

Inconsistency of Trade Statistics and GDP in Some African Nations and the Implications: A Game Theory Perspective

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Abstract: The aim of this study is to formulate and apply cooperative game theory to develop a model for international trade administration and analyses the process of which the government of developing countries especially in Africa continent in collaboration with international marketers and the Customs service can jointly take part in international trade administration and achieve game balance. The research result is that the performance improvement in balance of trade administration should be based on the cooperative mechanism of which government, international traders and the customs service. Therefore, it is essential for us to take some measures to establish a coordinate mechanism of which the government, the international marketers, and the third sector participate in international trade administration.

Keywords: International Trade, Trade Statistics, Game Theory Model, GDP, Sub-Saharan African Nations

1. Introduction

The trend in international trade and economic activities have recorded a tremendous increase but yet, real trade statistics continue to diminished in progression statistically. Most African nations trade statistics have been massively affected adversely by either deliberate man-made actions or accidental occurrence which cannot be avoided. The fact remains that corruptions stemming out of economic smugglings and misinformation through underreporting by altering facts and figures continue to present wrong statistical figures of true trade volumes annually. At least twenty years after all these great developments in international economic growth, Alexander Yeats (1990) compares and contrast invoices of importers and exporters and summarized that the statistical data and could be utilized to determine, future position and direction and total composition of trade in the

continent. This paper revisits the significant issue: Do majority of African nations exports trade balance statistics matter at all? The former World Bank's economist, Alexander Yeats in the year 1990 while still a staffer at the International Economics Department, wanted to know in a paper he published. Having carefully analyzed the receipts of international importers and exporters as proof of statistical documentation of African nations, it very hard to depend holistically on the trend and impacts of the trading and the future direction it volumes projections could be misleading. According to Mr. Yeats conclusion derived from existing trade record, African continent is plague by unprecedented misinformation which actually is misleading in general, while economic saboteurs such smugglers and corrupt officials continue to subvert economic growth. my major focus in this paper is to critically analyzed some African states international trade statistics in order to verified the

current trend in import and exports. Two major tasks this paper tried to resolve first of all it begins by re-focusing relevant publications analyzed by Mr. Yeats from the year 1990. Having accomplished that, all relevant balance of payment by African States made public were consulted post Yeats work on African nations imports and Exports. Public statistics are majorly dependent on willingness for the members of the public to come forward to lodge it formally; therefore, reliable and precise economic statistics varies Morgenstern (1963) misinforming and general speculations in respect to international trade and economic activities are common to be noted thereby creating lack of trust and inability to work with official record which is highly misleading and nothing else but purely illusion of the human mind. This ascension made by Morgenstern was intended to addressing the then developed economies lacunae as at then, but as it is lately, it's invariably fitted into the issues currently face by the majority of African economies challenges as well. The appropriate way of simplifying the complicated issues of extremely misappropriate comparison of statistical claims and the actual reality on ground is simply to say too much exaggeration of fact and figures in the wrong way" (*ibid*: 137, italics directly extracted out of the real text). The author further warned that *Anyone who sat through meetings (as the author has) in which final balance of payments figures for most invisible items were put together, can only marvel at the naiveté with which these products of fantasy, policy, and imagination, combined with figures diligently arrived at, are gravely used in subsequent publications (ibid., p. 180).*

2. Could African Trade Statistics Really Matters at All? What Are the Implications

Advanced nations consistently keep up with statistical information and never fail to keep up a pace even if they do is just for at least a year. Looking back at the year 1989, similar statistics made available for African nations' economies got right up to 1983, unfortunately it's ceased to exist right after that period. Yeats findings discovered having scrutinized African statistics in the year 1990, realizing that African international statistics for trade identification deficient by in three fundamental proportions. In addition, it's became very obvious to Yeats that a lot of challenges is associated to African trade statistics coming to the United Nation Statistical Office after all. In gross contrast to what was obtainable from the Latin America region, it impaired for just two or three years, while the first world nations and East Asian nations are virtually current at all times. Furthermore, just few of African nations of just about six were able provide Statistics of trade beyond 1983, and never went farther than three years (1986), the credibility of these statistics were subverted by numerous loopholes in ranges of timings while about three of taken out the thirty-nine aggregate cases consist of non-statistical data at all. Compositions of all these statistical aggregates helped to

guide decisions by law-makers and researchers alike enjoyed a period of six years span of data and were fortunate to have just a little delayed of just three years, however, an interval occurrences of statistics availability were witnessed too while, lack of data not available at all was also recorded in some instances as well. Obviously increase in African trade surged is majorly attributed to international trade activities by nations (Jerven, 2010). Influenced arising from globalization far from the shores of African continent have massively improved African trade and the surged in GDP as well; a high increase was witnessed by mid-1990s as shown by official statistics. (Jerven, 2013a, 2013b, 2013c). Subsequently, the credibility and the reliability of foreign segment influenced determine the extent that statistical data are collected, analyzed and eventually interpreted in respect to Africa's economic increase lately. Most times the real combinations between trade and economic increase at omitted because of unethical attitude when documenting official statistical data accessible. The outcome is likely to be uneven in the way that the GDP might be underreported thereby laying greater analysis on surged in economic abundant inconsistency with economic growth to the detriment of GDP statistics once harness together. (Jerven, 2014). Data gathering played crucial roles in the way official statistics are collected, analyzed and interpreted, for example foreign trade as compares to internal trade or even agro-allied production as well, Statistics play a vital role in this direction. It's clear enough to note significantly that the gathering of data played an important role this because the subject that got the most data is most often discussed holistically in detail more than the subject with lesser information, for example discussing foreign trade statistics tend to dominate most discussion on African trade growth while little is talked about the local statistics since they are not readily in existence.

In order to theatrically proof balance of trade, Yeats used an easy method to show statistically by categorizing Nation X exports to Nation Y should balance or march Nation Y imports from Nation X. However, in real life situations, this simple theory does not always work out smoothly as theorized, according to Yeats both advanced and developing nations suffered the same fate. Statistics drawn out in this manner is usually structured just for the sake of facilitating formulation of policy by relevance bodies period. A classical proof of this claimed was the difference in frequency of trade between some African nations and the United States of America where statistics showed a trade average of 39% quite inconsistent with reports recorded in respect to United States of America's exports to some African Nations as well. Furthermore, Statistics on internal trading within the African continent is more complicated, this is because it challenging matching each individual nation with her biggest trading partner, a lot of inconsistency tend to played out most time, for instance the Gambia only was exempted with about 109% variation but most African nations average trade suffered about 64% discrepancy (Yeats, 1990, p. 146). Codification and classification is often subjected to standardization which must be in compliance to United Nation approval. For

instance, strictly abiding by Standard International Trade Classification (SITC) is the United Nations classifying medium of five -level program code for traded goods internationally. The principles behind this noted that section 0-is classified as code for food and livestock. Descending downwardly also showed that the fourth level where one can see clear variations of livestock for example bovine animals (001.1) and pigs (001.3) Specific identification of all kinds of animals can be extracted out on the fifth level with code such as 001.11 "real-bred breeding livestock" while 001.19 " also real bred breeding livestock". As witnessed in the year 1989 a large livestock migrated between borders in great number but difficulty occurred to figure-out what specific animal they could be. Due to the inability to accurately know what specific animal were involving in trade between nations boarder, furthermore lawmakers, researchers and analysts couldn't arrive at best decisions they are face with statistical dilemma following inaccurate information, it implications simply means errors of omission and deliberate human's mistakes or corrupt practices.

Obviously, the discrepancies are cause by various factors such as different accounting recording, then the other error that occurred are another challenges such a systemic or lack of stability thereby cause variations or unreliable statistics of in imports and exports. No doubt however, importations obviously overcome exportations on a long term. the differences in statistical values can be harmless; while "free on board" F. O. B values however, only the values of goods importers usually disclosed, "cost insurance Freight" (C. I. F). Thus, if everything else was accurate, imports would have exceeded exports by the value of insurance and freight. Of course, many other systematic challenges (such as rounding; the way that goods were traded and recorded, shipped to developing nation and the trade recorded; the manner which the monetary transaction was accounted for, the role played by multiple exchange rates, all these factors eventually affect importations and exportations at the end.

Facts and Figures of International Trades Statistics of selected African Sub-Saharan States

In the year 2012 a positive forecast was made by a renowned body known as World Economic Outlook about future economic development especially for the African continent. Material such as researches and information data from IMF were used to draw inferences. about future development, however approximately twenty countries, with overwhelming high rate of growth were put together to derived the magnitude of such forecast majorly from 2013 through 2017, according to IMF economic prediction. Approximately ten out of the probably twenty were located in the twenty nations of African Sub-Sahara, in the other hand about two or more are from Arid Northern African region.

Furthermore, based on already established statistical record derived from world bank data base as relate to international trading both in the aspect of import and export globally, Sub -Sahara African's record stood at about 50% between the period of under review, 1950s and 1990s. In the

same vein, the GDP of Sub-Sahara African have surged almost doubled the record established. in addition, the rate of export trades has risen to 75% in 2008 but late retracing down to 70% these days (World Bank, 2014).

Although the records are not thorough generally, but one thing remain obviously clear, this region is fully relying on international trade in term of their economic development and sustainability. At this point, it becomes vital to figure out the origin, the level of growth, the level of development, the direction the economic is heading and aggregate of trades globally by these Sub-Saharan Nations of Africa. The shortcomings of current data base or Statistics are limited in supplying all this important statistical information.

Inconsistency of trade data and Statistics is major shortcoming for research and analysis

"Data from Africa are typically incomplete, error ridden and inconsistent across authorities (...) The results presented here use data from several different international sources, and the numbers are sometimes contradictory or otherwise suspect. In consequence, the results should be treated with even more than the usual degree of caution" (Deaton and Miller, 1995, p. 36). Unfortunately, such statistical results are basically re-reported thereby lacking advancement or input to understand current realities and trends in both exports and imports generally. Appendix 1. critically exposed such lapses.

Unlike most African nations most countries of the world are complying to DQAF standards. Furthermore, about sixty-two other countries drawn from five other continents including every World Bank income category were assessed by the IMF.

Summary of ROSCs Statistics on inaccuracy in trades in Table 1.

This section will clearly show how the last twenty-five years of records from some selected nations in Africa Sub-Saharan were involved in trades reporting (exports and imports) and how inaccurate it turned out to be. The inquest into the quality of statistics revealed that comparing the receipts of trading partners; however, this paper used of the metadata reported on trade statistics by International Monetary Fund (IMF) and World Bank.

Balance of Payments Manual (BPM) is the focus of IMF over the years to determine economic growth and development which also influences GDP of every nation. Furthermore, the publication of some of the countries statistical practices was also part of the activities of IMF.

The BPM, currently in its sixth edition, embodies the IMF's interest in "developing and promulgating guidelines for the compilation of consistent, sound, and timely balance of payments statistics" (International Monetary Fund, 2006, p. ix). This is an indicator or benchmark for national balance of payment with four major objectives. These are as follow:

- i. To be able to make available balance of payments and international investment situation statistically, provide and explain concepts, conventions, classifications and definitions.
- ii. To promote and facilitate universally comparability of statistical data by creating awareness and laying down

guidelines to be globally accepted and popularize their utilizations worldwide.

- iii. Presenting channels through which balance of payments and global economic investments and other forms of macroeconomic statistical data can constantly be compared and analyze through different data sets from variety of sources.
- iv. Constantly updating all forms of changes or new developments in financial assets and liabilities, and global investment situations as a universal account of an economy; while providing short introductory usage of data on balance of payments.

To the credit of IMF determinations and efforts in popularizing its ideal and concepts worldwide to enhance and

promote economic growth and development, its member's nations willingly subscribed to BPM majorly from developing

nations of the world. Based on World Bank assessment, Development Data Group (DECDG, 2013), about 141 out of 149 developing nations utilized the BPM. This figure indicated that 94.6% of the total population have increased from 88% about nine years ago. Even with the positive development recorded in the utilization of BPM, yet five of the eight countries form Sub-Saharan Africa have not adopted the BPM (while the rest of the three countries originated from East-Asia and the Pacific) Here are the countries complying to BPM principles of IMF highlighted in Table 1.

Table 1. Prevalence of the Balance of Payments Manual (version 5 or 6) in Sub-Saharan Africa.

	2004	2005	2006	2006	2008	2009	2010	2011	2012	2013
Countries covered	42	47	47	47	47	47	47	47	47	48
Countries using BPM	33	35	35	35	36	37	37	38	41	43
%	78.6	74.5	74.5	74.5	76.6	78.7	78.7	80.9	87.2	89.6

Source: Journal of African Trade 1 (2014) 45–52

Report on the Observance of Standards and Codes (ROSC) is published for countries who desires so on request, however countries complying to IBM is just one aspect. Overall quality of its balance of payments has multiple factors.

Additionally, that an ROSC is produced at the request of a member country makes it likely that some form of self-selection bias exists. One might assume that countries that are more attentive to following agreed upon statistical practices would be more likely to request an ROSC. Accordingly, the findings that follow might be assumed to constitute an upper bound for the quality of balance of payment statistics or, at the very least, be understood to be positively biased in the sense that they overstate the quality of trade statistics in Sub-Saharan Africa. Sixteen such reports are available for countries in Sub-Saharan Africa. The remainder of this section summarizes the findings of these reports with the intention of gaining greater insight into the current state of statistical practices in Sub-Saharan Africa. Regrettably, the aforementioned problem of data availability also plagues metadata on trade statistics. The sixteen reports represent only a third of Sub-Saharan African countries.

Further, most of the ROSCs for Sub-Saharan Africa are at least ten years old at the time of writing with none being less than eight years removed from publication. Accordingly, there is no way of knowing if circumstances have improved, remained static, or regressed in the years that have followed each ROSC's publication.

Data dissemination is one of the twelve areas in which ROSC are produced and balance of payments is one of the six fields traditionally covered by an ROSC on data dissemination.

ROSCs on data dissemination rely on the IMF's Data Quality Assessment Framework (DQAF). The DQAF assesses six fields– a set of prerequisites and five dimensions of data quality. Each dimension is composed of three to five elements each with their own set of relevant indicators (see Appendix 1).

Based on a country's adherence to these indicators, one of four scores is given for each element. The possible scores are “practice observed” (O); “practice largely observed” (LO); “practice largely not observed” (LNO); and “practice not observed” (NO).

Table 2. Average scores for states in Sub-Saharan Africa, by ROSC. (Averages were calculated first for specific DQAF fields, and then as an overall).

	Year	Prerequisites of quality	Assurances of integrity	Methodological soundness	Accuracy and reliability	Serviceability	Accessibility	Average
Botswana	2003	0.750	0.889	0.917	0.667	0.667	0.778	0.778
Burkina Faso	2003	0.667	0.889	1.000	0.867	0.750	0.667	0.806
Chad	2003	0.583	0.889	0.917	0.867	0.444	0.556	0.709
Gambia, The	2003	0.417	0.778	0.417	0.333	0.556	0.333	0.472
Kenya	2003	0.583	0.778	0.833	0.600	0.778	0.556	0.688
Malawi	2003	0.556	0.778	0.583	0.533	0.583	0.556	0.598
Mauritius	2002/2008	0.778	0.833	0.625	0.533	0.528	0.667	0.661
Mozambique	2002	0.667	0.889	0.667	0.533	0.583	0.556	0.649
Namibia	2002	0.778	0.889	0.917	0.467	0.750	0.556	0.726
Niger	2003	0.750	0.889	0.917	0.733	0.667	0.556	0.752
Senegal	2002	1.000	0.889	1.000	1.000	0.750	0.667	0.884
South Africa	2001	1.000	1.000	0.667	0.667	1.000	0.889	0.870

	Year	Prerequisites of quality	Assurances of integrity	Methodological soundness	Accuracy and reliability	Serviceability	Accessibility	Average
Tanzania	2004	0.778	0.889	0.667	0.533	0.667	0.667	0.700
Uganda	2006	0.833	1.000	0.667	0.867	0.667	1.000	0.839
Zambia	2005	0.750	0.889	0.583	0.533	0.778	0.556	0.681
Average		0.726	0.878	0.758	0.649	0.678	0.637	0.721

Table 3. Standardized Statistical Framework for international trade data collections and analysis.

Element 0 Prerequisites of quality	0.1 Legal and institutional environment	0.1.1 The responsibility for collecting, processing, and disseminating the statistics is clearly specified.
		0.1.2 Data sharing and coordination among data-producing agencies are adequate.
		0.1.3 Individual reporters' data are to be kept confidential and used for statistical purposes only.
		0.1.4 Statistical reporting is ensured through legal mandate and/or measures to encourage response.
0.2 Resources	0.2.1 Staff, facilities, computing resources, and financing are commensurate with statistical programs.	
	0.2.2 Measures to ensure efficient use of resources are implemented.	
0.3 Relevance	0.3.1 The relevance and practical utility of existing statistics in meeting users' needs are monitored.	
	0.4.1 Processes are in place to focus on quality.	
0.4 Other quality management	0.4.2 Processes are in place to monitor the quality of the statistical program.	
	0.4.3 Processes are in place to deal with quality considerations in planning the statistical program.	
	1.1.1 Statistics are produced on an impartial basis.	
Element 1 Assurances of integrity	1.1 Professionalism	1.1.2 Choices of sources and statistical techniques as well as decisions about dissemination are informed solely by statistical considerations.
		1.1.3 The appropriate statistical entity is entitled to comment on erroneous interpretation and misuse of statistics.
		1.2.1 The terms and conditions under which statistics are collected, processed, and disseminated are available to the public.
	1.2 Transparency	1.2.2 Internal governmental access to statistics prior to their release is publicly identified.
1.2.3 Products of statistical agencies/units are clearly identified as such.		
1.2.4 Advance notice is given of major changes in methodology, source data, and statistical techniques.		
Element 2 Methodological soundness	1.3 Ethical standards	1.3.1 Guidelines for staff behaviour are in place and are well known to the staff.
		2.1.1 The overall structure in terms of concepts and definitions follows internationally accepted standards, guidelines, or good practices.
	2.1 Concepts and definitions	2.2.1 The scope is broadly consistent with internationally accepted standards, guidelines, or good practices.
		2.2.2 Scope
2.3 Classification/vectorization	2.4.1 Market prices are used to value flows and stocks.	
	2.4 Basis for recording	2.4.2 Recording is done on an accrual basis.
Element 3 Accuracy and reliability		3.1 Source data
	3.1.1 Source data are obtained from comprehensive data collection programs that take into account country-specific conditions.	
	3.1.2 Source data reasonably approximate the definitions, scope, classifications, valuation, and time of recording required.	
	3.2 Assessment of source data	3.1.3 Source data are timely.
3.2.1 Source data—including censuses, sample surveys, and administrative records—are routinely assessed, e.g., for coverage, sample error, response error, and non-sampling error; the results of the assessments are monitored and made available to guide statistical processes.		
3.3 Statistical techniques	3.3.1 Data compilation employs sound statistical techniques to deal with data sources.	
	3.3.2 Other statistical procedures (e.g., data adjustments and transformations, and statistical analysis) employ sound statistical techniques.	
	3.4.1 Intermediate results are validated against other information where applicable.	
3.4 Assessment and validation of intermediate data and statistical outputs	3.4.2 Statistical discrepancies in intermediate data are assessed and investigated.	
	3.4.3 Statistical discrepancies and other potential indicators or problems in statistical outputs are investigated.	
Element 4 Serviceability	4.1 Periodicity and timeliness	3.5.1 Studies and analyses of revisions are carried out routinely and used internally to inform statistical processes (see also 4.3.3).
		4.1.1 Periodicity follows dissemination standards. 4.1.2 Timeliness follows dissemination standards.
	4.2 Consistency	4.2.1 Statistics are consistent within the dataset.
4.2.2 Statistics are consistent or reconcilable over a reasonable period of time.		
4.2.3 Statistics are consistent or reconcilable with those obtained through other data sources and/or statistical frameworks.		

	4.3 Revision policy and practice	4.3.1 Revisions follow a regular and transparent schedule. 4.3.2 Preliminary and/or revised data are clearly identified. 4.3.3 Studies and analyses of revisions are made public (see also 3.5.1).
Element 5 Accessibility	5.1 Data accessibility	5.1.1 Statistics are presented in a way that facilitates proper interpretation and meaningful comparisons (layout and clarity of text, tables, and charts). 5.1.2 Dissemination media and format are adequate. 5.1.3 Statistics are released on a preannounced schedule. 5.1.4 Statistics are made available to all users at the same time. 5.1.5 Statistics not routinely disseminated are made available upon request.
	5.2 Metadata accessibility	5.2.1 Documentation on concepts, scope, classifications, basis of recording, data sources, and statistical techniques is available, and differences from internationally accepted standards, guidelines, or good practices are annotated. 5.2.2 Levels of detail are adapted to the needs of the intended audience.
	5.3 Assistance to users	5.3.1 Contact points for each subject field are publicized. 5.3.2 Catalogs of publications, documents, and other services, including information on any changes, are widely available.

Source: M. Jaren / Journal of African Trade 1 (2014) 45–52

3. A Game Theory Model

Table 4. Matrix of three-player payoff.

Y		
Option 1	Option	Option 1 (a ¹ , a ² , a ³) (b ¹ , b ² , b ³)
G		
Option 1	Option	Option 1 (c ¹ , c ² , c ³) (d ¹ , d ² , d ³)

Table 5. When R chooses the option 2.

Y		
Option 1	option 2 (S ¹ , S ² , S ³)	(Z ¹ , Z ² , Z ³)
G		
Option 1	option 2 (Y ¹ , Y ² , Y ³)	(M ¹ , M ² , M ³)

Table 6. The payoff matrix in the case When R chooses option 1, matrix 1 is.

G		
option 1	option 2 (1, 1, 4)	(1, 3, 3)
Y		
Option 1	option 1 (2, 1, 4)	(2, 3, 4)

Table 7. When R chooses option 2, matrix 2 is.

Y		
Option 1	option 2 (1, 1, 4)	(1, 3, 3)
G		
Option 1	Option 1 (2, 1, 4)	(2, 3, 4)

Table 8. The payoff matrix after cooperation.

Y		
Option 1	option 2 (1, 1)	(1, 3)
G		
Option 1	option 1 (1, 1)	(2, 3)

4. Merits Associated with this Model

Based on true business environment, the leading issues is the inconsistency in terms of the GDP leading resulting from lack of well coordination and team work in foreign trades

administration, underreporting of trades etc. “Their behavioral changes are slow evolution rather than rapid learning or adjustment, therefore, simulation of the process by the copy dynamic mechanism of biology evolution, that is the evolutionary stable strategy (ESS)”. When unbalance trade problem appearances, government, international marketers and customs service play games with each other continuously for the sake institutional interests in the market. So, constructing a dynamic game model for the cooperate behaviour of inconsistence GDP resulting partly from unbalance in international trade based on evolutionary game theory. Suppose that player’s game sets are $H(1, 2, 3) n$. T_i refers to the strategy decisions making of each player, $i=1'2' \dots 'n$; and its pure strategies sets is

$$T(i) \equiv \{t_{1}^{(i)}, t_{2}^{(i)}, t_{3}^{(i)}, \dots, t_{ji}^{(i)}\} \tag{1}$$

Each player i 's mixed strategic sets is

$$C^{(i)} \equiv \{C_{1}^{(i)}, C_{2}^{(i)}, C_{3}^{(i)}, \dots, C_{ji}^{(i)}\} \tag{2}$$

Where $\delta_i^{(i)} \geq 0, \sum_{\delta_i} C^{(i)} \delta_i = 1$. $F(i)$ refers to each player’s payoffs function Where, $I = 1, 2, \dots, n$

When $\delta \equiv \{t_{\delta i}^{(i)}, t_{\delta i}^{(n)}\}$, $F(i) \delta$ refer to random player i 's income, where, the number of income are $j_1 \times j_2 \times \dots \times j_1 \dots \times j_n$

Where, $\delta_1 = 1, 2, \dots, j_1, \delta_2 = 1, 2, \dots, j_2, \delta_n = 1, 2, \dots, j_1 \times j_2 \times \dots \times j_1 \dots \times j_n$ According to evolutionary game theory, constructing a general model of each player’s strategy, that is

$$p = (F, \{T_i\}_{i \in n}, \{f_i\}_{i \in n}) \tag{3}$$

Assuming that $C^{(i)}_{Gi}$ is random player i 's evolutionary stable strategy, and expected payoff of ESS more than that of other strategies. Even if other player not choose ESS, player i 's expected income of ESS more than that of other strategies. That is:-

$$\forall C^{(i)}_{\delta_i} \neq C^{(i)}_{\delta^1} \text{ Where, } C^{(i)}_{\delta} \in C^{(i)}_{\delta^1}, \text{ and then}$$

$$E^{(i)}_{\delta^1} (C^{(i)}_{\delta^1}, (C^{(i)}_{\delta_2}, \dots, (C^{(i-1)}_{\delta_{i-1}}, (C^{(n)}_{\delta_n}))) = E^{(i)}_{\delta_i} (C^{(i)}_{\delta_i}, (C^{(i)}_{\delta_i}, (C^{(i)}_{\delta_i}, \delta, \dots, (C^{(i-1)}_{\delta^{i+1}}, \dots, (C^{(n)}_{\delta_n})))$$

Implies:-

$$E^{(i)} \delta_{i2} (C^{(i)} \delta_i, (C^{(i)} \delta_i, \dots, (C^{(i-1)} \delta_{i-1} \delta_{i+1}, \dots, (C^{(n)} \delta_n)$$

Copy dynamic equation is vital for the game analysis when player *i* select $(C^{(i)} \delta_i)$ his copy dynamic equation is:

$$\frac{\partial C^{(i)}}{\partial \kappa} \delta_i = (C^{(i)} (E^{(i)} \delta_i - E^{(i)})) \quad (4)$$

Where, $E^{(i)} \delta_i$ refers to player *i*'s expected income. $E^{(i)} \delta_i$ refers to player *i*'s total expected income in the entire game, and $C^{(i)} \delta_i$ the equilibrium point of evolutionary stable strategy. When, copy dynamic equation can be zero. The value of ESS must be equilibrium value, and it can correct strategic decisions deviation from equilibrium value. If some disturbance cause (*i*) and the must be less than or must be more than zero, that is, the slope is negative. The communication between game players will be stopped when they achieve the point of evolutionary stable strategy. Game players, limited by the rationality of man, can achieve Nash equilibrium eventually through communication.

5. The Game Model of Tripartite Benefits Distribution: Government, International Marketers, and Customs Service

For the convenience of analysis, the following assumptions was proposed:

(1) There are three leading characters in international trade: *G* refers to governmental goal, of some private benefits; *R* refers to Customs service which is majorly the pursuit of public interest; *Y* refers to International marketers' sole goal is the to pursuit private goal before pursuing the public interests. The assumption technically that, all limited rationality economical men. (2) Each player has two strategies. International marketers import or exports goods to the country. The government chooses active supervision or passive supervision. Customs service actively protect contrabands goods, smugglings while imposing duties and tariffs on goods passively.

According to the assumption (2), Player's randomly strategy choices, and can be shown at Table 4 above. Game players are limited rationality economical actors or parties. So, they do not choose the optimal strategy based on completely rational assumption at beginning of the game.

The probability of player *G* choosing option 1 is p_1 , and then, the probability of choosing option 2 is $1-p_1$. The same as player *G*, the probability of player *Y* choosing option 1 is p_2 , and then, his probability of choosing option 2 is $1-p_2$; the probability of player *R* choosing option 1 is p_3 , and then, his probability of choosing option 2 is $1-p_3$. When the game beginning, one player may meet the other two players who choose the same strategies or the different strategies. One player's payoff depends on internal strategy decision taken, but also the other two player's strategy decision. Each player's payoff matrix as shown Table 3. above

(1, 1, 2) refers to the low payoff, that is, the worst outcome of the game between government, international marketers, and customs service. It occurs if government makes the conflict laws or regulations based on its own interests, the interests of international marketers are inconsistent with the public interest, and customs services affected by multiple regulations. Now, customs services in Africa are facing two major obstacles: one is legal barriers, another is institutional barriers. The two obstacles are the low payoffs. Legal barriers including the lag in the international trade laws, the lack of harmony in international trade standards, and inadequate supervision, and so on. Institutional barriers including too much government oriented, customs service regulated by multi sectors such Ministries of Foreign Affairs, Finance, Internal Affairs, etc. Lastly neglect of the function of international marketer's association.

(1, 2, 4) refers to the high payoff, that is, the best outcome of the game between government, international marketers, and customs service. It means that government provides the better institutional environment for international marketers to carry out exports or imports; customs service help administered and raise revenues for the government, the operation of international marketers is under perfect legal system. On the other word, each of them obtains the maximizing interesting from the stability and coordination environment. But, each of players does not know the optimal strategies because of limited rationality economical man. So, system should be perfected based on the common effort of government, international marketers, and customs service. When the player *G* choose option 1, then;

$$F^{(G)}_5 = (a^l, b^l, s^l, z^l) = (1, 1, 1, 1) \quad (5)$$

Expected payoff is:-

$$\begin{aligned} E^{(G)}_1 &= \sum_{5-1}^2 \sum_{5R-1}^2 F^{(G)}_5 \times C^{(Y)}_{5Y} C^{(R)} \\ &= F^{(G)}_1 \times C^{(CY)}_X C^{(CY)}_X C^{(R)}_1 + F^{(G)}_2 \times C^{(CY)}_2 \times C^{(R)}_1 + F^{(G)}_3 \times C^{(Y)}_2 \times C^{(R)}_2 + F^{(G)}_4 \times C^{(Y)}_1 \times C^{(R)}_1 \\ &= a^1 P_2 p_3 + b^1 (1-P_3) P_3 + b^1 (1-P_2) P_3 + S^1 (1-P_2) (1-P_3) + z^1 P_2 (1-P_3) = 1 \end{aligned}$$

When the player *G* choose option 2, then

$F^{(G)}_5 = (c^l, y^l, d^l, m^l) = (2, 2, 2, 2)$, Expected payoff is:

$$E^{(G)}_2 = \sum_{\delta y-1}^2 \sum_{\delta R-1}^2 F^{(G)}_5 \times C^{(Y)}_Y C^{(Y)}_Y \times C^{(R)}_R \quad (6)$$

$$C^1 P_2 P_3 + d^1 (1-P_2) P_3 + y^1 (1-P_1) (1-P_2) + M^1 P_2 (1-P_3) = 2 \tag{7}$$

The player *G*'s average expected payoff is:-

$$E^{(G)} = C \times E^{(G)}_1 + (1-C) \times E^{(G)}_2 = 2 - C \tag{8}$$

The player *G*'s copy dynamic equation is:-

$$\begin{aligned} \frac{\partial C}{\partial K} &= C, (E^{(G)}_1 - E^{(G)}) = C^2 - C \\ \text{Let } \frac{\partial C}{\partial K} &= 0, \& \frac{\partial C}{\partial K} \leq 0 \end{aligned} \tag{9}$$

The point obtained (*c**), that is the player *G*'s evolutionary stable strategy. Based on the above analysis, player *Y*'s copy dynamic equation is:-

$$E^{(Y)}_1 = 1, E^{(Y)}_2 = 3, E^{(Y)} = 3, E^{(Y)} = 3 - 2 P_2^2, \frac{\partial C}{\partial K} = 0, \& \frac{\partial P_2}{\partial K} = 2P_2^2 - 2P_2 \tag{10}$$

The player *R*'s copy dynamic equation is:-

$$E^{(R)}_1 = 1, E^{(R)}_2 = 4, E^{(R)} = 4, E^{(R)} = 4 - 2 P_3, \frac{\partial P_3}{\partial K} = 2P_3^2 - 2P_3 \tag{11}$$

6. Resolution of ESS Equilibrium of Two Players

First, analysis of copy dynamic equation of two-player game, evolutionary stable strategy and its equilibrium. Secondly, the third player's evolutionary stable strategy, and then calculate three-player's the solution of ESS. Therefore, suppose that the player *R* chooses option 1, and then, three-player game turn into two-player game. Its payoff matrix is as shown below the player *G*'s copy dynamic equations are:

$$\begin{aligned} E^{(G)} &= P_2 a^1 + (1-p_2) b^1 = 1 E^{(G)}_2 = P_2 C^1 + (1-P_2) d^1 = 2 \\ E^{(G)} &= 4-3 P_1, \frac{\partial P_1}{\partial K} = P_1^2 - P_1 \end{aligned}$$

So, the player *G*'s ESS equilibrium solution is $P_1 = 0$. The player *Y*'s copy dynamic equation is: -

$$\begin{aligned} E^{(Y)}_1 &= P_1 a^2 + (1-P_1) C^2 = 1, E^{(Y)}_2 = P_1 b^2 + (1-P_2) d^1 = 3 \\ E^{(G)} &= F_2 E^{(Y)}_1 + (1-P_2) E^{(Y)} = 1, E^{(Y)}_2 = 3 - 2P_2, \frac{\partial P_2}{\partial K} = 2P_2^2 - 2P_2 \end{aligned}$$

So, the player *Y*'s ESS equilibrium solution is $P_2 = 0$. From the above analysis, as the limited rationality economical men, although player *G* and player *Y* cannot attain the optimal strategy at the beginning of the game, attaining the game equilibrium through repeated games, mutual communication, and decision adjusting. That is, player *G* and player *Y* all choose option 2. For player *R*, obviously, if the one choose some strategy, the other two may obtain similar game equilibrium. After three-player game finished, equilibrium must be occurring, that is, *G, Y, R* all choose option 2, the solution is $\sqrt[2]{3^4}$.

7. Conclusion

The development of modern market economy over the years has made international trade more dynamics, its operations is getting more and more complex globally. The number of stakeholders in the foreign trade's behaviors adversely affects gross domestic products (GDP). However, for the limited rationality, each stakeholder cannot solve the problem of international

trade independently. In the process trade management, each stakeholder seeks the optimal strategy though trying error constantly, self-adjust and mutual learning. Based on the above model analysis, there is a solution which can make government, international marketers, and customs services achieve the point of game equilibrium. It shows that the efficiency trade administration depends on the cooperative behavior of government, international marketers, and customs service. Similarly, multipartite cooperative governance of foreign trade can set up learning organizations among the government, international trade marketers and customs service, and stimulate the initiative of which the other social members participate in the foreign trade, and cause the high payoff of the game and produces a positive effect on the improvement of international trade. Therefore, it is essential to take some measures to establish a coordinate mechanism of which the government, the international marketers, and the customs service participate in the international trade administration. These measures including change the model of government oriented in

foreign trade management, and promote foreign business and accountability by all the leading players.

Statistical quality evaluation framework

Statistical data are requiring in predicting and making policies and schemes economically by various bodies such as those in authority like politicians, technocrats and trade entrepreneurs such as international marketers. This review indicated that there is high level of inaccuracy in reporting export and imports by majority of African nations especially those in Sub-Sahara region in term of procedure. Potential errors of commission or omissions were prevalence. Efforts should be directed toward decreasing the consistence prevalence or occurrence of errors reporting or under-reporting. Lastly, the lack of statistical capacity to cover African borders suggests that errors of omission will remain a problem.

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