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Is the export-led growth hypothesis valid for African countries? An application of panel data approach

Abstract

The purpose of this paper is to investigate the export-led growth (ELG) hypothesis for African countries. The data used is a panel data covering 30 African countries for the period of 1990 to 2005. The paper uses four panel data models: pooled ordinary least square (OLS), fixed effects model (FE), random effects model (RE) and two-stage least-squares (2SLS). The results from these models provide some modest support for the export-led growth paradigm in Africa – a 1% increase in export leads to 0.1% increase in economic.

Key words: export led growth hypothesis, exports, economic growth, and labor force
JEL Classification: F00, F01, F02, F10, F20, F50, O11, O19, O24.

Introduction

In December 2011 the Economist published an article entitled "The sun shines bright", which painted a rather positive picture of African economies. This article showed that some African economies have already been growing by more than 6% a year for six or more years. It also highlighted that some of these countries like Ghana and Mozambique were consistently growing faster than those of almost any other region of the world. Various studies have shown that a substantial percentage of GDP in these countries comes from the export sector. For example, in most South African countries, exports account for more than half of their GDP. In his Thesis Sinoha-Lopete, (2006) provided figures of how the percentage of exports contributed to GDP in South Africa for the period of 1980-2002. He showed that Swaziland's exports were 74.3% of GDP, Botswana's 57%, Namibia's 54.2%, Zambia's 32%, Zimbabwe's, 27.5%, South Africa's 27%, Malawi's 25%, Lesotho's 22%, and Mozambique's 11%. A natural question that emerges from this brief discussion is whether export is an engine for growth in African countries. Although several international studies have shed some light on this question, few empirical studies have been done in the recent past to investigate the export led growth (ELG) hypothesis for African countries. Thus the aim of this paper is to answer this and other related questions, using four panel data models: pooled ordinary least square, fixed effects model, random effects model and Two-Stage Least-Squares.

The rest of this paper is organized as follows. Section 1 provides a brief literature review on the ELG hypothesis. Section 2 presents econometric methods and section 3 summarizes the paper's findings. Final section gives the conclusion.

1. Literature review

There is a vast amount of empirical literature on the export-led growth paradigm. The empirical studies regarding the relationship between exports and growth can be divided into two groups. The first group comprises cross-country studies, of which key contributions are: Michaely (1977), Balassa (1978), Heller and Porter (1978), Tyler (1981), Feder (1983), Kavoussi (1984), Ram (1985), and McNab and Moore (1998). These studies generally provide support for the export led growth paradigm. For example, Michealy (1977) investigated the impact of export on growth using a cross-section data of 41 less developed countries using the spearman's rank correlation. This study found that an increase in export growth leads to an increase in economic growth in these countries.

Similarly, Kavoussi (1984) investigated the impact of export expansion on economic growth in a sample of 73 developing countries. He employed correlation tests and found that export expansion is associated with better economic performance in developing countries. Moreover, the study looked at the effect of export growth on total 13 factor productivity in terms of an estimated production function, and found that export expansion has a positive impact on total factor productivity leading to higher economic growth.

Some studies have tested the export-led growth hypothesis using time series data. Among these studies are Jung and Marshall (1985), Chow (1987), Hsiao (1987), Bahmani-Oskooee et al. (1991), Dodaro (1993), Sharma and Dhakal (1994), Love (1994), Ukpolo (1994) and Riezman et al. (1996). Most of these authors suggest that export growth has no causal effect on output growth in the developing countries.

For example, in their paper Riezman et al. (1996) used time-series data for the countries in the Summers-Heston (1991) data set, in an attempt to investigate the export-led growth hypothesis. They used

the measure of conditional linear feedback, while controlling for the growth of imports. Their findings provided modest support for the export-led growth hypothesis. Further, they found that conditional on import growth, they found a causal ordering from export growth to income growth in 30 of the 126 countries analyzed.

In their paper Jung and Marshall (1985) used granger causality test to examine the causality link between exports and economic growth in developing countries which included four African countries. Only four cases out of 37 provided support for export-led growth hypothesis. And only 1 case (Kenya) out of 4 African countries included in the sample was their evidence which supported ELG. Ukpolo, (1994) used a time-series data covering the period of 1969-1988, and he reported that while non-fuel primary exports had a positive impact on economic growth, the impact of manufactured exports on economic growth was inconclusive.

The differences in the results obtained by the abovementioned studies can be largely attributed to different statistical techniques used (de Pineres and Cantavella-Jorda, 2007). It seems that the first group of studies – cross-country studies relied heavily on the simple correlation coefficient or simple OLS regressions in their investigations. The limitation of this group of studies is that the correlation coefficient and OLS were used to draw firm conclusions about the link between export and growth. In light of these limitations, another group of studies used cointegration techniques to examine the long-run relationship between exports and output for individual countries. The limitation of these studies is the low power of the tests due to the small sample size associated with the use of individual country time-series data.

Although a number of empirical studies have been conducted on ELG for developed and developing countries very few empirical studies have been done in the recent past to investigate the export-led growth (ELG) hypothesis for African countries. The few studies that exist include the works of Jung and Marshall (1985), Fosu (1990) and Ukpolo (1994). While these studies have shed some light and brought the relationship of export and growth to the fore of academic discussion, the literature is still very much limited and the empirical results remain inconclusive. Thus the objective of this paper is to attempt to close this research gap by re-investigating the relationship between export and economic growth in African countries and to improve the quality of the results by using more appropriate econometric technique that has not been used by the abovementioned studies (i.e. in the African context): use pooled ordinary least square (OLS), fixed effects, random effects and two-stage least-squares.

2. Data and empirical methodology

The data used in this study was obtained from Quantec. Given the availability of data for each country the data used are for the period of 1990 to 2005. The sample of countries include Botswana, Malawi, Swaziland, Burundi, Mozambique, Zambia, South Africa, Congo, Burkinafaso, Cote d'lvoire, Cameroon, Algeria, Ethiopia, Gabon, Ghana, Guinea – Bissan, Equatorial Guinea, Kenya, Morocco, Madagascar, Mali, Mauritius, Niger, Rwanda, Sudan, Senegal, Chad, Togo, Tanzania and Uganda. Our analysis follows on the work of Pazim (2009), which used a panel data analysis. To our knowledge only one paper Pazim (2009) has attempted to use this technique in BIMP-EAGA countries (i.e. Indonesia, Malaysia and the Philippines). However one doubts the validity of his results. The reason for this is twofold. Firstly, the author utilized a bivariate model – two variable framework. However, using a two-variable framework can lead to misspecification bias (i.e. omitting important variables). Secondly, the author used random effect model as an appropriate model, effectively assuming that the error term (i.e. unmeasured omitted variables) is not correlated to the explanatory variables and he also completely ignores the possibility of a feedback relationship between export and growth – endogeneity problem. Failure to consider endogeneity problem always leads to biased and inconsistent estimates.

In addition to the use of panel data analysis, in our paper two variables used by Pazim (2009) are expanded to include government expenditure, gross domestic investment, labor force and inflation. The dependent variable used in our paper is the natural logarithm of total exports. More formally, the link between export and economic growth is specified by the following representations of the panel models:

$$\ln GDP_{it} = \beta_0 + \beta_1 EXP_{it} + \beta_2 INFI_{it} + \beta_3 GOV_{it} + \beta_4 GDI_{it} + \beta_5 LF_{it} + \pi_{it}, \quad (1)$$

$$\ln GDP_{it} = \beta_0 + \beta_1 EXP_{it} + \beta_2 INFI_{it} + \beta_3 GOV_{it} + \beta_4 GDI_{it} + \beta_5 LF_{it} + \alpha_i + \pi_{it}, \quad (2)$$

$$\ln GDP_{it} = \beta_0 + \beta_1 EXP_{it} + \beta_2 INFI_{it} + \beta_3 GOV_{it} + \beta_4 GDI_{it} + \beta_5 LF_{it} + \pi_{it}. \quad (3)$$

In all the above three equations i represents each country and t represents each time period; ln GDP_{it} is average annual growth for country i during period t; EXP_{it}; GOV_{it}; INF_{it}; GDI_{it}; LF_{it} are, respectively export, the government expenditure, inflation, gross domestic investment and labor force for country i

during period *t*. The βs are the estimated coefficients and the π_{it} is the error term.

Equation 1 was estimated using pooled OLS estimation. Although pooled OLS widens the database by pooling together cross-sectional and time series observations of the sample to get more reliable estimates of the parameters, it is not always appropriate for use with panel data because it ignores heterogeneity among cross-sectional units. To account for heterogeneity in countries we used fixed effect estimated by Equation 2. The major attraction of fixed effect model is that it accounts for differences in cross-sectional units. Despite its ability to capture the heterogeneity in cross-sectional units, the fixed effects model fails to compute coefficients for time-invariant variables. Because of this we also estimated Equation 3 (i.e. using random effect model) that includes time-invariant variables. The major drawback of the random effects estimation is that it assumes that specific effects are uncorrelated with other regressors. We use the Hausman specification test to determine which of the two models is appropriate for our analysis.

A feedback relationship between exports and output cannot be ruled out as a possibility. In their study, Helpman and Krugman (1985) argue that exports may rise from the realization of economies of scale due to productivity gains; the rise in exports may further enable cost reductions which may result in further productivity gains. Bhagwati (1988a) conjectures that increased trade (irrespective of cause) produces more income, and more income leads to more trade and so on. If there is a feedback relationship between export and economic growth, then we will experience endogeneity problem. That is pooled OLS, FE and RE panel data models will produce biased and inconsistent estimates. To correct this we employed 2SLS model. Two-stage least squares sterms from the two regressions in the estimation procedure. In stage one, an ordinary least squares prediction of the instrumental variable is obtained from regressing it on the instrument variables. In stage two, the coefficients of interest are estimated using ordinary least square after substituting the instrumental variable by its predictions from stage one.

3. Empirical results

Firstly, we begin by reporting the results of the pooled OLS model. As indicated earlier on, OLS estimation model is the most restrictive of all the specifications because it does not take into account the fact that there might be differences in cross-sectional units – assuming a common intercept for the whole panel. Thus we need to make sure first that pooling the data is the solution in our case. The null hypothesis based on the poolability test is that all the individual effects are zero. To verify this hypothesis we perform a poolability test. The result obtained rejects the null hypothesis that all the individual effects are zero (see Table 1). This also means that the OLS estimator is biased and inconsistent and we accept the presence of the individual effects.

Although the pooled OLS estimators are biased and inconsistent we nonetheless report the results of the pooled OLS, because we use it as a benchmark model and pooled OLS results do give us a sense of the relationship between export and growth. The pooled OLS results reported in Table 1 show that although export which is a variable of interest is positively related to growth, it is insignificant – a 1% increase in export will lead to 0.056% increase in economic growth ceteris paribus.

Table 1. Regression results: what affects the coefficient on growth?

VARIABLES	POOLED-OLS	FIXED EFFECT	RANDOM EFFECT	2SLS
Export	0.0569669 (0.128)	0.1509988 (0.000)	0.8325141 (0.036)	0.1257798 (0.000)
GDI	0.2811708 (0.000)	0.1580176 (0.000)	0.2387611 (0.000)	0.1807763 (0.000)
Labor force	0.8815621 (0.000)	0.9918717 (0.000)	0.9531522 (0.000)	0.9610173 (0.000)
Inflation	-0.0003988 (0.000)	-0.0002084 (0.000)	-0.0003252 (0.000)	-0.0001781 (0.000)
Gvt exp	-0.1988273 (0.003)	-0.3137298 (0.000)	-0.2455957 (0.000)	-0.3366747 (0.000)
Hauseman test		Prob > chi2 = 0.0000		
Poolability test		T- stat = 3.24 Prob > f = 0.000		
Countries	30	30	30	30
Observations	480	480	480	450
Period	1990-2005	1990-2005	1990-2005	1990-2005

The other control variables such as inflation and growth present negative and significant estimates on growth. The fact that government expenditure is negatively related to growth – presents negative and significant estimates on growth, that is worrisome because it suggests that governments tend to be detrimental to economic growth. There is however a great deal of controversy about the nature of relationship between government size and growth. Some studies suggest that there is a negative relationship between these variables. These include the work of e.g., Barro (1991), Engen and Skinner (1992), Hansson and Henrekson (1994), Gwartney, Holcombe and Lawson (1998), Fölster and Henrekson (2001). In sharp contrast, a study by Ram (1986), analyzed a panel data of 115 countries, and concluded that growth of government is positively related. So our result on the relationship between growth and government expenditure is consistent with the former studies. Presumably the negative relationship between growth and government expenditure could be attributed to the fact that high levels of government expenditure tend to crowd out investment which in turn reduces growth.

Having reported the results based on the pooled OLS we now turn to fixed and random effect results. Employing fixed and random effect models requires one to check which of the two models is most appropriate. An attempt was made in this article to check which model is more efficient between fixed effects model and random effects by using Hausman specification test which compares the fixed versus random effects under the null hypothesis that the individual effects are not correlated with the other explanatory variables in the model (Hausman, 1979). If correlated (H0 is rejected), a random effect model produces biased estimators, violating one of the Gauss-Markov assumptions. Our specification test result which we performed, H0 is rejected. This means that fixed effect model is more appropriate and preferred model. The results of the Hausman specification test are shown in Table 1 above.

In column 3 and 4 we report the estimates of export, labor force, gross domestic investment, inflation and government expenditure using fixed effects and random effects estimators respectively. The results are quite similar to OLS results except for export: gross domestic investment and labor force as expected, still presents positive and significant estimates on growth. And again, inflation and growth present negative and significant estimates on growth. However, the magnitude of export is greater and its significance is stronger than the corresponding OLS estimates. For example a 1% increase in export leads to 0.15% increase in growth for a FE model and 0.83% increase in growth for RE model, ceteris paribus.

Implicit in the pooled OLS, fixed effect and random effect models is the assumption that explanatory variables are exogenous. However this assumption is not necessarily true. To correct this, the firth column of Table 1 reports two-stage least squares estimates (2SLS). Two-stage least squares is important because it allows us to relax the assumption that the explanatory variables are exogenous and thus attempts to correct both the simultaneity bias (endogeneity problem) and the bias coming from the correlation between the country-specific effects and the regressors. The 2SLS regression assumes that export variable is endogenous and instruments for it by lagging it. As can be seen from the fourth column, the estimated coefficient of the lagged dependent variable is 0.12, which lies between bounds estimated by the FE and pooled OLS. The estimates for the controlled variables are consistent with the fixed and random effects: the GDI and labor force are positively and significantly related with growth, while government expenditure and inflation are negatively and significantly related with growth. In a nutshell, the results consistently indicate that export has a positive and significant impact on growth in African countries. The signs of the significant variables all go in the expected direction except for government expenditure, as pointed out earlier on. These results are very much in line with previous empirical studies such as: Krueger, (1978), Chenery, (1979), Tyler (1981), Kavoussi (1984), Balassa (1985), Ram (1985, 1987), Chow (1987), Fosu (1990) and Salvatore and Hatcher (1991) which generally provide support for the export-led growth paradigm.

Concluding remarks

The purpose of this paper has been to investigate the export-led growth (ELG) paradigm for African countries using panel data covering 30 African countries for the period of 1990 to 2005. The paper applied four panel data models: pooled ordinary least square (OLS), fixed effects model (FE), random effects model (RE) and two-stage seast-squares (2SLS) to investigate the link between growth and export. The results from these models provide modest evidence of the existence of the export-led growth (ELG) paradigm for African countries – a 1% increase in export leads to 0.1% increase in economic growth ceteris paribus. These results are very much in line with previous empirical studies such as: Krueger (1978), Chenery (1979), Tyler (1981), Kavoussi (1984), Balassa (1985), Ram (1985, 1987), Chow (1987), Fosu (1990), and Salvatore and Hatcher (1991) that generally provide some support for the export-led growth paradigm.

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