How Changes In International Trade Affect African Growth?

Adolfo C. Fernández Puente
Departamento de Economía
Universidad de Cantabria

fernanac@unican.es

Marta Bengoa Calvo
Departamento de Economía
Universidad de Cantabria

ABSTRACT

The dismal growth performance of Africa in the last decades is one of the main worries of the global economy. In this paper we design an empirical model to explain how the growth rate of the economy is affected by changes in international trade. The main message of the model is that integration enables countries to exchange more varieties of goods and take advantage of some spillovers linked to the export-import process. These predictions are tested using GMM technique in a panel data performed on a sample of 22 countries belonging to the Sub-Sahara region over the period 1970-2002. The estimations suggest that Africa's growth rates are positively related to a more open attitude and to a greater integration in international markets. However, the empirical analysis also points out the need of a certain degree of "social capacity" to ensure a successful integration. Finally, our results imply that African nations can profit from the economic growth of the OECD countries, as they are the main buyers of the region.

RESUMEN

El lento crecimiento de África en las últimas décadas es una de las mayores preocupaciones de la economía global. En el presente artículo diseñamos un modelo empírico para explicar cómo la tasa de crecimiento económico se ve afectada por los cambios en el comercio internacional. La conclusión principal del modelo es que la integración permite a los países intercambiar una mayor variedad de bienes y aprovecharse de excedentes procedentes de la importación-exportación. Analizamos estas predicciones aplicando el método generalizado de momentos (por sus siglas en inglés GMM) a datos recogidos de una muestra de 22 países pertenecientes a la región subsahariana durante el período 1970-2000. Los resultados sugieren que las tasas de crecimiento en África se ven proporcionalmente favorecidas por una actitud más abierta y una mayor integración en los mercados internacionales. No obstante, el análisis empírico muestra la necesidad de un cierto grado de "capacidad social" para asegurar una integración positiva. Finalmente, nuestros resultados indican que las naciones africanas pueden beneficiarse del crecimiento económico de los países miembros de la OECD, puesto que éstos son los principales inversores en dicha región.

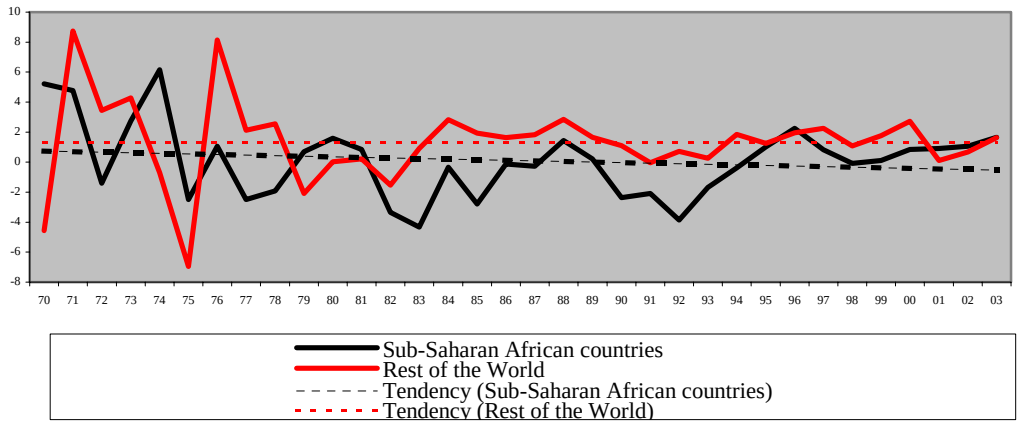
1. Introduction.

Over the last three decades, Sub-Saharan Africa has performed badly related to the rest of the world (see figure 1). After one decade of moderate growth, during the 70's, a slowdown in growth rates is placed. Economic, social and health indicators have improved poorly during these years. Several studies have been developed, including a great range of variables, to give us a broad picture of the detrimental situation of African countries (Sachs, 2004; Block, 2001; Collier y Gunning, 1999). Additionally, there are many papers that have tested the influence of international trade on economic growth of a selection of countries (Michaely, 1977; Balassa, 1978; Fosu, 1990, 2001; Edwards, 1993, 1998; Villanueva, 1994; Savvides 1995; Sachs and Warner, 1997; Collier and Gunning, 1997; Dollar and Kray 2001) using cross-country data, multiple regression and few studies employ the fixed-effect model. The evidence suggests that outward oriented economies positively affect the rate of economic growth but these regression analyses contains several problems relating to the data used and specification.

We develop an alternative proposal for the African countries with a different focus following the argument pointed out by Bloom and Sachs (1998): "among the policy variables, one of the most important is Africa´s lack of openness to international trade". First of all, from the point of view of economic policy, it is interesting to know how changes in the attitude of governments towards a favorably increase in the international trade at a country level are related to changes in the country's growth performance. Secondly, these changes are highly influenced, not only by the domestic factors, but the external shocks of the whole world economy. Our estimations focus on these propositions employing a more sophisticated econometric method, the Arellano and Bond Technique that specifically addresses the first question and it solves some of the problems related with cross-country estimations and fixed effects regressions. In order to assess the second objective we test how the GDP *per capita* growth of Sub-Saharan countries is being affected by the growth rate of the OECD economies, as they are the main African buyers. In addition, this paper goes deeply into the previous analyses increasing the period of study to the latest 90s and the earliest years of the 21st. century, that are probably the most relevant ones for the analysis of economic integration[1].

[1] As Sachs and Warner (1997) pointed out "only a small number of African economies adopted open trade by the 1970s or 1980s". Most Sub-Saharan economies have begun to liberalize trade by the beginning of 1990s.

Figure 1. Growth Rate of Real per capita GDP.

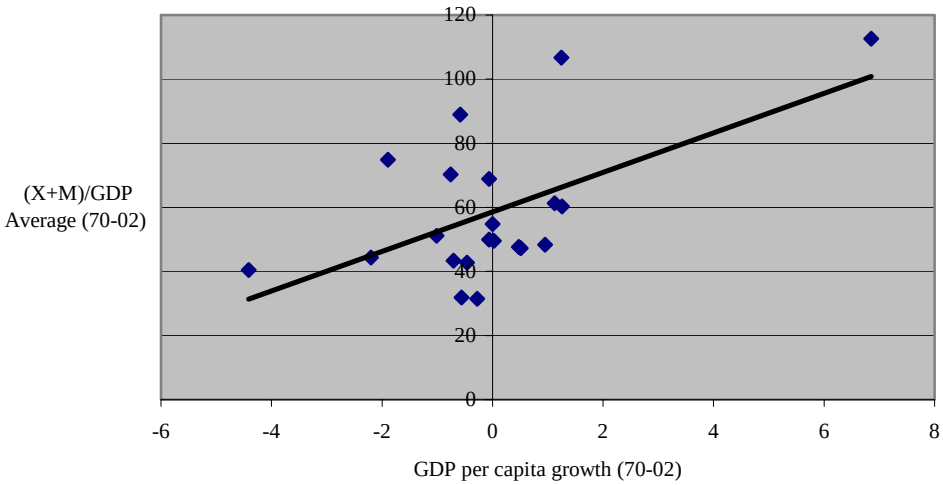


Source: World Development Indicators (2005).

As can be observed in figure 1, the growth rates of Sub-Saharan countries are less dynamic than those of the rest of the world. However, given this weaker position, the evolution of these two variables is quite similar, so their economies are strongly influenced by the international context, that is the reason to emphasise in this relationship in the specific case of African countries. Exchange in tangible commodities would imply higher demand and a more fluent exchange of new ideas. In figure 2 it is possible to observe the relationship between the average of the degree of openness, during the period, and the growth rates. Adding the trend line it is possible to observe a positive relationship between both variables. In this paper, integration in international markets is one of the factors that relates both growth rates.

Section 2 presents the empirical model for testing the two main hypothesis of this work across African countries. We limit the sample because of the deeper relationships between the region and these countries. Sub-Saharan countries are specialised in primary commodities, that's why their commercial partners should be those producing manufactured goods. Besides, the colonial origins of Sub-Saharan countries justify this pattern of trade. In the third section we test the hypothesis using GMM technique in a panel data performed on a sample of 22 countries belonging to the Sub-Saharan region over the period 1970-2002. Subsequently, we present the empirical results and compare our estimate of the international trade impact with those for previous works in this field. Finally, in the last section, we gather the conclusions that summarise our findings.

Figure 2. Openness and Growth



Source: World Development Indicators

2. The Model and the Data.

The assumptions developed in this section are not specified for the whole world, but only for Sub-Saharan countries. They could be applied to other countries with similar characteristics, but in other regions they would be incomplete and even inappropriate. African economies, though by no means homogeneous, share more similarities with each other than with other economic areas[2].

We will assume an economy, defined as the one that does not affect the economic environment in which it operates. In particular, these countries do not generate R&D and they do not influence the rate of accumulation of knowledge capital in the world at large, because the spillovers that they do generate are negligible in magnitude[3].

The possibility to enjoy the new ideas is limited to the interactions with other developed countries through international trade. Long run growth is facilitated by international discoveries and the implementation of new ideas in advanced countries[4]. None of the countries, in our sample, are included in this group, so we can assume technical progress as exogenous. In this sense, Grossman and Helpman (1991) argue that international trade in tangible commodities facilitates the exchange of intangible ideas, so they can improve total factor productivity in the domestic market. International trade can increase the productivity by two other different ways. First, imports may embody differentiated intermediates that are not available in the local economy, and production processes can be improved. Second, when local goods are exported, the foreign agents that purchase the goods may suggest ways to improve their manufacturing process, increasing the sales and the production.

[2] See Fosu (1990, 2000) for discussion of this topic and references there in.
[3] Grossman and Helpman (1991)
[4] See Romer (1990), Grossman and Helpman (1991), Aghion and Howitt (1992) and Jones (2002) for recent works related with this topic.

Not all Sub-Saharan countries are able to absorb new world technology generated by the technological advanced countries, but only those integrated in the global economy. Integration enables countries to exchange more varieties of goods and, linked to this exchange, technological diffusion is easier. The problem is that most of African imports are focused on consumer goods with little o no technology integrated and they have a heavy dependence on a small number of primary exports; its share of global manufactured exports is almost zero (Bloom and Sachs, 1998).

In this framework, we assume a simple model in which growth depends on investment, OECD growth, openness, exports, imports and an index of economic freedom that captures the minimum threshold needed to absorb technology from international trade. It is possible to include a number of additional variables, therefore, this specification is trying to analyse the relationship between changes in the attitude of Sub-Saharan countries to the international trade with OECD economies and changes in African growth.

Additionally, since sample size is limited by the availability of data for Sub-Saharan African economies, a simple specification maximize the degrees of freedom and it allows a more accurate estimation using panel data.

The basic specification underlying our analysis is an equation of the form:

$$\left(\frac{\dot{y}}{y}\right)_{it} = \beta' x_{it} + \alpha_i + \eta_t + \mu_{it} \qquad (1)$$

Where *i* represents the country i[th], and *t* represents each time period. $\left(\frac{\dot{y}}{y}\right)_{it}$ is the rate of growth of the real GDP *per capita*, α_i captures the basic idiosyncratic features of each country, η_t are period dummies. X_{it} is a vector of regressors that encompasses those variables affecting the steady state of the members of the sample. The error term is expressed by μ_{it} (i.i.d. random disturbances).

The data used to estimate the model come from different sources and they are expressed in Table 1.

Table 1. Description of variables and sources.

VARIABLES	SOURCES
1- Real $GDP_{p/c}$ in constant dollars of 1995.	Summers and Heston and Global Development Finance & World Development Indicators (World Bank).
2- Nominal $GDP_{p/c}$.	World Development Indicators (World Bank).
3- Real Investment as a percentage of GDP (1995 prices).	International Financial Statistics (International Monetary Fund).
4- Index of Economic Freedom.	Fraser Institute. http://www.freetheworld.com/
5- Exports and imports as a percentage of GDP (1995 prices).	World Development Indicators (World Bank).

Moreover, since yearly growth rates incorporate short-run disturbances, we use five-year averages to avoid cyclical dynamics and because of the data availability, the temporal horizon is 1970-2002. Finally, the sample is made up of a representative group of 22 African countries[5].

3. Estimation and Empirical Results.

In order to test the empirical model for the Sub-Saharan African countries, we have carried out an analysis of the relationship between technological progress in OECD countries, investment, some proxies of the country outward orientation policy and output growth using panel data.

To estimate the equation (1) it is possible to use different methods, the standards techniques are fixed effects or random effects. The fixed effects estimates take into account differences within each country across time; the random effects use information across countries and across periods but, it is only consistent if α_i is uncorrelated with the regressors (X_{it})[6].

[5] The countries that encompass the sample are Benin, Botswana, Burundi, Cameroon, Central African Republic, D. R. Congo, R. Congo, Ivory Coast, Chad, Ghana, Guinea-Bissau, Kenya, Malawi, Mali, Niger, Nigeria, Rwanda, Senegal, South Africa, Togo, Zambia and Zimbabwe.

[6] The Hausman test evaluates if the individual term is uncorrelated with the regressors, in analytical terms this is the assumption that is tested: $Cov\ (\alpha_i, x_{it}) = 0$.

We were confronted with an econometric difficulty as far as the empirical analysis was concerned. Some variables may be considered as *predetermined* or non exogenous and in the sense they could be conceivably correlated with the error term. In particular, the proxies that capture the outward policy of the country in period *t* can be correlated with the error term of period *t-1*. The economic intuition is the following: if a particular country is affected, say, by a natural catastrophe in a particular year, this episode will influence the entrance of new inflows of capital and the exports[7] of the next period, so a problem with both fixed effects and random effects[8]. This idea can be expressed as follows: $E(X'_{it}\ \mu_{is}) \neq 0$ for s<t and 0 otherwise.

Additionally, previous works on this field have concentrated in cross-sectional correlations using OLS estimators or they estimate a fixed-effect model, but little attention was paid to the existence of endogenous variables or reverse-causality on some of the explanatory variables. To avoid the possibility of casual relations conducts to generate bias on estimated coefficients. Hence, a causal link between international trade, openness and growth indicates that it is necessary to study the relationship between changes in patterns of trade and changes in growth, that is the main objective of this paper[9]. Such analyses do not directly address the important policy question: whether a Sub-Saharan African nation, with its other characteristics held constant, is likely to grow more quickly as its economy increases the commercial relations with the developed countries. The cross-country results do not directly deal with these issues of how a change in trade policy within a given country is related to growth within that country.

Estimation by instrumental variables is advisable in this case since less sophisticated regression methods could yield misleading results. In order to circumvent the above-mentioned difficulty, the equation (1) can be solved using first differences following Anderson and Hsiao (1982):

$$\left(\frac{\dot{y}}{y}\right)_{it} - \left(\frac{\dot{y}}{y}\right)_{i,t-1} = (\boldsymbol{X'_{it}} - \boldsymbol{X'_{i,t-1}})\boldsymbol{B} + (\mu_{it} - \mu_{i,t-1}) \qquad (2)$$

In this specification we are trying to analyse how changes in the economic variables may affect the growth rate of the economy. White (1980), Hansen (1982), and Arellano and Bond (1991) suggest the generalized method of moments (GMM) to obtain a consistent and efficient estimator.

[7] Sub-Saharan Africa has a nearly 100 percent concentration of exports in primary commodities (Bloom and Sachs, 1998).

[8] We estimate the model by fixed and random effects. The Hausman test does not reject the null hypothesis but we do not display the results in this section because the inconsistency of both methods due to the presence of non-exogenous variables. The results are available upon request.

[9] Harrison (1996) founded evidence in support of bi-directional causality between trade share and economic growth using a VAR specification. However, Frankel and Romer (1999) found no evidence that ordinary least-squares estimates overstate the effects of trade.

We have taken as instruments the lagged values of the variables. As posed by Islam (1995), Sachs and Warner (1997), Easterly and Levine (1998) and Temple (1998) applied to growth empirics. In this particular case the lags of the endogenous variables provide consistent estimators, under the assumption that the errors are not correlated. We will test this assumption using the test for second order serial correlation.

Basic results of the estimation are displayed in Table 2.

Table 2. How are changes in economic performance related to economic growth in Africa (1970-2002)

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REGRESSION 1. ESTIMATION IN FIRST DIFFERENCES, GMM2 (ARELLANO AND BOND TECHNIQUE)

Number of countries: 22      Sample period is 1970 to 2002
Observations:       110      Degrees of freedom:       107

Dependent variable is:  growth

Instruments used are:

Open (-1)

Wald test of joint significance:     194.372752   df =   3     p = 0.000

                    Sargan test:      12.898085   df =  17     p = 0.743

Variable      Coefficient      Std. Error     T-Statistic        P-Value
------------------------------------------------------------------------
  INVEST        0.368376        0.113010        3.259677        0.001115
   OECDG        0.091558        0.041813        2.189713        0.028545
OPENNESS        0.515841        0.048368       12.112051        0.000000

Test for  first-order serial correlation:  -2.927  [   22 ]    p = 0.003
Test for second-order serial correlation:  -0.787  [   22 ]    p = 0.431
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REGRESSION 2. ESTIMATION IN FIRST DIFFERENCES, GMM2 (ARELLANO AND BOND TECHNIQUE)

Number of countries: 22      Sample period is 1970 to 2002
Observations:       110      Degrees of freedom:       107

Dependent variable is:  growth

Instruments used are:

EXPORT (-1)


Wald test of joint significance:     158.766913   df =   3     p = 0.000

                    Sargan test:      18.463065   df =  17     p = 0.360

Variable      Coefficient      Std. Error     T-Statistic        P-Value
------------------------------------------------------------------------
  INVEST        0.648477        0.125868        5.152057        0.000000
   OECDG        0.053829        0.024596        2.188547        0.028630
     EXP        0.148072        0.170739        2.867242        0.015809


Test for  first-order serial correlation:  -3.028  [   22 ]    p = 0.002
Test for second-order serial correlation:  -0.743  [   22 ]    p = 0.458
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Software: DPD98 for Gauss, Arellano and Bond (1998). Standard errors and test statistics robust to heteroskedasticity.

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REGRESSION 3.ESTIMATION IN FIRST DIFFERENCES, GMM2 (ARELLANO AND BOND TECHNIQUE)

Number of countries: 22      Sample period is 1970 to 2002
Observations:       110      Degrees of freedom:       106

Dependent variable is:  growth

Instruments used are:

OPENNESS (-1)

Wald test of joint significance:      37.559844   df =   4     p = 0.000
                    Sargan test:      18.818555   df =  16     p = 0.278

Variable      Coefficient      Std. Error     T-Statistic        P-Value
------------------------------------------------------------------------
  INVEST        0.761579        0.185295        4.110100        0.000040
   OCDEG        0.101581        0.158406        2.739221        0.001996
OPENNESS        0.461372        0.132525        3.481408        0.000499
     IEF        0.537567        0.287696        1.868527        0.061689

Test for  first-order serial correlation:  -3.210  [   22 ]    p = 0.001
Test for second-order serial correlation:  -0.391  [   22 ]    p = 0.696
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REGRESSION 4.ESTIMATION IN FIRST DIFFERENCES, GMM2 (ARELLANO AND BOND TECHNIQUE)

Number of countries: 22      Sample period is 1970 to 2002
Observations:       110      Degrees of freedom:       107

Dependent variable is:  growth

Instruments used are:
IEF (-1)

Wald test of joint significance:     168.868792   df =   3     p = 0.000
                    Sargan test:      15.406014   df =  17     p = 0.566

Variable      Coefficient      Std. Error     T-Statistic        P-Value
------------------------------------------------------------------------
   INVEST       0.881901        0.130844        6.740108        0.000000
   OECDG        0.034839        0.009326        3.735825        0.000187
     IEF        0.026569        0.022827        1.163920        0.244456

Test for  first-order serial correlation:  -2.790  [   22 ]    p = 0.005
Test for second-order serial correlation:  -0.644  [   22 ]    p = 0.520
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REGRESSION 5.ESTIMATION IN FIRST DIFFERENCES, GMM2 (ARELLANO AND BOND TECHNIQUE)

Number of countries: 22      Sample period is 1970 to 2002
Observations:       110      Degrees of freedom:       107

Dependent variable is:  growth

Instruments used are:

IMPORT (-1)

Wald test of joint significance:      38.941392   df =   3     p = 0.000
                    Sargan test:      14.472564   df =  17     p = 0.633

Variable      Coefficient      Std. Error     T-Statistic        P-Value
------------------------------------------------------------------------
  INVEST        0.716146        0.167455        4.276640        0.000019
   OECDG        0.082379        0.023842        3.455241        0.000550
 IMPORTS       -0.333587        0.145974       -2.285242        0.022299

Test for  first-order serial correlation:  -2.908  [   22 ]    p = 0.004
Test for second-order serial correlation:  -1.271  [   22 ]    p = 0.204
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Software: DPD98 for Gauss, Arellano and Bond (1998). Standard errors and test statistics robust to heteroskedasticity.

Table 2 reports estimates of equation (1) using the Arellano and Bond technique. We use this method instead of a fixed or random effects specification because of the non exogeneity of the regressor. To circumvent this problem the equation is rewritten (see eq. 2) and estimated by means of the GMM procedure.

Some diagnosis tests have been performed. The Sargan test for the validity of the instruments (Sargan, 1958) suggests their adequacy[10]. The test of second order serial autocorrelation in the residuals has been pursued along the lines proposed by Arellano and Bond (1991). They define a statistic m_2, distributed asymptotically as N (0,1) under the null hypothesis of no autocorrelation in the residuals. The p value associated with the test does not lead to a rejection of the null hypothesis (this method introduces first order serial correlation because it solves the equation in first differences).

The main messages we can extract from this estimation are the following:

[10] The null hypothesis in this test is that the instruments have been correctly chosen. Therefore a large value of the correspondent statistic, distributed as a χ^2, or a small p value, leads to reject the null.

First, the importance of private capital accumulation, proxied by the investment rate, is apparent from all the regressions. This variable is positive, highly significant and the coefficient is rather large in magnitude. This result agrees with most empirical studies on economic growth, which stresses the relevance of capital formation in the process of development[11].

Additionally, economic growth in the OECD countries seems to play an important role in the developing process of Sub-Saharan Africa. The coefficient varies from 0.1 to 0.034, showing stability across the regressions, and it is significant at conventional levels. The spillover effects can explain the link between the economic growth rate of the developed countries and the growth rate of the Sub-Saharan Africa. Most of the commercial partners of these nations are from OECD countries, that means that if the economies of the buyers grow, the international commerce within an African nation will increase.

The inclusion of other regressors, as openness, exports, imports and the index of economic freedom elaborated by the Fraser Institute, also seem to provide some interesting information[12].

Changes in the degree of openness and exports are positively and significantly correlated with growth. The intuition for this result is simple: a more open economy promotes competitiveness and hence exports. Additionally, export growth is needed to import capital goods and intermediate products. However, our findings also suggest that openness may require other ingredients in order to become growth enhancing. Export-led growth would benefit Africa but not if the pattern of export remains tied to primary commodities. At this point, we will be faced with the diversification in exports performance, manufacturing and service exports growth. Is it possible in Africa like it was for the developing countries in East Asia? The answer depends on the international and local commitment to construct transport facilities and infrastructure. Moreover, more effort from the developed countries is needed to open their frequent opposition to relax the tax policy with third world countries; obviously there are more factors regarding to growth, the development of efficient institutions and the investment in human capital (see Collier and Gunning, 1999).

This evidence is in accordance with the outcome of regression 3 and 4. When we introduce the Index of Economic Freedom (IEF) we find that it is positively and marginally significant at conventional levels. This index is not only understood as a proxy of the attitude towards international trade but the social capacity of the country. Most African nations are classified as no totally free. The estimations demonstrate that less free countries are poorer, based on lack of respect for the rule of law, property rights and the other institutions of free

[11] Similar results were obtained for the Sub-Saharan Africa by Khan and Reinhart (1990), Khan and Kurmar (1993), Ghura and Hadjimichael (1996) and Calamitsis, Basu and Ghura (1999).
[12] We tested some equations including population growth. We obtained similar results and the influence of this variable is negative and statistically significant. More results under request.

societies, which are so important for development. Our results suggest that a change in institutions can promote economic growth in African countries.

This result is in accord with the work of Sachs and Warner (1997). They find support for the hypothesis that greater number of year of openness accelerates convergence in a cross-section of countries. Taking into account the existence of causality between economic growth and the variables on the right-hand side of the growth equation, we find that the incidence of changes in the attitude through international trade on African growth is larger than in previous cross-country studies (Fosu 1990 and Savvides 1995) and they are similar to those reported in Edwards (1998) and Lewer and Berg (2003).

Finally, we test the role of imports in economic growth in regression 5. As we expected a change in the imports (M) process, making the economy more dependable, has a negative correlation with economic growth. Imports can benefit economic growth in developed countries since they facilitate the diffusion of technology that is produced elsewhere. The process is different in an undeveloped economy: patterns of import growth are usually correlated with policies of import substitution industrialization, and they do not contribute to develop an efficient local industry[13]. Sachs and Warner (1997) conclude that poor policies and institutions explain a large share of Africa´s slow growth, and we find that changes in policies *within* a country towards a more open attitude would contribute to stronger economic performance.

4. Policy Implications and Concluding Remarks.

Generally speaking, Sub-Saharan African countries lack the necessary background, in terms of educated population, infrastructure, economic and social stability and so forth, to be able to develop efficient markets and industries. Accordingly, they would benefit from the growth of the OECD countries. One of the ways whereby these spillovers to Africa may take place is through international trade. The reverse is also true: OECD often takes advantage from the trade relations with Africa. Because of that Africa´s economic development will need a greater commitment to policies and institutions to promote export diversification, to foster infrastructure investment and to achieve a minimum level of "social capacity".

This paper describes and discusses a simple model whose main prediction is that changes in international trade, an export-led growth and investment in productive capital may act as a drive engine of growth if a certain degree of social and economic background exists. Next, it presents the results from a panel data analysis of 22 Sub-Saharan African countries that lend countenance to the main hypothesis of the paper.

[13] Consumer goods compose a significant percentage of Africa's imports, so the spillovers linked to the import process of commodities with a higher added value are very small. In 2000 the percentaje of agricultural raw materials, ores and metal, and food and fuel imports was 29,2.

Policy conclusions are straightforward: international trade is a source of growth for Africa. Governments may favor faster rates of growth in their countries applying economic policies to promote manufactured exports[14]. More direct focus on export diversification and competitiveness is needed and as well as more effort to promote infrastructure investment. To identify the factors that influence growth is a crucial step in developing strategies that help Africa out of poorness.

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