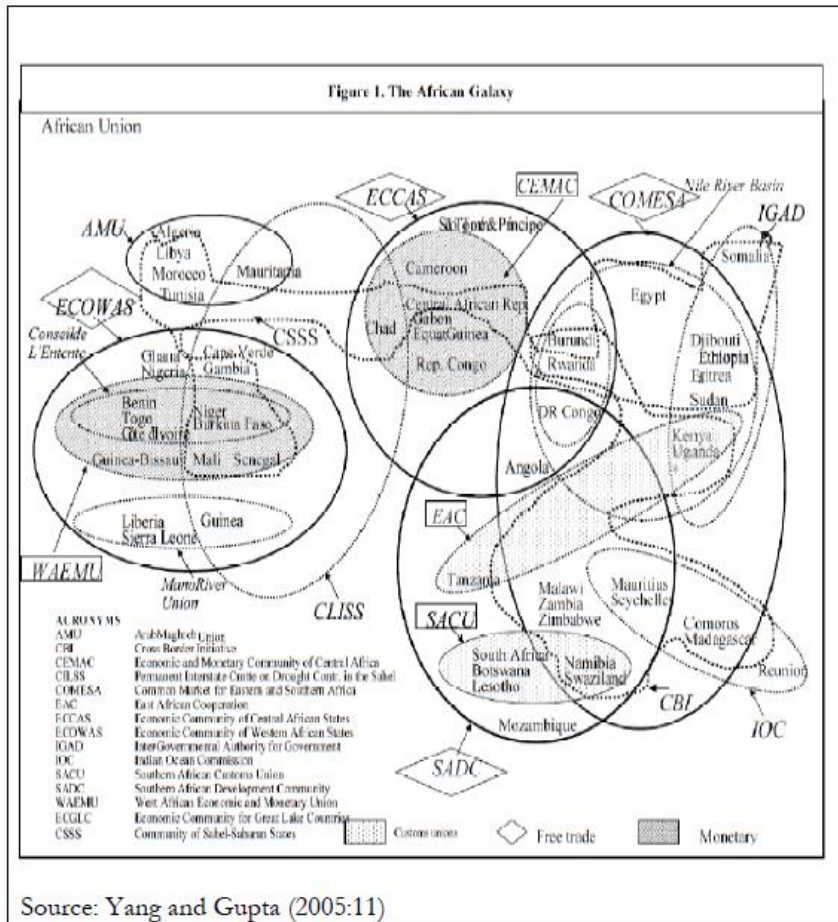


**Revisiting the Effectiveness of African Economic
Integration. A Meta-Analytic Review and
Comparative Estimation Methods
Sylvanus Afesorgbor
(Aarhus University)**

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Motivation for the Study

- African spaghetti bowl



- Africa is home to about 30 different REIs and on average African country belongs to at least 4 REIs (World Bank 2005).
- Econometric investigations on the impact of African RTA produced mixed and contrasting results.
- Large proportion of zero flows that engulfed LDCs trade flows. The failure of the previous studies to adequately deal with it.

The paper in nutshell

- Meta-analysis (MA) of 14 previous studies with a total of 139 effect sizes
- African RTAs has a general positive effect on bilateral trade
- The trade effects of RTAs are sensitive to estimation methods and the study characteristics
- Econometric concerns of controlling for zero flows and MRT also significantly affect estimates.
- Gravity model. Panel data, data (1980-2006) and 47 African countries, 5 major RTAs in Africa.
- Results indicate when zero flows are not controlled there is significant upward bias in the RTA effects.
- Comparative assessment of the five major RTAs indicates highly uneven performance.

What to expect?

1. Theoretical and empirical perspectives
2. Meta-analysis and regression
3. Models specification and estimation
4. Comparative estimation results
5. Conclusion

Theoretical Perspective on African RTAs

Contra

- Similarity of supply structure and comparative advantage (Venables 2003)
- Welfare effect (Viner 1950). Trade creation and diversion
- Import demand not price elastic and price difference among member countries not large (Van Dijk 1992)
- Less imports from member states before the formation of RTA (ibid)
- Musila (2005) empirically shown that most African RTAs are trade diverting

Pro

- New trade theory with the assumption of economies of scale and imperfect competition, there is rationale for trade between similar countries (Feenstra 2004)
- Dynamic impact from RTAs extremely large and relevant for LDCs (Ezenwe 1983, Baldwin 1992)
- Increases of African RTAs complementary to global trade openness (Van Dijk 1996)

Empirical perspective on African RTAs

- We divided them into three groups
 1. Group 1 consist of papers that used OLS and ignore zero flows. They find significant positive impact of African RTAs on trade. Deme (1995) and Cernat (2001).
 2. Group 2 consists used FE estimation and ignore zero flows. Find significant positive impact of African RTAs. Carrere (2004) and Afesorgbor & Bergeijk (2011)
 3. Group 3 consists of studies used the Tobit estimator in an attempt to control the zero flows. Foroutan and Pritchett (1993), Elbadawi (1997), Longo and Sekkat (2005), Kirkpatrick and Watanabe (2005), Geda and Kebret (2008).

Estimates of RTA effect

- The effects of the African RTAs on bilateral trade differ in sign, size and significance.
- The mean effect of the African RTAs indicate a mean (0.86) and median (0.76)
- Compare with general effect of RTA effects on trade of 0.5 Head and Mayer (2013). More specific RTAs, Cipollina and Salvatici (2010) indicates 0.52 (EU) and 0.90 (NAFTA).

Table 3: Categorisation of the Effect Sizes

Ranges of RTA Effect on Trade (estimates)	Frequency	Percentage
$estimates \leq -1$	5	3.6
$-1 < estimates < 0$	26	22.30
$0 < estimates < 1$	50	35.97
$estimates \geq 1$	58	41.73
Total	139	100

Estimates and Estimation methods

Methods	Frequency	Significant estimates	Mean	Std. Dev	Min	Max
Fixed Effect (FE)	16	75%	0.54	0.86	-0.57	2.43
Hausman-Taylor (HT)	12	92%	0.76	0.86	-0.54	2.41
Non-Linear Squares (NLS)	4	100%	0.44	2.01	-1.40	2.57
Ordinary Least Squares (OLS)	30	87%	1.04	0.78	-0.40	2.49
Random Effect (RE)	3	100%	1.30	1.03	0.12	2.01
Tobit (TE)	50	60%	1.05	1.35	-2.61	3.73
Weighted Least Squares (WLS)	24	71%	0.52	0.56	-0.26	1.29

Detour on Meta-Analysis

- Meta-analysis is defined as the statistical and analytical technique of collecting the results from different empirical studies for the purpose of synthesizing and integrating them into a common result (Wolf, 1986)
- Historically, the scientific method of combining individual studies was common practice in the field of natural sciences, however, became, a common tool in social science in 1976.
- At its introduction, meta-analysis was heavily criticised resulting in many researchers' reluctance in its application.
- The major critiques were;
 1. Combination of different quality of studies, however, Stanley and Doucouliagos (2012) discarded.
 2. Publication bias. However, we now have publication bias test.
analysis in presence of publication bias.
- The application of meta-analysis technique is gradually gaining acceptance in field of economics considering the vast number of studies with contrasting results. To buttress its acceptability and application, the Journal of Economic Surveys in 2005, dedicated a special Issue [volume 19(3)] to meta-analysis
- Some of its contemporary application can be seen in studies such as Rose and Stanley (2005), Cipollina and Salvatici (2010), Genc et al (2011) and Head and Mayer (2013).

Techniques of Meta-analysis

Fixed effect method

- The FEM assumes the differences across studies can be explained by only a within-variation as a result of sampling fluctuation
- the ES from each study is assumed to be a function of two components. That is, $\delta_i = \theta + \varepsilon_i$, where θ is the single population ES and ε_i is the deviation of the ESs from the true population ES

$$\hat{\theta} = \frac{\sum_{i=1}^n w_i \delta_i}{\sum_{i=1}^n w_i}$$

$$w_i = \frac{1}{(se(\delta_i))^2}$$

Random effect method

- REM assumes the differences in estimates to be explained by both within and between-study variations.
- It assumes the studies are random samples from a population of all possible studies.
- Technically, the REM conceptualises the population distribution of the ES as derived from the normal distribution with mean 0 and variance (τ^2).
- The ES under the REM is decomposed into three components, $\delta_i = \mu + \xi_i + \varepsilon_i$,
- μ is the mean of the distribution of the population of the ESs and ξ_i is the deviation from the mean of the population ES and ε_i is the sampling deviation
- $w_i^* = \frac{1}{\tau^2 + \sigma^2}$

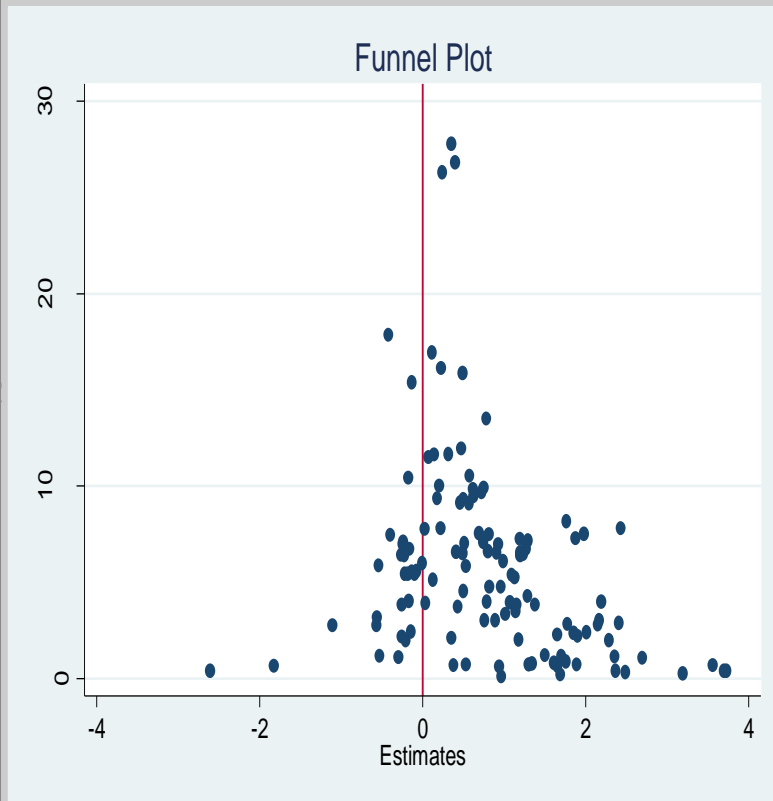
Results of Meta-analysis

Effects	Pooled estimates	Lower bound of 95% CI	Higher bound of 95% CI	Q-Statistic	I-square	Z-Statistic
Fixed	0.406	0.383	0.429	1981.24	93.8%	34.98
Random	0.634	0.526	0.742	1981.24	93.8%	34.98

- For the combined ES of RTAs, the confidence interval (CI) under both FEM and REM is greater than zero, and
- An indication that African RTA may have a positive trade effect.
- The estimates obtained under FEM (0.406) and REM (0.634) were considerably smaller compared to the simple mean effect of 0.86.
- The results indicate the African RTA increase bilateral trade between 49 to 89%.
- This is plausible and comparable effect of African RTAs to N-N RTAS.
- The I^2 index indicates that about 94% of total variance is explained by between-study variance. Thus, the REM estimates are more consistent and appropriate.

Publication bias

Graphical Approach



Regression Approach

$$t_i = \beta_0 + \beta_1 \frac{1}{Se_i} + \epsilon_i$$

Dependent variable: t-statistics

Inverse of standard error

0.240***

(0.0686)

Constant (β_0)

1.721***

(0.386)

Observations

123

R-squared

0.094

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Meta-analysis Regression (MRA)

Dependent variable: t-statistics	Model 1	Model 2
Inverse of std. error	1.932***	1.877***
	(0.393)	(0.355)
Number of countries	0.00241	-0.00310
	(0.00232)	(0.00243)
Type of data (Cross section=0/panel=1)	0.0940	0.141
	(0.229)	(0.321)
Control for Zero flows	-0.353*	-0.432***
	(0.188)	(0.154)
Published	-1.078***	-0.456
	(0.339)	(0.315)
Control for MRT	-1.054***	-0.821***
	(0.347)	(0.278)
FE	-0.638*	-0.142
	(0.331)	(0.231)
HT	-0.798**	-0.408
	(0.310)	(0.260)
OLS	-0.261*	-0.232***
	(0.136)	(0.0753)
RE	-0.894***	0.0755
	(0.207)	(0.226)
TE	-0.315**	-0.364***
	(0.136)	(0.110)
Constant	0.140	0.679*
	(0.375)	(0.378)
Control for specific RTAs	No	Yes
Observations	123	123
R-squared	0.393	0.765

Empirical model

- The traditional gravity model by Tinbergen (1960)

$$X_{ij} = Y_i^\alpha Y_j^\beta d_{ij}^\gamma, \text{ where } \alpha, \beta > 0 \text{ and } \gamma < 0$$

- Augmented gravity model with bilateral accessibility variable (ϕ_{ij})

$$X_{ij} = Y_i^\alpha Y_j^\beta d_{ij}^\gamma \phi_{ij}$$

- Anderson van Wincoop introduction of MRT

$$X_{ij} = Y_i^\alpha Y_j^\beta \left(\frac{t_{ij}}{\Pi_i P_j} \right)$$

$$\ln(X_{ijt}) = \alpha_{ij} + \alpha_t + \beta \ln M_{it} + \gamma \ln M_{jt} + \gamma D_{ijt} + \delta RTA_{ijt} + \varepsilon_{ijt}$$

- α_{ij} is the dyadic fixed effects and α_t are the time dummies.
- $M_{i(j)t}$ is vector of monadic variables of the exporter (importer) consist of GDP, Population and Area. Exporter and importer remoteness index as proxies for MRT.
- D_{ijt} is vector the dyadic variables consisting of distance between i and j, dummy variables capturing contiguity, common language and common currency.
- The variables of interest include a dummy for all the five major RTAs, AMU, COMESA, ECCAS, ECOWAS and SADC.
- The dependent variable (X_{ijt}) is the export from country i to j at time t.

Data

- Panel data on 47 African countries from 1980-2006.
- Trade flow (export) from the IMF DoTS
- The proportion of zero flows is extremely large amounting to about 55%
- Standard gravity model variables from CEPII
- Data on African RTAs membership from WTO website.
- The RTAs include ECOWAS in Western Africa, SADC in Southern Africa, AMU in Northern Africa, CEMAC in Central Africa and COMESA in Eastern and Southern Africa.
- These RTAs span and represent all the regions on the continent
- These RTAs have been perceived as the main building block for continental integration (Teshome, 1998).

Estimation Methods

- Estimation method used were informed by the estimation methods in these previous studies
- We compare the estimation methods of previous studies with the Poisson Pseudo Maximum Likelihood (PPML) as used by Santos Silva and Tenreyro (2006)
- The PPML has been indicated as well-behaved and consistent in presences of large proportion of zero flows
- To empirically determine the sensitivity of the RTA effects on trade to these estimation methods
- We rely on the PPML as a solution to dealing with the zero flows. For the PPML, the expected trade is modelled using an exponential function.
- $E(X_{ijt} | Z_{ijt}) = \alpha_{ij} \exp(Z_{ijt}'\beta)$
- where Z_{ijt} and β are vector of covariates and coefficients respectively.
- The PPML assumes a non-negative predicted trade flows. The PPML is consistent and well-behaved even if X_{ijt} is not logically consistent with the parametric approximation of Poisson distribution SST (2006)
- SST (2011) further confirm the PPML as better and it outperforms the Tobit estimator or arbitrarily adding of small values

Estimated Results

VARIABLES	OLS Ln (X)	OLS Ln(X)	FE Ln(X+1)	TE Ln(X+1)	RE Ln (X)	FE Ln (X)	PPML (X)
AMU	1.182***	0.139	3.076***	1.805***	1.389***	1.364***	0.629**
	(0.117)	(0.143)	(1.079)	(0.666)	(0.379)	(0.433)	(0.295)
COMESA	0.710***	1.269***	0.953*	0.000261	0.574***	0.936***	0.00220
	(0.0982)	(0.102)	(0.533)	(0.528)	(0.208)	(0.236)	(0.218)
ECCAS	-0.410***	-0.180	-0.331	-1.956**	-0.283	-0.233	-0.420**
	(0.120)	(0.125)	(0.878)	(0.762)	(0.330)	(0.508)	(0.211)
ECOWAS	0.789***	0.619***	-0.549	1.428***	0.0604	-0.442	-0.0568
	(0.0621)	(0.0844)	(0.706)	(0.459)	(0.187)	(0.317)	(0.262)
SADC	1.501***	0.579***	3.066***	2.159***	1.024***	0.951***	0.660*
	(0.0831)	(0.101)	(0.945)	(0.545)	(0.220)	(0.261)	(0.391)
Constant	-2.051***	8.225***	-10.72***	25.28***	3.878***	-9.572***	
	(0.442)	(2.646)	(2.772)	(3.703)	(1.223)	(2.048)	
Observations	21,094	21,094	46,081	46,081	21,094	21,094	40,758
R-squared	0.377	0.504	0.127			0.091	
FE		country	dyadic	dyadic			

Results

- The estimates differ considerably in sign, size and significance.
- Comparing the other estimation techniques to PPML is obvious observation of upward bias in the coefficient of the RTAs.
- In exception of PPML, the coefficients of the other estimation techniques report very high magnitude of RTA effects on bilateral trade.
- For instance, the approach of adding an arbitrary value (1) to exports reports an RTA impact of over 2000% ($e^{3.076} - 1$) in contrast to the less than 100% you find when zeros are correctly dealt with using PPML.
- A 2000% impact is obviously overestimated effect and unrealistic.
- Most of the RTAs tend to have significant positive effect as well, which may be spurious outcome
- This upward bias is conspicuously higher in the Tobit estimation and FE and OLS estimations, when zero flows are replaced with small values.

Results

- RTAs' impact in the PPML model is modest impact on trade with coefficient less than one.
- The positive and significant coefficient obtain in PPML did not differ considerably from the one obtain from the meta-analysis of 0.63.
- Regarding the comparative assessment of the African RTA, the results delineate a varying effect of the RTAs, an indication that the performance and progress of the RTAs across the continent is unequal.
- Specifically, AMU and SADC are the two main regional blocs that have a significant positive impact on trade, with COMESA and ECOWAS not contributing significantly to trade. AMU increased trade by 88% and SADC by 93%.

Conclusion

- The results from the meta-analysis indicate that although these RTAs have general positive effect on bilateral trade
- Their effect sizes critically depend on the study characteristics and the estimation techniques employed.
- The empirical results evidently support this by demonstrating that trade enhancing impacts of RTAs are highly sensitive to the estimation methods employed.
- The effect of the RTAs tends to be overestimated when zero flows are over-look or incorrectly dealt with by replacing zero flows with small values.
- The PPML seems the best estimation technique in dealing with the endemic zero flows in African dataset.
- Contrary to the general pessimistic connotation of all African RTAs of not contributing significantly to intra-African trade, the result otherwise show that some RTAs have contributed significantly to trade.
- However, the pace of progress and performance is highly unequal. The result gives credence to ECA (2012) report that African RTAs have shown contrasting outcomes with some achieving tangible and modest outcomes whereas others have realised disappointing results.

Thank you

- Thank you!!!
- Please your comments are welcome to improve this paper.