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and Import Growth in Sub-Saharan Africa**

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Abstract

This paper adopts panel data methodologies to investigate the impact of trade liberalisation on export growth and import growth across 28 Sub-Saharan African countries from 1981 to 2010. We find that trade liberalisation increases the growth of exports, however, imports grow faster by approximately two percentage points which gives a *prima facie* evidence that the trade balance in the region deteriorated in the post-liberalisation era. We also find that trade liberalisation significantly raises the price elasticity of demand for exports and imports, however, it does not significantly affect income elasticity of demand.

Keywords: Trade liberalisation, Export growth, Import growth, Price and Income elasticities of demand, Sub-Saharan Africa.

JEL Classification: C23, F13, F14, O55.

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1. Introduction

In the 1960s and 1970s, Sub-Saharan African (SSA) countries adopted interventionist policies aimed at protecting their domestic market from foreign competition. These policies were also seen as a feasible approach to achieving structural transformation and reducing the region's dependence on primary commodities. Unfortunately, however, the 1979 oil shock, together with the debt crisis and global recession of the early 1980s, left SSA in the doldrums: non-fuel primary commodity prices plummeted, debt to GDP ratio rose to 70 per cent while per capita income declined by 14 per cent between 1980 and 1987 (UNCTAD 2004). This precarious state prompted international financial institutions such as the World Bank and the International Monetary Fund (IMF) to offer financial aid to the region on condition that countries open up their trade regime. By the mid-1980s and early 1990s, free trade policies in the context of Structural Adjustment Programmes had started dominating the SSA region. Early liberalisers include Niger and Ghana while countries such as Angola, Burundi and the Democratic Republic of Congo (DRC) only embarked on significant trade reforms in the early twenty-first century owing to decades of political and social crises.

The removal or reduction of barriers to trade such as import tariffs, export duties and quantitative restrictions stimulates the growth of exports and imports. However, if imports grow relatively faster than exports, then an economy is at risk of balance of payments problems which could create a binding constraint on output growth.¹ This is the trade liberalisation conundrum which has not been adequately researched in the literature on Sub-Saharan Africa. Most empirical studies on trade liberalisation adopt the narrow approach of analysing its impact on output (GDP) growth, without considering whether growth is sustainable and consistent with long-run balance of payments (BOP) equilibrium. While we do not examine the impact of trade liberalisation on the trade-off between output growth and BOP in this paper, we investigate how free trade has affected export growth and import growth. This analysis will show whether imports grew faster than exports in the post-liberalisation era and will also give a preliminary indication of the trade balance position in SSA. Furthermore, we assess the impact of trade liberalisation on the price and income elasticity of demand for exports and imports, respectively.²

¹ See Thirlwall (1979).

² See Appendix 1 for the list and classification of countries.

We focus on a panel dataset of 28 SSA countries from the period 1981 to 2010.³ Export and import growth equations are specified to include explanatory variables such as domestic income growth, foreign income growth and a measure of price competitiveness. Fixed and random effects estimators as well as instrumental variables regressions are adopted. Trade liberalisation is measured quantitatively and qualitatively: first, we use the average duties applied to exports and imports, where an export duty represents export taxes as a percentage of total exports while an import duty denotes import taxes as a percentage of total imports.⁴ Second, we apply a dummy variable approach in which the trade liberalisation variable takes the value of one when uninterrupted trade reforms began in a SSA country and zero beforehand.⁵ Liberalisation dates are derived from a careful examination of the trade policy reviews of SSA countries.⁶

The empirical studies on the impact of trade liberalisation on export performance have produced mixed results. World Bank studies of Michealy et al (1991) and Thomas et al (1991), Joshi and Little's (1996) evaluation of the economic reforms in India, Bleaney's (1999) panel data study of manufactured exports for ten Latin American countries, Ahmed's (2000) co-integration analysis of Bangladesh's merchandise export, Pacheco-Lopez's (2005) study of the impact of trade liberalisation in Mexico, and Santos-Paulino's (2002 and 2007) panel data analysis of trade liberalisation in developing and least developed countries all found a significant positive relationship between trade liberalisation and export performance. On the other hand, Clarke and Kirkpatrick (1992), Greenaway and Sapsford (1994), Jenkins (1996), Ratnaik (2012) and the UNCTAD studies of Agosin (1991) and Shafaeddin (1994), found little or no evidence of any favourable impact of trade liberalisation on export performance.

Furthermore, only a few studies have analysed the relationship between trade liberalisation and imports.⁷ In the study by Melo and Vogt (1984), two hypotheses were proposed regarding the impact of import liberalisation on the behaviour of import elasticities. One is that the income elasticity of demand increases as the degree of import liberalisation increases, while the other suggests that as economic development continues, the price

³ Choice of time period and countries are based on the availability of data.

⁴ The export duty and import duty measures are chosen because they denote one of the trade policy instruments used across Sub-Saharan Africa. Moreover, they are easily calculated and there is sufficient data for the countries analysed.

⁵ Studies on trade liberalisation that adopted the dummy variable approach include Greenaway et al (1997), Santos-Paulino (2002 and 2007), Santos-Paulino and Thirlwall (2004), Pacheco-Lopez and Thirlwall (2006), Pacheco-Lopez and Thirlwall (2007).

⁶ See Appendix 5 for a summary of the different trade reforms taken by each country in the sample.

⁷ See Melo and Vogt (1984), Bertola and Faini (1990), Faini et al (1992) and Santos-Paulino (2002 and 2007).

elasticity of import demand rises owing to progress in import substitution. Using disaggregated annual data, their results provided support for the two hypotheses in Venezuela. Santos-Paulino (2002) found empirical evidence of these hypotheses across a group of developing countries while Boylan and Cuddy (1987) rejected the hypotheses in an investigation of the elasticities of import demand in Ireland. Mah (1999), on the other hand, found that income elasticity of demand increased as a result of import liberalisation in Thailand but price elasticity did not rise.

In SSA, there is a dearth of empirical studies on the relationship between trade liberalisation and export growth and to the best of our knowledge there are no studies on the impact of trade liberalisation on import growth in Sub-Saharan Africa. A plausible explanation for the scarcity of studies may be the paucity of data in the region. The United Nations Conference on Trade and Development (2008) conducted a study on the post-liberalisation export performance of 34 African countries. Using a liberalisation dummy in accordance with the Wacziarg and Welch (2008) classification and applying the Generalised Methods of Moment (GMM) estimator, they found that trade liberalisation increased the ratio of exports-to-GDP by 0.09 percentage points.⁸ This is a very small impact and also it is surprising that the exports-to-GDP ratio is used as the dependent variable in contrast to the growth of exports.⁹ Babatunde (2009) examined the impact of trade liberalisation on export performance across 20 SSA countries from 1980 to 2005. Using fixed and random effects estimation techniques, he found no significant relationship between trade liberalisation and export performance. This finding is not unexpected as Babatunde used average tariff rates (which do not directly affect exports) as the indicator of trade liberalisation in his export equation. In addition, Olofin and Babatunde (2007) examined the price and income elasticities of Sub-Saharan African exports from 1980 to 2003. Applying a fixed effects estimation technique on a panel dataset of 20 countries, they found that the calculated long run income elasticity of demand for exports ranges between 0.94 and 1.33 while the estimated long-run price elasticity of demand varies from -0.01 to -0.17. They also found that the real income of trading partners and price competitiveness of exporting countries are significant determinants of SSA exports. This paper departs from

⁸ Wacziarg and Welch (2008) derived liberalisation dates for 119 countries based on the Sachs and Warner (1995) openness index. This index classifies a country as open if it satisfies the following five conditions: (i) average tariff rate less than 40% (ii) Black market premium less than 20% (iii) non-tariff barriers covering less than 40% of imports (iv) no state monopoly on major exports; and (v) a non-socialist economy according to Kornai (1992).

⁹ Since the independent variables are specified in growth forms, it is expected that the dependent variable will also be in growth form and not in level.

the aforementioned studies by deriving liberalisation dates for sample countries instead of relying on the Dean et al (1994) or Wacziarg and Welch (2008) classifications.¹⁰ We also adopt the terms of trade of relative prices while our specifications analyse whether the short-run impact of trade liberalisation on export and import growth is instantaneous or not. Indeed, there is no study on SSA that has adopted this approach.

The remainder of this study is organised as follows. Section 2 shows simple descriptive statistics on export growth and import growth before and after liberalisation. Section 3 and 4 explains the methodology and empirical results on the impact of trade liberalisation on export growth and import growth, respectively. Section 5 is dedicated to discussion, interpretations and comparisons of results while section 6 concludes.

2. Export growth and Import growth before and after Liberalisation

We begin the analysis in this study by examining simple descriptive statistics on the growth of exports and imports before (from 1980) and after (until 2010) liberalisation. The aim of this approach is to have preliminary information on export growth and import growth in the post-liberalisation era. This method has the weakness that no other variables have been controlled for; hence, liberalisation alone cannot be accountable for the changes in the growth of exports and imports.

The descriptive statistics are presented in Table 1. We observe that in twenty-one countries, export growth increased after liberalisation while in seven countries export growth decreased. Also, the post-liberalisation period witnessed an increase in import growth in twenty-one countries while in six countries, import growth decreased. In Botswana, the growth of imports remained the same after liberalisation. Furthermore, the table indicates that post liberalisation imports grew faster than exports in all countries except Burkina Faso, Lesotho, Mali, Rwanda, Swaziland and Uganda. Again, we cannot attribute these results to liberalisation alone as simple descriptive statistics do not show a causal link between two variables. To find such causal evidence, an econometric analysis is required in the form below.

¹⁰ The Dean et al (1994) classification is only for 13 SSA which will drastically reduce our sample size. We argue that the Wacziarg and Welch (2008) measure is too strict for SSA countries. A violation of one of the Sachs and Warner (1995) criteria renders an economy closed. If liberalisation is a gradual process, then a non-socialist country that has its tariff and non-tariff barriers lower than 40% should be classified open. Countries like Senegal Chad and Togo are classified closed because of the existence of export marketing boards which are slow to eliminate as these boards provide farmers with credit and extension services.

3. The Impact of Trade Liberalisation on Export growth

3.1. Model Specification

We adopt the conventional export demand equation which relates the level of exports to world real income and a measure of price competitiveness. Assuming constant price and income elasticities of demand, the export equation can be expressed as:

$$EXP_t = A \left(\frac{EP_{ex}}{P_{im}} \right)_t^\delta W_t^\gamma \quad (1)$$

where EXP is the level of exports; A is a constant; E is the nominal exchange rate measured as the foreign price of domestic currency while P_{ex}/P_{im} represents the ratio of export prices to import prices so that the terms of trade (ToT) is measured as $[EP_{ex}/P_{im}]$. W is the level of world real income while γ denote the income elasticity of demand for exports which is expected to be positive.¹¹ A decrease in the foreign price of domestic currency or a fall in export prices should reduce ToT and hence, increase export growth so that the expected sign for the price elasticity of demand (δ) is negative. Taking logs and differentiating with respect to time, equation (1) becomes:

$$x_t = a + \delta(e + p_{ex} - p_{im})_t + \gamma(w_t) \quad (2)$$

Equation (2) can be transformed into a static panel specification in the form of:

$$epg_{it} = \alpha_i + \beta_1 rtot_{it} + \beta_2 wgdpg_{it} + \varepsilon_{it} \quad (3)$$

where epg is the growth of real exports, α_i is the country-specific effect, $rtot$ measures the rate of change of the terms of trade, $wgdpg$ is the growth of world real income while ε_{it} is the idiosyncratic error term. Also, β_1 and β_2 denotes the price and income elasticity of demand for exports, respectively.¹² We augment equation (3) to include the two measures of liberalisation as follows:

$$epg_{it} = \alpha_i + \beta_1 rtot_{it} + \beta_2 wgdpg_{it} + \beta_3 libdum_{it} + \beta_4 epd_{it} + \varepsilon_{it} \quad (4)$$

¹¹ In contrast to most studies on export growth, we do not adopt the real exchange rate (RER) as a measure of relative prices because it contains “non-tradable” goods. Instead, the terms of trade is used as this measures exchange rate for tradable goods only.

¹² δ and γ in equation (2) corresponds to β_1 and β_2 in equation (3)

where *libdum* is the liberalisation dummy which takes the value of 1 from the year significant trade reforms began in an SSA country and zero beforehand. Since trade liberalisation reduces the degree of anti-export bias, the variable *libdum* is expected to have a positive impact on real export growth. *epd* is measured as the rate of change of export duties.¹³

Furthermore, we are interested in the impact of trade liberalisation on the price and income elasticity of demand for exports. It is expected that free trade should raise the income and price elasticity of demand which implies structural change in the form of resources being transferred to sectors with high price and income elasticities. Hence, we create two interaction variables to examine whether trade liberalisation has significantly increased or decreased the responsiveness of export growth to world income and relative price changes:

$$epg_{it} = \alpha_i + \beta_1 rtot_{it} + \beta_2 wgdpg_{it} + \beta_3 libdum_{it} + \beta_4 epd_{it} + \beta_5 rtotlib_{it} + \beta_6 wlib_{it} + \varepsilon_{it} \quad (5)$$

where *rtotlib* represents an interaction between the rate of change of the terms of trade and the liberalisation dummy, while *wlib* denotes an interaction between world income growth and the liberalisation dummy.¹⁴ The expected signs of the coefficients of equation (5) are: $\beta_1(-)$; $\beta_2(+)$; $\beta_3(+)$; $\beta_4(-)$; $\beta_5(-)$; $\beta_6(+)$.

3.2 Fixed and Random effects: Empirical results

We apply the fixed and random effects estimator to equation (4) and (5) above. The fixed effects (FE) or within estimator assumes correlation between the time-invariant component of the error term (α_i) and the regressors which implies some form of endogeneity. This endogeneity bias is solved by mean-differencing the model, thereby eliminating α_i . Since all observations of the mean-difference of a time-invariant variable are zero, the FE cannot estimate the coefficient on a time-invariant variable. The random effects (RE), on the other hand, assume that α_i is independent and identically distributed. It uses a feasible generalized least-square method to estimate the coefficients of variables including those that are time-invariant. If FE is the appropriate estimator, however, then the estimates of

¹³ For consistency, we take the rate of change of export duties instead of the level variable, as the dependent variable is in growth form.

¹⁴ See Appendix 2 for the definition and sources of variables used.

RE are inconsistent. Therefore, a Hausman test is used to decide the appropriate estimator for the model between FE and RE. All results are presented in Table 2.

We concentrate on the RE results as the Hausman test shows that it is the appropriate estimator for the model. Liberalisation significantly increases export growth by 3.32 percentage points while a 10 percent decrease in export duties will increase export growth by 0.2 percent, albeit insignificant. The income elasticity of demand for exports is 1.12 which means that a change in world income will cause a marginally higher change in the demand for SSA exports. In addition, the price elasticity of demand is -0.24, implying that exports are much less responsive to changes in relative prices. In other words, SSA countries are still highly dependent on primary commodities.

The second RE regressions include the two interaction terms *rtotlib* and *wlib*. The price elasticity of demand for exports drops to -0.13 while there is also evidence that trade liberalisation increased the price elasticity of demand for exports by 0.26 percentage points. There is no significant evidence of the impact of trade liberalisation on income elasticity of demand for exports. We also test the joint significance of the two interaction terms and the results show they are jointly significant.

3.3 Dynamic Panel Estimators: Results and Discussions

We specify a dynamic panel model (DPM) to examine the effect of trade liberalisation on export growth. This will not only allow an Instrumental Variables (IV) estimation of parameters, but also long run and short run effects of variables can be estimated. Moreover, an IV approach helps control for measurement error which might be present in static panel models.¹⁵ Thus, equation (4) and (5) are specified in dynamic form as follows:

$$epg_{it} = \alpha_i + \beta_1 epg_{it-1} + \beta_2 rtot_{it} + \beta_3 wgdpg_{it} + \beta_4 libdum_{it} + \beta_5 epd_{it} + \varepsilon_{it} \quad (6)$$

$$epg_{it} = \alpha_i + \beta_1 epg_{it-1} + \beta_2 rtot_{it} + \beta_3 wgdpg_{it} + \beta_4 libdum_{it} + \beta_5 epd_{it} + \beta_6 rtotlib_{it} + \beta_7 wlib_{it} + \varepsilon_{it} \quad (7)$$

where epg_{it-1} is the lagged export growth variable, α_i is the fixed effect while ε_{it} is the idiosyncratic error term. The regressors are still the same as defined above. Long-run price

¹⁵ The use of DPM can also be regarded as a test to know whether results are robust to different estimation techniques.

and income elasticities of demand for exports can be calculated as $\beta_2 / (1 - \beta_1)$ and $\beta_3 / (1 - \beta_1)$, respectively; while long run liberalisation effect can be estimated as $\beta_4 / (1 - \beta_1)$

The DPM model has an endogeneity problem stemming from the correlation between the lagged dependent variable and the fixed effect. The random effects estimator applied to equation (6) and (7) will lower the degree of the endogeneity bias as the number of time periods approaches infinity.¹⁶ However, a more efficient and consistent estimator is the Generalised Methods of Moments (GMM) proposed by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998). The GMM eliminates the fixed effects by first differencing the model and then uses longer lags of regressors as instruments to control for endogeneity of other explanatory variables.¹⁷ The GMM produces consistent and efficient estimates as long as the idiosyncratic error term is serially uncorrelated. The Arellano-Bond (A-B) tests for 1st and 2nd order serial correlation are calculated to ensure this condition holds. The first-order serial correlation of the differenced error term is usually expected; however, if the second-order serial correlation test rejects the null hypothesis of “no second order serial correlation”, then we conclude that the original error term is serially correlated. Additionally, the Sargan test of over-identifying restrictions is applied to test the overall validity of the instruments used in the estimated model. The Sargan test has a null hypothesis that “instruments are valid”. The results of the GMM regressions can be found in table 3.

The lagged export growth variable has a low coefficient which implies a small difference between short run and long run estimates. Trade liberalisation raised the growth of exports by 2.67 percentage points in the short run with this figure increasing to 3.22 percentage points in the long run. The short run income elasticity is 1.43 while in the long run, the income elasticity is 1.72. The short run price elasticity of demand is -0.28 while the long run figure stands at -0.34. This figure is above the estimated range of long run price elasticity of demand for SSA exports by Olofin and Babatunde (2007). A plausible explanation for this difference is the use of terms of trade as the measure of price competitiveness in contrast to the conventional real exchange rate which contain non-tradable goods. Again, the export duty variable remains insignificant.

¹⁶ See Cameron and Trivedi (2010)

¹⁷ The first difference transformation has the weakness of magnifying gaps in unbalanced panels. Hence, we use the “forward orthogonal deviations” proposed by Arellano and Bover, (1995). Instead of subtracting the previous observation from the contemporaneous one, it subtracts the average of all future available observation of a variable. This is computable for all observations except the last of each individual, irrespective of the number of gaps.

The second GMM regressions produce similar results to the RE regressions. Liberalisation increases the price elasticity of demand for exports by 0.25 percentage points while there is no significant evidence of the effect of trade liberalisation on income elasticity of demand. The correlation tests show that the error term is serially uncorrelated while the Sargan test shows that instruments are valid.

3.4 Timing Impact of Trade Reforms on Export Growth

We investigate the timing impact of trade reforms on export growth in SSA by replacing the average post-reform dummy variable (*libdum*) in our base specification with *libdum2* which equals one for the year of liberalisation only and *libdum3* which captures the year after liberalisation alone. A significant coefficient on either of these variables will imply that the liberalisation had an instant short run effect on export growth.¹⁸ We apply the RE and GMM estimators and results can be found in table 4.

We observe that the RE and GMM estimators produce similar results in terms of signs and significance of variables. The short run price elasticity of demand lies between -0.24 and -0.28, while the short run income elasticity of demand ranges from 0.97 to 1.45. There is a decrease in export growth in the liberalisation year only. Although statistically insignificant, the drop in export growth can be attributed to buyers delaying their purchases of export goods in anticipation of a liberalisation policy which will lower export prices. In the year after liberalisation, there is a positive export growth but this is still statistically insignificant. Even when the average post-reform liberalisation dummy is included, the signs and significance of independent variables remain unchanged. In other words, the short run impact of trade liberalisation on export growth is not instantaneous in SSA.

In view of the three econometric analyses adopted in sections 3.2, 3.3 and 3.4, the appropriate specification for the impact of trade liberalisation on export growth is that which includes the average post reform liberalisation dummy (equation 4 and 6). The implication of this specification is that the response of export growth to trade liberalisation is slow.¹⁹

¹⁸ A similar approach was adopted by Greenaway et al (2002) to investigate the impact of trade liberalization on output (GDP) growth in developing countries. Using different measures of liberalization and applying panel data methodology, they found a *J-curve* effect of liberalization on GDP growth.

¹⁹ We run regressions to include a liberalisation dummy which equals 1 in the third year after liberalisation only but the variable is statistically insignificant (See Appendix 3).

4. The Impact of Trade Liberalisation on Import Growth

4.1 Model Specification

To analyse the impact of trade liberalisation on import growth, we use the same countries, time period and methodology as in the export growth analyses. The reason for this approach is to ensure a consistent framework for comparing the impact of trade liberalisation on export growth and import growth. We adopt the traditional import demand equation which makes the level of imports a function of domestic real income and the ratio of export to import prices measured in a common currency.

$$M_t = \left(\frac{EP_{\text{exp}}}{P_{\text{imp}}} \right)_t^\lambda Y_t^\varphi \quad (8)$$

where M is the level of imports; E is the nominal exchange rate while $P_{\text{exp}}/P_{\text{imp}}$ is the ratio of export to import prices. Y is the level of domestic real income while λ and φ are price and income elasticity of demand for imports, respectively.

We modify equation (8) in two ways: first, we take logs and differentiate with respect to time and second we specify a static panel equation including a constant and two measures of liberalisation.

$$\text{imp}g_{it} = \alpha_i + \delta_1 \text{rtot}_{it} + \delta_2 \text{gdp}g_{it} + \delta_3 \text{libdum}_{it} + \delta_4 \text{imp}d_{it} + \varepsilon_{it} \quad (9)$$

where $\text{imp}g_{it}$ is the real import growth; rtot_{it} represents the rate of change of terms of trade; $\text{gdp}g_{it}$ is the domestic real income growth; libdum_{it} denotes the liberalisation dummy; $\text{imp}d_{it}$ is the rate of change of import duties; α_i is the country-specific effect while ε_{it} is the idiosyncratic error term. δ_1 and δ_2 measure the price and income elasticity of demand for imports, respectively.²⁰ Again, we include two interaction variables, rtotlib and ylib to examine the impact of import liberalisation on price and income elasticities of demand, thereby testing the Melo and Vogt (1984) hypothesis. Hence, equation (9) becomes:

$$\text{imp}g_{it} = \alpha_i + \delta_1 \text{rtot}_{it} + \delta_2 \text{gdp}g_{it} + \delta_3 \text{libdum}_{it} + \delta_4 \text{imp}d_{it} + \delta_5 \text{rtotlib}_{it} + \delta_6 \text{ylib}_{it} + \varepsilon_{it} \quad (10)$$

rtotlib is an interaction variable between the rate of change of terms of trade and liberalisation dummy while ylib is an interaction term between domestic income growth

²⁰ λ and φ in equation (8) corresponds to δ_1 and δ_2 in equation (9)

and the liberalisation dummy. The expected signs of the coefficients are: $\delta_1(+)$; $\delta_2(+)$; $\delta_3(+)$; $\delta_4(-)$; $\delta_5(+)$; $\delta_6(+)$.

4.2 Fixed and Random effects: Results and Discussions

Again, we estimate equation (9) and (10) using fixed and random effects techniques, followed by a Hausman test which provides the appropriate estimator for the equations. The results are presented in table 5 in which the Hausman test indicates that the FE is the appropriate estimator for the model. Liberalisation significantly increases the growth of imports by 4.87 percentage points which is higher than export growth by 1.55 percentage points. Also, a 1 percent decrease in import duties increases the growth of import by 0.66 percent while the income and price elasticities of demand for imports are 1.20 and 0.30, respectively. The second FE regression produces similar results to the first, except for the liberalisation dummy coefficient which drops by almost one percentage point. Also, liberalisation has a positive impact of price and income elasticity of demand for imports; however the latter effect is insignificant. The joint significance test shows that the two interaction variables are jointly insignificant.

4.3 Dynamic Panel Estimators: Results and Discussions

In addition, a dynamic panel model is used to examine the effect of trade liberalisation on import growth. The model is specified as:

$$imp_{it} = \alpha_i + \delta_1 imp_{it-1} + \delta_2 rtot_{it} + \delta_3 gdp_{it} + \delta_4 libdum_{it} + \delta_5 impd_{it} + \varepsilon_{it} \quad (11)$$

$$imp_{it} = \alpha_i + \delta_1 imp_{it-1} + \delta_2 rtot_{it} + \delta_3 gdp_{it} + \delta_4 libdum_{it} + \delta_5 impd_{it} + \delta_6 rtotlib_{it} + \delta_7 ylib_{it} + \varepsilon_{it} \quad (12)$$

Where imp_{it-1} is the lagged import growth variable, α_i is the fixed effect while ε_{it} is the idiosyncratic error term. The regressors remain the same as defined above. Long-run price and income elasticities of demand for imports can be calculated as $\delta_2 / (1 - \delta_1)$ and $\delta_3 / (1 - \delta_1)$, respectively; while, long run liberalisation effect can be estimated as $\delta_4 / (1 - \delta_1)$. The fixed effects estimator applied to equations (11) and (12) will lower the endogeneity

bias since T is large²¹ but a more efficient estimator is the Generalised Methods of Moments. The results (in table 6) show that liberalisation raised import growth by 4.33 and 4.92 percentage points in the short run and long run, respectively. This is above the long run post liberalisation export growth by 1.70 percentage points. A 10 percent decrease in import duties increase the growth of imports by 5.6 percent. The short-run income elasticity of demand for import is 1.05 while the long run figure is 1.19. The short run price elasticity of demand is 0.30 while in the long run the coefficient increases to 0.34. Again, we find a positive impact of trade liberalisation on price elasticity of demand while there is no significant evidence of the effect of liberalisation on income elasticity of demand for import. Furthermore, the diagnostic tests show that the error term is serially uncorrelated and that the instruments used for the estimated model are valid.²²

4.4 Timing Impact of Trade Reforms on Import Growth

Again, we test the timing impact of trade reforms on the growth of imports by introducing two liberalisation dummies (*libdum2* and *libdum3*) to our base specification. Table 7 clearly shows a decrease in import growth in the liberalisation year which can be attributed to an expectation of future lower prices following import liberalisation. In the following year, however, a positive significant import growth is witnessed. The inclusion of the average post-reform dummy variable in second GMM result does not change the significance of the “year after” dummy variable. This implies an immediate short run impact of liberalisation on import growth. More importantly, GMM II represents a more appropriate specification for the impact of trade liberalisation on import growth in SSA as it allows for a “jump” in growth of imports following liberalisation. The price elasticity of demand is 0.30 across different estimation techniques while the income elasticity of demand ranges from 1.04 to 1.26.

²¹ See Roodman (2009).

²² As a check for robustness, we add a variable for foreign aid in the import growth regression. However, we do not find a statistically significant coefficient. This can be explained by the fact that donors pay directly to oversea companies for imported goods rather than paying to the government of SSA countries due to political weakness (see Appendix 6 for results).

5. Discussions, Interpretations and Comparisons

Thus far, we have reported empirical results on export growth and import growth regressions specified in both static and dynamic forms. The reason for these two specifications is to ascertain whether our results are robust to different estimation techniques. We have applied both qualitative and quantitative measures of liberalisation while adopting the more appropriate terms of trade as a measure of relative prices in contrast to the conventional real exchange rate which contain non-tradable goods. In general, we found that imports grew faster than exports in the post-liberalisation era, giving a preliminary indication that the trade balance has deteriorated in Sub-Saharan Africa.²³

In the export growth regression, all variables have the expected signs and are statistically significant except for the export duty variable. It is plausible that the insignificant effect of export duties is caused by the presence of a binding quota set by the exporting country. The reduction in export taxes will only significantly raise exports if there is an increase in export quotas. While the measurement of export quotas in SSA is almost impossible, the liberalisation dummy variable represents a reasonable proxy as it picks the effect of non-tariff barriers. Indeed, this variable has a positive significant effect of export growth.

Also, we found that the price elasticity of demand for SSA exports is inelastic which suggests that exports from the region are mainly composed of agricultural commodities. The income elasticity of demand is, however, fairly elastic. A plausible explanation for this finding is the fact that the major exports of some SSA countries consist of petroleum products and precious stones such as diamonds and gold which are more sensitive to changes in income.²⁴ To investigate this hypothesis, we ran regressions on two sets of countries: agricultural exporters (AG) and non-agricultural exporters (NAG).²⁵ Results show that the income elasticity of export demand for NAG is 1.97 while that of AG is 0.34, albeit insignificant (See Appendix 4). In addition, liberalisation raises the price elasticity of export demand which suggests that resources are easily transferred to sectors whose goods have a high price elasticity of demand. On the other hand, liberalisation does not have a

²³ To be sure the liberalization dummy is not picking a time trend, we include a measure of time trend in our regression (see Appendix 3) but results are inconclusive as both the time trend and liberalization dummy variables are insignificant.

²⁴ Using a simultaneous equations model for world crude oil and natural gas markets, Krichene (2005) found the short run income elasticity of demand for crude oil and natural gas (for the period 1974 to 2004) to be 1.43 and 0.80, respectively.

²⁵ Agricultural exporters are countries in which over 60% of their exports comprise of food items and agricultural raw materials while non-agricultural exports have over 60% of their exports consist of petroleum products or precious stones.

significant impact on income elasticity of demand even though the coefficient has the correct sign.

Furthermore, we investigate the timing impact of trade reforms on export growth and find that the impact of liberalisation on the growth of export is not instantaneous. This is not far-fetched as SSA exports have a low price elasticity which means that demand for these goods is less responsive to price changes. In other words, a drop in the price of exports as a result of dismantling export taxes may not significantly alter demand immediately. On the supply side, SSA countries are slow to increase their productive capacity due to poor infrastructure, inadequate equipment and social insecurity, to mention a few. In order to check for robustness, we estimate parameters using the random effects estimator and generalised methods of moment (GMM). Both produce similar results in terms of signs and significance of variables.

All variables in the import growth model have the expected signs and are statistically significant. The import duty coefficient is quite high; but this is not surprising as most of these countries were heavily protected before the adoption of free trade. The income elasticity of demand for imports is fairly elastic as countries import manufactured goods. The price elasticity of demand for imports is, however, inelastic and this can be attributed to the increasing importation of food products in SSA. The Food and Agricultural Organisation (2011) found that since the 1980's agricultural imports have been exceeding agricultural exports in SSA due to the rising population growth, low agricultural productivity and weak institutions.²⁶ In addition, the major imports of some SSA countries comprise of petroleum products which are less sensitive to price changes. The short run impact of trade liberalisation on import growth is immediate as we found a positive significant growth in imports in the year after trade reforms began. This is expected as the removal of quantitative restrictions and lowering of tariff rates tends to cause a sharp rise in demand for inputs and equipment used to facilitate domestic production.

Furthermore, we compare the results of this study with Santos-Paulino and Thirlwall (2004) and Santos-Paulino (2007). Santos-Paulino and Thirlwall (2004) examine the impact of trade liberalisation on export and import growth across 22 developing countries (DC) from 1972 to 1998 while Santos-Paulino (2007) performs the same analysis for 17

²⁶ It will be worthwhile to examine the role of institutional quality in the post-liberalisation era. However, we do not analyse this effect in our study due to data limitations.

Least Developed Countries (LDC) from 1970 to 2001.²⁷ We use the GMM results from our base specifications (that is, equation 6 and 7 for exports and equations 11 and 12 for imports) for comparison as they are similar to those used in the aforementioned studies (See Table 8).

The most consistent finding is that liberalisation increased the growth of imports above that of exports across all samples of countries. Suffice to say that the trade balance of these countries worsened in the post-liberalisation era, *ceteris paribus*. Furthermore, import duties have a significant impact on import growth across the three sets of countries with the coefficient for SSA being the highest. This might be caused by the fact that the import duty variable in this study is in growth form, while in the other two studies the variable appear in levels.²⁸ Export duties have a significant effect of the growth of exports across all samples of countries except those in SSA.

Also, the price elasticity of demand for exports and imports is highest in SSA compared to the other sets of countries. This can be explained by the different measures of relative prices adopted. While Santos-Paulinio and Thirlwall (2004) and Santos-Paulinio (2007) applied the real exchange rate measure which contains non-tradable goods, this study adopted the more appropriate terms of trade measure which examines exchange rate between exportables and importables.²⁹ The income elasticity of demand for exports is approximately between 1.4 and 1.7 across the different sets of countries; while the income elasticity of demand for imports is lowest in Sub-Saharan Africa as the region is fast becoming an importer of food items. Across DC and LDC, trade liberalisation had a significant impact on the price and income elasticity of demand but in SSA, liberalisation only significantly raised price elasticity of demand for exports and imports.

²⁷ The LDCs are defined by the United Nations' Economic and Social Council as low-income countries that are suffering from long-term handicaps to growth, in particular low levels of human resource development and/or severe structural weakness.

²⁸ When we estimate with import duty in levels, we get a coefficient of 0.25; however, since we assume constant elasticity, the appropriate estimation should be in growth form.

²⁹ The inclusion of non-tradable goods in the real exchange rate tends to lower the price elasticity of demand (PED) as when we estimate with this variable, we get a PED of 0.07 for exports and 0.02 for imports.

6. Conclusion

This paper has investigated the impact of trade liberalisation on export growth and import growth in Sub-Saharan Africa. We used a dataset of 28 countries from 1981 to 2010 and applied panel data and time series/cross sectional estimators. From the empirical results obtained, we conclude that trade liberalisation has significantly raised the growth of exports in Sub-Saharan Africa, however, import growth has risen faster by approximately two percentage points which gives a *prima facie* evidence that the trade balance in the region has deteriorated. This finding is robust to the different estimation techniques adopted and also consistent with other studies on developing countries (Santos-Paulino and Thirlwall, 2004) and least developed countries (Santos-Paulino, 2007). In addition, the price elasticity of demand for exports is low in Sub-Saharan Africa, suggesting that exports in the region still consist mainly of agricultural commodities. Import duties expectedly have a significant negative impact on import growth, but no such significant relationship was found between export growth and export duties.

Furthermore, the price elasticity of demand for imports in SSA is inelastic as the region is fast becoming an importer of food items as a consequence of rising population growth (See FAO, 2011). We find evidence that trade liberalisation increases the price elasticity of demand for exports and imports but does not have a significant impact on income elasticity. Besides, the timing investigation of trade reforms shows that the short run impact of trade liberalisation on import growth is instantaneous while for export growth, it is much slower.

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Table 1: Average export and import growth before and after liberalisation in Sub-Saharan Africa

Country (28)	Average Export growth				Average Import growth		
	Lib Year	Before Lib (%)	After Lib (%)	Increase/Decrease	Before Lib (%)	After Lib (%)	Increase/Decrease
Benin	1988	-1.13	2.06	Increase	-6.24	3.53	Increase
Botswana	1994	8.84	2.85	Decrease	5.65	5.63	Same
Burkina Faso	1991	2.64	6.98	Increase	0.96	3.12	Increase
Burundi	2003	5.30	21.56	Increase	1.09	37.14	Increase
Cameroun	1989	7.89	1.55	Decrease	8.88	3.79	Decrease
Cote d'Ivoire	1994	1.01	4.33	Increase	-2.19	6.24	Increase
DRC	2001	4.66	6.24	Increase	6.53	15.37	Increase
Ethiopia	1992	0.67	10.02	Increase	3.99	10.70	Increase
Gabon	1994	5.14	-1.39	Decrease	2.35	1.66	Decrease*
Gambia	1986	8.24	2.08	Decrease	-11.13	2.61	Increase
Ghana	1983	-46.70	10.43	Increase	-4.5	11.78	Increase
Kenya	1993	4.07	4.35	Increase*	0.06	8.85	Increase
Lesotho	1994	6.30	9.67	Increase	4.26	7.37	Increase
Madagascar	1988	-5.44	6.30	Increase	-9.91	7.34	Increase
Malawi	1988	1.55	3.69	Increase	-5.57	3.67	Increase
Mali	1988	4.33	8.97	Increase	6.38	4.77	Decrease
Mauritius	1985	2.51	5.64	Increase	-1.48	6.13	Increase
Namibia	1994	2.82	0.57	Decrease	1.21	4.28	Increase
Nigeria	1986	-6.72	3.45	Increase	-3.02	4.72	Increase
Rwanda	1995	-4.77	20.36	Increase	10.27	1.98	Decrease
Senegal	1986	7.68	3.37	Decrease	6.84	3.70	Decrease
Sierra Leone	1989	-4.1	-0.56	Increase	-8.04	2.90	Increase
South Africa	1994	2.20	3.90	Increase	1.38	6.05	Increase
Swaziland	1994	4.25	6.23	Increase	3.20	5.05	Increase
Togo	1994	-2.58	3.01	Increase	-2.57	6.04	Increase
Uganda	1987	0.63	14.12	Increase	0.94	9.52	Increase
Zambia	1991	-3.39	14.99	Increase	-4.14	15.47	Increase
Zimbabwe	1990	5.31	-1.76	Decrease	6.23	1.27	Decrease

Sources: WTO policy reviews for various countries; (*) denotes a marginal increase or decrease while all values are the author's calculations.

Table 2: Fixed and Random effects regressions

Dependent variable: Export growth				
Independent variables	Fixed Effects (I)	Random Effects (I)	Fixed Effects (II)	Random Effects (II)
<i>rtot</i>	-0.25 (4.60)*	-0.24 (4.44)*	-0.15 (2.08)**	-0.13 (1.80)***
<i>wgdp</i>	1.18 (2.50)**	1.12 (2.40)**	1.02 (1.41)	0.99 (1.38)
<i>libdum</i>	3.60 (2.33)**	3.32 (2.33)**	2.95 (0.87)	2.81 (0.87)
<i>epd</i>	-0.17 (0.34)	-0.02 (0.05)	-0.14 (0.27)	-0.02 (0.03)
<i>rtotlib</i>			-0.23 (2.07)**	-0.26 (2.41)**
<i>wlib</i>			0.26 (0.28)	0.21 (0.22)
Diagnostic statistics				
R ²	0.077	0.069	0.088	0.083
F-stat [p-value]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Joint Sig	-	-	[0.1136]	[0.0532]
No. of Observations	399	399	399	399
Hausman [p-value]		[0.4099]		[0.6741]

*,** and *** indicate that a coefficient is statistically significant at 1%, 5% and 10% significance level, respectively. The figures in parenthesis () are absolute *t/z* ratios while figures in brackets [] are p-values. “Joint Sig” is a F-test for the joint significance of the two slope dummies. Fixed and Random effects (I) do not control for the slope dummies while (II) controls for these variables.

Table 3: GMM results

Independent variables	Dependent Variable:	
	GMM (I)	Export Growth GMM (II)
<i>l.epg</i>	0.17 (1.13)	0.15 (0.89)
<i>rtot</i>	-0.28 (3.22)*	-0.15 (3.22)*
<i>wgdp</i>	1.43 (3.25)*	1.55 (1.69)***
<i>libdum</i>	2.67 (1.95)***	3.65 (1.01)
<i>epd</i>	-0.12 (0.18)	-0.03 (0.04)
<i>rtotlib</i>		-0.25 (2.08)**
<i>wlib</i>		-0.25 (0.23)
<i>LR income elasticity</i>	1.72	1.82
<i>LR price elasticity</i>	-0.34	-0.18
<i>LR Lib effect</i>	3.22	4.29
No. of Observations	380	380
Diagnostic statistics		
Joint Sig		[0.1065]
Wald test	[0.000]	[0.000]
1st-Order serial correlation	[0.015]	[0.032]
2nd-Order serial correlation	[0.133]	[0.172]
Sargan Test	[0.477]	[0.539]

*** and ** indicate that a coefficient is statistically significant at 1%, 5% and 10% significance level, respectively. The figures in parenthesis () are absolute t/z ratios while figures in brackets [] are p-values. "Joint Sig" is a F-test for the joint significance of the two slope dummies. GMM (I) do not control for the slope dummies while GMM (II) controls for these variables.

Table 4: Timing impact of trade reforms

Independent variables	Dependent Variable: Export growth			
	Random Effects (I)	Random Effects (II)	GMM (I)	GMM (II)
<i>l.epg</i>	-	-	0.21 (1.38)	0.20 (1.39)
<i>libdum</i>	-	3.55 (2.45)**	-	2.77 (1.83)***
<i>libdum2</i>	-3.50 (0.89)	-5.21 (1.32)	-2.59 (0.68)	-3.86 (0.93)
<i>libdum3</i>	3.24 (0.80)	1.58 (0.38)	3.36 (0.73)	2.14 (0.45)
<i>rtot</i>	-0.24 (4.42)*	-0.25 (4.48)*	-0.28 (3.37)*	-0.28 (3.42)*
<i>wgdp</i>	0.97 (2.08)**	1.14 (2.45)**	1.37 (3.28)*	1.45 (3.35)*
<i>epd</i>	0.04 (0.08)	-0.03 (0.07)	0.04 (0.06)	-0.11 (0.17)
Diagnostic tests				
No. of Observations	399	399	380	380
Wald test / F-stat [p-value]	0.000	0.000	0.000	0.000
1st-Order serial correlation	-	-	0.015	0.015
2nd-Order serial correlation	-	-	0.133	0.129
Sargan Test	-	-	0.477	0.495

*,** and *** indicate that a coefficient is statistically significant at 1%, 5% and 10% significance level, respectively. The figures in parenthesis () are absolute *t/z* ratios while figures in brackets [] are p-values. GMM and Random effects (I) do not control for the average post-liberalisation dummy while (II) controls for this variable.

Table 5: Fixed and Random effects regressions

Dependent Variable: Import growth				
Independent variables	Fixed Effects (I)	Random Effects (I)	Fixed Effects (II)	Random Effects (II)
<i>rtot</i>	0.30 (5.99)*	0.31 (6.12)*	0.22 (3.31)*	0.24 (3.70)*
<i>gdpg</i>	1.20 (7.96)*	0.97 (6.94)*	1.15 (5.99)*	0.83 (4.85)*
<i>libdum</i>	4.87 (3.96)*	4.38 (3.29)*	3.96 (2.18)**	2.65 (1.56)
<i>impd</i>	-0.66 (3.00)*	-0.61 (2.78)*	-0.66 (2.26)*	-0.62 (2.80)*
<i>rtotlib</i>			0.20 (1.96)**	0.17 (1.69)***
<i>ylib</i>			0.20 (0.62)	0.45 (1.51)
Diagnostic statistics				
R ²	0.2765	0.2366	0.2853	0.2467
F-stat [p-value]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Joint Sig			[0.1288]	[0.0909]
No. of Observations	363	363	363	363
Hausman [p-value]	[0.0007]		[0.0031]	

*,** and *** indicate that a coefficient is statistically significant at 1%, 5% and 10% significance level, respectively. The figures in parenthesis () are absolute t/z ratios while figures in brackets [] are p-values. “Joint Sig” is a F-test for the joint significance of the two slope dummies. Fixed and Random effects (I) do not control for the slope dummies while (II) controls for these variables.

Table 6: Dynamic Panel Results: GMM

Independent variables	Dependent Variable:	
	GMM (I)	Import growth GMM (II)
<i>l.impg</i>	0.12 (1.78)***	0.13 (2.09)**
<i>rtot</i>	0.30 (4.45)*	0.21 (2.17)**
<i>gdpg</i>	1.05 (4.02)*	0.93 (2.52)**
<i>libdum</i>	4.33 (3.25)*	2.86 (1.23)
<i>impd</i>	-0.56 (2.12)**	-0.57 (2.20)**
<i>rtotlib</i>		0.20 (2.00)**
<i>ylib</i>		0.35 (0.63)
<i>LR income elasticity</i>	1.19	1.07
<i>LR price elasticity</i>	0.34	0.24
<i>LR lib effect</i>	4.92	3.29
No. of Observations	321	321
Diagnostic statistics		
Joint Sig		[0.1339]
Wald test	[0.000]	[0.000]
1st-Order serial correlation	[0.004]	[0.003]
2nd-Order serial correlation	[0.224]	[0.201]
Sargan Test	[0.490]	[0.484]

*,** and *** indicate that a coefficient is statistically significant at 1%, 5% and 10% significance level, respectively. The figures in parenthesis () are absolute t/z ratios while figures in brackets [] are p-values. "Joint Sig" is a F-test for the joint significance of the two slope dummies. GMM (I) do not control for the slope dummies while GMM (II) controls for these variables.

Table 7: Timing impact of trade reforms

Independent variables	Dependent Variable: Import growth			
	Fixed Effects (I)	Fixed Effects (II)	GMM (I)	GMM (II)
<i>l.epg</i>	-	-	0.12 (1.59)	0.12 (1.78)***
<i>libdum</i>	-	4.90 (3.26)*	-	4.23 (2.70)*
<i>libdum2</i>	-1.84 (0.51)	-4.40 (1.20)	-1.27 (0.68)	-3.37 (0.93)
<i>libdum3</i>	6.90 (1.84)***	4.42 (1.17)	7.17 (2.73)*	5.14 (1.84)***
<i>rtot</i>	0.30 (5.98)*	0.30 (5.94)*	0.30 (3.37)*	0.30 (4.26)*
<i>gdp</i>	1.26 (8.32)*	1.19 (7.84)*	1.12 (4.11)*	1.04 (3.85)*
<i>impd</i>	-0.72 (3.23)*	-0.68 (3.07)*	-0.62 (2.52)**	-0.57 (2.26)**
Diagnostic tests				
No. of Observations	363	363	321	321
Wald test / F-stat [p-value]	0.000	0.000	0.000	0.000
1st-Order serial correlation	-	-	0.005	0.005
2nd-Order serial correlation	-	-	0.157	0.173
Sargan Test	-	-	0.605	0.482

*,** and *** indicate that a coefficient is statistically significant at 1%, 5% and 10% significance level, respectively. The figures in parenthesis () are absolute t/z ratios while figures in brackets [] are p-values. GMM and Fixed effects (I) do not control for the average post-liberalisation dummy while (II) controls for this variable.

Table: 8 Comparing results

		Current Study (Sub-Saharan Africa)	Santos-Paulino and Thirlwall (2004)	Santos-Paulino (2007)
Liberalisation dummy	Exports	2.67*	1.91*	0.50*
	Imports	4.33*	9.10*	1.06*
Duties	Exports	-0.12	-0.16*	-0.19*
	Imports	-0.56*	-0.43*	-0.17*
Price elasticity	Exports	-0.28*	-0.14*	-0.03*
	Imports	0.30*	0.16*	0.11*
Income elasticity	Exports	1.43*	1.42*	1.72*
	Imports	1.05*	2.60*	1.68*
Liberalisation on price elasticity	Exports	-0.25*	-0.07	-0.02*
	Imports	0.20*	-0.40*	-0.08
Liberalisation on income elasticity	Exports	-0.25	1.41*	0.15*
	Imports	0.35	0.93*	0.22*

(*) denotes significant coefficient at either 10%, 5% or 1% significance level

Appendix 1: Classification of Countries

All Countries	Agricultural goods exporters	Non-agricultural goods exporters
Benin	Benin	Botswana
Botswana	Burkina Faso	Cameroun
Burkina Faso	Burundi	DRC
Burundi	Cote d'Ivoire	Gabon
Cameroun	Ethiopia	Ghana
Cote d'Ivoire	Gambia	Lesotho
DRC	Kenya	Mauritius
Ethiopia	Madagascar	Namibia
Gabon	Malawi	Nigeria
Gambia	Mali	Sierra Leone
Ghana	Rwanda	South Africa
Kenya	Senegal	Zambia
Lesotho	Swaziland	Zimbabwe
Madagascar	Togo	
Malawi	Uganda	
Mali		
Mauritius		
Namibia		
Nigeria		
Rwanda		
Senegal		
Sierra Leone		
South Africa		
Swaziland		
Togo		
Uganda		
Zambia		
Zimbabwe		

Appendix 2

Definition and Sources of Variables

Real Export growth(epg_{it}): This is the annual percentage growth rate of exports of goods and services based on constant 2000 US dollars. Exports of goods and services represent the value of all goods and other market services provided to the rest of the world. *Source: World Development Indicators, 2011*

Real Import growth(imp_{it}): This is the annual percentage growth rate of imports of goods and services based on constant 2000 US dollars. Imports of goods and services represent the value of all goods and other market services received from the rest of the world. *Source: World Development Indicators 2011*

Liberalization Dummy($libdum_{it}$): This variable takes the value of one when uninterrupted trade reforms began in a SSA country till the end of the sample period and zero beforehand. *Source: WTO Trade Policy Reviews, 2011*

Export duties(epd_{it}): These are all levies on goods being transported out of a country or services being delivered to non-residents by residents. It is calculated annually. *Source: IMF Government Financial Statistics, 2011 and World Development Indicators, 2011*

Import duties($impd_{it}$): These are all levies collected on goods that are entering a country or services delivered by non-residents to residents. It is calculated annually. *Source: IMF Government Financial Statistics, 2011 and World Development Indicators 2011*

Domestic Income Growth($gdpg_{it}$): This is the annual growth rate of domestic GDP based on constant 2000 US dollars. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. *Source: World Development Indicators 2011*

World Income Growth($wgdpg_{it}$): This is the annual percentage growth rate of World GDP based on constant 2000 US dollars. *Source: World Development Indicators, 2011*

Terms of Trade($rtot_{it}$): The terms of trade is defined as the ratio of export prices to import prices measured in a common currency. It is an annual data. *Source: World Development Indicators, 2012*

$Aid(aid_{it})$: This is defined as the annual net official development assistance and official aid received by a SSA country. It is expressed in constant 2010 US dollars. *Source: World Development Indicators, 2011*

Appendix 3: Timing impact of trade reforms

Independent variables	Dependent variable: Export growth			
	Random Effects (I)	Random Effects (II)	GMM (I)	GMM (II)
<i>l.epg</i>	-	-	0.21 (1.41)	0.20 (1.39)
<i>libdum</i>	-	3.69 (2.52)**	-	2.92 (1.84)***
<i>libdum2</i>	-3.53 (0.90)	-5.35 (1.35)	-2.60 (0.68)	-4.01 (0.96)
<i>libdum3</i>	3.20 (0.78)	1.43 (0.35)	3.35 (0.72)	2.00 (0.41)
<i>libdum4</i>	-1.42 (0.30)	-3.16 (0.67)	-1.93 (0.82)	-3.26 (1.21)
<i>rtot</i>	-0.24 (4.38)*	-0.24 (4.42)*	-0.28 (3.36)*	-0.28 (3.39)*
<i>wgdp</i>	0.96 (2.07)**	1.14 (2.45)**	1.37 (3.30)*	1.44 (3.38)*
<i>epd</i>	0.04 (0.08)	-0.04 (0.08)	0.04 (0.06)	-0.12 (0.17)
Diagnostic tests				
No. of Observations	399	399	380	380
Wald test / F-stat [p-value]	0.000	0.000	0.000	0.000
1st-Order serial correlation	-	-	0.014	0.014
2nd-Order serial correlation	-	-	0.132	0.125
Sargan Test	-	-	0.483	0.511

*,** and *** indicate that a coefficient is statistically significant at 1%, 5% and 10% significance level, respectively. The figures in parenthesis () are absolute *t/z* ratios while figures in brackets [] are p-values. GMM and Random effects (I) do not control for the average post-liberalisation dummy while (II) controls for this variable.

Appendix 4: Regressions with a time trend variable.

(a) Exports

	Random Effects	GMM
<i>l.epg</i>	-	0.20 (1.27)
<i>libdum</i>	1.86 (0.79)	2.46 (1.51)
<i>wgdpg</i>	1.17 (2.48)**	1.42 (3.22)*
<i>rtot</i>	-0.24 (4.45)*	-0.28 (3.30)*
<i>epd</i>	-0.04 (0.07)	-0.11 (0.17)
<i>year</i>	0.10 (0.76)	0.01 (0.08)
Diagnostic tests		
Wald test / F-stat [p-value]	[0.000]	[0.000]
1st-Order serial correlation	-	[0.021]
2nd-Order serial correlation	-	[0.166]
Sargan Test	-	[0.531]

*,** and *** indicate that a coefficient is statistically significant at 1%, 5% and 10% significance level, respectively. The figures in parenthesis () are absolute t/z ratios while figures in brackets [] are p-values

(b) Imports

	Fixed Effects	GMM
<i>l.impg</i>	-	0.12 (1.80)***
<i>libdum</i>	3.97 (1.53)	3.71 (1.50)
<i>gdpg</i>	1.20 (7.91)*	1.05 (4.01)*
<i>rtot</i>	0.30 (5.99)*	0.30 (4.46)*
<i>impd</i>	-0.67 (3.02)*	-0.57 (2.16)**
<i>year</i>	0.06 (0.42)	0.05 (0.33)
Diagnostic tests		
Wald test / F-stat [p-value]	[0.000]	[0.000]
1st-Order serial correlation	-	[0.004]
2nd-Order serial correlation	-	[0.224]
Sargan Test	-	[0.490]

*,** and *** indicate that a coefficient is statistically significant at 1%, 5% and 10% significance level, respectively. The figures in parenthesis () are absolute t/z ratios while figures in brackets [] are p-values

Appendix 5: Generalised Least Squares regressions³⁰

Independent variable	Dependent variable:	
	Agricultural goods	Export growth Non-agricultural goods
<i>rtot</i>	-0.44 (5.02)*	-0.21 (3.23)*
<i>wgdp</i>	0.34 (0.62)	1.79 (3.04)*
<i>libdum</i>	3.23 (1.89)***	3.14 (1.52)
<i>epd</i>	0.33 (0.61)	0.39 (0.33)
No. of Observations	200	152
Diagnostic statistics		
Wald test (1)	[0.0000]	[0.0001]
Wald test (2)	[0.0000]	[0.0000]
Wooldridge test	[0.3029]	[0.0025]

*,** and *** indicate that a coefficient is statistically significant at 1%, 5% and 10% significance level, respectively. The figures in parenthesis () are absolute t/z ratios while figures in brackets [] are p-values. Wald test (1) is for joint significance of regressors while Wald test (2) is for group-wise heteroskedasticity. The Wooldridge test is for autocorrelation in panel data.

Appendix 6: Import growth regression with foreign aid

	Fixed Effects	GMM
<i>l.impg</i>	-	0.12 (1.81)***
<i>libdum</i>	5.27 (3.50)*	4.57 (3.35)*
<i>gdp</i>	1.17 (7.66)*	1.01 (3.95)*
<i>rtot</i>	0.31 (6.00)*	0.30 (4.33)*
<i>impd</i>	-0.68 (3.03)*	-0.57 (2.12)**
<i>aid</i>	0.63 (0.25)	0.78 (0.45)
Diagnostic tests		
Wald test / F-stat [p-value]	[0.0000]	[0.0000]
1st-Order serial correlation	-	0.005
2nd-Order serial correlation	-	0.217
Sargan Test	-	0.420

*,** and *** indicate that a coefficient is statistically significant at 1%, 5% and 10% significance level, respectively. The figures in parenthesis () are absolute t/z ratios while figures in brackets [] are p-values

³⁰ Since the countries in each group become small relative to the time period, we adopt a long panel model which allow estimation in the presence of cross-sectional correlation, heteroskedasticity and AR (1) autocorrelation within panels. The parameters are estimated using a two-step feasible generalised least squares estimator

Appendix 7: Sub-Saharan African Countries and their Liberalisation episodes

Country (Year of liberalisation)	Significant Trade Reforms
Benin (1988)	<p>Benin started liberalising its trade regime in 1988 with the elimination of all quantitative restrictions (QRs) on imports and exports. In 1991, import licences were abolished together with the import price lists. The tariff reforms in 1991 and 1994 led to a drop in the number of import taxes to two and the range of duty rates decreased from 16 to 5 (viz, 0%, 5%, 10%, 15% and 20%). Although, export taxes were eliminated in 1993, a fiscal exit duty of 3% free-on-board (f.o.b) still applies to cocoa beans, crude-oil and precious metals. The national currency was devalued by 50% in 1994 while all forms of export subsidization schemes and domestic support measures were abolished in 1997.</p> <p>From 31st January 2000, Benin's tariff structure became entirely based on the West African Economic and Monetary Union (WAEMU) Common External Tariff (CET) which has four major categories of duties: 0% on Essential goods, 5% on staple goods, 10% on intermediate goods and inputs and 20% on Final consumer goods.</p>
Botswana (1994)	<p>Being a member of the oldest customs union in the world, Southern African Customs Union (SACU), Botswana does not have an independent trade policy. The extent of its openness to the outside world is dependent on the trade policies adopted by SACU. Under the SACU agreement, member countries apply import duties, excise duties, tariff exemptions, valuation methods, anti-dumping and safeguard duties and other customs related laws set by South Africa, the largest trading partner in the union. SACU trade reforms significantly started in 1994 following the end of the Apartheid in South Africa. Imports permits are only maintained to administer quotas on health, sanitary, phytosanitary and environmental grounds. Tariff reforms have reduced the applied Most-Favoured-Nation (MFN) common external tariff from 15% in 1997 to 11.4% in 2002. By 2009, the rate had further dropped to 8.1%. Some SACU members apply export taxes (Namibia and South Africa on rough diamond; Swaziland on sugar) while Botswana maintains an export monopoly on the export of beef.</p>
Burkina Faso (1991)	<p>Trade liberalisation in Burkina Faso started in 1991 under the Structural Adjustment Programme supported by the World Bank and IMF. Between 1991 and 1994, QRs were abolished on all imports except those relating to health and security (e.g. asbestos-based products), the arithmetic average of import duties fell to 31.1% with a minimum of 6% and a maximum of 37% and, the CFA Franc was devalued by 50%. Within the same period, all export duties were banned with the exception of a special levy</p>

on the export of livestock.

Furthermore, state monopoly is maintained on sectors such as electricity, water and rail transport, which the government describe as “strategic”. Just like Benin, Burkina Faso also adopted the WAEMU CET on the 1st of January 2000 which reduced its average applied MFN tariff rate to 12.1%.

Burundi (2003)

Originally, trade reforms in Burundi began in 1986 with the dismantling of QRs on most goods and the rationalisation of the tariff structure. However, the civil war between 1993 and 2002 resulted in a break in the reform process. During this period, there were ten tariff rates, ranging from 0% to 100%. The 10% modal rate and 100% maximum rate applied to 38% and 12% of tariff lines, respectively. Also, an import licensing system was applied.

Trade reforms resumed in January 2003 and the maximum tariff rate fell to 40% with five tariff bands - 0%, 10%, 12%, 15% and 40%. In addition, the arithmetic mean and standard deviation of tariff rates dropped to 23.5 and 14.4, respectively. The import licensing system was abolished and import bans only applied to products such as ivory, narcotic drugs, weapons and ammunition. In the same year, export taxes on coffee, tea and cotton were all eliminated.

Cameroon (1989)

Trade liberalisation in Cameroon started in 1989 after decades of import-substitution policies. In the same year, the number of goods subject to QRs was reduced, the special import authorization system was abolished and, export taxes on coffee and cocoa were eliminated. In 1994, the CFA Franc was devalued by 50% in order to raise the level of exports and restore Cameroon’s competitiveness. Cameroon’s tariff structure is based on the CET of the Economic and Monetary Community of Central Africa (CEMAC) which the country adopted in 1993. The CEMAC CET consists of five rates which are all *ad valorem*: 0% on pharmaceutical preparations, books and brochures and aviation-related goods, 5% on staple goods, 10% on raw materials and capital goods, 20% on intermediate goods and 30% on wage goods. Lastly, The exports of logs of certain species are prohibited for economic reasons.

Cote d’Ivoire (1994)

Cote d’Ivoire began to liberalise its trade regime in 1994 with the devaluation of the CFA franc. By the end of the year, QRs on imports have been lifted except for those levied on sanitary, security and phytosanitary grounds, while the average ad-valorem import duty fell to 23.5%. In January 2000, Cote d’Ivoire adopted the WAEMU CET along with a 10% special import tax on products such as soya bean and palm oil. There are duties levied on the exports of cocoa and coffee (raw or processed) while key productive sectors are still under government control.

Democratic Republic of Congo (2001)	After decades of economic downturn owing to, <i>inter alia</i> , irrational economic decisions and political crises, the DRC embarked on a series of uninterrupted reforms aimed at liberalising its economy in 2001. Among the reforms was the introduction of an <i>ad valorem</i> MFN tariff system comprising of four rates: 0%, 5%, 10% and 20%. The simple average tariff is 11.3% while the modal rate and standard deviation are 5% and 6.1%, respectively. Export duties, ranging from 1% to 10%, apply to goods such as green coffee, mineral oil, electric power and fresh water. For economic reasons, there are still restrictions on unrefined mineral ores and logs.
Ethiopia (1992)	Under the Structural Adjustment Programme initiated by the World Bank and IMF, Ethiopia started liberalizing its trade regime in 1992. In the same year, QRs on imports were eliminated except those on used clothes, harmful drugs and armaments, while the birr (domestic currency) was devaluated. In 1995 the maximum tariff rate reduced to 80% and by 2002 the rate dropped to 35%.The country's average applied MFN tariff rate is 17.3%, a slight increase from its value of 16.8 in 2007.
Gabon (1994)	Gabon's trade reforms started in 1994 following the devaluation of the CFA franc. By 1996, QRs have been dismantled on all goods except sugar and mineral water. Also, farm produce are subject to sanitary and phytosanitary certificates while hazardous products such as weapons, ammunitions and explosives are subject to import permits. The average Most Favoured Nation (MFN) tariff rate in Gabon was 18.2% in 2007 with five tariff bands, namely, 0% on cultural products; 5% on staple commodities; 10% on raw materials and capital goods; 20% on intermediate and other goods and 30% on final consumer goods.
Gambia (1986)	Since the introduction of the Economic Recovery Program in 1986, Gambia has been implementing significant trade reforms. Import prohibition has been abolished on all goods except for those maintained for environmental, health, security and morality reasons. Also, export licences and quotas have been completely eliminated. In 2000, the 1998 tariff structure with 30 rates ranging from 0% to 90% was replaced with six rates running from 0% to 18%. The simple average applied MFN tariffs also fell from 13.6% to 12.7%. The Gambia applies a 10% export duty on all goods except diamonds (which are taxed at 3%), fish, fish products, groundnuts (including their by-products) and all exports to the European Union

Ghana (1983)	Extensive trade reforms started in Ghana in 1983 under the Economic Recovery Programme. From that year to the end of 1986, the Ghanaian Cedi was devaluated and a dual exchange rate system was introduced along with a new import licencing system which allowed for the import of non-consumer goods by the private sector without restriction. In 1987, the dual exchange rate was unified, while in 1989 import licencing, prohibitions and foreign exchange rationing were fully abolished. The average MFN tariff rate was 17% in 1999; a figure which fell to 14.7% in 2000 and 12.7% in 2007. Export taxes are levied on cocoa, gold, bauxite, manganese, processed timber and aviation jet fuel.
Kenya (1993)	In May 1993, Kenya began liberalising its trade and foreign exchange regime after years of inward –looking policing and policy reversals. In the same year, the Kenyan shilling was devalued three times; the maximum duty rate reduced to 50% from 135% in 1988; import licences were abolished except those maintained for conservation, environmental and national security purposes; and the export compensation scheme was abolished. In 1994, the maximum duty rate fell to 25% with 5 bands (0%, 5%, 10%, 15% and 25%) while a managed floating exchange rate system was adopted. In 2004, an export tax of 25% on hides and skins was introduced in order to encourage local processing. Kenya adopted the East African Community CET in 2005 which reduced average tariff from 16.8% in 2004 to 12.9%. The country applies neither voluntary export restraint nor export quotas.
Lesotho (1994)	As part of SACU, trade liberalisation started in Lesotho in 1994. Refer to Botswana for more details.
Madagascar (1988)	Even though trade liberalisation was part of the objectives of the economic reform initiated in 1982, efforts to liberalise trade didn't start until the late 1980s. All QRs on import have been eliminated, except for prohibitions maintained on health, phytosanitary and security grounds. In 1996, a privatisation programme was launched which led to the deregulation of several state-owned enterprises. In the same year also, most marketing boards in agriculture were liquidated while price controls were abolished on virtually all products. The simple average applied MFN tariff rate is 13.0% (2008) while there are no tariff quotas. Also, Madagascar does not impose any export tax.
Malawi (1988)	Trade liberalisation in Malawi began in 1988 under the auspices of IMF -sponsored structural adjustment programmes. The maximum tariff rate dropped from 70% to 45% in 1988, and to 40% and 35% respectively in 1996 and 1997. In 1991, a negative list of imports requiring foreign exchange approval was introduced, but later abolished in 1994. The government

	<p>embarked on a privatisation programme in 1996, while all licencing requirements on imports were eliminated in 1997, except those maintained for health, safety, security and environmental purposes.</p> <p>Export surrender requirements were abolished in February 1994 except for traditional products such as tobacco, tea and sugar, while all export taxes were fully terminated in April 1998. Export licences apply only to a few products such as war materials, wildlife, maize and maize meals, atomic energy materials and unmanufactured tea and tobacco.</p>
Mali (1988)	<p>Trade reforms started in Mali in 1988 under the IMF and World Bank sponsored structural adjustment programmes. In the same year, import monopolies were abolished while in 1990, all QRs and import licencing requirements were eliminated. In 1991, a value-added tax of 10% and 15% was introduced while price controls on goods were terminated in 1992. The CFA franc was devaluated in 1994 and by the end of 1997, twenty state enterprises had been dissolved while 40 wholly or partially privatised.</p> <p>Mali adopted the WAEMU CET in January 2000. Consequently, its average applied MFN tariff rate fell from 22.1 in 1997 to 14.6% in 2003. By 2010, the rate had decreased to 12.1%.</p>
Mauritius (1985)	<p>Mauritius started liberalising its foreign trade in 1985 with the dismantling of QRs, reduction of export tax on sugar and lowering of the number of items subject to price control. In 1991, import licensing, which hitherto applied to majority of imports, was eliminated except for those maintained for health and sanitary reasons. In 1993, the remaining export taxes were fully terminated while a value-added tax of 10% replaced the sales tax in 1998.</p> <p>The simple average applied MFN tariff rate fell from 19.9% in 2001 to 6% in 2007 which consisted of only four bands viz 0%, 10%, 15% and 30%.</p>
Namibia (1994)	<p>As part of SACU, trade reforms started in Namibia in 1994. Refer to Botswana for details.</p>
Nigeria (1986)	<p>Trade reforms in Nigeria commenced in 1986 under the structural adjustment programme sponsored by the IMF. In the same year, QRs on imports were eliminated except those maintained for health and safety reasons; export taxes and import licensing system were removed; six marketing boards were abolished and 16 public enterprises, mainly in agro-industries, were privatised. In 1991, duty suspension schemes, which permitted Nigerian manufacturers to import duty-free raw materials for the production of exportables, were introduced while in 1992 the first Export Processing Zone was established. In 1994, a value-added tax of 5% on most imported goods and services was introduced while all excise duties levied on domestically</p>

produced goods were abolished in 1998. The average applied MFN tariff in Nigeria fell from 28.6% in 2003 to 11.9% to 2009.

Rwanda (1995)	Rwanda undertook significant trade reforms to rebuild its economy after the 1994 genocide. The country abolished all QRs except those imposed on goods for health and security reasons. Between 1997 and 2004, 37 enterprises were privatised while export taxes were fully eliminated in 1999. The country applies the CET of the Common Market for Eastern and Southern Africa (COMESA) after joining the free trade area in January 2004. The COMESA CET has four rates namely 0% (capital goods), 5% (raw materials), 15% (intermediate goods) and 30% (finished goods).
Senegal (1986)	Trade reforms started in Senegal in 1986 under the Medium and Long-term Structural Adjustment Plan. Between 1986 and 1989, QRs on imports and import licensing systems were largely abolished; while by mid-1993, 26 enterprises had been privatised. In 1994, the CFA franc was devalued while QRs on exports and export licencing systems were dismantled except those levied on gold, hides and skins and petroleum products. In 1999, Senegal adopted the WAEMU CET which lowered its average applied MFN tariff rate from 37% in 1994 to 14.7% in 2002.
Sierra Leone (1989)	Trade Liberalisation in Sierra Leone started in 1989 under the Structural Adjustment Program sponsored by the IMF. Tariff reforms reduced rates ranging from 0% to 100% in the 1980s, to between 5% and 40% in 1994. The average MFN tariff was 13.9% in 2005 with seven tariff bands: 0%, 5%, 10%, 15%, 20%, 25% and 30%. Import and export restrictions are still maintained on goods for health, safety and environmental reasons. Most export taxes were eliminated in 1993; however, exports of cocoa and coffee products remain subject to a levy of 2.5% of the f.o.b. export value. Also, Sierra Leone does not issue export subsidies.
South Africa (1994)	As part of SACU, trade reforms started in South Africa in 1994. Refer to Botswana for more details.
Swaziland (1994)	As part of SACU, trade liberalisation started in Swaziland in 1994. Refer to Botswana for more details.
Togo (1994)	Togo originally began trade reforms in the late 1980s; however, the social and political crises between 1991 and 1993 undermined these reforms. In 1994, the CFA franc was devaluated by 50% as trade reforms resumed under the second structural adjustment programme. By August 1995, import licensing only applied to goods on health, sanitary and

environmental grounds while exports of coffee, cocoa and cotton fibre were no longer subject to licensing and price controls by 1996. The average applied MFN tariff rate was 16.5% in 1998; however, the introduction of WAEMU common external tariff lowered the tariff rate to 12.1%.

Uganda (1987)

Trade reforms started in Uganda in 1987 under the Economic Recovery Program. In 1990, export licensing requirements were replaced by a less restrictive export certificate but export taxes were abolished. By 1994, all QRs have been dismantled except for those maintained for moral, health, security and environmental reasons. The simplification of the tariff structure has led to the reduction of tariff bands from five in 1995 to three in 2000 (0%, 7% and 15%) while maximum tariff rate also dropped from 60% in 1995 to 15% in 2000. Uganda adopted the East African Community CET in January 2005; however, this generated an increase in average MFN tariff rate from 9% in 2000 to 12.9%. Also, Uganda does not apply export voluntary restraints or export subsidies.

Zambia (1991)

Zambia started liberalising its trade regime in 1991 under the IMF's Structural Adjustment Programme. The goal of opening up the economy was mainly to diversify exports in order to reduce the dependence on copper. By the end of 1991, QRs and all export taxes had been abolished; import controls only applied to goods for health and safety reasons while all direct consumer and producer subsidies were eliminated. In 1992, price regulations and controls were abolished for all goods and services except transportation, electricity and petroleum products, while Zambia completed the dismantling of import licensing in 1995. Between 1992 and 1996, maximum tariff fell from 100% to 25% with tariff bands dropping from 12 to 4 viz 0%, 5%, 15% and 25%. The simple average applied MFN tariff rate has only dropped slightly from 13.6% in the late 1990s to 13.4% in 2009.

Zimbabwe (1990)

Comprehensive trade reforms in Zimbabwe started in 1991 under the Economic Structural Adjustment Programme supported by the World Bank. In the same year, the Export Retention Scheme (ERS) was established in which exporters were granted 15% of the revenues from export. In 1993, an export subsidy available to manufacturers was eliminated while a dual foreign exchange market which had an ERS and an official exchange rate was introduced. In 1994, all goods except those on a published negative list became importable without a licence, while the dual exchange rate was unified. Even though there is provision for imposing export taxes in its legislation, Zimbabwe levies none. The simple average MFN tariff rate was 15.4% in 2011.
