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THE INFLUENCE OF WAGE INEQUALITY ON TRADE IN SERVICES IN SUB-SAHARAN AFRICA

Ngouwouo Younchawou*

Lecturer-Researcher, RGEAD (Research Group in Economics and Development)-University of Dschang.

***Corresponding Author**
Ngouwouo Younchawou

Lecturer-Researcher, RGEAD (Research Group in Economics and Development)-University of Dschang.

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Abstract: The aim of this research is to analyze empirically the influence of wage inequality on international trade in services in Sub-Saharan Africa (SSA). This work uses a methodology based on data from the World Bank's World Data Indicator and the United Nations Industrial Development Organization (UNIDO), on the one hand, and panel data modelling using Ordinary Least Squares (OLS) and Generalized Moment Methods (GMM), on the other. The results obtained show that trade in services in SSA contributes to economic diversification in this region, notably with the supply of tourism, financial, information and communication technology and personnel services. However, wage inequality has a negative impact on trade in services in Sub-Saharan Africa, and consequently reduces trade in services in this part of the world.

Economic policies in Sub-Saharan Africa should therefore be geared towards improving people's purchasing power. What's more, public authorities need to strengthen the enforcement of labor laws, improve working conditions and the business environment, and combat discriminatory practices in the workplace.

Keywords: Wage inequality, International trade in services, Panel data, OLS and GMM methods, Sub-Saharan Africa.

JEL codes: D63, F1, C23, C13, R1.

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I. Introduction

International trade is the flow of goods, services and capital between at least two countries. It also refers to the organization of international exchanges between several economic areas, particularly in terms of trade settlement methods, customs measures, exchange risk management, etc. With trade becoming increasingly dominant, it is generally agreed that no country or production unit can live in autarky or without trade. Over the past 20 years, trade in services has become the most dynamic segment of world trade. It is growing faster than trade in goods. Developing countries and economies in transition have played a growing role in this sector. According to World Trade Organization (WTO) data, their share of world services exports rose from a quarter to a third between 1995 and 2004.

Indeed, economists generally consider and argue that international trade is an engine of growth that opens up economic opportunities, provides certain benefits, as it enables a country to capitalize on its comparative advantages, sparks competition, improves competitiveness, increases participation and promotes inclusion (Mayaki, 2013). According to the Statistical Review of World Trade 2020, trade in services, despite weakening in 2019, remained stronger than trade in goods. For example, exports of transport services fell by 0.8% in 2019 after recording growth of 9.1% in 2018; while exports of "other commercial services" (including financial and IT services) rose by 3.3%, below the 9.2% recorded in 2018. The WTO' s 2019 report shows that international trade in services is growing faster than trade in goods, with a value that reached $13,300 billion in 2017. The share of developing economies in world trade in services was 34% in 2017 (WTO, 2019). Analysis of the dynamics of trade in services (as a % of GDP) in certain regions of the World over the period 2005-2019 shows that Sub-Saharan Africa is the third region with 11.10% of GDP, ahead of North America (7.08%) and behind the European Union (EU) and Asia 11.24% of GDP.

In Sub-Saharan Africa, trade in services is extremely dynamic, given its remarkable performance. Over the period 2005-2019, total imports of services represented on average 66.61% of overall trade in services, compared with 33.38% for exports. However, due to the COVID19 pandemic, exports and imports of

services fell significantly in 2020, with a 15.55% drop in total trade in services compared with 2019. The most important segments of this trade sector in Sub-Saharan Africa to have evolved in the 2005-2019 period include transport, insurance, finance and tourism. With an annual average growth rate of 3.16% over this period, SSA is a major tourist destination, recording 25.92 million visitors in 2005 and over 48 million in 2016, before dropping to 38.3 million in 2019. Travel services represent on average 43.97% of exports and 16.94% of imports, while imports of transport services are 41% against 23.78% of exports. Over the same period, financial and insurance services saw an increase in exports (9.14 and 6.61% respectively) and imports (11.50% and 8.27% respectively).

It should be stressed that these trends are partly attributable to the liberalization efforts, free trade agreements and regional integration favored by countries in this part of the world. After the global financial crisis of 2008-2009, trade grew at a slower pace than economic activity, particularly in Sub-Saharan Africa. Trade openness fell from 69% of GDP in 2008 to 51% of GDP in 2017. It has to be said that policies that promote international trade integration create opportunities for growth, but also entail risks. If poorly managed, opening up the economy could expose the country to weaker growth, increase instability and inequality (Calderón, 2020). Indeed, three major "stylized facts" can characterize international trade trends in developing countries (DCs): accelerated trade liberalization accompanied by rapid trade expansion, growth in the industrialization process, and rising inequality and poverty (Cling et al, 2006).

Inequalities express the differentiated access to important economic and social goods due to the stratification of human society (Miamo and al. 2020). When observed on a distribution of earnings or wages, inequalities refer to different wage levels, and are referred to as wage inequality. These remain a major obstacle on the road to a better, more sustainable future for developing countries. One example of inequality is the gender pay gap, which today constitutes one of the greatest social injustices (ILO, 2016). Various studies have shown that, in most countries for which data is available, these inequalities have generally narrowed over time, but have not been completely closed (ILO, 2016, *Op.Cit*); despite progress in some areas, they continue to increase in many parts of the world.

Thus, the evolution of inequalities has contributed to placing the related issue on the public agenda. It has also led UN member countries, in the wake of the Millennium Development Goals (MDGs), to include the reduction of inequalities as an objective in the international development agenda for 2030. It was against this backdrop that the fight against inequalities in all their forms was included as the tenth Sustainable Development Goal (SDG.10) entitled "Reduce inequalities between and within countries" out of the seventeen goals adopted by UN member countries in 2015. This goal groups together several targets, including target 8.5, which aims, among other things, to guarantee equal pay for work of equal value as part of the UN's 2030 Agenda for Sustainable Development. The main aim of these targets is to combat poverty, hunger and inequality simultaneously, both locally and globally, and to promote equal access to health and education.

Since then, the debate on international trade has prompted a large number of researchers to focus on a range of factors such as structural transformation, levels of corruption, food security, employment levels, poverty, economic growth, financial inclusion, unemployment and even population (Linnemann, 1966), all of which are conducive to trade between different economic partners. But today, with the considerable increase in inequalities in the world in general and in Africa in particular (OECD, 2008), we are questioning wage inequality as a key factor in the development of international trade in services. A World Bank study shows that Africa's trade shares are systematically lower than those of any other region in the world. It is therefore necessary to understand the reasons for the lower levels of Sub-Saharan Africa's share of world trade in services, which involves understanding African trade and country characteristics. We want to understand whether wage inequality is one of the factors influencing the development of trade in SSA countries, and therefore their level of openness to international trade, especially at a time when the covid-19 pandemic has given rise to an extreme increase in inequality, with examples of variations of 27.6% in Algeria, 63.3% in South Africa, and making Africa one of the most unequal continents in the world (UNCTAD, 2021). While a certain degree of inequality reflects differences in the individual and professional characteristics of workers, there is a growing concern about the harmful social and economic consequences of excessive inequality, which can deteriorate social cohesion, reduce household consumption, and weaken international trade and economic growth. Since the works of authors such as Bourguignon (2013), Milanovic (2007) and Krishna and al (2009), who note a significant increase in income inequality over the last few decades in a number of countries, several researchers and academics have set out to show that there is a relationship between this inequality and international trade. However, most of the existing works on the subject do not show a direct link between inequality and trade in services, but rather the opposite effect. It is therefore important to address the issue of wage inequality, as it may affect progress towards the MDGs and poverty reduction in general.

Interest in wage inequality stems from the fact that it has not been studied in relation to international trade. Moreover, studies in the African context do not seem to have any interest in analyzing the effect of wage inequality on international trade, despite the fact that Sub-Saharan Africa is experiencing increasing inequality and growing involvement in international trade. It therefore seems appropriate to examine this issue in Sub-Saharan African countries. Thus, the main question to which this research aims to provide an answer is: does the increase in wage inequality lead to a reduction in trade in services in SSA? Obviously, to answer this fundamental question, our overall objective is to determine the effect of wage inequality on international trade in services in SSA.

II. Brief Literature Review

This discussion of wage inequality and international trade is inspired by the theory of effective demand, which predicts that wage inequality can affect international trade (Keynes, 1936), in particular the demand for goods and services. Similarly, the theory of political economy developed in 1776 by Adam Smith with the publication of his book "The Wealth of Nations" argues that wage inequality influences the trade policies adopted by countries.

Generally speaking, several economic theories find a link between wage inequality and trade in services, such as the Product Cycle theory and the Life Cycle theory developed by American economist Raymond Vernon in the 1960s. According to Product Cycle theory, wage inequality can affect the competitiveness of a

country's industries on the international market. Countries with high wage inequality can be more competitive with low-cost, low-skilled labor. This can lead these countries to specialize and export products that use cheaper labor on the world market. Life-cycle theory suggests that workers in developed countries tend to earn higher wages at the beginning and end of their careers, while those in developing countries earn lower wages throughout their working lives. This wage asymmetry may partly explain international trade in services, as workers in developed countries tend to be employed in high value-added service industries, such as information technology, while workers in developing countries are more often employed in low value-added sectors, such as cleaning or catering services.

The cost-competitiveness theory of Michael Poter (1980), Paul Krugman (1980) and Joseph Stiglitz (1990) shows that companies in developing countries can produce services at lower cost than those in developed countries, due to low wages and benefits. This cost difference may be the reason why companies in developed countries outsource certain services, such as call center or data processing services, to developing countries where wages are lower. This may contribute to the wage gap between workers in these two types of countries. With regard to the theory of wage competitiveness, it states that wage inequalities can affect a country's competitiveness in trade in services. If wages are too high in a country relative to its competitors, this can make its services more expensive and less competitive on the world market (Krugman, 1980, *Op.Cit*). Along the same lines, specialization theory holds that countries specialize in the production of goods and services for which they have a comparative advantage. Countries that have developed comparative advantages in high value-added services tend to specialize in these types of services, thus driving up wages in these sectors. Developing countries, on the contrary, tend to specialize in low-value-added services, resulting in lower wages for the workers employed there. According to this theory, wage inequalities can affect a country's economic specialization in trade in services. If wages are higher in some sectors of the economy than in others, this can encourage workers to specialize in these sectors and neglect others where wages are lower. This leads to unbalanced economic specialization, which can adversely affect trade in services.

As for the theory of economic growth developed by several economists over the years, notably Robert Solow in 1956 and Paul Romer in 1986, wage inequality can affect a country's economic growth. If wage inequality is too high, it can reduce domestic demand for services and slow economic growth. It can also affect adversely the country's competitiveness on the world market.

Empirically speaking, several authors (Lundberg and al (2003), Meschi and al (2011) show that inequality increases when emerging countries trade mainly with developed countries. These results contradict those of Milanovic (2007), Sanchez and al (2003), who find that trade openness reduces income inequality for the population as a whole. For other authors, the extension of capital markets is associated with an increase in inequality, as in the case of developing countries, where opening up to foreign capital primarily improves the incomes of skilled workers (Choi and al. 2006). In the same vein, Daymon and al. (2011) write an article that shows, over the period 1980-2003 in the southern and eastern Mediterranean countries, that trade flows, linked in particular to imports, accentuate the unequal nature of wage distribution; but that through exports and their diffusion effects in the economy, contribute rather to the reduction of income inequality. It should be noted that many of these empirical studies have focused on the link between international trade and income inequality, in particular the effects of international trade on this inequality, with controversial results. However, these studies do not consider the influence of wage inequality in an economy on international trade in services, despite the predictions of effective demand and political economy theories mentioned above. Thus, although the literature, where it exists, has divergent views on the links between wage inequality and international trade, it is generally accepted that wage inequality is an essential indicator for stimulating international trade as a whole. However, very few studies in the African context have analyzed the effects of wage inequality on international trade in services. At a time when sub-Saharan Africa is experiencing a growing trend in inequality, and an increasing involvement in international trade, it therefore seems appropriate to examine this issue in the context of sub-Saharan African countries.

III. Methodological Approach

3.1 Data sources and variables

To answer the fundamental question on which this study is based, a sample of 19 SSA countries was mobilized with aggregate macroeconomic data covering the period from 2000 to 2018. The information is mainly drawn from international agency databases, such as the World Bank Data base (WDI, 2021), Worldwide Governance Indicators (2021) for institutional data and the United Nations Industrial Development Organization (UNIDO) for the variable of interest (wage inequality).

More specifically, the trade in services variable comes from the World Bank Data base (WDI; 2021), while the variable of interest (wage inequality) comes from UNIDO. These databases are perfectly harmonized worldwide, and have contained information since the 1960s. This is annual information with very few missing data, which can be filled in using standard extrapolation methods. The UTIP-UNIDO index is calculated on the basis of a Theil index. The control variables, notably internet, inflation, GDP/capita, gross primary school enrolment ratio, population density and exchange rate, are taken from the World Bank database (WDI 2021). The variables described are presented in the following table:

Table 1: Presentation of the variables

Variables	Abbreviations	Description	Data source
Theil index	Theil	Wage inequality	UTIP-UNIDO
Internet	Internet	Number of internet users per 100 people	WDI (2021)
Inflation	Inflation	Consumer price inflation	WDI (2021)
Education	Educ	Gross primary school enrolment	WDI (2021)
Economic growth	GDP/head	GDP per head	WDI (2021)
Population	Pop	Population density	WDI (2021)
Exchange rate	TC	Real exchange rate	WDI (2021)

Source : Author

- **Dependent variable**: trade in services, which is a continuous variable of trade openness measured by the sum of exports and imports of services relative to GDP at current prices (WDI, 2021). According to our research hypothesis, wage inequality is expected to reduce trade in services.
- **Variable of interest**: wage inequality measured by the Theil index, a classic statistical measure of dispersion inspired by the measurement of entropy. Indeed, the Theil index can be decomposed into two interdependent terms, one of which is interpreted as the measure of inequality within a single category of individuals (intra stratum), and the other as the measure of inequality between different categories (extra stratum). This decomposition makes it possible to analyze the evolution of inequalities in populations partitioned into homogeneous groups.

It should be emphasized that the choice of these main variables was motivated by a good literature on international trade and economic development (Cipollina and al. (2016), Dary and al. (2018), Blanas and al. (2018), Asongu and al, (2016), Kaminchia, (2019), Shobande and al.(2019), Uysal and al.(2019)).

- **Control variables**

  - Internet: this variable designates the intensity of Internet use, i.e. the number of users per 100 people who can access the global network. The Observation shows that Information and Communication Technologies (ICT) have enabled the production of numerous services and service activities, and are no longer subject to asymmetries of location or information. The Internet has influenced the economy and can be seen as a determinant of trade in services.
  - Education: this variable is measured by the gross primary school enrolment rate. This is calculated by dividing enrolment in primary education in school year *t* by the population of the age group officially corresponding to primary education in school year *t*. The inclusion of this variable in the model explicitly incorporates the notion of human capital developed by authors such as Schultz (1981, 1961, 1959) and Becker (1964). Wood (1995) argues that workers in developing countries will need to acquire a minimum level of education in order to benefit from trade liberalization. Much more, an OECD study (2012) on education and income inequality worldwide shows that education policies are among the most powerful levers available to countries to reduce income inequality over time.
  - Inflation: this is the quantitative variable used to assess the price level recorded by a country *i* in year *t*. In this study, this indicator is measured by consumer price inflation.Inflation has mixed effects on economic growth and income inequality. When inflation is high, it can lead to a slowdown in economic growth and a deterioration in employment. Chronic inflation has a number of adverse effects: it disrupts the macroeconomic distribution of income, reduces the attractiveness of the economy, and reduces price competitiveness and purchasing power. On the other hand, it can promote economic growth and reduce income inequality through: debt relief for economic agents, improved corporate financial profitability and increased investment likely to boost productivity and employment. Thus, a positive and significant sign can be expected between inflation and trade in services in SSA.
  - Population density: this is known to affect economies through both demand and supply (Surec and al. 2020). Under this assumption, it is therefore expected that any increase in population density will increase the demand for service provision. An increase in demand or need for services can create pressure on imports of services in the event of insufficient supply (Surec and al. 2020, *Op.Cit*).
  - Exchange rate: It refers to the official exchange rate determined by the national authorities or the rate determined on the legally sanctioned foreign exchange market. It is calculated as an annual average based on monthly averages (units of local currency against the US dollar). It is also used as a determinant of trade openness in an empirical study on the factors of trade openness in African economies.

3.2 Model specification

Previous empirical work has shown that movements in economic activity and the real exchange rate are the most important determinants of trade flows in services (Deardorff and al. 1979, 1982). On the basis of this information, we will build a model of trade in services.

The trade in services equation used in this study incorporates other determinants such as wage inequality as a variable of interest, internet use, inflation measured by consumer price, population density, education, economic growth measured by GDP/capita and the exchange rate. The general model is presented as follows:

$$\text{TRADESV}_{it} = \beta_0 + \beta_1 \text{TRADESV}_{it-1} + \beta_2 \text{THEIL}_{it} + \beta_4 \text{Internet}_{it} + \beta_5 \text{Inflation} + \beta_6 \text{EDUC}_{it} + \beta_7 \text{POP}_{it} + \beta_8 \text{PIB}_{it} + \beta_9 TC_{it} + \varepsilon_{it}$$

Where; β represents the coefficients of the variables and ε_{it} is the error term.

To analyze the effect of wage inequality on international trade in services in SSA countries, we use panel data econometrics, unlike Guttmann and al. (2006) who used cross-sections with indicator variables. The value of panel data econometrics lies in the fact that it enables us to study international trade in services in all its diversity and dynamics. Indeed, panel data integrates the two dimensions of the trade phenomenon, namely the individual and temporal dimensions. This dual dimension gives panel data econometrics a distinct advantage over other methods based on temporal or cross-sectional data. Indeed, according to Hsian (2003), the advantages of using panel data over cross-sectional data are :

- by combining time series and cross-sectional observations, panel data provides more information, more variability, less collinearity among variables, more degrees of freedom and more performance;
- panel data can detect more easily and measure effects that cannot be easily observed in time series or cross-sectional data. They enable more precise parameter estimates. The complexity of individual behavior is often better described. The problems raised by the non-stationarity of time series and estimation errors are limited;
- the use of panels also makes it possible to simultaneously account for the dynamics of behaviors and their possible heterogeneity. They enable both cross-sectional and serial estimates to be made, thus improving model specification;
- the use of panel data corrects the shortcomings that can arise when only cross-sectional data are used, or when only time-series data are used. Issues such as the potential endogeneity of the variables used and the control of individual specific effects are removed.

This research draws on the work of Meschi and al (2011) and Bergh and al (2010), who use a dynamic non-cylindrical panel. This leads to the specification of a first econometric model in which wage inequality is measured by the Theil index.

$$\text{TRADESV}_{it} = \beta_0 + \beta_1 \text{TRADESV}_{it-1} + \beta_2 \text{Theil}_{it} + \beta_4 \text{Internet}_{it} + \beta_5 \text{Inflation} + +\beta_6 \text{EDUC}_{it} + \beta_7 \text{POP}_{it} + \beta_8 \text{PIB}_{it} + \beta_9 TC_{it} + \mu_i + \delta_t + \varepsilon_{it}$$

With :

- I: country; *t*: years,
- Theil: Theil index measuring wage inequality,
- Internet: Internet users per 100 people,
- Inflation: consumer price inflation,
- Educ: education measured by the gross primary school enrolment rate,
- POP: population density,
- GDP/head,
- TC: exchange rate,
- μt: time component, μi: individual component, ε_{it}: error term.

There are two reasons for the dynamic nature of the model. From an econometric point of view, the continuous nature of trade in services requires the use of an AR(1). From an analytical point of view, the lagged nature of the trade dependent variable is explained by the fact that today's trade depends on yesterday's trade, or on the initial level of trade in the economy. The "viscous" nature of trade in services is influenced by structural factors that are slow to change over time: institutional context, factor endowments, distribution of land and assets, urbanization, and so on.

We estimate the model using a macroeconomic approach. For the sake of econometric rigor, we set all the variables in the equation in logarithm in order to linearize their evolution over time. We have :

$$\ln\text{TRADESV}_{it} = \beta_0 + \beta_1 \ln\text{TRADESV}_{it-1} + \beta_2 \ln\text{Theil}_{it} + \beta_4 \ln\text{Internet}_{it} + \beta_5 \ln\text{Inflation} + +\beta_6 \ln\text{EDUC}_{it} + \beta_7 \ln\text{POP}_{it} + \beta_8 ln\text{PIB}_{it} + \beta_9 \ln TC_{it} + \mu_i + \delta_t + \varepsilon_{it}$$

With :

I: Country; **t**: years ;

Ln Theil: logarithm of wage inequality ;

Ln Internet: logarithm of the Internet variable;

Ln Inflation: logarithm of the inflation variable;

Leduc: logarithm of the education variable;

ln POP: logarithm of population density;

Ln GDP/head: logarithm of GDP/head;

Ln TC: logarithm of exchange rate

Ln: natural logarithm; μt: time component; μi: individual component; ε_{it}: error term.

With regard to estimation, two techniques are favored in this study to assess the effect of wage inequality on trade in services in SSA countries: Ordinary Least Squares (OLS) and System Generalized Method of Moments (GMM). OLS estimation does not take into account country fixed effects and year fixed effects. Since the OLS technique can be biased if the inherent heterogeneity of countries is neglected, we take this heterogeneity into account in GMM. The time fixed effect is taken into account by introducing year dummies into the estimation. The country fixed effect is also taken into account by introducing country dummies into the estimation. These specific effects make it possible to take into account the specificities of SSA countries, both between them and over time. Similarly, estimation using the GMM system takes these fixed effects into account. The endogeneity problem introduced by dynamizing the model is generally corrected using the GMM system of Blundell and Bond (1998). The latter have shown that the GMM system estimator performs better than the first-difference estimator, since the latter gives biased results in finite samples when the instruments are weak. By eliminating the "noleveleq" option in the GMM control with the first-difference estimator, we obtain the System GMM estimation results in two steps.

IV. Results and Discussion

4.1. Descriptive statistics for variables

Table 2: Summary of the main descriptive statistics for model variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Trade in services	324	14.875	9.233	2.602	50.146
Theil Index	259	.089	.053	.016	.249
Internet	346	9.618	12.966	.015	62.4
Inflation	354	9.619	15.632	-16.228	200.77
Education	247	29.234	27.055	.79	106.407
Population density	361	109.367	142.41	3.047	623.302
GDP per capita	354	1.768	4.099	-18.324	19.939
Exchange rates	351	4.308	2.45	-3.113	22.629

Source : Author

Trade in services over the period 2000 - 2018 in sub-Saharan Africa averaged 14.87%. Throughout this period, it varied between 2.60% and 50.14% as a percentage of GDP. The Theil index of wage inequality in this region averages 0.08, with minimum and maximum limits of 0.016 and 0.249 respectively. The number of Internet users per 100 people in the area ranged from 0.015% to 62.4%, with an overall average of 9.61%. The gross primary school enrolment rate was also relatively stable over time, ranging from 0.79% to 106.4%, with an average of 29.23%. Similarly, population density has seen successive, relatively low and stable rises and falls over time, with an average of 109.36% of the population. In addition, over the above period, the exchange rate averaged around 4%. This average has progressed relatively steadily over time, with minimum and maximum values of -3% and 22% respectively.

4.2 Correlation matrix between variables

Table 3: Correlation matrix between model variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Trade in services	1.000							
(2) Theil Index	-0.249	1.000						
(3) Internet	0.227	-0.189	1.000					
(4) Inflation	-0.211	-0.044	-0.173	1.000				
(5) Education	0.674	-0.136	0.451	-0.046	1.000			
(6) Population density	0.755	-0.086	0.283	-0.146	0.698	1.000		
(7) GDP per capita	0.208	-0.250	0.011	-0.112	0.141	0.123	1.000	
(8) Exchange rates	-0.066	0.109	-0.296	-0.096	-0.335	-0.011	-0.196	1.000

Source : Author

With the exception of the correlation coefficient between trade in services, education and population density, all other variable coefficients are below 0.5. This shows that the Theil index is negatively related to trade in services. The "wage inequality" variable measured by the Theil index is also negatively correlated with all the other variables in the model. There is also a negative link between trade in services and inflation.

4.3 Stationarity test

As a prerequisite to estimating the model, we perform a stationarity test to assess the conditions under which the model can be applied. Thus, if the variables are non-stationary, the standard OLS regression will be said to be spurious or illusory.

Indeed, among the various tests that can be used to determine the existence or non-existence of unit roots in panel data, we have the Levin Lin Chou (Harris and Tzavalis (1999), Breitung and Pesaran (2005), Tests ImPesaranShin (Im and al. 2003) and Fisher's test. The latter is preferred because it does not require highly balanced data and also accepts cross-sections with deviations.

Table 4: Summary of stationarity tests using the Fisher test

Variables	**Statistics**	**Statistics**	**Order of integration**
	A level	**In first difference**	
TradeSV	4.4968***	**3.4616*** **	I (0)
Thiel	25.1604***	8.0984***	I (0)
Internet	35.9400***	11.5826***	I (0)
Inflation	23.0500***	7.8112***	I (0)
Educ	8.1261***	-1.0506	I (0)
Pop	18.1879***	3.6277***	I (0)
Corr up	5.5017 ***	10.3204***	I (0)
TC	2.9791***	1.0882	I (0)

Source: Author based on statat 17 ***significances at 1%; ** at 5%; * at 10%.

Table 4 shows that all variables are stationary at level or order I (0).

4.4 Effect of wage inequality on trade in services: OLS estimation

Table 5: Effect of wage inequality on international trade in services.

	Dependent variable: logarithm of trade in services						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Theil	-0.203***	-0.227***	-0.236***	-0.248***	-0.289***	-0.253***	-0.356***
	(0.0609)	(0.0572)	(0.0582)	(0.0630)	(0.0656)	(0.0555)	(0.0605)
Ln Internet		0.0417**	0.0151	-0.0704**	-0.00134	0.0169	0.00352
		(0.0204)	(0.0223)	(0.0322)	(0.00324)	(0.0390)	(0.00309)
Ln Inflation			-0.129***	-0.133***	-0.137***	-0.113***	-0.0646*
			(0.0353)	(0.0407)	(0.0403)	(0.0351)	(0.0372)
LnEduc				0.193***	0.126***	0.0273	0.0907**
				(0.0529)	(0.0441)	(0.0521)	(0.0397)
LnGDPpercapita					3.411**	0.579*	0.821***
					(1.543)	(0.300)	(0.247)
LnPop						0.191***	0.134***
						(0.0287)	(0.0320)
Ln TC							0.0804***
							(0.0223)
Constant	2.054***	1.977***	2.220***	1.800***	1.240***	2.351***	2.101***
	(0.161)	(0.150)	(0.168)	(0.229)	(0.325)	(0.642)	(0.480)
Observations	240	231	231	160	163	153	163
R-squared	0.027	0.092	0.109	0.182	0.159	0.263	0.298
Numbers of id	15	15	15	15	15	15	15
Fisher	3.603	4.000	2.753	4.939	5.400	57.44	28.25

NB: values in brackets are standard deviations, ***significances at 1%, **5%, *and 10%.

Table 5 presents an OLS regression of the variable of interest (wage inequality) on trade in services. Column 1 measures the effect of wage inequality on trade in services, without taking into account the other control variables. The coefficient associated with this variable is negative and significant at 1%. This means that as inequality increases in the Sub-Saharan zone, trade in services deteriorates. Indeed, wage inequality negatively affects trade in services in several ways. Firstly, when wages are very different in trading partner countries, this can have an impact on the competitiveness of companies. Companies with higher production costs due to higher wages may find it difficult to compete internationally. Secondly, wage inequality can also influence companies' decisions to relocate. These companies may relocate to countries with lower wages in order to reduce production costs and remain competitive. This can have significant economic consequences for home countries, particularly in terms of job losses.

In the second column, we regress the control variable "internet" and find that its sign is positive and significant at 5%. This suggests that the development of the internet increases the level of trade in services. This result confirms the work of authors such as Gallouj and al (2009), who believe that ICT, particularly the Internet, creates comparative advantages, influences market structuring and contributes more to trade in services. For example, these authors have shown that e-tourism is a crucial tool for the development of sustainable tourism for SMEs. What's more, in most countries, the most ICT-intensive firms are also those that innovate most frequently and combine several types of innovation (Le Bas, 2004).

Following the same logic, we ran a regression on the "inflation" variable (column 3). Once again, we find that the coefficient linked to the "wage inequality" variable remains negative and significant at 1%, thus explaining that wage inequality does not favor trade in services. Indeed, at the 1% threshold, inflation contributes to a decline in trade in services. These results are in line with those of Balavac and Pugh (2016), who showed that permanent price-level instability is unfavorable to export product diversification.

The coefficient associated with the "education" control variable shown in column (4) is positive and significant at the 1% level. The coefficient associated with the variable of interest also remained negative and significant at the 1% level, despite the introduction of this variable. This situation demonstrates once again that inequality in wage redistribution is not conducive to the development of trade in services. We can therefore conclude that the more members of a society are endowed with human capital, the greater the development of trade in services.

Column (5) explains the effect of GDP per capita on trade in services. The coefficient associated with this variable is positive and significant at the 5% level. Thus, if the level of growth increases by one unit, trade in services will increase by 3.411.

Looking at column (6) on population density, we see that its coefficient is positive and statistically significant at the 1% level. An increase in population of one unit leads to an increase in trade in services of 0.191. This positive and significant coefficient on population density indicates the positive impact of SSA's workforce on trade in services. This idea is in line with that of Surec and al, (2020, *Op.Cit.*) who showed that the increase in the workforce is mainly absorbed by the services sector and positively affects services exports.

When we introduce the "exchange rate" control variable in column (7), we see that its sign is positive and economically significant at the 1% level. This means that the 0.0804 growth in trade is due to a one-unit increase in the exchange rate. The variable (real) exchange rate has been included in the model with the expectation that it will significantly and negatively affect trade. This is based on the argument that, in most cases, exchange rate volatility discourages trade. However, there are other studies that have different conclusions about this relationship, attributing a positive sign to trade volume. The argument is that the exchange rate volatility that results from risk increases the potential gains from trade, while some also argue that it increases the value of the trader's option to export and thus increases export volumes (Dellas and al. 1993, Broll and al.1999). The results in both cases reveal that it is not significant and takes on a positive sign. Another explanation for this could be the dollarization effect whereby, in most weak-currency African countries, transactions are dominated by the US dollar, so that the effect of fluctuations in local currencies (which are normally measured in terms of US dollars) does not pose any threat to trade transactions.

❖ **The right model**

		Different specifications for the right model						
		1	2	3	4	5	6	7
Wooldridge test (autocorrelation)	F	294.83	260.23	148.21	6.93	9.38	5.67	18.41
	Prob	0.0000	0.0000	0.0000	0.0001	0.0000	0.0005	0.0000
Breusch-Pagan test (heteroscedasticity)	χ^2	5.95	3.55	0.05	3.70	3.55	15.09	11.42
	Prob	0.0147	0.0594	0.8158	0.0544	0.0594	0.0001	0.0007

Source : Author

The results of the Breusch-Paga test for error heteroscedasticity and the Wooldridge test for autocorrelation of panel residuals are presented in the table above. The significance of these tests implies on the one hand that, the errors are heteroscedastic. In other words, the variance of regression residuals is not constant. The consequence is that, in the presence of non-homoscedastic errors, ordinary least squares (OLS) estimators become ineffective. On the other hand, the Wooldridge test shows the presence of first-order autocorrelation in the residuals. Hence the need to use an estimation method capable of taking into account the problems of heteroscedasticity and autocorrelation.

4.5 The effect of wage inequality on trade in services: a system generalized method of moments (system GMM) regression

Table 6: Results of GMM estimation in a system

	Dependent variable: logarithm of trade in services						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
L.lnTradeservice	0.951***	0.850***	0.797***	0.955***	0.670***	0.595***	1.508**
	(0.0766)	(0.0474)	(0.0589)	(0.0965)	(0.154)	(0.191)	(0.518)
Theil	-0.192***	-0.187**	-0.459***	-0.363***	-0.199**	-0.317**	-0.780**
	(0.0357)	(0.0852)	(0.143)	(0.109)	(0.0746)	(0.134)	(0.312)
Ln Internet		0.0521***	0.0339*	0.0102***	0.115*	0.0542	0.448*
		(0.00569)	(0.0183)	(0.00268)	(0.0641)	(0.110)	(0.251)
Ln Inflation			-0.123**	-0.168**	0.142**	-0.0135	0.0154
			(0.0436)	(0.0610)	(0.0519)	(0.0479)	(0.0706)
LnEduc				-0.256***	0.0492	-0.132	-0.0630
				(0.0590)	(0.140)	(0.171)	(0.125)
LnGDPper capita					1.806**	0.984	4.310*
					(0.806)	(0.751)	(2.228)
LnPop						0.157*	-1.239
						(0.0858)	(0.717)
Ln TC							0.594*
							(0.310)
Constant	-0.385*	-0.199	-0.528	0.0468	3.146*	1.750	6.419*
	(0.192)	(0.255)	(0.359)	(0.194)	(1.555)	(1.665)	(3.561)
Observations	189	175	164	147	130	121	126
Nomber countries	14	13	13	14	13	14	14
AR (1)	0.0516	0.0109	0.0166	0.0111	0.0164	0.0781	0.0401
AR (2)	0.582	0.963	0.334	0.992	0.0806	0.741	0.802
Instruments	13	14	12	15	10	11	10
HansenOIR	1	0.252	0.971	0.871	0.471	1	0.983
Fisher	83759	302074	8539	5855	1103	14572	20355

NB: values in brackets are standard deviations; ***significance at 1%, ** 5%, * and 10%.

Using the two-stage Generalized Method of Moments (GMM) system, and performing several calibrations, the results show that all models are well specified. The Hansen test does not reject the validity of the instruments (Hansen test p values ≥ 10), nor is the absence of second-order serial correlation rejected (AR (2) p values ≥ 10).

Based on the principle that too many instruments biases the Hansen restrictions test, and in line with the rule of thumb that the number of instruments should be less than the number of countries (Roodman, 2009), we find in our results that the number of countries is greater than the number of instruments, indicating that there is no instrument proliferation problem.

In the same vein of analysis, column (1) shows that the coefficient is negative and significant at the 1% level. If inequality increases by one unit, trade in services falls by 0.192. This implies that wage inequality reduces trade in services in SSA. The negative influence of wage inequality on trade in services in SSA can have several consequences: Firstly, loss of motivation among workers who feel underpaid compared to their colleagues with the same skills and qualifications. The result is a drop in productivity and quality of work (Lazear, 1989). Secondly, wage inequality can contribute to economic imbalance, as workers with higher wages will spend more, while those with lower wages will spend less; this can affect demand for the services on offer. Finally, this situation can also adversely affect the company's reputation, with a negative impact on customer and employee loyalty.

With regard to the control variables, the results obtained show, for the most part, the expected signs. More specifically, we found a significantly positive relationship at the 1% threshold with the "internet" variable and the "trade in services" variable. This

result remains in line with those of Freund and Diana (2004), who presented a theoretical model of the impact of the Internet on international trade, and empirically examined its predictions using both panel and cross-sectional data. Furthermore, the coefficient associated with the level of economic development (GDP/head) takes on a positive sign as expected, indicating a positive and significant relationship at 5%. This result is contrary to that obtained by Guttmann and al (2006, *Op.Cit.*), whose findings show that countries with higher GDP per capita tend to have lower levels of openness. However, our result is consistent with the hypothesis that countries with a high level of economic development trade more. It corroborates the situation of some African countries, notably the Seychelles, with a GDP per capita of 10,591 USD in 2008, and the highest level of openness in 2007, compared with other African countries (World Bank, 2011).

Conclusion

The main aim of this research was to determine the effect of wage inequality on trade in services in Sub-Saharan Africa. To achieve this objective, we have highlighted theoretical and empirical findings on the link between wage inequality and international trade in services. The results of several studies show the effects of international trade on wage inequality, to the detriment of the direct influence of wage inequality on international trade, although there are theories such as John Maynard Keynes' effective demand theory (1936) which predict that wage inequality can affect international trade. Using a sample of 19 SSA countries over a period of 18 years, we carried out an empirical verification using various methods, notably Ordinary Least Squares (OLS) and Generalized Moments (GMM). Our main finding is that wage inequality has a negative and significant influence on trade in services in Sub-Saharan Africa, and consequently reduces trade in services in this part of the world.

Public authorities in sub-Saharan African countries should therefore work to combat wage inequality between populations by promoting economic policies that improve purchasing power. These include :

- ✓ promote equal opportunities by implementing policies that encourage equitable access to education and vocational training for all. This can reduce skills gaps and improve employment opportunities, then help to reduce wage inequality;
- ✓ implement social protection policies to guarantee a decent standard of living for all workers, notably by setting adequate minimum wages and ensuring social security. This could reduce the pay gap between workers and improve their purchasing power;
- ✓ encourage collective bargaining between employers and workers to guarantee fair working conditions and just wages. This policy involves creating trade unions and supporting their activities in defense of workers' rights;
- ✓ strengthen the enforcement of labor laws to combat discriminatory practices and abuses in the workplace, through the reinforcement of labor inspectorates and dispute resolution mechanisms;
- ✓ promote women's entrepreneurship and economic empowerment through specific financing and training, to reduce the gender pay gap and encourage their participation in international trade.

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