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Effects of Trade Facilitation on Inequality: A Case Study of Sub-Sahara Africa

By Ebenezer A. OLUBIYI †

Abstract. Inequality in the sub-Saharan Africa has been on the high side compared to other regions of the world. The policy makers in the region are aware of this and have implemented several policies to stem it. Among the solutions is inclusive growth and strong trade reforms. However, the trade position is still not encouraging even though it is rising. One major factor inhibiting trade and hence inequality is costs attached to the movement of goods across border, that is, trade facilitation. This study investigated the effectiveness of trade facilitation on inequality in a panel of 38 SSA countries spanning from 2005 to 2012. The results show that not all trade facilitation variables contribute to reduction in inequality. While reduction in time required to export significantly reduce inequality, time required to import, and to set up a new business worsened inequality. Custom efficiency is effective and has positive impact on inequality, that is, inequality is less, and the more efficient Customs are. Following these findings, authorities in the region will do well in addressing inequality issues by paying more attention to transaction challenges facing exports and custom efficiencies.
Keywords. Inequality, Trade facilitation, Generalized method of moments, Logistic index.
Jel. D63, F18, B23, F13.
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1. Introduction

Economic performance of the sub-Saharan Africa (SSA) showsimpressive sign in the recent time as the growth rate posted a 5.5 percent in 2011 up from 2.6 percent it recorded in 2009. The growth rate was further projected to maintain the 5.5 percent or more in 2015. Following this growth trend, the region is now considered as the fastest growing region while some countries such as Angola, Ethiopia, and Nigeria are among the top ten fastest growing economies in the world (Chotikapanich et al, 2014). However, this relatively impressive growth performance has not translated to notable decline in income inequality. Evidence also shows that periods of economic growth disproportionately benefits the rich with meagre or negligible positive impact on the low income earners (Roine et al, 2009). Compared to other regions, SSA is still the most inequitable region in the world after Latin America. Specifically, as there are fast growing economies in SSA, so also there exist, the most unequal countries. For instance, the 2010 reports of the UNDP show that six out of the most unequal countries in the world were in sub-Saharan Africa. His suggests that fast growth did not translate to fast decline in inequality. Income inequality, measured by the Gini coefficient was 45.5 in 2000-2010 but fell slightly to 44.8 in 2003-2012 (UNDP, 2014).

† Federal University of Agriculture Abeokuta, Nigeria.
+90 382 288 24 13
biyimclincon@yahoo.co.uk

The literature has unarguablydocumented the drivers of inequality in SSA but as Anderson & Mckay (2004) pointed out, these factors, that is, factor endowment, population and economic size account for only small proportion of the variation in inequality in SSA. Furthermore, the causal effect of trade on inequality is still debatable even though trade is one of the important growth drivers in the region. Perhaps the reason why the positive effect of trade on growth did not lead to significant decline in inequality is due to weak trade facilitation experienced in the recent time. In particular, sub-Saharan Africa remains by far, one of the two regions where trade is most expensive along with Eastern Europe and Central Asia (UNECA, 2013). In 2012, the cost of importing is so high that importing a standard container takes on average 31 days and costs $1,990 while the same container imported to East Asia and Pacific will take 22 days, costing $958 and 19 days in Latin America with concomitant cost of $1,612. This suggests that it takes 9 days and costs $1,032 more to import to SSA than to East Asia and the Pacific, while it takes 12 days and $378 more than Latin America. Other trade facilitation measures such as number of documents for export and for imports, custom efficiency, overall logistics, time to enforce contract and time to start a business exhibits the same characteristics. Reports from the World Economic Forum for Africa held in Abuja in 2013 pointed out that large concentration of people at the various African borders raises border inefficiencies and hence increases trade cost (Punch, 2014).

The high cost associated with trade usually translate to high import prices and high cost of domestic production, particularly when the factor content is import-intensive, thereby increasing price of both tradable and nontradable goods. Amjadi & Yeats (1995) reported that freight rates for Sub-Saharan African countries are often considerably higher than on similar goods originating from other countries and thus have contributed to the high cost of trade in the region. Consequently, the high price will make the low income earners worse off while the rich may not likely be affected. Also, the high cost of production may force the small and medium scale entrepreneurs to exit the real sector, thereby widening the gap between the rich and the poor. Thus, it is important to investigate the contribution of trade facilitation on inequality.

Numerous papers have investigated the effects of trade facilitation on trade and GDP while others have looked into the interconnectedness of inequality and trade. However, the contributory effect of trade facilitation on inequality has not benefitted from research exercise. Among the very few available evidence and the most recent was Nguyen (2013). He explored, among others, inequality effects of trade facilitation in 52 low and middle income countries. His result vindicated the effectiveness of trade facilitation on inequality as reduction in numbers of documents to exports and imports on one hand and the days it take to export and import on the other hand negatively affected inequality. Another recent paper by De & Raychaudhuri (2013) assess the potential impact of trade facilitation on poverty reduction in three Asian countries and the result from the field survey suggests that trade facilitation improves poverty reduction through lower nontariff barriers and better business conditions.

However, the study of Nguyen (2013) failed to recognize other trade facilitation measures such as time to enforce contract and time it takes to start a business in his differenced generalized method of moment (D-GMM). De & Raychaudhuri (2013) controlled for this but since the result is interpreted as perception of respondents (perhaps due to the type of methodology employed), the result cannot be generalized. Also, data on inequality in SSA is relatively inaccessible on time

series basis[1]. Thus, the use of generalized method of moment could cast doubt onNguyen results and the author recognized this by noting that his result must be interpreted with care. Thus, instead of using D-GMM, our study adopts an econometric method that account for omitted observation arising from unreported data or unavailability of data. Specifically this study employed the pseudo Poisson maximum likelihood which can be used to handle unreported observations and at the same time reduce the presence of heteroscedasticity (Tenreyro, 2006). Apart from the contribution of this paper in terms of methodology, other trade facilitation measures, that are necessary for domestic trade activities are incorporated in the inequality model. Doing this will provide additional information on how inequality are affected by both international trade facilitation and domestic trade facilitation.

2. Background Information

The economies of sub-Saharan Africa has been experiencing persistent income inequality over time. Meanwhile, several structural policies were implemented by the authorities to reduce the gap between the rich and the poor. Such policies included the PRSP instituted in 1999 by the IMF and the World Bank, the sector-wide approaches (SWAPS), support to education, support to health insurance mechanism, and recentlythe inclusive growth strategies (AfDB, 2012). These approaches appear to have reduced inequality over time as the Gini value fell from 45.8 in 2005 to 45.4 in 2006[2] but rose to46 percent in 2006 before a gradual decline occurred from 2007 with 45.9 to 2009 with Gini of 45.6 (Figure 1). Generally, income inequality appear to be falling, albeit slightly since 2005. This analysis was supported by the UNDP Human Development when the weighted average for the sub-Saharan Africa was computed to have fallen from 45.5 in 2000-2010 to 44.8 in 2003-2012.

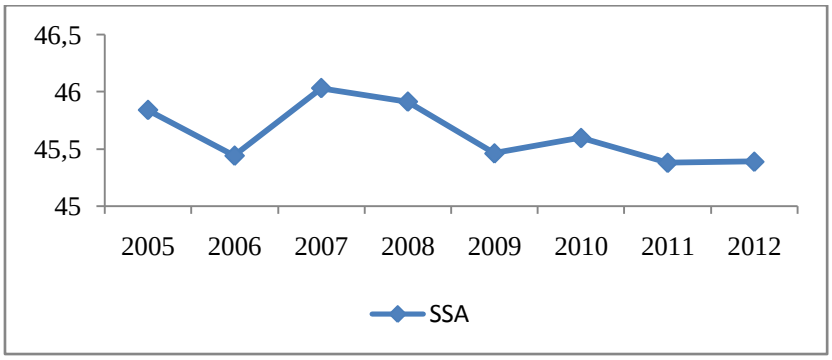

Figure 1. *Trend of inequality*
Source: Author's computation using SWIID and WDI dataset

Although the Gini value for the continent as a whole is relatively small - an indication of overall reduction in inequality - the country-specific analysis show a disproportionate figures. Given the fact that the Gini value posted by SSA since 2005 hovered between 45.3 and 45.8, it is justified to claim that the continent's inequality position has been declining since 2005. Table 2.1provides data for 41 SSA countries for which extrapolation can be performed between 1980 and 2012.

[1] However, Chotikapanich (2014) generated times series data on inequality for 10 SSA countries through the method of interpolation and extrapolation
[2] All the figures in this table were computed for 37 SSA countries using extrapolation method (see Chotikapanich et al, 2014) for more details on extrapolation and interpolation.

Table 1. *Gini Index of SSA (1980-2012)*

Country Name	Gini Index	Country Name	Gini Index	Country Name	Gini Index
Ethiopia	33.16	Cameroon	40.00	Zimbabwe	50.10
Sudan	35.29	Cote d'Ivoire	40.49	Cape Verde	50.52
Tanzania	35.34	Mali	40.65	Angola	50.65
Burundi	36.33	Gabon	41.45	Sao Tome and Principe	50.82
Togo	36.85	Guinea-Bissau	41.68	Zambia	51.54
Liberia	38.16	Uganda	42.84	Central African Republic	53.73
Ghana	38.60	Guinea	42.84	Seychelles	54.25
Benin	38.62	Senegal	43.26	Swaziland	54.27
Sierra Leone	38.94	Nigeria	43.61	Lesotho	57.41
Niger	39.02	Burkina Faso	44.24	South Africa	60.85
Chad	39.78	Malawi	44.41	Comoros	64.30
Djibouti	39.96	Madagascar	44.68	Namibia	69.12
Congo, Rep.	47.32	Mozambique	45.75	Gambia, The	48.76
Kenya	47.43	Rwanda	46.08		

Source: *Computed underlying data from WDI, 2014*

Out of the 41 countries listed, Ethiopia (East Africa) had the least inequality while Namibia (Southern Africa) had the highest inequality index. Available data also shows that the gap between the rich and the poor was somehow narrow in 12 countries while it was large in 12 countries of which 3 countries had the highest. The general picture from the Table is that inequality subsists in SSA and it is more pronounced in the Southern and Central Africa. It is important to note that South Africa which is one of the highest income countries and also one of the mineral producing countries was one of the countries with highest inequality. Also, Nigeria, Kenya and a couple of African mineral-based countries with relatively high income in SSA experienced high inequality.

Turning to trade faciliation behaviur in the SSA. Trade facilitation refers to simplifying and improving efficiency of international trade procedures (United Nations, 2002). Trade facilitation commences from improving the trade logistics at ports to improving the environment of transaction costs such as simplicfication and harmonanization of procedures on international movements of goods and services (Wilson et at, 2003; Nguyen, 2013). Instruments of trade facilitation include time required to export, time required to import, number of documents for imports and for exports, custom efficiency and logistic performance index[3]. All of these instruments measure the efficiency of overall international trade. Other trade instruments that tend to facilitate domestic production include time required to start a business, time require to enforce contract, and time to resolve insolvency among others. Dearth of data justifies the choice of choosing the most relevant indicators and Figure 2 shows the behaviour in SSA.

[3] Various components of logistics index is available in the Word Development Indicators (the most recent is 2014). Published by the World Bank.

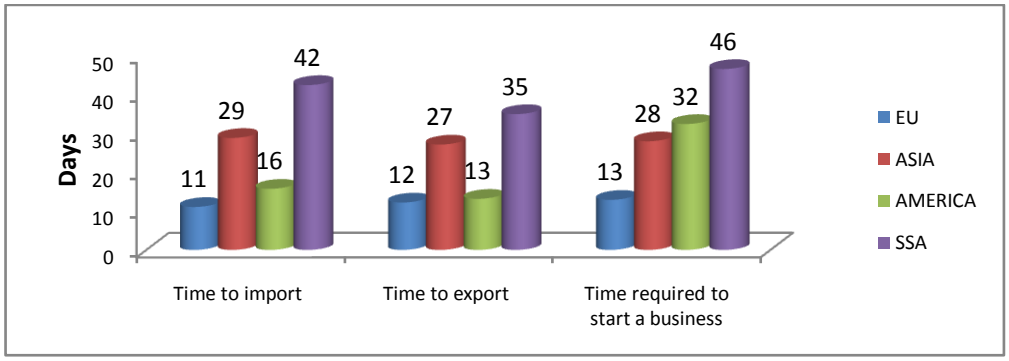

Figure 2. *Trade facilitation across regions*
Source: Computed using data from World Development Indicators (2014)

The behaviour of these indicators in SSA compared with other regions is presented in Figures 2 and 3. The charts present the average days for which a trade facilitation indicator is required per year between 2005 and 2013. The graphs reveal that trade facilitation is weak in SSA compared to Asia, EU and America. This is because it takes averagely longer days to export, import, and start a business in SSA than in America or EU or Asia (Figure 1). It took 11 days for importation to take place in the EU while it took 16 days in America. But in Asia and SSA, it took 29 and 42 days respectively. This suggests that the EU must have completed importation more than three times within a period that SSA completed only one. It took the EU 12 days to export, 13days in America and corresponding 27 and 35 days in Asia and SSA. Hence, SSA only exported ones within the period that EU had exported three times. Time to start a business in SSA was more than two times it required in the EU and almost one and a half times it requried in America.

When it comes to time requried to enforce contract, it is the case that on average, it took 659 days in SSA, 642 days in the EU, 524 days in America and 771 days in Asia. This suggests that Asia has the highest days of enforcing contract in the Worls, surpassing SSA with 12 days. Part of factors that tend to facilitate trade is logistics.

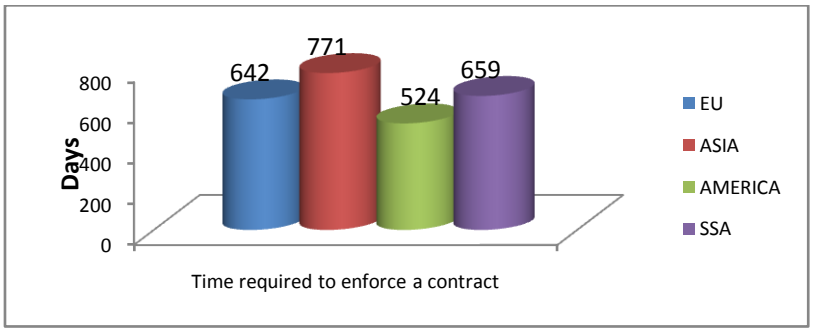

Figure 3. *SSA Trade facilitation compared to other regions (contract enforcement)*
Source: Computed using data from World Development Indicators (2014)

Logistic indicators include custom efficiency and overall logistic index. A country or region is said to have perfect logistic if the index is 5, while the lowest index is zero. From 2005 to 2012, average overall logistic index in SSA was 2.4, while thast of America, Asia and EU were 2.95, 3.05, and 3.62 respectively (Figure 3).

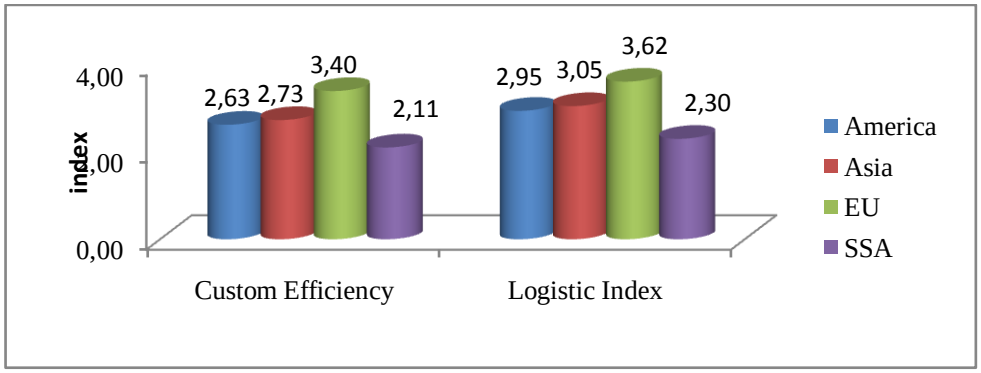

Figure 4. *SSA Trade facilitation compared to other regions (Logistics)*
Source: Computed using data from World Development Indicators (2014)

The same pattern exists for custom efficiency where the average index between 2005 and 2012 posted 2.11 whereas America, Asia and EU posted 2.63, 2.73, and 3.40 respectively. This suggests that logistics in not perfect in any region of the world but the EU have the most improved logistics, followed by Asia, then America. In the two logistic indicators shown SSA had the least index. Generally, the analysis shows that trade facilitation appears to be less pronounced in SSA compared to other regions.

To the extent that there exists high cost of exporting and importing, it is imperative to investigate the relationship between inequality and trade faciliation. The scatter plot matrix showing the relationship between the Gini index and trade facilitation measures for SSA as a whole is presented in Figure 5 (see Appendix).

The red lines are the slope (regression line) of the variable in the vertical axis and the horizontal variable. The slope of each of the regressions is statistically significant at 5 percent level. The variables on the horizontal axis are time required to start a business (BUS_TIME), time required to enforce contract (CONTRACT_TIME), time to export (TIME_EXPORT), and time to import (TIME_IMPORT). The vertical axis contains inequality measured by the Gini index (INEQUALITY), time required to import, time required to export, and time required to enforce contract. The slopes show positive relationship among any pair of variables.

Specifically, inequality and each of the trade facilitation indicators are positively related. Meanwhile, the slope of inequality and time to start a business is relatively flatter compared to the relationship between inequality and any of the remaining indicators. Also, there is positive relationship between pairs of trade facilitation indicators. For instance, increase in the time required to import is associated with increase in the time required to contract enforcement or to export. However, logistics and inequality were negatively related. What can be learned from this background information is that first, SSA countries have more inequality and exhibits high cost of trading, measured by trade facilitation variables than other regions in the world. Second, improvement in trade facilitation, both outside the border and within the border (logistics) will reduce inequality. Third, the degree of the association differ because the slopes are not the same across indicators.

3. Literature Review

The concept of trade facilitation begins from a narrow perspective of addressing the logistics of clearing and moving goods across border to a broader sense of dealing with both "inside the border" and the"behind border" logistics. In this regard, trade facilitation encompasses transparency and professionalism of customs, port efficiency, domestic policies and technical regulations, institutions,

standards and physical infrastructure that influence the movement of goods across border (Wilson et al, 2004). Trade facilitation addresses issues surrounding unobserved transaction costs associated with trade. Transaction costs are classified into direct and indirect costs. Direct costs include costs of compliance in relation to the collection and processing of information and charges for trade-related services. Indirect costs include time-sensitive costs brought about by administrative processes and customs procedures which delay goods in the warehouse (UN, 2003). Effective trade facilitation, which implies clearing and moving goods across border within few time period at reduced cost, is expected to increase trade and affects growth, and inequality among other macroeconomic indicators.

Attention began to shift to trade facilitation as a means of enhancing trade after the emergence of the WTO and the negotiation rounds in 1994 where it was established that dealing with policy barriers, in this case, tariff cannot fully ensure increased trade to the expected level. Instead, other barriers that are connected with ports, customs and business environment should be addressed. In particular, administrative barriers and red tape costs tend to stiffen trade in spite of large success achieved in reducing tariff barriers (OECD, 2002). In addition, the so called "Spaghetti Bowl", that is, increased commercial regimes' complexity has raised delays in imported inputs, inflict more injury on domestic production, which then feed into widening income gaps. Thus, inequality will reduce when these barriers are eliminated or reduced in such a way that it recovers waste resources generated by quota rents and tariff revenue (Denis, 2006).

The theoretical workhorse of inequality suggests that the functional distribution of capital and labour that constitute the major factor of production explains income distribution over time. To the extent that infrastructural facilities, which constitute some measures of trade facilitation are considered as part of capital, it follows that even though there is no explicit mention of trade facilitation in the theory of inequality, it is an important catalyst. However, the literature did not unanimously agree on the direction of effects. The Ricardian trade theory shows that trade benefits all factor owner (since labour is the only factor) provided goods are allowed to move freely across border under perfect competitive conditions. Thus, the problem of inequality does not arise because all are better-off. The factor specific and factor proportion theories address the issue of income distribution outcome of trade. However, the effect is not clear because it is not only nominal income that determine income distribution but also consumers' preferences and the purchasing power. But in the event that trade reforms do not significantly affect income distribution, a more regulated trade tends to increase income inequality (Slaughter, 1997).

The empirical evidence on the inequality effects of trade facilitation is limited. The assessment of trade facilitation is mostly linked to its effects on trade rather than on inequality. Hertel et al. (2001) modified a Global Trade Analysis Project (GTAP) model in their analysis of the Japan-Singapore free trade agreement by introducing time costs as a technical shift in the Armington import demand function. Similarly, by introducing an import-augmenting technical change, Fox et al. (2003) simulated the removal of an iceberg tariff on welfare by applying a positive shock to the technical efficiency of the trade flow. APEC (1999) modelled trade facilitation, through an increase in the productivity of the international transportation sector to capture the downward shift in the supply line of imports resulting from the implementation of cost-reducing measures.

From the works of Hummels (2001), reduction in the numbers of days to import leads to decrease in ad-valorem tariffs, which invariably increases imports. From the OLS and probit results of Fink et al (2002), an 8 percent increase in bilateral trade is informed by 10 percent increase in business services (phone calls). The

works of Limao & Venables (2001), De (2009a) and Brooks & Hummels (2009) pointed out that port infrastructural facilities was the most important factor in the reduction of trade costs for Asian countries, given the preponderance of sea freight in trade costs for Asian countries.

Aggregating trade facilitation measures (port efficiency, customs environment, regulatory environment and service sector), the gravity results of Wilson et al (2004) showed, in 75 countries covering 2000-2001 period that exports and imports will increase for a country and for the world at large with improvements in these indicators of trade facilitation. In addition, the simulation predicts that manufactured trade increased by $377 billion following improvement in these indicators. Specifically, trade facilitation biased gains towards exports of developing countries to the OECD market. OECD (2005b) reports that a large number of mostly developing countries tend to increase government revenue, have ability to attract foreign direct investment and increase trade flows through improved cross-border movement of goods.

Some authors demonstrated that the welfare and income distribution effects of trade facilitation works in through improvement in trade. Isik-Dikmelik (2006) investigated the importance of trade reforms on household welfare in Vietnam and found that trade reforms tend to reduce inequality, not by reducing the wealth of the rich but by increasing the wealth of the poor. While dealing with the relative importance of trade-mandated effects on industry wage premia; industry and economy-wide skill premia; and employment flows in accounting for changes in the wage distribution during the 1988-1995 trade liberalization, Ferreira et al (2009) commented that unlike in other Latin American countries, trade liberalization has appeared to have made a significant contribution towards a reduction in wage inequality in Brazil. Raychaudhuri & De (2012) analysed the impact of increased trade in services in India on inequality. They found that one major component of India's service sector growth comprised information and communication technology (ICT) services. The study showed that the ICT sector led the service trade in India. However, the sector is skill and infrastructure intensive. As a result, the sector does not support unskilled workers nor has it made its presence felt in the rural areas. Thus, this type of increase in services trade has increased the inequality within the urban regions of India as well as greater income divergence between rural and urban incomes.

Zaki (2011) employed a multi-regional and multi-sectoral computable general equilibrium (MIRAGE) to investigate gains from trade arising from trade facilitation. The author extended the trade facilitation model of Fontagne (2009) by using more accurate ad-valorem equivalents of red tape costs, computed from a gravity model. He found that developing countries, particularly the SSA gain much more from trade facilitation than developed countries. In particular, trade facilitation increases welfare through export diversification. Dennis (2006) examined the potential contribution of trade facilitation in enhancing development of the Middle and North Africa regions (MENA). Using 13 regions by 16 commodity aggregation which captures all the MENA sub-regions, key trading partners and key commodities, the results from GTAP show that welfare gains from integrating triples following improved trade facilitation.

Wilson et al. (2002) generated seven indicators of trade facilitation and analysed their effects on the APEC economy. The indicators are efficiency of port logistics, customs procedures, regulatory environments, standards harmonisation, business mobility, e-business use and administrative professionalism and transparency. It was revealed in the results that intra-APEC trade will increase by about $280 billion following improvement in the trade facilitation indicators. Specifically, improvement in trade facilitation would raise exports inIndonesia, Thailand,

Malaysia, Mexico, and China by $2.9 billion (5%), $3.9 billion (5%), $6.3 billion (6%), $1.9 billion (1%) and $32 billion (11%) respectively. Further, gains from trade facilitation surpasses gains from tariff reduction. Meschi & Vivarelli (2009) investigated within country income differences in 65 developing countries over 1980-1999. Employing a variety of Arellano and Bond dynamic panel data analysis, it was found that other variables such as literacy rate, and inflation do significantly affect income inequality more than trade.

In the recent time, Nguyen (2013) explored, among others, inequality effects of trade facilitation in 52 low and middle income countries. His result shows that improvement in trade facilitation leads to reduction in inequality. Specifically, reduction in numbers of documents to exports and imports on one hand and the days it take to export and import on the other hand negatively affected inequality. In the same vein, De & Raychaudhuri (2013) assess the potential impact of trade facilitation on poverty reduction in three Asian countries and the result from the field survey suggests that trade facilitation improves poverty reduction through lower nontariff barriers and better business conditions.

The empirical evidence of the effects of trade facilitation on inequality is, no doubt, scanty. Nevertheless, results are not unanimous. Furthermore, evidence based on country heterogeneity and particularly the case of sub-Saharan Africa is absent. Therefore, this study seeks to fill the empirical gap.

4. Theoretical Framework

The theoretical motivation for the work follows UN (2003) where the channel through which trade facilitation affects inequality was articulated. These channels was explained with the aid of a diagram as presented in Figure 5. Trade facilitation affects income distribution, that is, inequality, in three ways, namely; trade, economic growth and government spending. Improvement in trade facilitation tends to reduce transaction costs attached to exports. Reduction in the cost of exporting reduces export prices, thereby makes exports more competitive with the resultant effect of increase in wages and the numbers employed in the exporting sectors. Such arrangement could also imply decreased import prices and hence increase real wages. In the case of economic growth effect, with trade facilitation, aggregate output increases thereby leading to economic growth over time.

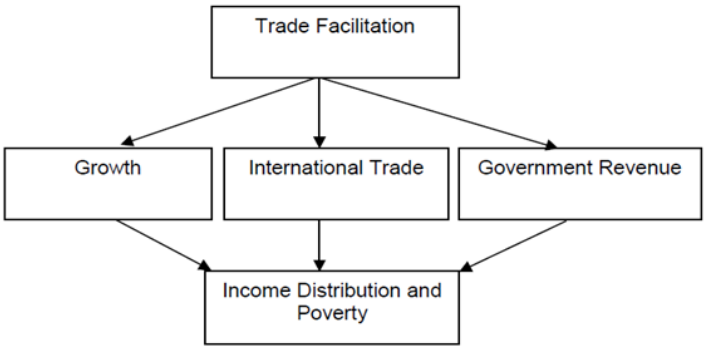

Figure 5. *Trade facilitation and inequality*

To the extent that economic growth leads to higher income and greater unemployment, inequality will reduce. Not only that trade facilitation enhances reduced inequality through growth, but also generates some by-product which reduces inequality. or instance, strong economic growth and high degree of openness tends to shield the economy from exogenous shocks (UN, 2003). Strong economic growth also generates a signalling effect and this could induce foreign

direct investment and human capital development. Government spending has been established as a fiscal instrument used to reduce unemployment and generate more income. Increase in exports increases government revenue while reduction in time to import may increase government revenue turnover. Not only that, custom efficiency, reduction in corruption and red tape removal could free up funds for other social and physical infrastructure that will benefit economic activities which will generate income and employment.

Thus, from the theoretical discussion, trade facilitation such as time required to export, time required to import, custom efficiency are important variables that influence inequality. The theory predicts that improvement in each of these indicators leads to reduction in inequality. However, apart from these four indicators, time to start a new business and time to effect contract can be included because these two also have influence on inequality.

5. Methodology and Data

Following the theoretical motivation articulated above, the econometric models that will measure the effect of trade facilitation on inequality is specified. The regression model contains inequality as the dependent variable while trade facilitation indicators alongside other control variables such as government spending, degree of openness and growth are included as independent variables 2. The estimable econometric equation is given as follows:

$$Y_{it} = \alpha + T_{it}\beta + V_{it}\lambda + \varepsilon_{it} \quad (1)$$

Where Y_{it} is the inequality, measured by the Gini coefficient of country i at time t; T is a set of trade facilitation variables and V is the control variables. Following the discussion on the theoretical motivation, the explicit panel data model is given in equation 2

$$gini_{it} = \alpha + \beta_0 cus_{it} + \beta_1 \log c_{it} + \beta_2 tcont_{it} + \beta_3 t\exp_{it} + \beta_4 timp_{it} + \beta_5 tbus_{it} + \beta_6 growth_{it} + \beta_7 \inf_{it} + \beta_8 open_{it} + \beta_9 lit_{it} + \beta_{10} govt_{it} + v_i + \varepsilon_{it} \quad (2)$$

Where *gini* is the Gini coefficient, *cus* is customefficiency, *logc* is logistic index, *tcont* is time required to enforce contract, *texp* is time required to export; *timp* is time required to import; *tbus* is time taken to set up a new business; *inf* is inflation rate; *open* measures degree of openness, *lit* is literacy rate and *govt* is government spending. The term $v_i$captures country specific effect in the panel analysis while ε is the white noise.

Owing to the nature of inequality data, using panel fixed, randomeffect may cast doubt on our result since all the years for which observations are unavailable will be removed, thereby leading to inefficient and inconsistent result. Although it is easy to reduce this problem either by using moving average or by resulting in a 5-year averaging. The first method may lead to biasedness, particularly if the time interval is long. In the case of the second method (5-year averaging), it reduces observation size and so, it is mostly applicable in a large country and period size. Another method is to use interpolation or extrapolation approach. This is also a form of data transformation that may not likely yield the best result.

The 'count outcome' possesses the ability to deal with missing observation whether due to unreported or unavailable data. However, unobserved heterogeneity of the dependent variable generated by unobserved data tend to weaken the ability of this method. The problem of overdispersion has been addressed by some authors

(see Helpman, 2007; Linders & De Groot, 2006) by making use of modified Poisson in the form of negative binomial pseudo maximum likelihood (NBPML). This approach is better than the Heckman selection model because it is less restrictive and do not require an instrument for the second stage of the regression (Hoekman & Nicita, 2008). Further, the bias that results from the logarithmic transformation in the second part of the Heckman selection model is avoided because of the multiplicative nature of the equations used. For this reason, the NBPML was adopted for this work.

Data for inequality, growth rate, degree of openness (ratio of trade in GDP), government spending, inflation rate and government spending were sourced from the World Development Indicators (2014). Data on trade facilitation indicators were also extracted from the same source. Based on data availability, the time period was 2005 to 2012. We collected data on these variables for 38 SSA countries for which such data are relatively available.

6. Results and Discussions

Results from the descriptive statistics reveals that 303 observations were available for the trade facilitation indicators except custom efficiency (lncust) and time required to complete contract (lncont) while literacy (lit) recorded the lowest observations among all the series. The average growth rate (grate) was 5% while the average inflation (infl) rate was 7.7% (Table 2). Furthermore, average literacy rate was 58% while degree of openness (open) in the region was computed to be 76% on average. The growth of the trade facilitation indicators hovered between 0.78 (lncust) and 6.48 (lncont). This suggests that on average, time required to effect contracts has the fastest growth while time required for custom clearancehad the slowest growth. In the same vein, time required to import tend to increase faster than time required to export and to start up a new business. To the extent that trade facilitation affects inequality, the statistics suggest that if import inputs explains part of variation in inequality then time to import may have a strong effect on inequality.

Table 2. *Descriptive Statistics*

Variable	Obs	Mean	Std. Dev.	Min	Max
grate	299	5.251828	3.844736	-9.52852	22.59311
gini	301	44.84159	8.456378	29.83	67.42
infl	302	7.794112	6.483871	-8.97474	44.39128
lit	146	58.11851	20.36076	23.55372	92.98314
open	288	76.3135	31.13186	30.96624	179.1209
lngov	259	20.8113	1.498469	17.69127	25.1949
lncust	95	0.783611	0.142426	0.457425	1.20896
lnlogal	95	0.872088	0.130858	0.476234	1.300192
lntcont	303	6.4796	0.408795	5.438079	7.447168
lntexp	303	3.434176	0.392033	2.484907	4.356709
lntimp	303	3.584003	0.427424	2.639057	4.624973
lntbus	303	3.466117	0.806458	1.098612	5.556828

This assertion is further strengthened by the result of the pairwise correlation of the variables presented in Table 3. Whereas weak association between inequality and mostly all the other variables is observed, it is the case that time required for customs clearance – which measures customs efficiency had the highest magnitude

of association (0.18). Other association of interest are inequality and time to import (0.01), inequality and time to export (0.07) inequality and logistic index (0.16), inequality and time to start a new business (0.18) and the association between inequality and time to enforce contract was computed to be 0.02.

The association between any pair of other variables are also very weak. This implies that multicolinearity problem is weak when all the control variables are included. It is also of note that not all the associations are positive. The association between time to start a new business, time to enforce contract at the port, time to obtain custom clearance, logistic index and inequality are negative. Suggesting that more time in each case implies contraction of inequality. Government spending, inflation, degree of openness, time to import and time to export associated positively with inequality.

In order to justify the appropriateness of negative binomial employed for this study, we first present results of the panel fixed effect. The variation explained by the variables are small but improving as we include trade facilitation variables. The result shows that only 25% of the observation were available for use in the panel fixed estimations. None of the variables was able to significantly affect inequality. This suggests that the panel fixed effect appears not to be the appropriate estimation technique.

As mentioned earlier, other powerful estimation techniques such as the varieties of the Generalized Method of Moments could have provided efficient and consistent result but the missing values will not allow such technique to be employed. In the case of count outcome, zero inflated could have been the best estimation technique due to minimal zeros in the observations, but there were large unobserved observations. Thus the appropriate technique appears to be negative binomial pseudo-maximum likelihood.

Table 3. *Pairwise correlation matrix of the variables*

	grate	Gini	infl	lit	open	lngov	lncust	lnlogal	lntcont	lntexp	lntimp	lntbus
Grate	1											
gini	0.0651	1										
infl	0.2033*	-0.0094	1									
lit	-0.0765	0.4708*	0.1082	1								
open	0.07	0.0999	-0.0064	0.3122*	1							
lngov	0.0948	0.2744*	0.1465*	0.3483*	-0.036	1						
lncust	-0.1074	0.1763	0.0101	0.3572	0.0244	0.3410*	1					
lnlogal	-0.1377	-0.163	0.009	0.4359	-0.0158	0.4469*	0.8445*	1				
lntcont	-0.0179	-0.0241	-0.1233*	0.1069	0.3046*	0.0314	-0.0256	-0.0535	1			
lntexp	0.1980*	0.0691	0.1237*	-0.3259*	-0.1419*	-0.0759	-0.2177*	-0.2401*	-0.1810*	1		
lntimp	0.2189*	0.0103	0.1012	-0.2545	-0.0929	0.0226	-0.1381	-0.1674	-0.1724*	0.8639*	1	
lntbus	-0.0303	0.1762*	0.0169	0.0798	0.3758*	0.0432	0.046	0.0275	0.3654*	0.1019	0.0151	1

There are at least three things to observe in the negative binomial regression result presented in Table 4. First, when estimating count outcome model of this type, the value of the pseudo r-squared cannot be interpreted as the usual r-squared in terms of magnitude. However, it is the case that a rising value of pseudo r-squared as variables are subsequently included suggests incremental contribution of the variable. Second, there was an improvement in the numbers of observations used for the regression (about 41% of total). Third, the log of dispersion (lnalpha) shown indicate that there is overdispersion in the data due to unobserved

heterogeneity. Finally, Table 4 (Appendix 1) presents result for all the 38 SSA counries for which data on inequality and other variables could be easily assessed within the period of 2005 and 2012.

To appreciate the incremental contribution of trade facilitation varibales to inequality, the indicators were included subsequently. Starting from the variables affecting inequality in the absence of trade facilitaion, only literacy rate and government spending were significant. Growth rate and degree of openness were positive but insignificant. Inflation rate was negative but was also insignificant. Literacy rate was negatively associated with inequality suggesting that increase in literacy rate leads to reduction in inequality. However, the magnitude of effect was mild as it will take literacy rate to double before inequality could fall by a meagre 1.5%. The second model considered what happens to inequality when customs efficiency was included in the model.

If anything, it is the slight increase observed in the pseudo r-squared. The magnitude of effect of literatcy rate on inequlity also dropped by 0.02 even though the level of significance and the direction of effect was not affected. By including logistics index in the model, pseudo r-squared rose slightly while customs efficiency and degree of opennes were found to be significant at 10 percent level. Openness widens the gap between the rich and the poor because openness was positively associated with inequality even though the effect was small. Nothing happened until all the trade facilitation indicators were incorporated (model 14). As the result suggests, apart from increased value of pseudo r-squared, six variables significatly affected inequality. In addition to the first two, that is, literacy rate and degree of openness, cutom efficiency, time to export, time to import and time required to start a new business significantly affected inequality.

Custom efficiency, time to import and time to start a new business negatively affected inequality. This suggests that increase in port efficiency reduces inequality. Also, increase in time to import causes inequality to fall while increase in time to start a new business increases inequality. Time required to export affected inequality positively, suggesting that the longer it takes to export, the higher the level of inequality.

Overall, out of six trade facilitation indicators used in the study, four had significant effect on inequality. This implies that not all trade facilitation may likely be effective for inequality. In fact, as the result shows, improvement in some trade facilitation could worsen inequality. For instance, improvement in the time to import will worsen inequality. One reason for this is that to the extent that proliferation of imported products negotiates away competition from the low income producers and consumers, reducing time to import will only benefit the rich and the large scale businessmen. In the same vein, the longer it takes to start up a business, the smaller inequality becomes. Most producers in the micro and small scale levels, which constitute the bulk of comparatively low income earners don't register their businesses, due to many reasons ranging from literacy level to tax evasion. Thus, the longer it takes to register businesses among the rich, the better it is for the low income producers and vice versa.

The positive effect of time required to export on inequality suggests that an improvement in the indicator will reduce inequality. It must be recalled that employment and production technology in the agricultural sector exhibits labour intensity. Therefore, given market availability of agricultural products abroad, reduction in time to export will, all things being equal, increase speed with which agricultural products are exported and by implication creates incentives for farmers to produce and hence employ more workers. Increase in labour income arising from employment will lead to increase in consumption thereby generating further

production, leading to more income with the resultant effect of reduction in inequality.

7. Conclusion and Remarks

Several researchers have demonstrated that trade facilitation influences inequality of a country. In most theoretical and empirical analyses, improvement in trade facilitation tends to reduce inequality. However, most of the theoretical foundations and empirical findings indicated that trade is the channel through which trade facilitation affects inequality. To the extent that the effectiveness of trade on inequality is not automatic, it may not be in all cases that improvement in trade facilitation could reduce inequality. In particular, whether improvement in trade facilitation affects inequality negatively or positively depends on the nature and pattern of products being traded, the structure of imports relative to domestic products engaged by the low income and also, the consumption pattern. This study seeks to investigate whether trade facilitation increases or reduces inequality. Collecting data for 38 SSA countries spanning from 2005 to 2012 and employing negative binomial Poisson regression, it was found that not all trade facilitation significantly affect inequality. The study also established the fact that in the family of those that significantly affect inequality, they do so in different direction. That is, some affected inequality positively while some affected it negatively. In particular, custom efficiency, time required to import and time required to start up a new business affected inequality negatively while time to export impacted positively on inequality.

Following this result, the policy makers should note that although improvement in trade facilitation is good, it must be handled with care. Since most empirical analyses use trade reform as the basic channel through which trade facilitation affect inequality, the policy makers will do well by investigating the possible direction of effect of trade on inequality. In a region where trade worsens inequality, improvement in trade facilitation may not be a panacea to it, just as tariff reduction or import ban is not a panacea to improved trade. If trade is targeted at reducing the gap between the rich and the poor, and if trade facilitation is to be used to improve trade, it is important to first study the structure of trade in order to know which of the trade facilitation indicators should be on the priority list and why should other indicators behave in an unexpected manner.

Appendixes

Table 4. *Panel fixed effects results of the effects of trade facilitation on inequality*

	1	2	3	4	5	6	7
Inflation	0.05	0.32	0.05	0.08	0.09	0.11	0.14
	(0.052)	(0.471)	(0.058)	(0.070)	(0.070)	(0.082)	(0.102)
Openness	0.01	0.14	0.01	0.01	0.01	0.00	0.01
	(0.041)	(0.333)	(0.040)	(0.038)	(0.038)	(0.040)	(0.044)
Govt_spending	-3.23	-0.39	-3.37	-3.23	-2.95	-2.90	-3.57
	(2.145)	(6.192)	(2.069)	(1.872)	(1.823)	(1.859)	(2.106)
Custom_effic	-1.52		-2.66	-1.11	-1.25	-1.25	-0.28
	(3.875)		(4.569)	(5.555)	(5.558)	(5.612)	(5.810)
literacy_rate		-0.06					
		(0.363)					
Logistics			2.28	-1.61	-1.40	-1.09	-2.48
			(5.962)	(7.877)	(8.031)	(8.308)	(8.343)
t_contract				-6.82	-6.89	-6.35	-6.01
				(8.391)	(8.495)	(8.606)	(8.428)
t_export					0.88	4.74	7.29
					(2.667)	(5.188)	(6.802)
t_import						-3.43	-2.92
						(4.312)	(4.347)
t_business							-1.50
							(1.364)
CONSTANT	113.22*	43.83	115.16**	157.88	149.33	143.80	149.71
	(42.637)	(120.245)	(41.121)	(86.607)	(85.626)	(87.733)	(88.360)
R-sqr	0.09	0.05	0.09	0.12	0.12	0.13	0.14
F-stat	1.89	0.38	1.55	1.28	1.15	1.28	1.37
F-Prob							
sigma_u	11.54	10.26	11.64	11.82	11.54	11.55	12.52
sigma_e	3.16	4.99	3.20	3.19	3.23	3.26	3.28
Observation	76	40	76	76	76	76	76

Note: * p<0.05, ** p<0.01, *** p<0.001
Standard errors are in parentheses

Table 5. *Negative Binomial Regression showing the effects of trade facilitation on inequality in SSA*

	8	9	10	11	12	13	14
inequality							
Growth_rate	0.002	-0.014	-0.015	-0.014	-0.011	0.002	0.024
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)
Inflation	-0.007	0.005	0.003	0.002	-0.003	-0.007	-0.014
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
literacy_rate	-0.015***	-0.013***	-0.013***	-0.013***	-0.012***	-0.014***	0.009*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Openness	0.000	0.004	0.005*	0.005*	0.006**	0.006**	0.006*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Govt_spending	0.047*	0.068	0.034	0.036	0.038	0.067	0.034
	(0.02)	(0.05)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Custom_effic		-0.412	-1.243*	-1.221	-1.203	-1.302*	-1.717*
		(0.33)	(0.63)	(0.65)	(0.63)	(0.63)	(0.84)
Logistics			1.318	1.309	1.387	1.624	1.725
			(0.85)	(0.85)	(0.85)	(0.86)	(1.03)
t_contract				-0.019			-0.101
				(0.14)			(0.17)
t_export					0.242	0.524*	0.560*
					(0.17)	(0.23)	(0.28)
t_import						-0.421	-0.445*
						(0.23)	(0.16)
t_business					-0.336*		
							(0.13)
Constant	-0.304	-0.755	-0.563	-0.499	-1.685	-1.886	2.231
	(0.44)	(1.02)	(1.02)	(1.12)	(1.27)	(1.29)	(1.56)
lnalpha							
Constant	-4.622***	-17.298	-18.543	-20.449	-18.455	-21.330	-18.151
	(0.72)	(1801.02)	(465.12)	(.)	(465.39)	(.)	(785.98)
Chi-sq	54.01	19.58	22.00	22.02	24.09	27.47	38.21
P_chi-sqr	0.10	0.59	0.68	0.68	0.73	0.84	0.85
Pseudo_R-sqr	0.16	0.17	0.19	0.19	0.20	0.23	0.29
Log_likelihood	-138.83	-49.192	-47.980	-47.97	-46.93	-45.249	-45.910
Observation	146	123	123	123	123	123	123

Note: * p<0.05, ** p<0.01, *** p<0.001
Standard errors are in parentheses

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