Agricultural Exports: Important Issues for Sub-Saharan Africa*

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Abstract: The central argument of this paper is that African countries stand to benefit more from the goodwill currently being shown by industrialized countries who have committed themselves to further opening up of their markets for commodities from the region. However, more needs to be done by African governments and the international community if these benefits are to trickle down to the African farmers and result in attaining the goal of poverty reduction. This paper identifies the issues that need to be addressed by all parties involved. At the macro level, our results find that the distortion in the macro environment is a major factor hindering African exports. At the micro level, our results show that for farmers to benefit from the opening up of the international market, they would need more access to market information, easier road access to the markets for both their output and inputs, improve their farming techniques by utilizing modern scientific farming methods and inputs, and to increase their productivity. At the international level, our study finds strong results indicating that foreign tariff rate, price support (PNAC) and standards act as a market barrier to African agricultural exports.

Resume: L'argument principal de cet article est que les pays africains entendent tirer davantage parti de la bonne volonte actuellement affichee par les pays industrialises, qui se sont engages a ouvrir davantage leurs marches aux produits originaires de l'Afrique. Cependant, beaucoup reste a faire de la part des pays africains et de la communaute internationale, si Ton veut que ces avantages parviennent aux exploitants agricoles africains et contribuent a la realisation de l'objectif de reduction de la pauvrete. L'article identifie les questions que toutes les parties prenantes sont appelees a resoudre. A l'echelon macroeconomique, il ressort de nos resultats que la distorsion de l'environnement macroeconomique constitue une des entraves aux

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expectations africaines. A l'echelon microeconomique, nos resultats montrent que, pour tirer parti de l'ouverture du marche international, les exploitants agricoles doivent avoir un meilleur acces aux informations sur les marches, ainsi que des routes d'acces plus facile aux marches pour les intrants et la production, ameliorer leurs techniques culturales grace a des methodes et intrants scientifiques modernes, et accroitre leur productivite. A l'echelon international, il ressort de notre analyse que les tarifs etrangers, le soutien des prix (PNAC) et les normes a respecter entravent les exportations agricoles de l'Afrique.

1. Introduction

At the 2002 G8 meeting in Canada, Prime Minister Jean Chretien of Canada was quoted as saying that the biggest favor that rich countries could do for Africa would be to lower the subsidies, as well as import quotas and tariffs.[1] The G8 *Africa Action Plan* promises benefits for African countries 'whose performance reflects the Nepad commitments' — a commitment to improve global market access for African exports by tackling trade barriers and farm subsidies by 2005.[2]

Agricultural markets are among the most heavily distorted in the world. For example, agricultural exports to the OECD countries face tariffs that exceed those on typical inter-OECD exports of all products by factors of 10 or more (International Monetary Fund (IMF) and World Bank, 2002, p. 5). This tends to hurt Africa more because the level of agricultural protection applied by industrial countries to sub-Saharan African (SSA) exports is generally higher than that applied to other developing countries (IMF, 2002).

Agriculture subsidies in developed countries undermine developing countries' exports by depressing global prices and pre-empting markets (World Bank, 2001). The OECD has calculated that total transfers from consumers and taxpayers to farmers averaged about 30 percent of gross farm income in 2001, cost over $300 billion (1.3 percent of GDP), and amounted to six times overseas development aid (IMF, 2002).[3]

If most industrial countries adopt the scheme proposed by the G8, that progressively reduce subsidies and high tariffs on agricultural goods,[4] the unrestricted market access provision for lesser developed countries (LDCs) could have significant benefits to LDCs' economies without imposing undue costs on other suppliers in the industrial countries (IMF and World Bank, 2002, p. 21; and World Bank, 2001). This is because the LDCs' share in world trade is negligible.[5]

The benefits of a reduction or the removal of agricultural barriers in the industrial countries would be of immense benefit to about three-quarters of the world's poor who live in rural areas and are mostly dependent on agriculture. According to Ianchovichina *et al.* (2001), if all trade barriers to SSA exports in the Quad were eliminated, non-oil exports would expand by 14 percent.[6] If greater market access is granted by industrial countries to Africa's produce, real incomes in SSA would increase by US$6 per person as a result of enabling producers to sell their commodities at higher prices to those markets and in greater volumes (world Bank, 2000, p.6).

To the extent that sub-Saharan Africa is a region with some of the world's poorest countries, with the majority of the population still living in the rural areas, the opening up of industrial countries' markets ensures that the increased trade benefits the poorest of the poor in those economies. According to the IMF and World Bank (2002, p. 4) more rapid growth associated with a global reduction in protection could reduce the number of people living in poverty by as much as 13 percent by the year 2015, thus making a valuable contribution to meeting the Millennium Development Goals.

However, these benefits are academic and might remain elusive to Africa, if it cannot increase its capacity to expand its supply of agricultural commodities in the industrialized countries' market. According to the IMF and World Bank (2002, p. 21), improved market access for Africa's exports alone will not be sufficient to engender a sustained growth performance, but should form part of a broader strategy to promote a vigorous supply response. There is evidence that indicates that impediments to trade in agricultural products remain far greater than in manufacturing trade. Inefficiencies in key infrastructure sectors like telecommunications, transport and financial services often add more to export costs than foreign trade barriers (IMF and World Bank, 2002, p. 21). The Global Poverty Report (World Bank, 2001) reiterates that in many countries in Africa, trade liberalization has been partial (e.g., tariffs remain high) and has not always spurred investment and growth because of weaknesses in the macroeconomic environment and in complementary policies for regulation, infrastructure, and human capital (World Bank, 2001).

These arguments are consistent with what researchers have long argued — that some of the more fundamental problems constraining African agricultural exports seem to be more than just the policies of rich countries. Elbadawi (2002, p. 130) argues that the experience of successful exporters have shown that the responsiveness of exports to appropriate incentives depends crucially on the extent of weakness or market failure in key sectors like financial markets, technology and market information.

The argument put across is that even if macroeconomic stabilization, exchange rate adjustment and trade liberalization policies deliver an appropriate structure of incentives for exports, a timely and adequate supply response may still not be forthcoming if the constraints related to incomplete or absent information are not solved. This includes such areas as appropriate technology for producing competitive goods. Such points of view are gaining much currency in the recent literature. According to *World Economic Outlook* (IMF, 2002), the dynamic gains can only arise as countries adopt new technologies, increase investment, accelerate productivity growth, and specialize in accord with their comparative advantage of protection. Such dynamic gains arising from agricultural liberalization in both industrialized and SSA economies could far exceed the static gains, even in poor countries with large agricultural sectors.

Delgado (1995) points out that Africa would need to overcome the structural bottlenecks that translate to high transfer cost across space and time relative to world prices, improve its institution, and increase agricultural research and the extension system in order to improve its agricultural exports share to developed nations.

Thus the initiatives to open up OECD markets should only be seen as one component of a broader strategy to promote a supply response in developing countries, especially in sub-Saharan Africa. It can also be used to send a strong signal to Africa's policymakers about the importance and urgency of following up with their own reforms. African countries need to put in place a framework of supportive domestic policies and infrastructure (transport, logistics, credit, technical assistance) that will lead to increased investment and enhanced technologies that could magnify the benefits of liberalization (IMF and World Bank, 2002, p. 5).

Given the significance of agriculture in SSA countries, this paper focuses on the possible direct and indirect effects of policies on this sector's exports. In particular, the paper analyses the direct effect of structural and institutional constraints[7] that agricultural exports face and pinpoint what the impact of relaxing these constraints would mean as incentives for the agricultural exports. As such, the paper attempts to empirically identify unifying (both demand and supply) factors that impede African agricultural exports. On the demand side, we attempt to incorporate OECD's tariff and price support scheme that hinder Africa's agricultural export into the OECD market. On the supply side, we include what has been called 'factors affecting technical capabilities and the effectiveness of strategic interventions' (see Elbadawi, 2002, p. 138). This includes infrastructure, access to information and agricultural inputs. In addition, we have incorporated factors reflecting the profitability of the sectors like real exchange rate, and the extent of macro distortion.

This paper has six sections. Section 2 gives a brief discussion on the importance of agriculture and agricultural exports in Africa. We discuss the domestic and external factors that impede agricultural exports in the region in Section 3. We outline the model we intend to estimate and give a brief discussion of some of the important variables in Section 4. Our econometric results and the analysis are given in Section 5 and we conclude in Section 6.

2. Brief Overview of the Importance of Agriculture in Africa

The United Nations Millennium Development Goals of reducing by half, between 1990 and 2015, the proportion of people whose income is less than one dollar a day has energized the school of thought calling for Africa to redefine the importance of agriculture for its development. Wood (2002) argues that because it is land-abundant, Africa will always have a larger primary sector and a smaller manufacturing sector than the land-scarce regions of Asia and Europe.

The importance of agriculture in SSA cannot be stressed enough given that it is central to economic growth and most of economic activities in the region depends on it. Agricultural sector remains the primary source for employment for sub-Saharan Africa, accounting for approximately 70 percent of the total employment in the late 1990s (Delgado, 1995). In the year 2000, agricultural value added as a share of GDP was 17 percent, service sector 53 percent, and the manufacturing sector 14 percent. Agricultural export performance in sub-Saharan Africa has declined significantly in the last two decades. The region's share of global agricultural trade value has dwindled from 8.4 percent in 1965 to 2 percent in 2001.

Table 1 shows that in 1997, agriculture contributed about a 28 percent share of GDP of sub-Saharan Africa. Agricultural exports share of merchandise exports was about one-third, which is equivalent to 5 percent of GDP. The importance of agricultural output and exports in this region lies in the fact that its main activities are based in the rural areas where the majority of the poor people live and as such its benefits are bound to trickle down to a majority of the population.

Table 1 shows that the importance of agriculture in SSA countries is not homogenous but varies with the relative wealth of countries. Whereas overall the share of agriculture in GDP has remained unchanged in the last two decades, dividing the countries by income groups paints a different picture. In poor African countries the share of agriculture as a

Table 1: Share of agriculture in Sub-Saharan Africa exports and GDP (median values)

	Agriculture as share of GDP (%)			Manufactures exports (% of merchandise exports)			Agricultural exports (% ratio of merchandise exports)			Agricultural exports (% ratio of GDP)		
	1980	1990	1997	1980	1990	1997	1980	1990	1997	1980	1990	1997
Low	39	40	40	12	5	6	64	50	49	7	6	6
Lower middle	35	35	36	6	14	13	75	66	49	12	5	6
Upper middle	27	25	24	12	16	28	61	38	28	7	4	4
High	12	15	10	10	24	56	27	16	11	10	7	5
All SSA	**28**	**28**	**28**	**10**	**17**	**23**	**56**	**42**	**34**	**9**	**6**	**5**

Notes: Low income countries include: Ethiopia, Eritrea, Burundi, Democratic Republic of the Congo, Mozambique, Sierra Leone, Malawi, Tanzania, Niger, Guinea-Bissau, Burkina Faso, Chad.
Lower middle income countries: Rwanda, Madagascar, Uganda, Mali, Nigeria, Kenya, Gambia, Togo, Central African Republic, Sudan, Benin, Sao Tome and Principe.
Upper middle-income countries: Zambia, Ghana, Lesotho, Mauritania, Comoros, Guinea, Senegal, Zimbabwe, Angola, Cameroon.
High income: Cote d'lvoire, Djibouti, Equatorial Guinea, Republic of the Congo, Cape Verde, Swaziland, Namibia, Botswana, Mauritius, South Africa, Gabon, Seychelles.
Source: World Bank Database, 2002.

percentage of GDP has remained relatively the same. In the middle income and high-income African countries, the share of agriculture to GDP has reduced by two to three percentage points in the last two decades.

Turning to agricultural exports the story is more worrying. Agricultural exports as a share of GDP has reduced by about 50 percent in the last two decades for median sub-Saharan African countries. The share of agricultural export for lower-income African countries fell by only 14 percent in two decades while it fell by 50 percent for richer African countries.

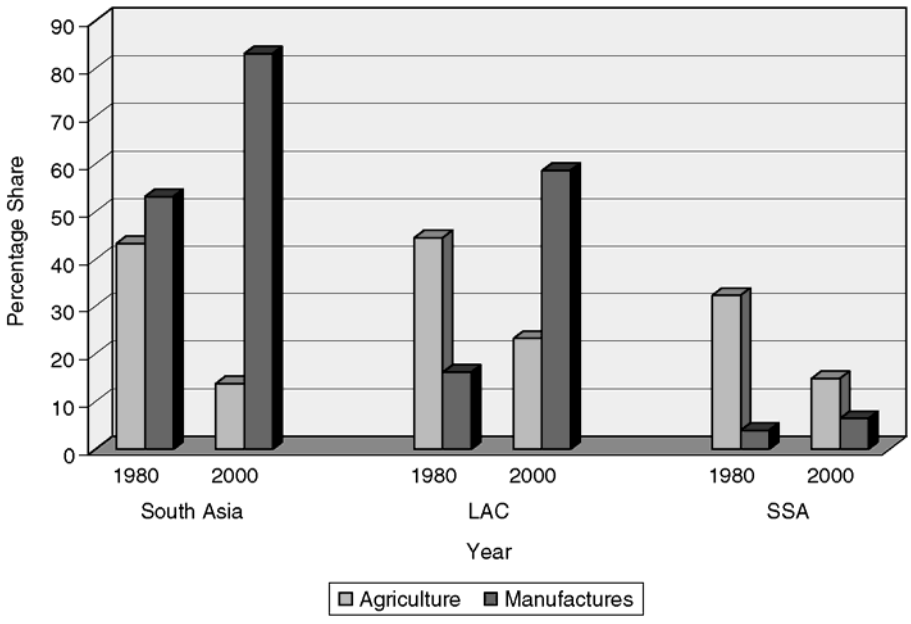
Looking at agricultural exports as a share of merchandise exports, the ratio has fallen from 56 percent in 1980 to 34 percent in 20 years for a median African country (a drop of about 39 percent). The share of agricultural exports has fallen by 59 percent for African rich countries and 23 percent for poor countries. Comparing this with the performance of manufactured exports as a share of merchandise exports we observe that overall the share has increased by 130 percent in the two decades. The irony is that the share of manufactured exports to merchandise exports has increased by 460 percent for rich African countries but fallen by 50 percent for poor countries.

The cause of poor performance in the agricultural sector has been attributed to poor domestic policies as well as restrictive policies in developed countries. Hoekman *et al.* (2001) point to restrictive market access policies in developed countries as a source of Africa's marginalization,

while Yeats *et al.* (1997) argue that African countries' domestic policies led to the decline in the region's share of global exports. In the 1980s, policies such as exchange rate appreciation and anti-agricultural industrial policies were some of the dominant domestic policies that contributed to the deterioration in agricultural export performance (Schiff and Valdes, 1992). In recent years domestic conditions, including the persistence of State Trading Enterprises (STEs), high transportation costs, low productivity, among others, have adversely impacted the agricultural sector.

Despite the marginalization of exports, it is clear that the agricultural sector in sub-Saharan Africa still plays a vital role in the region's economy in terms of employment, output, and exports revenue. Agricultural export accounted for 32 percent and 15 percent in 1980 and 2000 respectively (see Figure 1). In South Asia, manufacturing dominated, accounting for over 50 percent of the total exports in 1980 and 2000. Latin American countries (LAC) experienced a structural transformation, as the manufacturing sector became the more dominant sector in 2000 as opposed to agriculture that was dominant in 1980. The share of total manufacturing exports increased from 23 percent in 1980 to 59 percent in 2000 while the agricultural exports declined by 64 percent in 20 years. Intuitively, as economies develop, the share of agriculture in GDP tends

Figure 1: Share of agriculture and manufacturing in total trade, 1980 and 2000

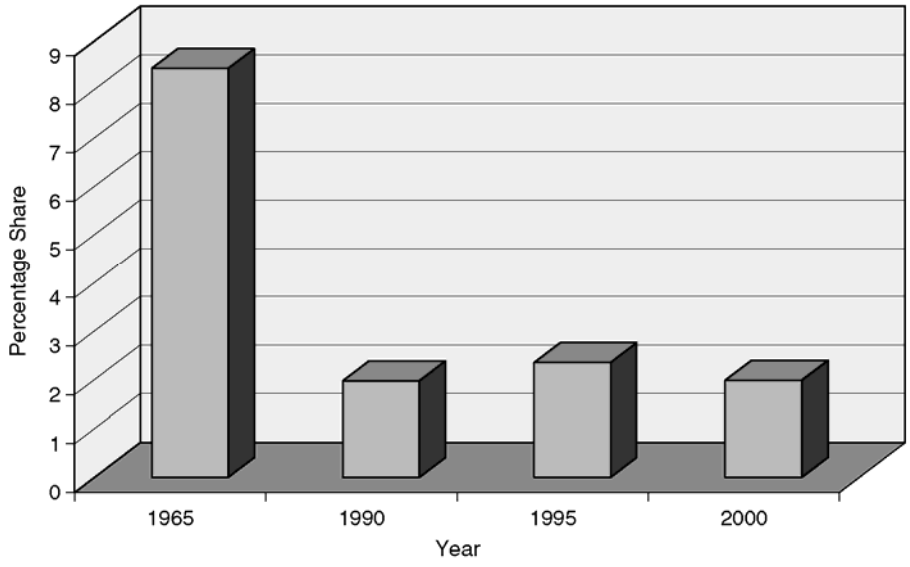


to drop, as countries prosper, while those of manufacturing and services do increase. This has been attributed to higher income elasticity of demand, the price elasticity of demand and supply, and higher productivity growth in other sectors compared to agriculture (see Sekkat and Varoudakis, 1998).

The major concern among development and trade economists is why sub-Saharan Africa's share of the agricultural trade value decreased substantially from 8.4 percent in 1965 to 2 percent in 2000, even though there was a slight increase in 1995 (see Figure 2).

The important observation coming from Table 1 is not that Africa's share of agricultural exports has fallen while that of manufactured exports has increased, but that for the very poor African countries both the exports of manufactured and agricultural exports has declined while the importance of agriculture (i.e. share of agriculture in GDP) in these economies have increased. One implication of this is that the poor African countries are worse off today than they were twenty years ago. The other implication could be that these countries are more indebted or are having more current account or balance of payment problems today than they were two decades ago. Ten out of twelve countries listed as poor countries in Table 1 are heavily indebted poor countries (HIPC), while eight out of twelve are categorized as post-conflict or conflict-affected countries. It has been argued in the literature that poor domestic policies as well as restrictive policies in developed countries have contributed to this poor performance

Figure 2: Sub-Saharan Africa's share in world agricultural exports, 1965-2000



in the agricultural exports sector. On the domestic front, it is argued that over the years the region has been constrained by poor infrastructure, poor macroeconomic policies, little access to information and technology, adverse terms of trade, human disease (i.e., HIV/AIDS), among others. On the world market, developed countries, in particular the EU and the USA, continue to use subsidies, increase support to the farmers, and still maintain high tariffs on some agricultural products of interest to the region. We explore some of these issues in the following sections.

3. Domestic Factors Affecting SSA Agricultural Exports

The problem facing agricultural exports currently being addressed by the international community is the restrictions that Africa's export commodities face at the borders of industrialized countries. What could be a larger problem is the environment in Africa where these commodities are produced before they are exported. Creating incentives for the poor African farmers to start producing for export in an environment where it is assured that not only will their products reach foreign markets in time, but do so, may go a long way in relieving poverty in the region. A variety of factors prevent the rural poor from responding as they may wish to emerging market opportunities and to heightened competition (Killick, 2000). The market access bottlenecks in African countries prevent the farmers from taking the potential advantages of OECD markets for their products.

Much progress has been made in liberalizing the world trade through WTO and this has in turn created opportunities for SSA countries to access developed country markets more easily (Henson and Loader, 2000). In particular, since the late 1990s, efforts to reduce barriers to trade in agricultural and food products, for example tariffs, quantitative restriction and other trade barriers through the Uruguay Round of Multilateral Trade Negotiations, has provided opportunities for enhanced export performance for both traditional and non-traditional exports (Henson and Loader, 2000, p. 85).

A further commitment by the industrialized nations to open up their markets to African nations should now focus the attention of African policymakers to bring about structural and institutional reforms to enable the farmers to benefit. To this end, this paper tries to identify the problems of market access and how they can be addressed.

Market access problems that face farmers are mostly related to: macro environment; poor infrastructure; access to inputs (like fertilizer, credit) to bolster production; access to information about markets, prices, standards and quality of the goods required in the markets; and the structures and

institutional arrangements in the African countries, especially the rural areas where most of the produce are from (see also Kydd *et al,* 2000).

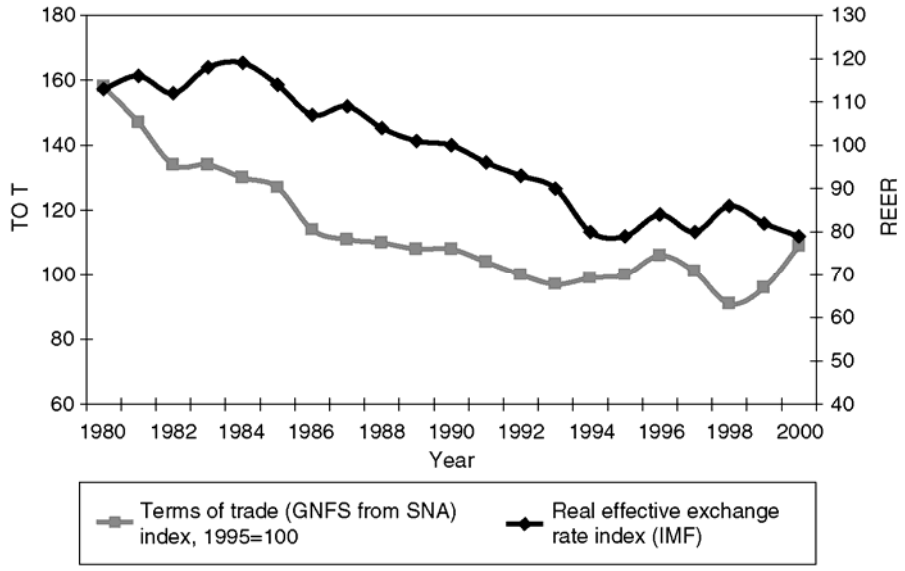
Agricultural sector policies remain a critical component of the production incentive provided to farmers in sub-Saharan Africa. Many policies have tended to tax agriculture excessively, with farmers only receiving a minor fraction of the world price.[8] As a result farmers do not have enough resources to make farm improvements. The extent of these severe price distortions has been highlighted by Schiff and Valdes (1992) who argue that, among all developing country regions, sub-Saharan African countries imposed the highest level of taxation (both explicit and implicit) on agriculture, ranging from 46-59 percent. The direct tax on agriculture in these countries is similar to the implicit tax resulting from industrial protection and macroeconomic policies. This differs markedly from their findings in the other developing countries where the implicit tax was nearly three times that of the direct tax. Herrman (1997) did a similar study that focused on individual crops (coffee, wheat and rice) and found significant policy biases against agriculture, which were more excessive for export crops (coffee) than for food crops (rice and wheat). Nonetheless, favorable agricultural policies for food crops were often found to be offset by distorted macroeconomic policies with a resulting decline in the real producer price. Both of these studies used pre-1985 data which limits their use in identifying current distortions facing today's African farmers.

Real exchange rate and terms of trade are important elements when it comes to determining incentives to agriculture. As illustrated in Figure 3, sub-Saharan Africa experienced declining terms of trade from 1980 until 1998. However, there have been improvements since then. Increasing terms of trade mean better agricultural prices, giving the producers an incentive to produce more exports. The exchange rate policy adopted during the economic reforms of the late 1980s and 1990s significantly depreciated most African currencies, thereby substantially reducing the parallel market exchange premiums. The improvement in exchange rate management helped improve agricultural prices. As Figure 3 shows, however, the gains of competitive exchange rates have been significantly eroded by the worsening terms of trade.

Even though the terms of trade and exchange rate policy in sub-Saharan Africa have been favorable in terms of increasing incentives to farmers to produce more exports, other factors including agricultural productivity, infrastructure, access to information, among other factors, have offset the potential gains from exchange rate management and terms of trade.

Agricultural inputs — fertilizer usage — is an important factor when assessing the agricultural sector in sub-Saharan Africa. How much fertilizer is used is determined by the prices of fertilizer and trade restrictions

Figure 3: Real effective exchange rate and terms of trade in sub-Saharan Africa, 1980-2000



Source: World Bank (2002).

and regulations (World Bank, 2000). The removal of subsidies in recent years has caused prices to increase, reducing fertilizer usage among many small farmers. In some countries, the imposition of import controls on fertilizer and liberalized higher prices of fertilizers have led many farmers to sharply reduce the amount of fertilizer usage in production in an effort to cut costs. The median SSA fertilizer usage is below the global median (26.6 kg per hectare).

Access to information empowers farmers with valuable information pertaining to prices and agricultural extension services. Given poor road conditions, it is often difficult for extension workers to reach farmers in the interior. In addition, efforts to reduce government expenditure under structural reforms have led to huge cuts in extension services and manpower. Given this, the use of radios has proved to be one of the most effective ways the government can channel information to farmers on new farming techniques to enhance productivity and information on market prices. For this reason, our hypothesis is that improved access to information (in our case proxied by the number of radios per thousand people) in the region is likely to lead to an increase in agricultural exports.

The significance of radio as a medium of information cannot be exaggerated in sub-Saharan Africa where the literacy levels of farmers

are lower compared to other regions. As such, it is important for farmers who grow export crops to have important market information of their output price, input prices, requirements for exports and new markets. The importance of access to market information is mainly to enhance market integration at the national level. It also plays an important role in transmitting the price signals to farmers and the business community to recognize and take advantage of market opportunities. Killick (2000, p. 17) has argued that market information — access to knowledge about market conditions and opportunities — is often poor, leading, for example, to large price differences for identical products within quite confined regions. This lack of access to market information is attributed to the muted situation response of African agriculture to price liberalization (Killick, 2000, p. 17, see also Ahmed and Rustagi, 1987, p. 115; Lloyd *et al*, 1997).

Poor infrastructure is one of the major bottlenecks that producers of Africa's agricultural export face and as such, it limits the farmers' access to the output market and use of inputs.[9] The poor roads, or lack of roads altogether, constrain the farmers from having their inputs in time or their output to reach the market in time. This point has been stressed by Minten and Kyle (1999) who argue that poor infrastructure has a negative impact on rural prosperity as it affects fertilizer and other input uses, raises producer price elasticities and hinders market integration.

Poor infrastructures make the transaction cost that African producers face relatively high when compared to their competitors from other regions. The impact of high transport costs has been documented in the literature. Antle's (1983) results show transport and communications infrastructure to be an important constraint on agricultural productivity. Delgado (1995) has documented how high transport costs in rural Africa reduce the tradeability of much agricultural output, effectively turning parts of the rural economy into systems that are only 'semi-open', even though they might otherwise be expected to gain heavily through participation in trade (Killick, 2000). More recently a study by Limao and Venables (1999) reiterated a significant impact of transport costs on trade, finding that the median landlocked country has only 30 percent of the trade volume of the median coastal economy and that improving the standard of infrastructure of the most badly affected countries stands to have a large expansionary effect on their trade volumes.

3.1 Sub-Saharan Africa and its Trading Partners

In 2000, 45 percent of SSA exports went to the EU, 7 percent to the USA, 6 percent to Japan, and 1 percent to Canada. In each of these four

markets (also known as the Quad), tariff peaks and tariff escalation are relatively common. Despite most-favored nation (MFN) status and in some instances preferential tariffs, many products of trade interest to African countries continue to be subject to tariffs in excess of 100 percent in developed countries. Items of major export interest to developing countries which are subject to tariff peaks include: sugar, cereal, tobacco, vegetables, fish, and fruit. Tariff peaks and tariff escalation have a disproportional impact on exports from Africa and other developing countries. Hoekman *et al.* (2001) estimate that if Quad countries extended complete market access to developing countries on products currently subject to tariff peaks and quotas, Africa's exports would increase by $2.5 billion (11 percent).

While Africa faces tariff peaks in each of the four Quad countries, there are also obvious signs of tariff escalation in major markets (Gibson *et al*, 2001).[10]

Market access is also restricted by non-tariff barriers (NTBs) and technical barriers, for example, sanitary, and phytosanitary, and technical standards. The Agreement on Sanitary and Phytosanitary (SPS) measures, which is part of the Uruguay Round Agreement, gives detailed rules for the application of SPS measures that could restrict trade. The multilateral trading system requires that member countries should ascertain that their products and import goods meet a minimum level of quality and health standards. Ideally, the agreement attempts to prevent domestic standards from having a negative impact on trade.

Table Al in the Appendix shows that there was an increase in the total support to producers, measured by the Producer Support Estimate (PSE) from $246,226 million in 1986-88 to $266,605 million in 1997-99. The slight decline in market price support (MPS) was more than offset by increases in other forms of domestic payments to support domestic production or farm incomes.[11] Market price support and budgetary payments can create severe trade distortions (see Table Al and Figures A1-A4 in the Appendix).

Taking these issues together, access to markets and information can be seen to a large extent to be determined by the costs of engaging in these markets (in terms of costs of acquiring information, costs of transport, costs of establishing relationships with traders, and the risks of not being able to buy or sell at reasonable prices) as against the (expected) net benefits of engaging in a productive activity (Kydd *et al*, 2000, p. 12). Whereas the tangible costs and benefits of engaging in productive activities are generally well recognized, less tangible costs of accessing markets are more difficult to identify and measure, and hence are little understood and often ignored in policy analysis (Kydd *et al.*, 2000, p. 12). We model these issues below.

4. Model Specification

The case for an increase in agricultural exports in sub-Saharan Africa is based on the fact that the region stands to benefit immensely if it accesses the OECD markets. This is because SSA goods do not directly compete with manufacturing goods produced in the OECD markets. In order to benefit, SSA countries need to reduce the bottlenecks currently facing agricultural exports. They also need to increase the efficiency of production in the agricultural sector.

In modeling agricultural exports, the literature has identified the factors that constrain Africa's agricultural exports as mainly the competitiveness of the economy in which agricultural products are produced summarized by real exchange rate and terms of trade. In this paper, we attempt to extend the traditional determinants model by empirically estimating the impact of the following variables on Africa's agricultural exports. These variables include: (1) agricultural productivity (proxied by agricultural output per worker and the use of modern inputs like fertilizer); (2) access to information (proxied by the number of radios per thousand); (3) availability of infrastructure (proxied by the percentage of paved roads); and (4) external/foreign market access constraints — this includes foreign tariff facing Africa's agricultural exports, foreign governments market support variables as in Producer Nominal Assistance Coefficient (PNAC) and Producer Support Estimates (PSE).

We therefore specify our model as:

$$\begin{aligned} AgriExps = {} & \beta_0 + \beta_1 REER + \beta_2 TOT + \beta_3 INPUTS + \beta_4 PROD \\ & + \beta_5 INFO + \beta_6 INFRA + \beta_7 TAF + \beta_8 MACRO \\ & + \beta_9 PNAC + \beta_{10} Trend + \beta_{11} AgriExps_{t-1} \end{aligned} \quad (1)$$

where *AgriExps* is the value of agricultural exports as a share of GDP — it has been scaled by GDP to avoid picking up spurious effects; *REER* is the real effective exchange rate and is measured as the reciprocal of the ratio of nominal effective exchange rate index multiplied by the Consumer Price Indexes (CPIs) of the major trading partners to the CPI of the African country in question; *MACRO* is the sustainability of the macro environment and it is measured as the ratio of parallel exchange rate to official exchange rate; *TOT* is terms of trade; *INPUTS* is agricultural inputs proxied here by fertilizer consumption per hectare; *PROD* is the productivity measures and is proxied by value added per worker in the agricultural sector; *INFO* is information variable, proxied here by the number of radios per thousand; *INFRA* is infrastructure variable, measured by the percentage of paved roads to total roads in a country; *TAF*

is tariff charged by trading partners taken here as the average tax rate charged by developed countries on imports; *PNAC* is the price support variables given to producers in foreign markets; *Trend* is a variable capturing growing standards and technical bariers; and $AgriExps_t$.\ is the value of agricultural exports as a share of GDP is the previous year.

Our expectations are that $\beta_1, \beta_7, \beta_8, \beta_9, \beta_{10} < 0$ and $\beta_2, \beta_3, \beta_4, \beta_5, \beta_6 > 0$.

Real exchange rate. We use the real exchange rate to capture appropriate incentives for exports, which may trigger supply response. The nature of exchange rate management will either result in an overvalued or depreciated exchange rate. As such, the evolution of the real exchange rate determines the competitiveness of a country's commodities in the international market, thus profitability. In the past, exchange rate management in many countries in Africa resulted in overvaluation of the real exchange rate, leading to gross distortions in some of the cases. A depreciating real exchange rate would make Africa's agricultural exports more competitive in the world market while an appreciating real exchange rate would make it less competitive. We therefore expect the coefficient of RER, β_1, to be negative.[12]

Shatz and Tarr (2002) have identified the discrimination of exports as one of the many channels through which an overvalued exchange rate hurts the economy and growth. They argue that since a significant portion of the costs of production is paid in domestic currency, the overvalued exchange rate reduces exporters' incentives and ability to compete in foreign markets. This might choke foreign exchange receipts and might also reduce a country's ability to purchase imports (Shatz and Tarr, 2002).

Macro. We capture the sustainability of the macro environment in this model by the ratio of parallel to official exchange rate. When there is a distortion in the economy, in the form of inflation, budget deficits and many other forms, this is usually reflected in the parallel exchange rates. If the exchange rate regime is fixed and not determined by the market, the parallel exchange rate will be much higher than the official rate. The ratio of parallel to official exchange rate captures overvaluation due to less openness in an economy. The advantage of this measure is that it can capture overvaluation even when one sector is considered. The harmful effects of favoring one sector (manufacturing) at the expense of the other (agriculture) has been analyzed and reported by Helleiner (1992). The proportion of these two rates thus truly reflect the macro distortion affecting the profitability of agricultural exporters.

The extent to which unsustainable current account deficits and overvalued official exchange rates artificially inflate the value of a nation's currency from the viewpoint of farmers have been studied by Krueger *et al.* (1988) in which they point out that these macro situations do encourage the production of non-tradables relative to tradables. Krueger *et al.*

find that these macroeconomic policies proved less of a disincentive to agricultural producers than did industrial protectionism.[13] Their empirical analysis found that the combined indirect negative impact of industrial and macroeconomic policies on farmers' incentives was 2.5 times as large as the direct negative effects of agricultural export policies in the decade 1974-84. This was equivalent to depressing the price of farm exportables by 38 percent, compared with just 11 percent by direct measures (Kym, 2002, p. 13).

Terms of trade. The terms of trade, defined as the ratio of price of exports to price of imports, is intended to capture the profitability of Africa's exports — primarily dominated by agricultural exports. The impact of an increase in terms of trade should have a positive effect on exports from the agricultural sector, as it would become more profitable to produce goods for exports or simply to divert more resources for export production.

Agricultural productivity. It has been argued that for Africa to increase its share of agricultural exports, the productivity in the agricultural sector would have to increase. This desired increase could be achieved through the use of modern inputs like fertilizer and machinery. Differences in the amount of capital per worker explain roughly half the difference in output per worker between Africa and the OECD countries, and reflect big differences in past rates of investment in physical and human capital (see Wood and Mayer, 1998). In the past, most SSA countries used to subsidize the price of inputs like fertilizer and farm machinery. This acted as a big incentive for farmers to use these inputs and thereby it increased their productivity. The economic reforms undertaken in the 1980s and 1990s forced most governments to cut these subsidies. These actions have had negative consequence on productivity in the agricultural sector. Since farmers are faced with higher costs in the purchase of inputs, they have cut down on the amount of inputs that they use in production to less than optimal. We therefore expect that β_3 and $\beta_4 > 0$. That is, then higher the use of farm inputs, fertilizer, the higher production will be and there will be more goods to be exported. Higher productivity in the agricultural sector will also stimulate exports.

Tariff. The import tariff and other price-based border measures imposed by OECD countries on agricultural goods have restricted market access for Africa's agricultural products. The IMF and World Bank (2001) note that agricultural tariffs in OECD countries remain several times higher than those facing manufactured imports. A reduction or removal of tariff on goods, especially those from Africa would reduce the price of agricultural prices in those foreign markets, thus making them competitive. We therefore expect the coefficient $\beta_7 < 0$.

Trend. As statutory production has declined, many agricultural exports from Africa find a growing frequency of trade remedy actions

and proliferation of technical barriers that hinder market access. Annual notifications of new barriers (including health and safety standards, and product standards) to GATT/WTO increased steadily from a dozen or two in the early 1980s to over 400 in 1999 (IMF and World Bank, 2002, p. 16). Low- and middle-income countries reported that over the period from 1996-99 more than 50 percent of their potential exports of fresh and processed fish, meat, fruit and vegetables into the EU were 'prevented' by their inability to comply with SPS requirements (IMF and World Bank, 2002, p. 16; see also OECD, 2001). Developing country trade officials have viewed SPS and other technical requirements as a greater constraint on their ability to export than tariffs and quantitative restrictions (IMF and World Bank, 2001, p. 16). We expect to find a negative relationship that over time, controlling for other factors, African manufactured exports have found it hard to enter into foreign markets.

Producer price support. Trade-distorting subsidies imposed by industrial countries tend to be skewed toward labor-intensive manufactures and agricultural products. The use of agricultural support schemes in industrial countries does encourage greater domestic production in foreign countries, thus limiting African agricultural commodities exports to those economies. According to the IMF and World Bank report, prices received by OECD farmers were on average 31 percent above world prices (measured at border). In this paper we test whether African agricultural exports to OECD is sensitive to the Nominal Assistance Coefficient.[14] We expected a negative coefficient.

4.1 Data Sources

All the data used were from the World Bank SIMA database that also include World Development Indicators. We also used the FAO database to get data on agricultural exports to GDP. Data on tariff, agricultural support schemes and PNAC were taken from the World Bank's World Integrated Trade Solution (WITS) database.

5. Model Estimation and Results

From the discussion above, it emerges that increasing the market share of Africa's agricultural exports will need more concerted efforts in both industrialized countries and SSA countries. The industrialized countries not only need to reduce their tariff and non-tariff barriers but also need to reduce the massive agricultural support given to their farmers to encourage greater OECD production. SSA countries not only need to

deepen reforms that reduce macroeconomic distortion but must accompany this by structural and institution reforms to encourage investment in infrastructure, access of information, and availability of agricultural inputs.

This paper estimates the relative importance of these variables for SSA agricultural exports. We estimate the model specified above, respecified below for convenience, using different estimation techniques:

$$\begin{aligned} AgriExps = {} & \beta_0 + \beta_1 REER + \beta_2 TOT + \beta_3 INPUTS + \beta_4 PROD \\ & + \beta_5 INFO + \beta_6 INFRA + \beta_7 TAF + \beta_8 MACRO \\ & + \beta_9 PNAC + \beta_{10} TREND + \beta_{11} AgriExps_{t-1} \end{aligned} \quad (1)$$

A properly estimated model of the type specified in (1) may help us understand the relationship and influences of the market access variables on Africa's agricultural exports and in undertaking useful policy formulation that may enhance the region in addressing the constraints hindering them from taking advantage of the OECD market.

5.1 Estimation Issues

Since we are using cross-sectional time series data, several estimation techniques are available which we can choose from to estimate our model. However, before deciding on our preferred estimation technique we need to look into a number of issues. The natural starting point of estimation is through a simple pooling method that employs OLS estimation techniques. The conventional specification of a panel regression can be of the form:

$$\mathbf{y_{it}} = \alpha + \beta' \mathbf{x_{it}} + \gamma \mathbf{z_{it}} + \mathbf{u_{it}} \quad (2)$$

where *y* is the dependent variable, x and z are vectors of observed and unobserved regressors respectively, *u* is the residual and $u_{it} \sim N(0, \sigma_{it}^2)$. α, β, and γ denote parameter vectors, *i* denotes the cross section units (countries in our case) and *t* denotes the time period.

OLS estimation (i.e. pooled regression) of (2) that ignores the unobserved $\mathbf{z}_t$ in the regression will suffer from the omitted bias problem, thus β will be biased if $\text{cov}(x, z) \neq 0$.

If the covariance in (2) between x and z is non-zero, panel estimation can be used to control for the biasedness of β in the OLS estimator. For example, if the z variables are constant across time but differ across individual countries, taking the first differences of (2) will give us (3). Alternatively, if z variables are common across all individuals but vary over time, taking deviations of each individual observation from the means across all individuals at each time period yields (4).

$$y_{it} - \bar{y}_i = \beta'(x_{it} - \bar{x}_i) + (u_{it} - \bar{u}_i) \tag{3}$$

$$y_{it} - \bar{y}_t = \beta'(x_{it} - \bar{x}_t) + (u_{it} - \bar{u}_t) \tag{4}$$

where $\bar{y}_t$, $\bar{x}_t$, and $\bar{u}_t$ denote the group mean at a particular time period *t*.

The transformation in (3) and (4) sweeps out the unobserved variable z and the OLS estimation of (3) and (4) will yield unbiased and consistent estimates of β (see Adam, 2000).

Equation (2) above can be rewritten such that the vector of the unobserved variables z is aggregated in the residual as:

$$y_{it} = \alpha + X_{it}\beta + u_{it}, \quad \text{where } u_{it} = \mu_i + \nu_{it} \tag{5}$$

As before, *i* denotes the countries and *t* denotes time periods, μ_i denotes the unobservable individual specific effects which are time invariant and account for any individual-specific effects not included in X, ν_{it} is the usual error component which is assumed to be $IID(0, \sigma_\nu^2)$ (Adam, 2000).

We can test for the existence of fixed effect in (5) by using a standard F test:

$$H_0 = \mu_1 = \mu_2 = \ldots = \mu_{N-1} = 0 \tag{6}$$

A rejection of the null will imply preference of fixed effects. This is often referred to as a pooling restriction across the unobservable heterogeneity in the model.

Alternatively, we can respecify (5) in terms of deviations from the mean as:

$$y_{it} - \theta\bar{y}_i = (1-\theta)\alpha + (X_{it} - \theta\bar{X}_i)\beta + [(1-\theta)\mu_i + (\nu_{it} - \theta\bar{\nu}_t)] \tag{7}$$

where θ is a function of σ_μ^2, and σ_ν^2. If $\sigma_\mu^2 = 0$ meaning $\mu = 0$, then $\theta = 0$. In such a case (5) can be estimated directly by using OLS. Otherwise, if the unobserved individual and time effects are deterministic, that is, $\sigma_\nu^2 = 0$, then $\theta = 1$. In such a scenario the fixed effects estimation would be preferred. If σ_u^2, and σ_ν^2 are stochastic and independent of each other and X, then we have a random effects model. Again testing for a random effects model versus OLS implies testing a null hypothesis of $\sigma_u^2 = 0$. This is the Breusch and Pagan (1980) Lagrange multiplier test. A rejection of the null implies a random effects model.

The choice of an estimation technique to use between the random and fixed effects model can be determined through the Hausman (1978) test.

Basically, the Hausman procedure tests for the appropriateness of a random effects estimator.

We can also expand our objective in this empirical set up by eliminating cross-section variation and focusing exclusively on changes. Given that many African countries have a very short time-span of data, using the customary approach of fixed effects or random effects to this kind of time-series cross-section data may lead to biased coefficients. In order to avoid the potential bias associated with this approach, we use the Generalized Method of Moments (GMM) estimator derived by Arellano and Bond (1991). This approach relies on the use of first-differences to remove the fixed effects part of the error term and instrumental variable estimation, where the instruments are the lagged explanatory variables (in differences) and the dependent variable in level lagged twice. This approach was first suggested by Anderson and Hsiao (1981) and developed further by Arellano and Bond (1991). We will use one-step robust results as recommended by Arellano and Bond (1991) to make inference on coefficients.

5.2 Econometric Results and Analysis

Table 2 gives the econometric results of our model through various estimation techniques. Having discussed the various econometric issues that ought to be taken into consideration, we now have a good idea of which results are consistent and unbiased.

The Wald joint test in Table 2 shows that the null hypothesis that all the coefficients estimated are zero is rejected at the 1 percent significance level. The null hypothesis of no first and second order autocorrelation could not be rejected in the within-group and fixed effects estimation. Under the GMM estimation, the null hypothesis of no first order autocorrelation is rejected, while that of second order cannot be rejected at the 5 percent significance level. The presence of first order autocorrelation in the one-step GMM model residuals does not imply that the estimates are inconsistent, though the presence of second order autocorrelation would imply this (see Arellano and Bond, 1991). The Sargan test of over-identifying restriction cannot reject the null hypothesis that the over-identifying restrictions are valid.

Turning to the actual results, the coefficients of each variable across the different estimation techniques are broadly similar. However, the GMM estimation results are our preferred choice, as the estimation results yield superior results.

Column 3 of Table 2 shows the GMM results of the estimated model. Beginning the discussion with variables reflecting macroeconomic environment, that is, real effective exchange rate and the ratio of parallel to

Table 2: Regression results under different estimation techniques: Dependent variable – Agricultural exports, 1977–2000

Variable	Within groups estimation 1	Fixed effects estimation	GMM estimation
Lagged agricultural exports	0.2845	0.2894	0.2767
	(0.0548)*	(0.0487)*	(0.0478)*
Ln (real effective exchange rate)	−1.0704	−1.0970	−1.1549
	(0.5940)***	(0.6239)***	(0.6112)
Ratio of parallel to official exchange rate	−0.1373	−0.1366	0.1351
	(0.0221)*	(0.0223)*	(0.0258)*
Ln (terms of trade)	0.1657	0.1221	0.0809
	(0.6325)	(0.6000)	(0.6344)
Ln (agricultural inputs)	0.4536	0.4859	0.6136
	(0.3494)	(0.3487)	(0.3726)***
Ln (agricultural value added per worker)	3.4621	3.3863	3.3393
	(1.3150)*	(1.314)**	(1.417)**
Ln (information)	2.2056	2.274	2.2869
	(0.7979)	(0.7856)*	(0.7617)*
Ln (infrastructure)	1.1717	1.0982	1.1301
	(0.7154)	(0.6974)	(0.6778)***
Foreign tariff rate	−0.4591	−2.4023	−1.2279
	(0.1582)*	(1.0540)**	(0.3453)*
Trend (proxy for standards)	−1.1839	−2.6717	−1.4426
	(0.2663)*	(0.9114)*	(0.3435)*
Constant			−1.4460
Number of observations	243	243	205
Number of countries	38	38	38
Wald Joint test	276.4[0.0000]*	431.1[0.0000]*	248.5[0.0000]
AR (1) test	−1.462[0.144]	1.522[0.128]	− 2.771[0.006]*
AR (2) test	−1.882[0.060]	−1.882[0.060]	−1.520[0.129]
Sargan test			192.5[1.000]

Notes: Heteroskedasticity consistent standard errors are in parentheses.
Time dummies have been used and are found to be significant (Wald (time) test $\chi^2(7)$ 59.89 for model (1), 59.94 for model (2) and 60.76 for model (3).
*1% significance level, **5% significance level, ***10% significance level.
The eight periods of estimation are 1977–79, 1980–82, 1982–85, 1986–88, 1989–91, 1992–94, 1995–97, 1998–2000.
Pooling test: F(37,190) 6.21[0.0000]
Hausman test: chi(15) 222.55[0.0000]

official exchange rates, we find the coefficient of these variables to be negative. That is, an appreciation of the real exchange rate (i.e. the increase in REER) leads to a fall in the agricultural export share. This result is not statistically significant at the 10 percent level even though it is when we use the within group estimation and fixed effects estimation. Intuitively what this tells us is that an appreciation of the real exchange rate[15] or a nominal appreciation of currencies in SSA countries, will

make SSA agricultural exports non-competitive in the world market and the quantity demanded will decline. From our results in Table 2 and Table 3, a 10 percent depreciation of the real effective exchange rate will lead to about a 2 percent increase in SSA agricultural export shares. A deliberate and a conscious policy decision to depreciate any SSA's currency in an environment of low inflation will make that country's exports, not only agricultural, to be more competitive in the world market.

We find the coefficient of the ratio of parallel to official exchange rate to be negative and statistically significant. Specifically from Table 3, a 10 percent increase in the ratio of parallel to official exchange rate will reduce the agricultural export share by 0.6 percent. It is our opinion that this variable captures macro distortion in the economy. As such, the kind of higher macro distortion in an economy that we are referring to, are those caused by overvalued official exchange rate, unsustainable current account, budget deficits and many others. Such policies make the parallel exchange rate to increase relative to the official exchange rate. Alternatively, the black market exchange rate will depreciate and the premium (defined as black market minus official market exchange rate) will increase as economic agents expect depreciation. In such an environment, economic agents may decide to hold foreign currency for speculative purposes. This inevitably creates scarcity of foreign currency in the domestic market. Farmers who require foreign currency to import agricultural inputs such as fertilizer and machinery will be hard hit in the event of such scarcity. Less use of fertilizer, machinery, pesticides and so on may lead to less output and less exports.

Lastly, we observe some evidence that an improvement in the terms of trade for SSA economies will lead to a larger share of agricultural exports. However, this result is found to be not statistically significant.

Table 3: Africa's agricultural exports elasticity

Agricultural export elasticity with respect to:	Coefficients	Sample mean	Elasticity
Agricultural exports (inertia)	0.28	6.31	0.28
Real effective exchange rate	−1.15	110.56	−0.18
Ratio of parallel to official exchange rate	−0.14	2.83	−0.06
Terms of trade	0.08	109.99	0.01*
Agricultural inputs	0.61	21.92	0.10
Agricultural productivity	3.34	711.18	0.53
Information	2.29	152.66	0.36
Infrastructure	1.13	25.79	0.18
Foreign tariff rate	−1.23	5.61	−1.09
Trend	−1.44	8.84	−2.02
PNAC	−2.28	1.78	−0.64

Note: Calculated from Table 2 and Table A2.

Turning to the impact of institutional factors, which in this paper is captured by agricultural inputs and value added per worker in the agricultural sector, we find some interesting results. As shown in Table 2, we find a positive and significant coefficient of agricultural inputs on agricultural exports share. A 10 percent increase in the use of agricultural inputs increases the agricultural export share by 1 percent (see Table 3). This result reiterates the importance of the use of agricultural inputs on exports production. Policies that distort the macroeconomic environment like overvalued exchange rate or protectionist policies that in turn lead to rationing of the foreign currency, make it hard (expensive) for farmers to import agricultural inputs which in turn lead to lower agricultural export. This suggests that some of the decline in the agricultural export share we observed in Table 1 can be attributed to the reduction of government subsidy on fertilizer and other inputs. The decline in agricultural export production was accelerated by the increase in input prices after the implementation of exchange rate reforms under the structural adjustment programs.

We find the coefficient of agricultural productivity to be positive and statistically significant. Specifically, a 10 percent increase in agricultural productivity increases the share of agricultural exports by about 5 percent. Productivity here is proxied by agricultural value added per worker. There are so many ways that workers can increase their value added, for example through the use of the expertise of extension workers, access of information of crop diseases, use of inputs, correct seeds, new farming techniques and tips etc. The value added per worker implies higher productivity, higher output and larger surpluses for exports.

Turning to factors that are captured by access to information and infrastructure in this paper, we find that these structural factors do have a positive and statistically significant impact on agricultural export share. Our regression results indicate that a 10 percent increase in access to information increases agricultural export share by about 4 percent. Information plays an important role in sub-Saharan Africa given the high level of illiteracy rates in the region, especially in the agricultural sector where farming is not considered as a business or profession. With a sharp reduction of extension officers, lack of electricity and telecommunications in the majority of rural areas, communication through the media of radio plays a very significant role to the farmers in the region. The governments of most SSA countries are using the radio to inform the farmers about the market prices of agricultural commodities not only in their districts but both nationally and internationally. Governments have, in the past, increasingly relied on the radio media to inform the farmers on new seeds, new crop and animal diseases and used the radio as a forum to discuss the problems that farmers face in their day-to-day

activities and how to solve them. Access to information is therefore one of the most important determinants of what determines export share.

We find that a 10 percent increase in infrastructure leads to a 2 percent increase in agricultural exports share. Most African farmers are located in the rural areas where all-weather roads hardly exist, where during the rainy seasons agricultural inputs cannot reach the farmers, where farmers cannot take their output to the nearest market let alone to national and international markets. Lack of *access* roads also prevents farmers from using tractors for ploughing, weeding and harvesting etc. Lack of all weather roads or access roads mean that transporters of agricultural goods to and from rural areas charge higher prices to ship agricultural goods to the markets and high prices to deliver agricultural inputs to farmers. This acts like a production tax as it increases production costs to the farmers and makes SSA agricultural exports less competitive in the world market. An increase in investments on, not only, main roads but also access roads or feeder roads to farming communities will definitely encourage farmers to grow more export crops as they know most of their produce will reach the market in time and with a reduced transport cost.

Turning to external/foreign determinants, we find that foreign tariff rates on SSA exports to OECD markets, agricultural support to OECD farmers and standards and technical barriers have a statistically significant negative impact on SSA agricultural export share. From Table 2 and 3, a 10 percent reduction on the tariff that the OECD levies on SSA agricultural exports will increase SSA exports share by 11 percent. This is a very important result as it supports the argument that SSA agricultural exports are very sensitive to industrialized countries' tariff rates and any reduction in the tariff rates will significantly increase Africa's exports competitiveness in the foreign markets.

We also find that a reduction in agricultural support to OECD farmers by 10 percent will increase the African share of exports to those markets by about 6 percent. Lastly, we also find some evidence that a relaxation of standards and technical barriers will lead to an increase in agricultural exports share. We find that a 10 percent reduction of standards and technical barriers will increase African export share by about 20 percent.

Lastly, we want to briefly discuss some very interesting observations in the correlation matrix shown in Table 4. As we noted above there is a very significant correlation between the level of infrastructure in a country with the use of agricultural inputs, agricultural productivity and access to information. As discussed earlier in our analysis of results, lack of infrastructure in most SSA countries could be inhibiting the use of agricultural inputs and thus lowering productivity in the agricultural sector. Since all these factors are important and significant determinants of agricultural exports, more investment in infrastructure in SSA countries

Table 4: Correlation matrix

	Exports	L(REER)	Macro	L(TOT)	L(input)	L(prod)	L(info)	L(infra)	Tariff	Trend	PNAC-EU	PSE-EU	PSE-USA	PNAC-USA
Exports	1													
L(REER)	−0.08	1												
Macro	0.00	0.00	1											
L(TOT)	0.08	0.30*	0.15*	1										
L(input)	0.22*	0.11	−0.14*	−0.03	1									
L(prod)	−0.14*	−0.01	−0.10	0.04	0.33*	1								
L(info)	0.00	0.02	−0.24*	−0.03	0.26*	0.38*	1							
L(infra)	−0.11	0.12	−0.08	0.10	0.38*	0.44*	0.28*	1						
Tariff	0.11	0.46*	0.02	0.31*	−0.01	−0.04	−0.26*	−0.08	1					
Trend	−0.13*	−0.46*	0.01	−0.34*	0.03	0.07	0.30*	0.11	−0.93*	1				
PNAC-EU	0.02	0.21*	−0.02	0.03	0.01	0.00	−0.02	0.03	0.32*	−0.19*	1			
PSE-EU	−0.05	−0.11	−0.04	−0.19*	0.02	0.02	0.16*	0.08	−0.41*	0.48*	0.73*	1		
PSE-US	0.11	0.44	−0.01	0.22*	0.02	−0.04	−0.17*	−0.05	0.74*	−0.66*	0.72*	0.21*	1	
PNAC-USA	0.11	0.45	−0.01	0.23*	0.02	−0.04	−0.18*	−0.05	0.76*	−0.68*	0.70*	0.18*	1.00*	1

Notes: Exports: Agricultural exports; REER: real effective exchange rates; Macro: ratio of parallel to official exchange rates; TOT: terms of trade; input: agricultural inputs; prod: agricultural value added per worker; info: agricultural information; infra: infrastructure; Tariff: foreign tariff rate.
* Significant at 5% level.

will have significant forward linkages in the agricultural sector and will help African countries to increase the share of agricultural exports in the world market. We also observe from Table 4 the high and significant correlation between access to information and the use of agricultural inputs. As we reiterated above, governments should continue providing information to the farmers to advise them on the need for using modern technology and inputs to encourage production surpluses for export. We also observe a significant correlation between agricultural productivity and the use of more agricultural inputs.

Another observation we make from Table 4 is the negative and significant correlation between our measure of standards and technical barriers with the real exchange rate, terms of trade and foreign tariff rate. From Table 4 it is obvious that as tariff levied by OECD countries on SSA agricultural exports have been lowered, standards and technical barriers on agricultural exports to OECD has been raised (a correlation of —0.93). Another significant observation is positive and significant correlation between access to information and standards and technical barriers. What this tells us is that through the use of media/radio, farmers have been made aware of the requirements of standards and technical barriers in the OECD markets.

6. Implications and Conclusions

This paper attempts to identify factors that constrain agricultural exports from sub-Saharan Africa to the world market. This is done by specifying and estimating an equation that includes both foreign factors (i.e. agricultural support to OECD farmers, OECD tariff rates on SSA exports, and a measure of standards and technical barriers) and domestic factors (macro variables, structural and institutional variables). Macro distortions are found to be important and significant factors that influence agricultural export shares. Real exchange rate is found not to be significant, a finding which supports the fact that no significant mileage could be made by African countries further depreciating their currencies. This is because most countries are operating a flexible exchange rate regime today as opposed to the 1970s and 1980s when most exchange rate regimes were fixed. On structural factors, we find that investment in infrastructure and access to information are important factors that determine Africa's agricultural exports. We found a high and significant correlation between infrastructure and the use of agricultural inputs and agricultural productivity, which on their own are significant determinants of agricultural exports. Lastly, we find strong evidence that SSA

exports are very sensitive to policies in foreign markets. Agricultural exports from Africa is found to be very sensitive (highly elastic) to OECD tariff rates, OECD farm subsidies and standards and technical barriers. A reduction of these foreign factors would have a tremendous increase in SSA agricultural export share.

The implications of our findings are not new but go a long way to support, albeit empirically, what has been said before. For SSA countries to increase their share of agriculture in the world market, (1) they have to undertake reforms that reduce macro distortion in their economies; (2) the farmers must use more agricultural inputs and accelerate their productivity; (3) they must have access to more information on how to adopt new technology and invest more infrastructure; and (4) OECD countries must reduce their border barriers and agricultural support to its farmers.

Notes

1. *New York Times*, 27 June 2002, New York, available online at www.nytimes.com
2. BBC Online news, 27 June 2002, London, at news.bbc.co.uk
3. The figure was US$266 billion annually for farm subsidies in the period 1997-99, which accounted for about 35 percent of gross farm receipts. This amount was more than five times the level of all official development assistance to developing countries (World Bank, 2001).
4. that make it difficult for developing countries to penetrate their markets.
5. According to the IMF and World Bank, the share of LDC trade in the global market is about 0.5 percent.
6. 'Quad' refers to the EU, USA, Canada and Japan.
7. For example, investment in infrastructure, agricultural inputs etc.
8. Bevan, Collier and Gunning (1993) give a convincing report on how the coffee boom of 1976/77 in Kenya and Tanzania was managed and how taxing agriculture excessively creates disincentives for farmers.
9. Since most farmers live in the rural areas where there are hardly any roads in good conditions the transport component of input costs is so high. Due to the poor conditions of most feeder roads, most of them are impassable during rainy seasons when the use of inputs

(e.g. fertilizer) is mostly needed. In some cases fertilizer reaches the farms too late in the production cycle.

10. Tariff escalation is a characteristic of tariff regimes in which higher rates are levied on processed products than on products closer to raw materials in the processing chain. This protects the processing industries.

11. Market Price Support (MPS): Annual monetary value of gross transfers from consumers and taxpayers to support farmers, arising from policy measures with the intention to create a gap between domestic market prices and border prices of a specific agricultural commodity. MPS is measured at farm gate level.

12. $RER = \frac{P_D}{P_T^* e}$, where P_D is the domestic prices, P_T is foreign prices and e is the nominal exchange rate.

13. Kym (2002) argues that government intervention in currency markets also can have non-trivial distortionary effects on incentives. Farmers, Kym argues, may receive the international price for their produce and yet be harmed by having to convert from foreign to domestic currency at an artificially low exchange rate.

14. Nominal Assistance Coefficient: an indicator of the nominal rate of assistance to producers measuring the ratio between the values of gross farm receipts including support and gross farm receipts valued at world market prices without support.

15. Which in our definition can occur through an increase of domestic prices (non-tradable prices).

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Appendix

Table A1: Estimates of support to agriculture (US$ million)

	1986–88	1997–99
Producer Support Estimate (PSE)	246,226	266,605
Market Price Support	191,137	180,173
Budgetary Payments	55,088	86,432

Source: OECD (2000).

Table A2: Regression results under different estimation techniques: Dependent variable – Agricultural exports, 1977–2000

Variable	Within groups estimation 1	Fixed effects estimation	GMM estimation
Lagged agricultural exports	0.3115	0.3045	0.2926
	(0.0534)*	(0.0564)*	(0.0572)*
Ln (real effective exchange rate)	−0.6185	−0.7937	−0.8430
	(0.7602)	(0.7226)	(0.7090)
Ratio of parallel to official exchange rate	−0.1380	−0.1451	−0.1440
	(0.0287)*	(0.0250)*	(0.0280)*
Ln(terms of trade)	0.4003	−0.5696	0.5327
	(0.6835)	(0.7079)	(0.7408)
Ln (agricultural inputs)	0.4742	0.4274	0.5380
	(0.4145)	(0.3694)	(0.4157)
Ln (agricultural value added per worker)	3.2301	3.2138	3.1974
	(1.422)**	(1.489)**	(1.588)**
Ln (information)	1.5067	1.6460	1.5922
	(1.016)	(0.99934)***	(0.9553)***
Ln (infrastructure)	1.0530	0.8978	0.9266
	(0.8664)	(0.8446)	(0.8332)
PNAC	−2.2345	−2.2192	−2.2792
	(1.121)**	(1.107)***	(1.0830)
Trend (proxy for standards)	−0.4625	−0.4837	−0.2500
	(0.1624)*	(0.1651)*	(0.0855)*
Constant		−28.1385	−0.2500
Number of observations	243	243	205
Number of countries	38	38	38
Wald (Joint) test	391.0[0.000]*	361.5[0.000]*	290[0.000]*
AR (1) test	−1.751[0.080]	0.1554[0.120]	−2.83[0.013]*
AR (2) test	−1.707[0.088]	−1.694[0.090]	−1.214[0.225]*
Sargan test			194.1[1.000]

Notes: Heteroskedasticity consistent standard errors are in parentheses.
Time dummies are excluded from estimation because of high multicollinearity with the PNAC variable. See Table Al for the estimation results when time dummies are included.
* 1% significance level; ** 5% significance level; *** 10% significance level.
The eight periods of estimation are 1977-79, 1980-82, 1982-85, 1986-88, 1989-91, 1992-94, 1995-97, 1998-2000.

Table A3: Regression results under different estimation techniques: Dependent variable – Agricultural exports, 1977–2000

Variable	Within groups estimation 1	Fixed effects estimation	GMM estimation
Lagged agricultural exports	0.2992	0.2893	0.2767
	(0.0474)*	(0.0487)*	(0.0478)*
Ln (real effective exchange rate)	−0.9116	−1.0970	−1.1549
	(0.6471)	(0.6239)	(0.6112)
Ratio of parallel to official exchange rate	−0.1291	−0.1366	−0.1351
	(0.0263)*	(0.0223)*	(0.0287)*
Ln(terms of trade)	−0.1280	−0.1221	0.0809
	(0.5786)	(0.6000)	(0.6344)
Ln (fertilizer)	0.5337	0.4859	0.6136
	(0.3748)	(0.3487)	(0.3726)***
Ln (agricultural value added per worker)	3.3178	3.3863	3.3393
	(1.251)*	(1.314)**	(1.417)**
Ln (information)	2.1827	2.2741	2.2869
	(0.8111)*	(0.7856)*	(0.7617)*
Ln (infrastructure)	1.1803	1.0982	1.1301
	(0.7005)***	(0.6974)	(0.6778)
PNAC	−0.0649	−12.2028	−0.0102
	(0.0395)***	(5.445)**	(0.1035)
Trend (proxy for standards)	−0.8504	−1.1498	−1.4426
	(0.1765)*	(0.2732)**	(0.3435)*
Constant		−6.9624	−1.4426
Number of observations	243	243	205
Number of countries	38	38	38
Wald (Joint) test	443.3[0.000]*	480.4[0.000]*	263.9[0.000]*
AR (1) test	−1.874[0.061]	1.522[0.128]	−2.771[0.006]*
AR (2) test	−1.895[0.058]	−1.882[0.060]	−1.520[0.129]
Sargan test			192.5[1.000]

Notes: Heteroskedasticity consistent standard errors used in all estimation.
Time dummies have been used and are found to be significant (Wald (time) test χ^2 (7) = 60.52 for model (1), 56.11 for model (2) and 60.76 for model (3).
* 1% significance level; ** 5% significance level; *** 10% significance level.
The eight periods of estimation are 1977-79, 1980-82, 1982-85, 1986-88, 1989-91, 1992-94, 1995-97, 1998-2000.

Figure A1: Producer and market support in the EU, 1986–99

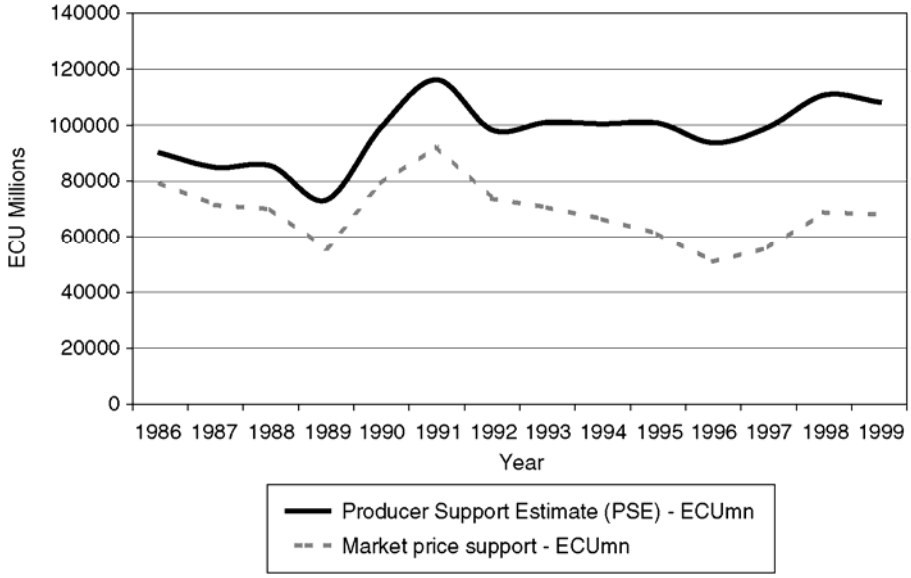
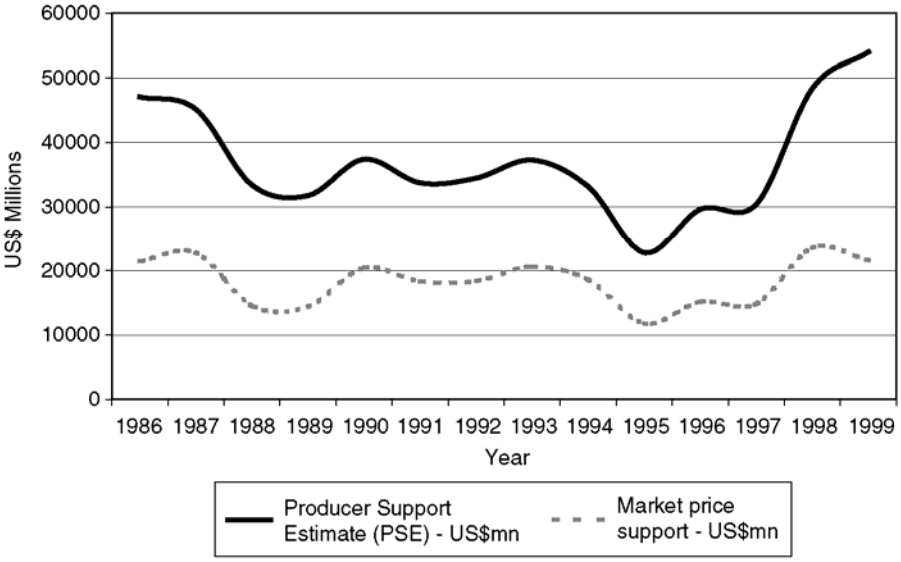
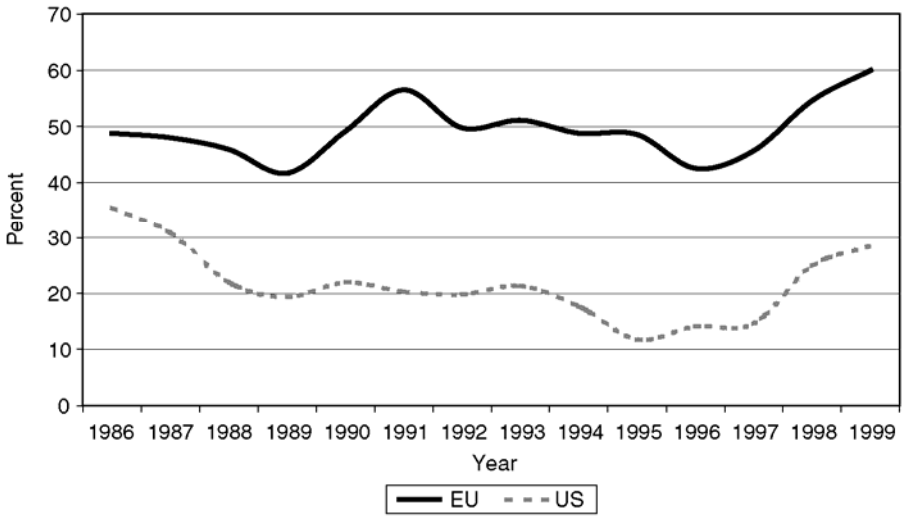


Figure A2: Producer and market price support in the USA, 1986–99



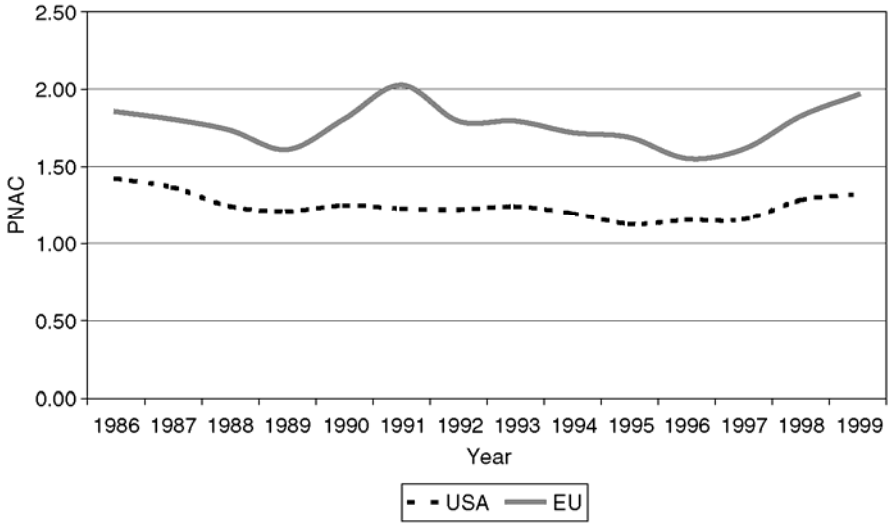
Source: OECD

Figure A3: Ratio of producer support estimates to production value in the EU and USA, 1986–99



Source: OECD

Figure A4: Nominal Assistance Coefficient for the EU and USA, 1986–99



Source: OECD