restrictions are in support of the null hypothesis that the instruments are valid.

Four sets of regression results are presented in Tables 2-5. Table 2 contains regression results for the full sample period 1970-2001 and the data from 39 countries, excluding the measure of ethnic fractionalization which is reported on a shorter time period, 1982-1997. Table 3 presents results including the measure of ethnic fractionalization. Table 4 contains results for the regressions exploring joint and threshold effects of the interaction between trade and institutions on the one hand, and trade and financial development on the other hand. Finally, Table 5 displays results from estimations including, in addition to the variables in Table 4, alternatively a measure of export concentration (Ogive index – columns 1-2) and a measure of export diversification (entropy index – columns 3-4).

In this section we highlight the key findings from the empirical analysis. First, trade openness has a positive and significant effect on economic growth only when we do not include ethnic tensions (Table 2), and/or interactions between trade and other relevant factors (as in Tables 3-5). Second, the results in Tables 4 and 5 clearly indicate that the joint effect of trade and institutions on growth is positive and robustly significant. The joint effects of trade and institutions on growth are non-monotonic and exhibit a U shape: when trade openness increases, good quality institutions enhance the growth engine of trade. This is because the good economic governance associated with high quality institutions translates into good strategies to manage export revenues and channel them in productive activities, which promotes growth. Third, the impact of institutions (the Polity 2 variable) is positive and fairly robust, once we account for the interaction between institutions and trade.

Table 5 displays the estimates including indicators of export concentration and diversification. In equations 1 and 2 we use the Ogive index (measure of concentration), while in equations 3 and 4 we use the Entropy index (measure of diversification). Recall that a high value of the Ogive index indicates higher concentration, while a higher value of the Entropy index indicates higher diversification. The results obtained with both measures are consistent. They show that, contrary to expectations, high concentration (low diversification) actually has a positive effect on growth in Africa. However this seems to be a correct illustration of the reality in Africa where countries which are least diversified have grown faster. In particular, oil-rich economies have grown faster than non-oil economies (Figure 1).<sup>2</sup> This was most evident in the past few years due to oil price hikes. In 2005-06, African oil economies as group grew by 6.1% compared to 4.9%

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<sup>2</sup> Table A2 in Appendix A gives the distribution of African countries by resource endowment.

for non-oil economies. Oil economies have posted double digit growth rates frequently, especially following discovery of oil or of new reserves or influx of FDI in the sector. In contrast, endowment in minerals does not seem to have given any edge in terms of growth (Figure 2). Thus, the association of export concentration and high growth in Africa is mainly an oil story, but not a mineral resource story.

In addition, the interaction between openness and concentration (Ogive index) has a negative and statistically significant coefficient (equation 2 in Table 5). The negative sign on the interaction between the export concentration index and openness to trade can be interpreted as the inability to sustain high growth led by resource booms. This is also consistent with the reality of very volatile growth in the continent. Alternatively, the positive sign of the interaction between the Entropy index and openness may suggest that in more open economies, diversification enhances the growth effects of increased openness. Diversification allows a country to sustain higher growth by increasing its resilience to shocks due to, among others, the vagaries of international commodity markets and weather changes.

It is worth noting that including measures of concentration did not alter the robust results in Table 4. In addition, now we have strong statistical evidence that landlockedness has a negative effect on growth, and total reserves have a positive impact. The latter result implies that African countries in general have not experienced negative growth effects of reserve accumulation and that the reserves accumulated may have been used to minimize risk, especially by protecting the exchange rate against shocks.



Three conclusions from the results are worth emphasizing. First, the results suggest that a country needs to reach a certain threshold of trade openness before it can reap the benefits of the growth-enhancing joint effects of institutions and trade openness. At high levels of trade, the quality of institutions plays a key role in the transmission of trade gains into growth. One possible explanation is that as trade increases, opportunities for embezzlement and other wasteful uses of resources increase, with damaging effects on growth. Good institutions are critical for channeling the proceeds from trade expansion into growth-enhancing activities, including investment. Moreover, good institutions are essential for managing trade booms to minimize economic instability.

The second conclusion is that poor quality of institutions prevents countries from reaping the benefits from trade booms. While trade booms may produce short-run growth, the ability of a country to sustain high growth is contingent upon the quality of its institutions. The evidence implies that poor quality of institutions may be one of the reasons for the failure of African countries to capitalize on trade gains associated with commodity export booms.

Third, the results confirm the advantage enjoyed by African economies in terms of growth as illustrated by the positive association between export concentration and real GDP growth. However, the results also indicate that export concentration will ultimately hurt growth as trade increases while diversification helps the country to sustain growth.

The regression results also confirm the role of factors which have been proved to be fundamental determinants of growth in the empirical literature. In particular, the results indicate that investment is positively and significantly related to growth. Exchange rate

instability undermines growth, an indication that economic instability is one of the reasons for slow growth among African countries. The variable ‘ethnic tensions’ seems to have an inverted-U relationship with income. Since ICRG assigns a higher value for lower tension (lower fractionalization), the results imply that as fractionalization (ethnic tension) decreases from very high levels (very low ICRG score) to medium levels, the impact on income (growth) is positive. However, as the score improves and ethnic tensions move to very low levels the impact on income becomes negative. This is not surprising; for example, Addison and Balamoune-Lutz (2004) find that there is a U-shape relationship between ethnic heterogeneity (where higher values indicate higher heterogeneity) and the success of peace-building. The variable ‘ethnic tensions’ has also been used in the literature to represent ethnic polarization (Keefer and Knack 1998). Thus, the results derived in this paper suggest that there is a level of polarization at which the positive effect on income is maximized and above which further decline in ethnic fractionalization could have a negative effect on growth.

Two regression results appear to be counterintuitive and deserve some explanation. The measure of human capital, literacy, has an insignificant coefficient, which implies that human capital (as measured here) has not played a significant role in growth in Africa. This is at odd with the evidence from the endogenous growth literature that identifies human capital as an important driver of long-run growth. However, in the case of African countries, the result could simply be an illustration of the fact that growth, which has been largely resource-led (especially oil), has often occurred in countries with very low levels of human capital. These countries have failed to invest adequate resources in building human capital through education. The lack of a significant positive relationship

between literacy and growth should be interpreted as reflecting this artifact of cross-country distribution of growth and literacy in African countries.

The result for financial development also needs some explanation. In most estimations, financial development is shown to be negatively related to growth, but its interaction with trade openness has a positive coefficient. However, regressions with a quadratic specification show that at high levels of trade, the joint effects of trade and financial development on growth are negative, which is contrary to expectations. This result could be an illustration of the fact that countries that have experienced trade booms in Africa tend to have low levels of financial development. Note that the inclusion of dummies for Southern Africa and North Africa, the two subregions with the most financially developed countries, reinforces this artifact. Therefore, the result should not be interpreted as a causal relationship but as a simple correlation illustrating the fact that financial development is low in many countries that have experienced trade-led growth.

#### **4. Conclusion**

In this paper, we have examined the questions of whether trade openness contributes to higher income and whether institutions influence the growth effects of trade. The empirical results indicate that, once we control for other factors, institutions have a robust and positive impact on growth. More importantly, institutions play an important role in the growth effectiveness of trade liberalization. However, the joint growth effect of institutions and trade has a U-shaped form. As trade openness reaches higher levels, improved institutional quality enhances the growth effects of trade. Export concentration has a positive direct effect on growth, which we interpret as a reasonable illustration of the oil-led growth observed in Africa in recent years. However, export diversification is

shown to enhance the growth effects of trade openness. We also find strong evidence supporting the role of other important factors of growth, especially the positive effects of domestic investment and negative effects of ethnic tensions, instability (as proxied by exchange rate variability) and landlockedness.

The evidence in this paper supports the view that one of the causes for the limited growth effects of trade liberalization may be the weakness of institutions. The empirical results suggest that institutions have an important influence on the effectiveness of trade policy (assuming that trade policy is strongly correlated with the volume of trade). This is consistent with the findings from empirical studies that conclude that institutions are crucial for the success of economic reforms in developing countries.

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Table 1. Descriptive statistics for selected variables

	Mean	Standard dev	Min	Max	Count
<i>Income (PPP)</i>					
1975-79	954.93	956.29	224.80	5111.50	170
1980-84	1322.01	1261.98	321.36	6607.50	187
1985-89	1681.42	1530.20	335.63	8026.40	199
1990-94	1928.40	1825.78	405.78	8279.40	208
1995-2001	2252.29	2252.29	448.00	11290.00	294
<i>Openness</i>					
1975-79	65.30	31.49	16.95	162.45	176
1980-84	65.99	35.04	6.32	178.99	189
1985-89	62.90	33.06	12.96	163.66	198
1990-94	67.32	33.89	15.20	172.18	208
1995-2001	71.65	33.84	20.82	181.77	299
<i>Adult literacy</i>					
1975-79	35.95	18.30	6.70	75.60	195
1980-84	40.95	18.79	7.90	78.40	195
1985-89	46.07	19.15	9.60	80.80	195
1990-94	51.26	19.19	11.40	84.00	195
1995-2001	57.18	19.07	13.50	89.34	273
<i>Ethnic tension</i>					
1982-84	2.88	1.24	1	5	66
1985-89	3.03	0.98	0.6	6	160
1990-94	2.97	1.20	0	6	165
1995-1997	3.84	1.19	0	6	97
<i>Polity</i>					
1975-79	-5.34	5.08	-10.00	9.00	204
1980-84	-4.99	5.31	-10.00	10.00	205
1985-89	-5.92	7.54	-10.00	10.00	205
1990-94	-2.25	5.82	-10.00	10.00	212
1995-2001	-0.12	5.31	-9.00	10.00	301
<i>Ogive index</i>					
1980-84	62.67	43.48	7.54	208.11	180
1985-89	69.97	52.98	2.15	212.84	180
1990-94	81.17	59.24	9.96	221.50	179
1995-2001	75.14	56.90	6.05	236.25	259
<i>Entropy index</i>					
1980-84	2.91	1.19	0.29	8.9	180
1985-89	2.75	1.33	0.13	6.82	180
1990-94	2.67	1.38	0.35	5.19	179
1995-2001	3.09	2.17	0.05	16.75	259

Table 2: Arellano-Bond GMM Estimation (excluding ethnic fractionalization)  
 Dependent variable: Income (per-capita income, in log)

	(1)	(2)	(3)
Income (lagged)	0.677*** (0.037)	0.6442*** (0.037)	0.640*** (0.037)
<b>Endogenous variables</b>			
Literacy	-0.099* (0.043)	0.028 (0.049)	0.046 (0.051)
Openness	0.037 (0.014)*	0.064** (0.025)	0.058** (0.026)
Investment	0.056*** (0.010)	0.054*** (0.010)	0.055*** (0.010)
FinDev	-0.008 (0.008)	0.052 (0.037)	0.051 (0.037)
Inst. Quality (Polity)	0.0008 (0.0008)	0.0011 (0.0008)	0.0011 (0.0008)
FinDev x Openness		-0.0158 (0.009)	-0.015 (0.009)
<b>Exogenous variables</b>			
Initial income	-0.0011 (0.0009)	-0.004*** (0.0097)	-0.005*** (0.0012)
Total Reserves	0.0009*** (0.0003)	0.0011*** (0.0004)	0.0011*** (0.0004)
Exchange rate instability	-0.011*** (0.003)	-0.013*** (0.003)	-0.012*** (0.003)
Landlocked	0.001 (0.001)		-0.0018 (0.001)
Northern Africa		0.0027 (0.002)	0.003 (0.002)
Southern Africa		0.010*** (0.002)	0.0117*** (0.002)
Constant	0.013** (0.006)	0.031*** (0.007)	0.037*** (0.008)
Number of obs.	741	741	741
Wald test-chi2	2110.91	2204.24	2211.95
Sargan test <sup>a</sup> , chi2 [prob>chi2]	783.80 [0.99]	788.39 [0.68]	787.72 [0.68]
M2 <sup>b</sup> , z ; [pr > z]	1.86 [0.06]	1.90 [0.057]	1.92 [0.055]

<sup>a</sup> Sargan test of over-identifying restrictions (Null: Instruments are valid)

<sup>b</sup> Arellano-Bond test that average autocovariance in residuals of order 2 is 0.



Table 3: Arellano-Bond GMM Estimation (including ethnic fractionalization)

Dependent variable: Income (per-capita income, in log)			
	(1)	(2)	(3)
Income (lagged)	0.7164*** (0.029)	0.6885*** (0.032)	0.6916*** (0.032)
<b>Endogenous variables</b>			
Literacy	-0.034 (0.061)	0.039 (0.067)	0.0440 (0.067)
Openness	-0.008 (0.0132)	-0.0058 (0.013)	0.051** (0.022)
Investment	0.050*** (0.012)	0.048*** (0.011)	0.047*** (0.012)
FinDev	-0.092 (0.007)	-0.010 (0.007)	0.079*** (0.030)
Inst. Quality (Polity)	-0.0001 (0.0007)	0.0003 (0.0007)	0.0003 (0.0007)
FinDev x Openness			-0.025*** (0.008)
Ethnic tensions	0.034** (0.013)	0.035*** (0.014)	0.038*** (0.013)
Ethnic tensions <sup>2</sup>	-0.0051*** (0.0021)	-0.0057*** (0.002)	-0.0059*** (0.002)
<b>Exogenous variables</b>			
Initial income	-0.0025** (0.001)	-0.0054*** (0.0017)	-0.0064*** (0.002)
Total Reserves	0.0014*** (0.0004)	0.0013*** (0.0005)	0.0014*** (0.0005)
Exchange rate instability	-0.019*** (0.004)	-0.0204*** (0.004)	-0.0203*** (0.004)
Landlocked	-0.0002 (0.0013)		-0.003* (0.001)
Northern Africa		0.0023 (0.0026)	0.0029 (0.0026)
Southern Africa		0.0087** (0.003)	0.0114*** (0.003)
Constant	0.0261*** (0.008)	0.0435*** (0.011)	0.0485*** (0.011)
Number of obs.	366	366	366
Wald test-chi2	1309.58	1345.26	1366.47
Sargan test <sup>a</sup> , chi2 [prob>chi2]	432.70 [0.99]	436.49 [0.39]	431.10 [0.92]
M2 <sup>b</sup> , z ; [pr > z]	-0.36 [0.72]	-0.34[0.73]	-0.51 [0.61]

<sup>a</sup> Sargan test of over-identifying restrictions (Null: Instruments are valid)

<sup>b</sup> Arellano-Bond test that average autocovariance in residuals of order 2 is 0.

Table 4: Arellano-Bond GMM Estimation (including interaction between trade and institutions)  
 Dependent variable: Income (per-capita income, in log)

	(1)	(2)	(3)	(4)
Income (lagged)	0.6355*** (0.037)	0.6346*** (0.037)	0.6952*** (0.032)	0.6670*** (0.032)
<b>Endogenous variables</b>				
Literacy	0.052 (0.051)	0.053 (0.051)	0.056 (0.068)	0.064 (0.067)
Openness	0.020 (0.030)	0.019 (0.027)	0.007 (0.025)	0.025 (0.025)
Investment	0.050*** (0.010)	0.050*** (0.010)	0.039*** (0.012)	0.037*** (0.012)
FinDev	0.005 (0.039)	-0.0028 (0.090)	0.033 (0.032)	-0.170** (0.068)
Inst. Quality (Polity)	0.089*** (0.023)	0.087*** (0.024)	0.078*** (0.021)	0.056** (0.021)
Inst. Quality x Openness	-0.045*** (0.013)	-0.044*** (0.012)	-0.041*** (0.011)	-0.029** (0.011)
Inst. Quality x Openness <sup>2</sup>	0.0057*** (0.001)	0.0056*** (0.001)	0.0052*** (0.0014)	0.0037** (0.0014)
FinDev x Openness	-0.0044 (0.010)	0.0130 (0.043)	-0.013 (0.009)	0.104*** (0.035)
FinDev x Openness <sup>2</sup>		-0.0022 (0.005)		-0.016*** (0.004)
Ethnic tensions			0.042*** (0.013)	0.0498*** (0.013)
Ethnic tensions <sup>2</sup>			-0.006*** (0.002)	-0.007*** (0.002)
<b>Exogenous variables</b>				
Initial income	-0.0052*** (0.0012)	-0.0052*** (0.0012)	-0.0061*** (0.002)	-0.0072*** (0.0017)
Exch. rate instability	-0.0117*** (0.003)	-0.0117*** (0.003)	-0.0182*** (0.004)	-0.182*** (0.004)
Landlocked	-0.0017 (0.0012)	-0.0017 (0.0012)	-0.0026 (0.0017)	-0.0027* (0.0016)
Total Reserves	0.0013*** (0.0004)	0.0012*** (0.0004)	0.0015*** (0.0005)	0.0015*** (0.0005)
Northern Africa	0.0026 (0.0022)	0.0026 (0.0022)	0.0019 (0.0027)	0.0036 (0.0027)
Southern Africa	0.0108*** (0.0023)	0.0109*** (0.0024)	0.010*** (0.0038)	0.0124*** (0.0038)
Constant	0.035*** (0.008)	0.036*** (0.008)	0.045*** (0.011)	0.052*** (0.0116)
Number of obs.	741	741	366	366
Wald test-chi2	2273.99	2270.67	1384.95	1455.92
Sargan test <sup>a</sup> , chi2 [prob>chi2]	779.55 [0.91]	778.18 [0.99]	418.71[0.99]	425.32 [0.99]
M2 <sup>b</sup> , z ; [pr > z]	1.58 [0.11]	1.58 [0.11]	-0.54 [0.59]	-0.60 [0.55]

<sup>a</sup> Sargan test of over-identifying restrictions (Null: Instruments are valid)

<sup>b</sup> Arellano-Bond test that average autocovariance in residuals of order 2 is 0.

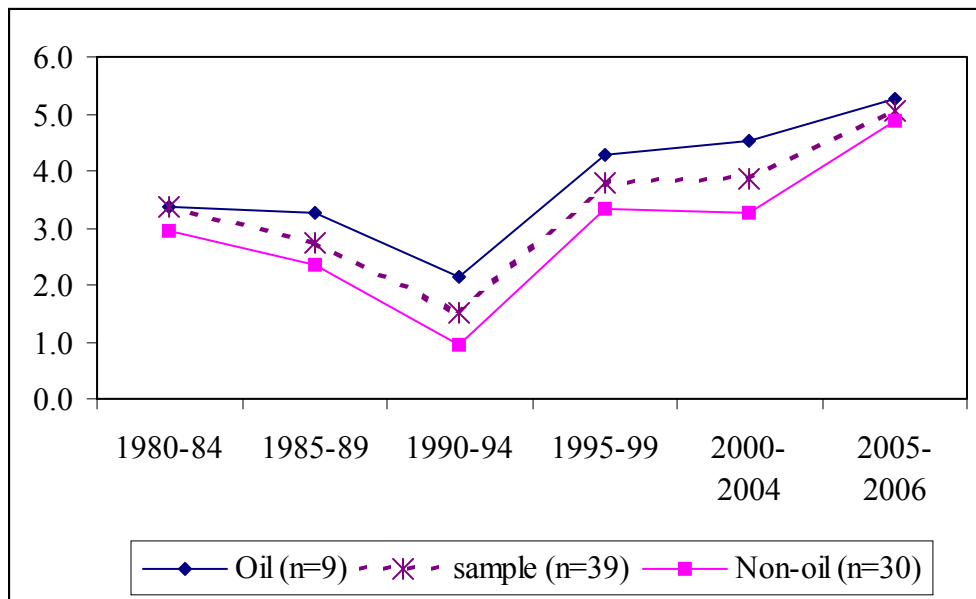
Table 5: Arellano-Bond GMM Estimation (including export diversification/concentration indices)

	Dependent variable: Income (per-capita income, inlog)			
	(1) with concentration (Ogive) index	(2) with concentration (Ogive) index	(3) with diversification (Entropy) index	(4) with diversification (Entropy) index
Income (lagged)	0.6654*** (0.034)	0.6690*** (0.034)	0.6755*** (0.034)	0.6760*** (0.0340)
<b>Endogenous variables</b>				
Literacy	0.046 (0.067)	0.045 (0.067)	0.046 (0.067)	0.039 (0.067)
Openness	0.029 (0.025)	0.068** (0.030)	0.034 (0.025)	0.0034 (0.031)
Investment	0.041*** (0.012)	0.040*** (0.012)	0.026*** (0.012)	0.035*** (0.012)
FinDev	-0.209*** (0.073)	-0.141* (0.078)	-0.203*** (0.073)	-0.161** (0.077)
Inst. Quality (Polity)	0.047** (0.022)	0.041* (0.022)	0.048** (0.022)	0.043* (0.022)
Inst. Quality x Openness	-0.023** (0.011)	-0.021* (0.011)	-0.024** (0.011)	-0.021* (0.011)
Inst. Quality x Openness <sup>2</sup>	0.0029** (0.001)	0.0026* (0.001)	0.0030** (0.001)	0.0027* (0.001)
FinDev x Openness	0.132*** (0.039)	0.098** (0.041)	0.127*** (0.039)	0.108*** (0.040)
FinDev x Openness <sup>2</sup>	-0.0208*** (0.005)	-0.016*** (0.006)	-0.0202*** (0.005)	-0.0183*** (0.005)
Ogive or Entropy index	0.00025*** (0.00008)	0.0022*** (0.0008)	-0.0061** (0.0023)	-0.058* (0.031)
Ogive or Entropy index x Openness		-0.0005** (0.0002)		0.0129 (0.007)*
Ethnic tensions	0.458*** (0.014)	0.042*** (0.014)	0.047*** (0.014)	0.045*** (0.014)
Ethnic tensions <sup>2</sup>	-0.0066*** (0.002)	-0.006*** (0.002)	-0.0065*** (0.002)	-0.0062*** (0.002)
<b>Exogenous variables</b>				
Initial income	-0.0089*** (0.002)	-0.009*** (0.0019)	-0.0091*** (0.002)	-0.0091*** (0.0019)
Exch. rate instability	-0.017*** (0.004)	-0.017*** (0.004)	-0.019*** (0.004)	-0.019*** (0.004)
Landlocked	-0.0042** (0.0016)	-0.0044*** (0.0017)	-0.0044** (0.0017)	-0.0044** (0.0017)
Total Reserves	0.0014*** (0.0005)	0.0016*** (0.0005)	0.0017*** (0.0005)	0.0018*** (0.0005)
Northern Africa	0.0064** (0.002)	0.0053* (0.002)	0.0047* (0.0026)	0.0041 (0.0026)
Southern Africa	0.019*** (0.004)	0.0181*** (0.003)	0.0185*** (0.004)	0.0177*** (0.004)
Constant	0.062*** (0.012)	0.062*** (0.012)	0.064*** (0.012)	0.063*** (0.013)
Number of obs.	332	332	332	332
Wald test-chi2	1313.80	1320.77	1306.56	1308.43
Sargan test <sup>a</sup> , chi2 [prob>chi2]	402.30 [0.99]	396.90 [0.99]	403.78 [0.99]	400.73 [0.99]
M2 <sup>b</sup> , z ; [pr > z]	0.24 [0.81]	0.30 [0.76]	0.33 [0.74]	0.28 [0.78]

<sup>a</sup> Sargan test of over-identifying restrictions (Null: Instruments are valid)

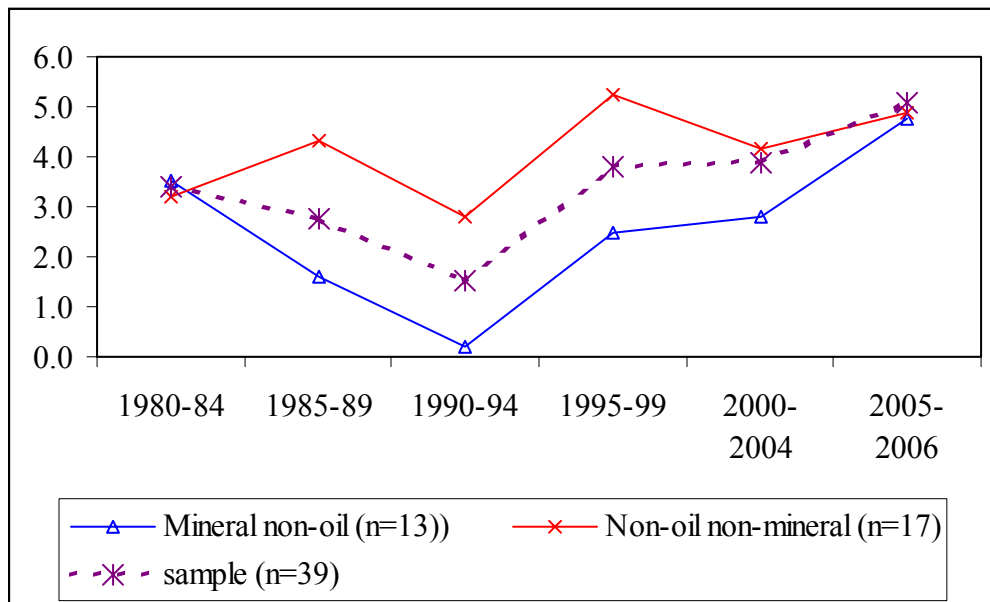
<sup>b</sup> Arellano-Bond test that average autocovariance in residuals of order 2 is 0.

Figure 1: Real GDP growth for oil vs. non-oil economies, 1980-2006 (% per annum)



Sources: World Bank, World Development Indicators 2006; Economist Intelligence Unit (online database).

Figure 2: Real GDP growth for mineral-rich vs. non-mineral non-oil African countries, 1980-2006 (% per annum)



Sources: World Bank, World Development Indicators 2006; Economist Intelligence Unit (online database).

## Appendix A

Table A1. List of countries

Algeria	Congo, Rep.	Mali	Senegal
Benin <sup>a</sup>	Egypt	Mauritius <sup>a</sup>	Sudan
Burkina Faso	Eritrea <sup>a</sup>	Malawi	Swaziland <sup>a</sup>
Botswana	Ethiopia	Morocco	Tanzania
Burundi <sup>a</sup>	Gambia	Mozambique	Togo
Central African Rep.	Ghana	Mauritania <sup>a</sup>	Tunisia
Cameroon	Guinea Bissau	Namibia	Uganda
Democratic Rep. of Congo <sup>a</sup>	Kenya	Niger	Zambia
Chad <sup>a</sup>	Lesotho <sup>a</sup>	Nigeria	Zimbabwe
Cote d'Ivoire	Madagascar	South Africa	

<sup>a</sup> Data on ethnic tensions in these countries are not available.

Table A2. Classification of African countries (included in this study) by resource endowment (oil and minerals)

Oil-rich countries	Mineral non-oil	Non-mineral non-oil
Algeria, Cameroon, Chad, Congo Rep., Côte d'Ivoire, Egypt, Nigeria, Sudan, Tunisia	Botswana, Central African Republic, Congo DR, Ghana, Mali, Mauritania, Mozambique, Namibia, Niger, South Africa, Tanzania, Zambia, Zimbabwe	Benin, Burkina Faso, Burundi, Eritrea, Ethiopia, Guinea Bissau, Gambia, Kenya, Lesotho, Madagascar, Malawi, Mauritius, Morocco, Senegal, Swaziland, Togo, Uganda

## Appendix B

### Concentration and diversification indices

Various measures of diversification and concentration of exports have been used in the literature (see Ali et al. 1991 and Ben Hammouda et al. 2006). In this paper we use two of these measures: the Ogive index which measures export concentration and the Entropy index which measures export diversification. The Ogive index is computed as follows:

$$Ogive\_index = \sum_{i=1}^N \frac{(P_i - 1/N)^2}{1/N}$$

The Entropy index is computed as follows:

$$Entropy\_index = \sum_{i=1}^N P_i \log_2(1/p_i)$$

In these formulas,  $N$  represents the total number of export commodities in the export portfolio (so  $1/N$  represents the mean export share for each commodity) and  $P_i$  represents the actual share of the  $i$ th commodity in total exports.

The lowest possible value of the Ogive index, which is zero, occurs when the share of export is distributed equally among commodities. Thus, higher values of the Ogive index imply higher concentration (or lower diversification). The maximum value of the Entropy index occurs when all the  $P_i$  are equal. This implies maximum diversification as all commodities in the export portfolio have identical share. Thus, higher values of the Entropy index imply higher diversification (or lower concentration).