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AN INVESTIGATION OF OPENNESS AND ECONOMIC GROWTH USING PANEL ESTIMATION

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and
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Abstract

This paper examines the impact of trade openness on economic growth for the SADC region in Africa over the period of 1990 to 2003. Based on a structure consistent with the endogenous growth theory, we find that trade openness have had a strong positive impact on economic growth in this region over this period. Our results are robust across alternative specifications and methodologies. The study also highlights the role of education in strengthening the effect of openness on sustainable growth, via better absorption of knowledge and technological spillovers from trade liberalization.

Keywords: Trade Openness; Growth; Endogenous Growth Theory.

JEL Classification: F15; H51; H52; N17; O47; R11.

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1 INTRODUCTION

Africa is embedded with an abundance of natural resources and this in turn, can be considered as a comparative advantage in terms of trade. But unfortunately, due to the immense lack of human and physical capital, Africa is still facing the dilemma of poverty. In this regard, economic regional integration for Africa plays a significant role in providing opportunities to expand trade, pool resources for investment, enlarging the domestic markets by utilizing the advantages of the economies of scale.

Thought, the main objective of this study is to analyze the importance of the relationship between trade and growth, we also empirically identify other determinants which might have an impact on economic growth, using a Panel data estimation technique for countries within the SADC region. Our analysis, in turn, provides a framework for the analysis of trade policy for the region and Africa overall.

The Southern African Development Community (SADC) came into existence in 1980 and was formerly known as the Southern African Development Coordination Conference (SADCC). The SADCC was initially established with the main aim of coordinating development projects to reduce economic dependence on the then apartheid South Africa. Today the SADC region has grown from members consisting of nine African states to fifteen in total¹. The community not only tries to ensure sustainable economic growth but also improve the standards of living and quality of life, freedom and social justice and peace and security for the people of Southern Africa. Being part of Africa, the SADC region has been challenged to adjust their economies to the rapid pace of globalization² and progressive opening up of national economies to trade and factor markets. The region is relatively small when compared to the rest of the world and, thus, cannot compete internationally due to trade barriers. In order to stimulate economic growth and export competitiveness, international trade and openness are essential to the region's

¹ The region is comprised of the following countries: Angola, Botswana, Democratic Republic of Congo, Lesotho, Malawi, Mauritius, Mozambique, Namibia, South Africa, Seychelles, Swaziland, United Republic of Tanzania, Zambia and Zimbabwe.

² This term refers to increasing integration of national economies through cross-border transactions.

development, since international trade has for a long time been hailed as an engine of growth (Strydom, 2003).

As stated earlier, this study aims to identify factors that boost economic growth, and, in turn, provide a better understanding of the existing ambiguity in the literature between trade and economic growth. The relationship between trade and economic growth has been extensively discussed in economics³. Many of the studies done previously have concentrated in areas of East Asia and other developing countries to explain their rapid growth records. Developing countries have expanded their share of international trade and investment significantly over the past decade. Opening up to international trade and reducing barriers to capital flows have been both, thought to improve the prospects for economic growth, with consequent improvements in per capita incomes. Note successful development delivers improved living standards. This is not simply a matter of raising gross domestic product (GDP) per capita, but also involves other factors that lead to an enhanced quality of life, such as lower poverty and longer life expectancy (Pain, 2000).

The major highlights of our study can be outlined as follows: To the best of our knowledge, this is the first paper to investigate the relationship between trade and economic growth for the SADC region. Compared to the literature, it is a more general study, since it is based on a wider set of variables consistent with the endogenous growth theory. To check for robustness of the results obtained from standard panel estimation techniques, a Generalised Least Squares (GLS) specification has also been used. This specification helps us correct for cross-sectional heteroscedasticity and contemporaneous correlation. Moreover, to account for the initial growth effects and to accommodate for the role of dynamicity, we carry out a Generalised Method of Moments (GMM) estimation of our model. Finally, our paper, along the lines of Chang et al. (2005), incorporates the role of complimentary reforms in shaping the relationship between openness and growth.⁴

³ See the section on literature review for further details.

⁴ It must, however, be pointed out that unlike our study, in Chang et al. (2005) the time series component of their panel is based on 5 year averages. They also use a broader data set, but we include a larger number of relevant control variables in our alternative models.

The paper is organized as follows: Besides the introduction and conclusions, Section 2 presents an elaborate literature review of the relationship between trade and growth. Section 3 presents the empirical analysis involving the discussion of the alternative econometric models, the methodologies used and the results, besides the data.

2 LITERATURE REVIEW

The importance of economic growth and development has always been an interesting topic for economists. Reasons for such interests are simply due to the fact that economic growth is variable among nations. Generally, economic growth is a result of greater quantity and better quality of natural, human, and capital resources, and also technological advances that boosts productivity. On the other hand, economic development is the process by which a nation enhances its standard of living.

Theories of economic growth and trade relations can be traced back to Adam Smith's and David Ricardo's theories of absolute and comparative advantage, respectively. Early neoclassical growth models such as Solow (1957), however, assumes that technological change is exogenous, which in turn, implied that there is no role of policy, inclusive of trade policies, on economic growth. The emergence of the endogenous growth theory due to the contributions of Romer (1986), Lucas (1988), and Barro (1990), have led to advanced growth models, where the technological change is endogenous and, thus, has a long term growth effect because of the benefits of the increasing returns to scale as a result of higher specialization. The endogeneity of the growth process, in turn allows for the role of policies, both in closed and open economy frameworks.

Grossman and Helpman (1992) were the first to develop an open economy endogenous growth model. They suggested that a country's openness to trade plays a pivotal role in technological change and, hence, growth, since opening of an economy tends to improve the standard of living and the quality of life for residents, and, thus, enables them to import more goods and services from abroad. Given that imports from the rest of the

world usually involve adopting new technologies, the production processes tend to become more efficient yielding higher economic growth. Based on the endogenous growth theory, though, one would usually associate growth of an economy to be a result of an expansion in exports (following increased productivity) which, in turn, affects trade positively, the endogenous growth theory suggests that trade openness results in knowledge spillovers across countries, thus increasing productivity, natural resources and human capital and, hence, growth (Sohn and Lee, 2005). Similarly, Chang et al. (2005) state that openness promotes the efficient allocation of resources through comparative advantage, allows the dissemination of knowledge and technological progress, and encourages competition in domestic and international markets. This implies that openness is expected to have a positive impact on economic growth.

A pertinent question, in this regard is whether trade-driven growth has a long-term or a short-term effect? More rapid growth may be a transitional effect rather than a shift to a different steady state growth rate, but since, the transition takes a couple of decades or more, it is reasonable to speak of trade openness as accelerating growth, rather than merely a sudden one time adjustment in real income (Dollar and Kraay, 2001). Furthermore, Easterly (2000), explains that growth regressions have become a standard tool for explaining variations in growth and not the determinants of economic growth. In contrast, the standard determinants of growth in growth regressions like financial development, black market premiums, real overvaluation, educational attainment, life expectancy, fertility, and infrastructure got steadily more favorable for growth from the 60s through the 90s.

It is not until recently, that a growing academic consensus has emerged regarding both trade policy openness and higher ratios of trade volumes to GDP to be positively correlated with growth, even after controlling for a variety of other growth determinants (Wacziarg and Welch, 2003). The relationship between trade and growth has, however, been proven to be weak empirically, since, there is very little evidence linking the role of trade to economic growth and development. Authors such as Dollar (1992); Sachs and Warner (1995) and Edwards (1998), have all tried to link trade policy to economic

growth. Their main findings suggests that trade openness is associated with economic growth. In addition, Frankel and Romer (1999) also examined the relationship between trade and growth. They use instrumental variables (geographic components of the countries) as measures of the effect of trade on income. They concluded that trade does have a positive effect on economic growth which is stimulated by physical and human capital investment. Similarly, Levine and Renelt (1992) have found trade to be positively related to economic growth when investment is excluded from the regression as a control variable, however, trade and investment is linked positively. On the contrary, Rodriguez and Rodrik (2001) and Baldwin (2003) have argued that there is no link between trade and economic growth. The relationship cannot be identified because of the failure to capture the impact of trade on economic growth.

Lederman and Maloney (2002) examined the relationship between trade structure and economic growth, using proxies and alternative control variables to check for robustness of the relationship. Their results showed that natural resource abundance does relate to growth positively, whilst, export concentration does tend to lower economic growth. In line with their study, Lawrence and Weinstein (1999) showed that economic growth is attributed to imports instead of exports. An economically sensible way of achieving industrialization seemed to be to restrict imports of manufactured goods, for which there already exists a domestic demand, in order both to shift this demand towards domestic producers and permit the use of the country's primary-product export earnings to import the capital goods needed for industrialization (Balwin, 2003). Thus, it implies that imports will not necessarily hamper developing economies if it encourages domestic production. It can be seen as a helping hand for the infant industry in developing countries. The firms can import intermediate goods that are essential to produce final goods within their own country, and, in turn, generate income by exporting it to other countries. It must be pointed out that the least developed countries' share in the world trade is an insignificant amount of 0.5 percent. Studies suggest that the increase in exports from these countries would have huge benefits for the population, in terms of income and employment in export-oriented sectors, and particularly for agriculture, food processing industries, textiles, and clothing (Spanu, 2003). However, in a study on the

impact of growth enhancing policies on income by Dollar and Kraay (2001), showed that in a large sample consisting of 80 countries, there is no significant correlation between trade volume and the changes in the income share of the poorest.

Wacziarg and Welch (2003) showed that trade liberalizing countries tend to gain higher volumes of trade, investment rates and also economic growth rates. The results imply that political stability does play an important role for trade liberalization to affect economic growth positively. Bolaky and Freund (2004) used a large sample of cross-country regressions in level and changes of per capita GDP. They tested whether trade effect on growth is dependent on a country's regulations or not. Their results showed that trade openness do promote economic growth in a positive way but only in countries where it is not excessively regulated. With the given results, they concluded that trade liberalization is enhanced through regulatory reform. This finding is in line with Grossman and Helpman (1992), who had indicated that protection could raise the long-run growth if government intervention in trade encourages domestic investment along the lines of comparative advantage.

A more recent study by Chang et al. (2005), examined how the effect of trade openness on economic growth depends on complementary reforms that helps a country take advantage of international competition. Their analysis is based on the Harris-Todaro model and showed that when labour markets are more flexible, trade liberalization will increase per capita income. A non-linear growth regression is estimated to test the growth effects of openness on structural characteristics. Trade openness is interacted with proxies of education, investment, financial depth, inflation stabilization, public infrastructure, governance and labour market flexibility. Their results showed that economic growth is positively correlated with openness if certain complementary reforms are undertaken.

From the above discussion, it is evident that the relationship between trade and growth is subject to immense ambiguity and depends critically, on the sample of countries, the definition of trade openness, and other control variables. Thus, to draw appropriate trade policies for a specific region, it is important to analyse the region all by itself by

including a wider set of variables, besides, trade openness, which are expected to have a positive influence on growth. The results obtained from this study can, then, be compared to the main findings of past studies related to this topic and be used as a guideline to ensure consistency and robustness of the results, based on the empirical model discussed in the next section.

3 EMPIRICAL ANALYSIS

This section examines the structural factors that may have an effect on economic growth. For this purpose, we work with panel data where observations are pooled on a cross-section over periods of time. We begin with a linear growth regression specification and then extend it to account for interaction terms. The interaction terms are between a variable to measure for openness and the various structural factors such as education, financial depth, public expenditure on education and health and the inflation rate.

3.1 Empirical Specification

The sample used in this study consists of African countries that belong to the SADC region. Table A.1.1, in Appendix 1, provides a list of countries used in the sample. Note the dataset ranges over a period of fourteen years from 1990-2003.

The growth regression models estimated are specified as follows:

$$GROWTH_{it} = \beta_0 + \beta_1(EDU)_{it} + \beta_2(FDI)_{it} + \beta_3(FIN)_{it} + \beta_4(GOV)_{it} + \beta_5(INF)_{it} + \beta_6(INV)_{it} + \beta_7(OPEN)_{it} + \beta_8(TOT)_{it} + \gamma_{it} \quad (3.1.1)$$

$$GROWTH_{it} = \beta_0(GROWTH)_{it-1} + \beta_1(EDU)_{it} + \beta_2(FDI)_{it} + \beta_3(FIN)_{it} + \beta_4(GOV)_{it} + \beta_5(INF)_{it} + \beta_6(INV)_{it} + \beta_7(OPEN)_{it} + \beta_8(TOT)_{it} + \gamma_{it} \quad (3.1.2)$$

where: *GROWTH* is the growth rate of GDP
EDU is the education level
FDI is the foreign direct investment
GOV is the government expenditure level
INF is the inflation rate
INV is the domestic investment level
OPEN is the openness level
TOT is the terms of trade

The term β_0 represents the constant intercept and the γ represents the stochastic error term. The subscript “*it*” denotes the number of cross-sections and time period. The variables are in ratios and also logarithmic form where possible. The dependent variable is the growth rate as measured by GDP. Equation (3.1.1) defines our benchmark growth regression model but in equation 3.1.2, when the lagged value of *GROWTH* is included as an explanatory variable, we apply the GMM estimation technique. The set of explanatory variables included in the growth regression specifications are based on the endogenous growth theory and can all be considered to be important determinants of economic growth. Table A.2.1, in Appendix 1, presents the sources and detailed explanation of the variables. A few proxies are used for some of the explanatory variables. The percentage enrolment rate of secondary education is used as a measure of human capital, while, financial depth is measured by the domestic credit provided by the banking sector as a percentage of GDP.

Below in equation 3.1.3, equation 3.1.1 is modified to include interaction terms to examine the role of complimentary factors in determining the role of openness on growth.

$$GROWTH_{it} = \beta_0 + \beta_k(X)_{it} + \beta_j(OPEN)_{it} * (Z)_{it} + \gamma_{it} \quad (3.1.3)$$

The term X_{it} represents the structural variables as presented in equations (3.1.1) and (3.1.2) and $(Z)_{it}$ is a subset of the variables in X_{it} and includes the measures of education, financial depth, inflation and government expenditures in health and education, while β_k

and β_j are the corresponding coefficients vector with dimensions of 1×8 and 1×4 , respectively.

3.2 Expected signs of the variables

Before proceeding to the estimation methodology, it is important to analyze the expected signs on the coefficients of the explanatory variables, based on intuition derived from economic theory. Table 3.2.1 lists the explanatory variables with their expected sign.

Table 3.2.1 Expected signs of the variables

| Variable | Theory intuition | Expected Sign |
|----------|--|---------------|
| EDU | Attainment of human capital is important for a country to specialise. It allows a nation to produce at an increasing rate with the given human capital stock. | Positive (+) |
| FDI | Foreign direct investment is positively related to the economic growth only when the host country has a great capacity in human capital and financial depth. | Positive (+) |
| FIN | Financial depth is the domestic credit that is provided in the banking sector. The amount of domestic credit given may indicate that a country will have less foreign liabilities and thus encouraging economic growth. | Positive (+) |
| GOV | Government expenditure increase may have a positive impact on economic growth because government may encourage production by increasing subsidies to producers; public spending on the economy may improve infrastructure conditions and thus improving education and living conditions. | Positive (+) |
| INF | Inflation in the economy will cause production to slow down since products are produced at higher prices. | Negative (-) |

| | | |
|------|---|--------------|
| INV | Domestic investment is linked to the development of human capital. Investments can be seen as a source of capital stock a country holds. | Positive (+) |
| OPEN | Openness relative to economic growth is generally positive. As the total trade increases within an economy, economic growth is stimulated. | Positive (+) |
| TOT | Terms of trade is defined to be exports taken as a ratio of imports. It is seen as a measure for openness in economic growth. If the terms of trade improve, exports will dominate imports thus it will spur economic growth. | Positive (+) |

Source: Own

3.3 Estimation Methodology

To start off our analysis we perform the panel unit root tests to ensure that our chosen macroeconomic variables are stationary and, hence, our correlations are not spurious. The tests include an intercept and a trend. Based on the Levin, Lin and Chu (LLC) unit root tests, reported in Table A.3.1, we find that all the variables are stationary.

Once we have ensured that all our chosen variables are stationary we can now estimate the alternative growth regressions specified in equations (3.1.1), (3.1.2) and (3.1.3). First we carry out OLS based pooled regressions. However, since the test of poolability, reported in Table A.3.2, indicates that the model is not poolable. Hence, we cannot lay much emphasis on the results obtained, and, in turn, estimate a fixed effects model. Note due to issues of degrees of freedom we restrict ourselves to the fixed effects model only, and, hence, ignore the random effects model. Moreover, unlike the fixed effects model, the random effects model suffers from the problem of serial correlation⁵. The test for serial correlation is provided in Table A.3.2. The fixed effects model is first estimated

⁵ The tests for serial correlation in the random effects model have been suppressed in this paper to save space. But can be made available upon request.

using OLS and then GLS. The GLS imposes a more complicated variance structure to take account for problems of cross sectional heteroscedasticity and contemporaneous correlation. This helps us in providing a robustness check to the results obtained from the fixed effects model based on OLS. Note the fixed effects model is also estimated via OLS and GLS by including the interaction terms.

When we include the lagged dependent variable in the growth regression 3.1.2, the Generalised Method of Moments (GMM) estimation is used. This is to avoid the problems of inconsistent and biased OLS estimators. The GMM estimator is applied by specifying a set of instrumental variables. To solve for inconsistency and biased estimates, Arellano and Bond (1991) introduced a method of first differencing. One disadvantage of using this first differenced method is that it may become less informative in the presence of persistent effects within the data. A new estimator is then introduced by Arellano and Bover (1995) and Blundell and Bond (1997) to solve for biased estimates. This is a combination of first differencing and taking the regressions in levels by transforming the data using orthogonal deviation. Our model, unlike, Chang et al. (2005), also uses the method of orthogonal deviations, besides, the standard first differencing method, to identify if our results change under the GMM estimation.

3.4 Results

Regression results are presented in Tables B.2.1 through B.2.3 in Appendix 2. As noted above, growth models with alternative specifications were estimated using OLS, GLS with cross-section SUR weights and GMM methods of estimations. Interaction variables of openness with education, inflation, financial depth and government expenditure were also included in testing the role of complementarity of these factors with openness in having an effect on economic growth. The dependent variable is “GROWTH” and eight explanatory variables, as described in Table A.2.1, are included to explain growth.

Even, though, the test of poolability implies that the economies are not poolable, the OLS and GLS estimation of the *pooled regression* model, given by equation 3.1.1, gives us an initial idea as to how the variables tend to affect growth. However, we do not place much emphasis on them due to obvious reasons. The results show that openness is positively related to economic growth at a significance level of 5%. This is in accordance with the expected sign. However, the coefficient on the terms of trade, government expenditure and financial depth are negative but are small in absolute value. The variables “FDI, EDU and INV”, on the other hand, are positively correlated with economic growth but the coefficients are insignificant. However, with the GLS specification for the model, the coefficients of education and foreign direct investment shows a positive correlation with economic growth and is also significant. This is consistent with the recent empirical literature discussed above. The adjusted R-square increases when weights are included in the model in comparison to the OLS. The model produces quite a good fit in terms of the R-square and adjusted R-square.

When the country *fixed effects*⁶ are included in equation 3.1.1, the coefficients of openness and domestic investment are both significant and strongly positive with respect to economic growth for the regression model estimated with Least Squares Dummy Variable (LSDV) approach. Financial depth is the only variable that has a negative effect, but is insignificant. For the model re-estimated with GLS openness continue to have a strong and significant positive effect. The variables which are also significant and positively correlated to economic growth are “FDI, TOT, INV, GOV and INF”. A positive and significant effect of inflation is however contradictory to the standard-growth inflation relationship.⁷ Finally, the coefficient on education is positively related to economic growth but is insignificant. Based on the underlying economic theory of endogenous growth, one would expect that human capital investments to have a

⁶ For the fixed effects model, estimated with OLS and GLS and with and without interactions, the countries that had a negative influence on growth over the chosen period were: Angola, Lesotho, Malawi, Mozambique, Namibia and Swaziland.

⁷ For a detailed summary on the relationship between growth and inflation, see Chari et al (1995). The authors indicate, empirically, the possibility of a growth-inflation trade-off. Hence, our, results, even though, counterintuitive, have been previously encountered.

beneficial impact on growth, but the insignificant coefficient of education can possibly be attributed to the low literacy rates in our chosen economies.

As far as equation (3.1.2) is concerned we apply the *GMM*⁸ estimation technique based on both first differences and orthogonal deviations. Note in here, the lagged value of the dependent variable, GROWTH, is also included as one of the regressors. The negative coefficient on the lagged value of growth shows evidence of convergence in the SADC region. This means that the poorer countries will catch up to the richer countries at a faster pace and thus we have a greater persistence of economic growth. The coefficient for openness is again found to be strongly positive and significant with respect to economic growth. In the GMM estimation with first differencing, except for the measure of inflation, all the variables possesses the anticipated positive sign. However, with orthogonal deviations, the variable measuring the effect of government expenditures on health and education has a negative effect. The rest of the variables continue to have the same signs as in the GMM estimation with first differencing.

Essence of the results tend to remain the same when we include the interaction terms in the fixed effects model, estimated with OLS and GLS, and the GMM estimated model. However, we can now produce a negative growth inflation relationship, as expected, but the effect of education in the GLS model is now negative and surprisingly significant. Recall, that the interaction terms tries to identify whether openness requires complimentary factors to influence growth. For the fixed effects model estimated with OLS and GLS, the interaction terms included, between openness and government expenditures on health and education and openness and financial depth have positive coefficients. This implies that economies where government spends more on education and health and is relatively financially developed, openness will have a positive effect on growth. However, the signs on the interaction terms between openness with education

⁸ The years which had a negative influence on growth in the GMM model estimated using first differences were: 1992, 1998, 1999, 2000 and 2002. With orthogonal deviations, however, we identified, 1993, 1994, 1995, 1996, 2001 and 2003 as the years having a negative impact.

and inflation, respectively, are counter-intuitive. The GMM⁹ estimation with interaction terms, estimated with first differences and orthogonal deviations, tend to indicate that in economies where government tends to spend more on education and health, openness will deteriorate growth. In fact, the direct effect of the government expenditures is also negative though insignificant. However, as with the fixed effects model, results indicate that openness in financially developed economies will tend to have a positive impact on growth. Surprisingly, the results with the interaction variables tends to suggest that though inflation negatively influences growth on its own, economies with high inflation are more likely to have a positive influence on growth when the degree of openness increases. The negative coefficient on the interaction between openness and education highlights the importance of improving the quality and standard of education required to understand and incorporate better the spillover of knowledge and technology through openness.

4 CONCLUSION AND POLICY RECOMMENDATIONS

The SADC region comprises of developing countries within Africa. The low literacy statistic is one of the indicators to reflect the underlying poverty within these developing countries. Poor countries individually are unable to compete against the rest of the world in manufacturing local products and exporting it abroad. The need for economic integration is, thus, seen as a way to improve trade performance. Given that, over the years, there has been lot of progress made towards reducing trade restrictions within this region, we, in this study, test whether trade openness can be identified as an essential method of increasing economic growth.

This study utilises a host of explanatory variables, in line with current growth theory, along with openness to identify the most important factors that have affected economic

⁹ The years which had a negative influence on growth in the GMM model, with interaction, estimated using first differences were: 1992, 1993, 1998, 1999, 2000. In this case of interactions, with orthogonal deviations, we found 1993, 1994, 1995, 1996, 2000, 2001, 2002 and 2003 as the years having a negative impact.

growth in the SADC region over the period of 1990 to 2003. Using alternative estimation methods for our panel, which involves robust forms of estimation like the GLS which takes account of serial correlation between residuals and heteroscedasticity for covariances among cross-sections and the period of time, we show that openness had a strong and positive influence on growth, besides FDI and improvements in terms of trade. Positive role of education, government expenditures on health and education, financial depth and domestic investment were also identified. Moreover, similar results were found, when the GMM estimation is used for a model incorporating the role of the initial level of growth as a dependant variable. The GMM helps us to control for correlation problems of error terms that other methods are unable to accommodate for when a lagged value of the dependant variable is used as a regressor. We also showed that openness tends to have a positive influence on growth in economies where the financial sector is well-developed and government spends more on education and health. However, the negative complementarity relationship between education and openness on growth, though, each of them tends to have a positive influence individually, indicates the requirement to improve the current standard of education to ensure better understanding and utilization of knowledge and technology spill over through openness.

Our results, thus, clearly advocate policies of free trade to ensure continuous improvements in growth for the SADC economies. Hence, it is imperative to develop and implement appropriate fiscal, monetary and exchange rate policies that will facilitate trade. Moreover, policies improving domestic capital accumulation and financial sector development, along with education, cannot be ignored as well.

Given the importance of economic ambience in shaping the effect of openness on growth, an immediate extension of our current analysis would be to political instability and bureaucratic corruption into our growth regressions to identify whether the variables have a significant effect individually, and in interaction with openness. Moreover, it would be interesting to delve into the issue of developing a theoretical model which would formalize the channel through which openness affects growth. The model would tend to highlight the role of education, research and development to be specific, since openness

involves technology exchange. This, in turn, would help us emphasize the role of educational policies, in strengthening the effect of openness on growth.

REFERENCES

- Arellano, Manuel and Stephen Bond. 1991. "Some Tests of Specification for Panel Data: Montecarlo Evidence and an Application to Employment Equations," *Review of Economic Studies* 58(2).
- Arellano, M., and O. Bover (1995). "Another Look at the Instrumental-Variable Estimation of Error-Components Models." *Journal of Econometrics* 68(1): 29-52.
- Baldwin, Robert E. 2003. "Openness and Growth: What's the Empirical Relationship?" NBER Working Paper 9578.
- Baltagi, B. 2001. "Econometric Analysis of Panel Data", John Wiley & Sons, NY.
- Barro, Robert J. 1991. "Government Spending in a Simple Model of Endogenous Growth," NBER Working Papers 2588.
- Barro, Robert J. 1991. "Economic Growth in a Cross section of Countries," *Quarterly Journal of Economics* 106.
- Baxter, M. and Kouparitsas. M. 2000. "What Causes Fluctuations in Terms of Trade?" NBER Working Paper 7462.
- Ben-David, Dan. 1993. "Equalizing Exchange: Trade Liberalization and Income Convergence," *Quarterly Journal of Economics* 3.
- Blundell, R. and S. Bond (1997). "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models". University College London Discussion Papers in Economics: July.
- Bolaky, Bineswaree and Freund, Caroline. 2004. "Trade, regulations, and growth," Policy Research Working Paper Series 3255, The World Bank.
- Chang, Roberto; Kaltani, Linda and Loayza, Norman. 2005. "Openness Can be Good for Growth: The Role of Policy Complementarities," NBER Working Papers 11787.
- Chari, V.V; Larry E. Jones and Rodolfo E. Manuelli. 1995. "The growth effects of monetary policy," *Quarterly Review*, Federal Reserve Bank of Minneapolis, issue Fall, pages 18-32.
- Dollar, David. 1992. "Outward-Oriented Developing Economies Really Do Grow More Rapidly: Evidence from 95 LDCs, 1967-85," *Economic Development and Cultural Change*, pp. 523-544.

- Easterly, W. 2000. "The Lost Decades: Developing Countries' Stagnation in Spite of Policy Reform 1980-1998".
- Edwards, Sebastian. 1998. "Openness, Productivity and Growth: What Do We Really Know?" *Economic Journal* 108, pp.383-398.
- Frankel, Jeffrey A. and David Romer. 1999. "Does Trade Cause Growth?" *American Economic Review* 89, pp. 379-399.
- Frankel, Jeffrey A; Romer, David and Cyrus, Teresa. 1995. "Trade and Growth in East Asian Countries: Cause and Effect?," Center for International and Development Economics Research (CIDER) Working Papers C95-050.
- Gaduh, Arya B. 2002. "Properties of Fixed Effects Dynamic Panel Data Estimators for a Typical Growth Dataset," *Macroeconomics Working Papers* 65.
- Grossman, Gene M. and Elhanan Helpman. 1992. "Innovation and Growth in Global Economy," Cambridge, MA: The MIT Press.
- Harrison, Ann. 1996. "Openness and Growth: A Time-Series, Cross-Country Analysis for Developing Countries," *Journal of Development Economics*, 48, pp. 419-447.
- Helpman E. and Paul Krugman. 1985. "Market Structure and Foreign Trade". Cambridge: MIT Press.
- Jin, Jang C. 2004. "On the Relationship Between Openness and Growth in China: Evidence from Provincial Time Series Data," *The World Economy*, Blackwell Publishing, vol. 27(10), pages 1571-1582, November.
- Jin, Jang C. 2000. "Openness and growth: an interpretation of empirical evidence from East Asian countries," *Journal of International Trade & Economic Development*, *Taylor and Francis Journals*, vol. 9(1), pages 5-17, March.
- Kraay, Aart and Dollar, David. 2001. "Growth is good for the poor," Policy Research Working Paper Series 2587, The World Bank.
- Kraay, Aart and Dollar, David. 2003. "Institutions, trade, and growth : revisiting the evidence," Policy Research Working Paper Series 3004, The World Bank.
- Lawrence, Robert Z. and David E. Weinstein. 1999. "Trade and Growth: Import-led or Export-led? Evidence from Japan and Korea." NBER Working Paper 7264.
- Lederman, Daniel and William F. Maloney. 2003. "Trade Structure and Growth," World Bank Policy Research Working Paper 3025.

- Levine R. and Renelt, D. 1992. 'A sensitivity analysis of cross-country growth'. *American Economic Review* 82(4), 942–63.
- Lucas, Robert, E. Jr., 1988. "On the Mechanics of Economic Development," *Journal of Monetary Economics*, 22(1), 3-42.
- Mazumdar, J. 1996. 'Do static gains from trade lead to medium-run growth?'. *Journal of Political Economy* 104(6), 1328–37.
- Pain, Nigel. 2000. "Openness, growth and development: trade and investment Issues for developing economies," NIESR Discussion Papers 174, National Institute of Economic and Social Research.
- Rodriguez, Francisco and Dani Rodrik. 2001. "Trade Policy and Economic Growth: A Skeptic's Guide to the Cross National Evidence," in *NBER Macroeconomics Annual 2000*. Ben Bernanke and Kenneth S. Rogoff, eds. Cambridge MA: MIT Press.
- Romalis, John. 2002. "Factor Proportions and Structure of Commodity Trade." Chicago GSB.
- Romer, Paul M, 1986. "Increasing Returns and Long-run Growth," *Journal of Political Economy*, University of Chicago Press, vol. 94(5), pages 1002-37, October.
- Sachs, Jeffrey and Andrew Warner. 1995. "Economic Reform and Process of Global Integration." *Brooking Papers on Economic Activity*, 1, pp.1-95.
- Sohn, Chan-Hyun and Lee, Hongshik. 2003. "Trade Structure and Economic Growth: A New Look at the Relationship between Trade and Growth," NBER Working Paper 364.
- Spanu, Vlad. 2003. "Liberalization of the International Trade and Economic Growth: Implications for Both Developed and Developing Countries," Harvard University.
- Strydom, P.D.F. (2003) Work and Employment in the Information Economy: Review Article. *South African Journal of Economics*, 71:1-20.
- Weinhold, Diana and Rauch, James. 1997. "Openness, Specialization, and Productivity Growth in Less Developed Countries". NBER Working Papers 6131.
- Wacziarg, Romain and Welch, Karen Horn. 2003. "Trade Liberalization and Growth: New Evidence". NBER Working Papers 10152.

APPENDIX 1

AFRICAN COUNTRIES CHOSEN

A.1 THE SADC REGION

The countries chosen are based on the SADC countries in Africa. The Democratic Republic of Congo and Seychelles are omitted from the study as a result of the limited data availability.

Table A.1.1 Countries of the SADC Region

| Country | Abbreviation used |
|-----------------------------|--------------------------|
| Angola | ANG |
| Botswana | BOT |
| Lesotho | LES |
| Madagascar | MAD |
| Malawi | MAL |
| Mauritius | MAU |
| Mozambique | MOZ |
| Namibia | NAM |
| South Africa | ZAR |
| Swaziland | SWA |
| United Republic of Tanzania | TAN |
| Zambia | ZAM |
| Zimbabwe | ZIM |

Source: Own

A.2 DESCRIPTION OF THE VARIABLES

The variables used in the regressions estimated are in ratios or indices. Table A.2.1 contains a list of the variables used with the descriptions.

Table A.2.1 Variable Explanations

| Variable | Description and Construction | Source |
|-----------------|--|---|
| EDU | Education: The enrolment rate of secondary education in percentage | World Bank Development Indicators (WDI) |
| FDI | Foreign Direct Investment: (FDI / total trade); where total trade is (exports + imports) | World Bank Development Indicators (WDI) |
| FIN | Financial Depth: Domestic credit provided by banking sector as a percentage of GDP | World Bank Development Indicators (WDI) |
| GOV | Government expenditure: (Public Health Expenditure + Public Expenditure on Education) as a percentage of GDP | World Bank Development Indicators (WDI) |
| GROWTH | Growth: Growth rate of GDP | World Bank Development Indicators (WDI) |
| INF | Inflation: Percentage change in Consumer Price Index | World Bank Development Indicators (WDI) |
| INV | Domestic Investment: (INV/ GDP) | World Bank Development Indicators (WDI) |
| OPEN | Openness: (Exports + Imports) / GDP | World Bank Development Indicators (WDI) |
| TOT | Terms of Trade in indices | African Development Indicator |

Source: Own

A.3 TEST FOR ROBUSTNESS

Unit root tests are applied to ensure that the data are stationary. Certain diagnostic tests are done to check for robustness in the models.

Table A.3.1 Unit Root Test

| Method: Levin Lin and Chu (LLC) Unit Root Test | | | | | |
|---|-------------|-------------|-------------|-------------|---------------|
| Variable | EDU | FDI | FIN | GOV | GROWTH |
| Statistic | -3.55210*** | -4.66532*** | -1.79990*** | -9.37229*** | -8.00754*** |
| Probability | 0.0002 | 0.0000 | 0.0359 | 0.0000 | 0.0000 |
| Variable | INF | INV | OPEN | TOT | |
| Statistic | -6.81009*** | -12.5380*** | -4.17934*** | -4.22598*** | |
| Probability | 0.0000 | 0.0000 | 0.0000 | 0.0000 | |

Table A.3.2 Diagnostic Tests

| Test for | Hypothesis | Test Statistic | Decision Rule |
|----------------------------|--|-----------------------|----------------------------|
| Poolability | Ho: $\delta_i = \delta$ Hi: not all equal to δ | 3.23 | Not Poolable |
| Serial Correlation: | | | |
| Fixed Effects | Ho: $\rho = 0$ Hi: $\rho \neq 0$ | 1.841 | No serial orrelation |
| Random Effects | Ho: $\sigma^2_{\mu} = 0; \lambda = 0$ Hi: $\sigma^2_{\mu} \neq 0; \lambda \neq 0$ | 150.64 | Serial Correlation present |

APPENDIX 2

RESULTS OF THE DIFFERENT MODELS

Table B.2.1 Pooled Regression Models

| Model Variable | 1 OLS | 2 GLS | 3 OLS (with interactions) | 4 GLS (with interactions) |
|---------------------------|---------------------------|----------------------------|---------------------------------|---------------------------------|
| FDI | 0.230158 (0.152405) | 0.191240*** (0.052727) | 0.212153 (0.154730) | 0.150027*** (0.054572) |
| TOT | -0.028198* (0.015547) | -0.033265*** (0.004598) | -0.016611 (0.018699) | -0.024035*** (0.005088) |
| INV | 0.933681 (1.131630) | 0.756074 (0.623112) | 1.524725 (1.103814) | 1.500540* (0.645582) |
| OPEN | 8.402645*** (2.082713) | 7.214102*** (0.855328) | 9.393234** (3.615059) | 6.176251*** (2.272555) |
| GOV | -0.060873 (0.085562) | -0.017412 (0.039963) | -0.102188 (0.094851) | -0.088162* (0.052327) |
| FIN | -0.009933 (0.009714) | -0.012460*** (0.002399) | -0.005712 (0.011043) | 0.008407*** (0.002511) |
| EDU | 0.019643 (0.018581) | 0.018074*** (0.006343) | 0.011503 (0.019093) | 0.013437* (0.007149) |
| INF | -0.000801 (0.000949) | 0.000264 (0.001204) | -0.006435*** (0.001657) | -0.007492*** (0.001085) |
| C | 4.268200*** (0.967755) | 4.317677*** (0.673067) | 5.281335*** (0.986630) | 5.397795*** (0.778958) |
| OPEN*EDU | | | -0.105298 (0.164420) | -0.068490 (0.055382) |
| OPEN*FIN | | | 0.025423 (0.081231) | -0.005910 (0.024215) |
| OPEN*GOV | | | -0.019091 (0.566987) | 0.228382 (0.230934) |
| OPEN*INF | | | 0.021166*** (0.005328) | 0.028455*** (0.003173) |
| R-squared | 0.143344 | 0.855554 | 0.222042 | 0.883947 |
| Adjusted R-squared | 0.103730 | 0.848874 | 0.166803 | 0.875707 |

Notes: (*, **, ***) denotes the level of significance levels at 10%, 5% and 1%, respectively.

The term in the parentheses reports the standard error.

Table B.2.2 Fixed Effects Models

| Model | 5 | 6 | 7 | 8 |
|---------------------------|---------------------------|---------------------------|------------------------------------|------------------------------------|
| Variable | OLS | GLS | OLS (with interactions) | GLS (with interactions) |
| FDI | 0.203967 (0.182636) | 0.204256*** (0.042474) | 0.214116 (0.185068) | 0.211872*** (0.017344) |
| TOT | 0.016382 (0.055632) | 0.022948** (0.010934) | 0.003709 (0.056842) | 0.005214 (0.006937) |
| INV | 10.16978*** (2.888130) | 9.572331*** (0.556689) | 9.721322*** (2.985322) | 9.336415*** (0.212782) |
| OPEN | 17.69470*** (3.982998) | 17.19775*** (1.276752) | 19.91885** (7.684517) | 21.26786*** (2.140043) |
| GOV | 0.256455 (0.244528) | 0.241987*** (0.085792) | 0.156380 (0.258798) | 0.124216 (0.076417) |
| FIN | -0.025483 (0.025642) | -0.024849** (0.005219) | -0.015194 (0.028070) | -0.013258*** (0.002583) |
| EDU | 0.018471 (0.038426) | 0.002295 (0.007273) | 0.001865 (0.039917) | -0.007009*** (0.003130) |
| INF | 0.000646 (0.000999) | 0.001135*** (0.000401) | -0.001970 (0.002002) | -0.001677*** (0.000346) |
| C | 7.217805 (2.926160) | 7.419304*** (0.812116) | 8.250593** (3.278283) | 8.580208*** (0.581319) |
| OPEN*EDU | | | -0.261284 (0.225826) | -0.318328*** (0.028256) |
| OPEN*FIN | | | 0.051993 (0.106402) | 0.074079*** (0.011828) |
| OPEN*GOV | | | 0.196413 (0.810465) | 0.200400 (0.189037) |
| OPEN*INF | | | 0.008269 (0.006070) | 0.008514*** (0.000953) |
| R-squared | 0.325730 | 0.979695 | 0.340634 | 0.997666 |
| Adjusted R-squared | 0.241970 | 0.977173 | 0.239839 | 0.997309 |

Notes: (*, **, ***) denotes the level of significance levels at 10%, 5% and 1%, respectively.

The term in the parentheses reports the standard error.

Table B.2.3 GMM Regression Models

| Model | 11 | 12 | 13 | 14 |
|---------------------------|----------------------------|------------------------------|--|--|
| Variable | First Differences | Orthogonal Deviations | First Differences (with interactions) | Orthogonal Deviations (with interactions) |
| Growth(-1) | -0.380406*** (0.040254) | -0.182363*** (0.060932) | -0.314223*** (0.058628) | -0.276222*** (0.052826) |
| FDI | 0.009061 (0.134465) | 0.077091 (0.141854) | 0.232948 (0.221020) | 0.266020 (0.229281) |
| FIN | 0.056185** (0.024758) | 0.040583 (0.024955) | 0.001379 (0.035346) | -0.020804 (0.027610) |
| INF | 0.000726*** (0.000243) | 0.000631 (0.000390) | -0.001405 (0.003960) | -0.000449 (0.004287) |
| GOV | 0.019879 (0.253269) | -0.041552 (0.259522) | -0.199113 (0.361117) | -0.269396 (0.278889) |
| EDU | 0.142921* (0.076446) | 0.004737 (0.067064) | 0.101132 (0.092976) | 0.055597 (0.066236) |
| INV | 1.796153 (1.207922) | 7.632210*** (1.748605) | 6.377871*** (2.339939) | 8.626146*** (2.033899) |
| OPEN | 16.57870*** (2.271022) | 16.55780 (2.671743) | 43.38983*** (8.388338) | 41.60212*** (7.296135) |
| TOT | 0.038826 (0.160737) | 0.054058 (0.140116) | 0.071659 (0.219564) | 0.118415 (0.155192) |
| OPEN*EDU | | | -0.629806*** (0.217656) | -0.642405*** (0.179112) |
| OPEN*FIN | | | 0.110042 (0.094625) | 0.085030 (0.092613) |
| OPEN*GOV | | | -2.060691* (1.110264) | -1.264511 (0.997873) |
| OPEN*INF | | | 0.003052 (0.012022) | 0.001481 (0.013247) |
| R-squared | 0.370669 | 0.279381 | 0.379608 | 0.213593 |
| Adjusted R-squared | 0.277435 | 0.172623 | 0.265948 | 0.069518 |

Notes: (*, **, ***) denotes the level of significance levels at 10%, 5% and 1%, respectively.

The term in the parentheses reports the standard error.