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South-South Trade: The role of Africa

Missing trade?

*Modelling international trade for African
countries: some challenges*

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Africa in the World Trade

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Analysis of South-South Trade:

- Very large residuals for African countries, theoretical trade values differ from current values
- For many countries (non neighbouring), low-level of intra-African trade, in spite of a very large openness rate (exports to GDP ratio close to 70%). ex: Cote d'Ivoire-Nigeria
- For some countries, low level of South-North trade, ex: Benin



Gravity models have micro-economic foundations and are widely used. Some of their applications:

- Regional Trade Agreements (RTA), "natural regionalism" (Frankel & Wei, 1993, Baier & Bergstrand 2005), WTO membership (Rose 2004)
- Impact of NTBs on trade (Fontagné et al. 2005)
- Trade costs (Hummels 1998, Anderson & Van Wincoop 2004)
- Cost of the border (Anderson & van Wincoop 2003, Mayer & Zignago 2005)
- Impact of conflicts on trade (Martin *et al.* 2005)
- FDI & trade: Fontagné, 2000; Bénassy-Quéré *et al.* 2007
- Effect of single currency on trade (Rose, 2000)
- Trade patterns: inter and intra-industry trade (Fontagné *et al.* 1998)
- Diasporas (community of immigrants)
- Trade potentials of economies in transition (Baldwin 1993, Fontagné *et al.* 1999)
- South-South trade (Fontagné & Coulibaly 2004, IMF paper 2000)
- Predicted values are used in some cases as an input for CGE modeling (Kuiper & van Tongeren, 2006)
- Identify the natural markets and markets with an untapped trade potential (ITC)



The Gravity Equation is actually a modified expenditure function (Baldwin & Taglioni 2006):

$$(1) \quad x_{ij} = Y_i \cdot E_j \cdot \left(\frac{t_{ij}}{\Omega_i \Pi_j} \right)^{1-\sigma}$$

where:

i : the exporting country

j : the importing country

x_{ij} : trade value from country i to country j

Y_i : production of traded goods of country i

E_j : expenditure on traded goods of country j

Ω_i : Openness of country i 's exports to world markets

Π_j : CES price index of country j (all goods are traded)

t_{ij} : trade costs faced by country i when exporting to country j

natural: distance, geography (mountains, seas)

cultural: communication, diasporas, colonial links

man made: borders, conflicts, roads, airlines, import duties, TBT and SPS

σ : Elasticity of substitution between all goods (CES)



- Equation (1) is usually estimated using logarithmic transformation (LOG-LOG)
- At the macro level, the GDP is used as a proxy for Y_i (production of traded goods) and E_j (expenditure on traded goods of country j)
- Some practical and conceptual problems:
 - colinearity
 - heteroscedasticity
 - zero values (LOG(0))
 - endogeneity & simultaneity: RTA, conflicts
 - autocorrelation, stationarity: (panel models)
 - data availability and reliability: production and consumption data, SPS/TBT, FDI, export subsidies
 - exclusion of raw minerals (oil, copper, ...), no theoretical foundations



More specific problems when working on African countries:

- GDP is not a good proxy for the production of traded goods simply due to the dependence on a limited number of commodities (cotton, coffee, tea, cocoa, minerals)
- Production and consumption data are not available on a consistent basis for most countries
- Many zero trade values in the sample



- Problem of zero values ($\text{LOG}(0)$)
 - Concern in particular large data samples (many countries and sectoral data)
- Solutions
 - Throwing observations (sample bias)
 - Use sample selection models (Heckmann)
 - $\text{LOG}(X_{ij} + 0.0001)$
 - Tobit with $(X_{ij} + 1)$ as a dependent variable (inconsistent estimator)
 - Do not take the LOG, estimate the model from its multiplicative form using Poisson Pseudo-Maximum Likelihood (PML) techniques

Country name	Products diversification (Nber of equiv product HS6 in this sector), 2005	Rank	Sectors diversification (Nber of equiv sector), 2005
Morocco	71.6	31	18.1
Tunisia	64.9	35	17.7
South Africa	59.6	38	30.5
Senegal	23.4	65	14.5
Namibia	22.6	66	10.8
Egypt	22.1	67	19.1
Djibouti	21.6	69	10.1
Togo	13.0	84	7.4
Kenya	12.1	86	10.8
Mauritius	12.1	87	7.2
Uganda	11.1	93	8.5
Madagascar	9.7	98	6.9
Zimbabwe	8.9	100	7.5
Sudan	8.4	102	7.5
Tanzania, United Rep. of	7.2	110	5.8
Somalia	6.1	120	5.8
Swaziland	6.0	121	5.6
Cape Verde	5.9	122	4.8
Gambia	5.2	126	4.5

GDP is not a good proxy for the production of traded goods for most African countries.

Empirical evidence: indicators of concentration of exports, which varies between 1 (one exported good) and 5'000 (extremely diversified export portfolio).

Country name	Products diversification (Nber of equiv product HS6 in this sector), 2005	Rank	Sectors diversification (Nber of equiv sector), 2005
Central African Republic	5.0	128	3.2
Eritrea	4.9	130	3.9
Ghana	4.5	136	3.6
Cameroon	4.5	137	4.2
Côte d'Ivoire	4.4	138	2.6
Ethiopia	4.3	139	3.9
Mauritania	4.1	141	3.0
Sierra Leone	3.6	143	3.5
Zambia	3.5	144	3.2
Benin	3.1	148	3.0
Niger	3.0	149	2.8
Algeria	3.0	150	2.5
Liberia	3.0	151	1.7
Malawi	2.9	152	2.6
Democratic Republic of the Congo	2.8	155	2.6
Burkina Faso	2.7	156	2.7
Seychelles	2.6	158	2.3
Mozambique	2.6	159	2.1
Lesotho	2.0	167	2.0
Guinea-Bissau	1.6	168	1.6
Mali	1.6	169	1.6
Chad	1.6	170	1.6
Comoros	1.6	172	1.2
Congo	1.4	176	1.4
Libyan Arab Jamahiriya	1.4	177	1.4
Burundi	1.4	179	1.4
Gabon	1.3	180	1.3
Angola	1.1	182	1.1
Equatorial Guinea	1.1	183	1.1
Botswana	1.1	184	1.1
Nigeria	1.0	186	1.0
Sao Tome and Principe	1.0	187	1.0



The case of Benin, ranked number 148 in terms of export basket diversification

Trade Performance HS : Exports of Benin (2005, in USD thousands)

	Industry	Exports in value	Exports as a share of total exports (%)	Exports as a share of world exports (%)	Growth of exports in value (% p.a.)	Growth of exports in volume (% p.a.)	Growth of world exports in value (% p.a.)
+	<u>00 All industries</u>	288,196	100.0000	0.0028	12		
+	<u>52 Cotton</u>	169,754	58.9068	0.3608	9		7
+	<u>08 Edible fruit, nuts, peel of citrus fruit, melons</u>	20,336	7.0568	0.0415	14	5	14
+	<u>24 Tobacco and manufactured tobacco substitutes</u>	19,372	6.7223	0.0785	72		5
+	<u>25 Salt, sulphur, earth, stone, plaster, lime and cement</u>	11,747	4.0764	0.0444	87		12
+	<u>15 Animal, vegetable fats and oils, cleavage products, etc</u>	9,338	3.2404	0.0244	94		19
+	<u>72 Iron and steel</u>	7,580	2.6304	0.0027	190		26
+	<u>71 Pearls, precious stones, metals, coins, etc</u>	7,001	2.4294	0.0037	-9		15
+	<u>12 Oil seed, oleagic fruits, grain, seed, fruit, etc, nes</u>	6,297	2.1851	0.0209			10
+	<u>23 Residues, wastes of food industry, animal fodder</u>	4,682	1.6247	0.0157	6		9
+	<u>11 Milling products, malt, starches, inulin, wheat gluten</u>	4,677	1.6230	0.0560	162		9

GDP is not a good proxy for the production of cotton

GDP is not a good proxy for the consumption of cotton

World exporters (8 African countries in top 20)

Exporters	Value exported in 2005, in US\$ thousand	Quantity exported in 2005
World estimation	9,646,605	8,186,184
United States of America	3,923,870	3,400,278
Australia	769,733	599,189
Uzbekistan	672,596	584,255
India	639,447	598,231
Brazil	449,732	316,104
Greece	327,231	288,613
Egypt	251,011	120,768
Burkina Faso	237,158	195,790
Mali	190,957	162,123
Syrian Arab Republic	171,235	145,342
Benin	167,028	161,271
Kazakhstan	162,659	159,990
Zimbabwe	141,911	108,191
Côte d'Ivoire	139,863	129,304
Tajikistan	136,014	121,961
Cameroon	132,596	116,396
Sudan	103,647	72,851
Pakistan	80,495	83,029
Turkmenistan	73,141	57,584
United Republic of Tanzania	67,967	66,330

World importers (leading textile and clothing manufacturers)

Importers	Value imported in 2005, in US\$ thousand	Quantity imported in 2005
World estimation	9,659,255	7,859,224
China	3,191,113	2,567,724
Turkey	908,201	775,512
Thailand	612,167	503,973
Indonesia	576,004	455,384
Pakistan	482,423	361,872
Mexico	458,189	388,642
Republic of Korea	355,352	278,288
Taiwan, Province of China	305,043	276,945
Russian Federation	268,716	309,881
Italy	258,108	186,149
Japan	224,470	168,626
India	155,723	82,634
Bangladesh	145,954	126,953
Viet Nam	93,035	80,291
Germany	92,293	73,445
Egypt	88,325	65,969
Portugal	86,803	68,058
Hong Kong (SARC)	84,490	76,969



Benin exports goods primarily towards textile and clothing manufacturers but its exports also include re-exports to neighbouring countries, even if most of them are unrecorded.

Partner countries	Average 2001-2005	2005	2004	2003	2002	2001
Total	268,775	288,196	298,312	271,526	304,005	181,837
China	55,381	104,191	93,070	62,325	16,877	441
India	33,667	19,906	21,934	27,442	43,313	55,739
Nigeria	24,048	16,572	13,590	12,762	67,648	9,668
Indonesia	18,865	10,479	24,254	25,301	24,099	10,191
Thailand	12,182	10,514	14,204	15,721	12,603	7,867
Ghana	10,175	5,445	3,414	4,838	26,460	10,718
Niger	10,140	15,135	17,753	7,745	5,616	4,452
Togo	7,346	9,937	14,399	12,396	0	0
Italy	7,129	4,238	3,636	6,591	12,834	8,346
France	6,614	8,417	3,595	4,432	11,938	4,689
Pakistan	5,211	1,575	5,972	4,405	12,783	1,321
Bangladesh	4,886	1,197	7,488	10,817	2,968	1,959
Viet Nam	4,606	4,446	9,994	4,073	1,214	3,304
Morocco	4,373	2,130	3,138	3,192	9,022	4,383
Spain	4,031	4,295	2,042	4,287	4,743	4,787
Mali	3,102	7,621	7,293	404	95	99
Switzerland	3,041	4,888	1,977	3,278	3,549	1,514
Taiwan, Province of China	3,011	3,686	1,421	6,360	860	2,729
South Africa	2,962	2,623	3,655	4,303	2,698	1,531



Bilateral trade of land-locked countries is even more difficult to assess.
 Example: Most of Burkina Faso cotton exports transit through
 neighbouring countries, sometimes not the same.

Exports of cotton, reported by Burkina Faso

Importers	Exported value 2004 in US\$ thousand	Exported value 2003 in US\$ thousand	Exported value 2002 in US\$ thousand	Exported value 2001 in US\$ thousand
World	280,016	220,420	104,316	104,057
Ghana	234,476	64,765	215	0
France	27,578	9,376	68,443	31,379
Special categories	17,962	0	0	0
Belgium	0	3,531	5,408	6,431
Benin	0	5,500	0	0
Iceland	0	0	214	0
Côte d'Ivoire	0	288	0	0
Mali	0	25	0	0
Nigeria	0	0	1,006	0
Russian Federation	0	0	1,696	0
Singapore	0	0	5,275	9,727
Switzerland	0	13,997	15,673	51,110
Togo	0	122,939	5,140	976
United Kingdom	0	0	1,246	4,436



Exports of cotton of Burkina Faso, mirror estimates

Importers	Exported value 2005 in US\$ thousand	Exported value 2004 in US\$ thousand	Exported value 2003 in US\$ thousand	Exported value 2002 in US\$ thousand
Total	237,158	235,076	152,782	93,122
China	163,265	122,584	32,330	669
Thailand	24,311	15,011	21,261	8,212
Taiwan, Province of China	18,838	13,330	10,153	5,913
Indonesia	8,418	10,861	3,807	4,339
Morocco	5,671	5,935	3,155	3,063
Republic of Korea	2,853	7,096	4,476	5,040
France	2,579	2,021	1,552	4,106
Italy	2,477	6,192	8,196	10,059
Portugal	1,453	2,158	2,136	3,372
Pakistan	1,196	4,755	4,935	
Peru	987	71	929	671
Belgium	904	2,051	748	705
Greece	415	0	0	0
Mauritius	382	2,224	4,141	846
Germany	372	1,886	0	1,050
India	335	7,068	7,143	8,773
Colombia	0	4,428	14,619	18,637
Bangladesh	n.r.	22,842	26,306	8,020
Madagascar	n.r.	294	0	0
Nigeria	n.r.		1,309	1,092



- Most papers, including those focusing on the analysis of South-South trade are based on aggregate data, trying to explaining total trade
- Minerals (crude oil, copper ores, etc.) are not often excluded from the analysis
- A common source is IMF DOTS statistics, available for 178 countries, since 1948 (withs gaps)
- Only a limited number of papers are based on sectoral data ("Trade and Production" databases of CEPII, World Bank), many wholes for African countries



TradeSim, version 3

- Sector-level data (19 sectors ISIC), cross section (average 2002-2003)
- Estimation by Poisson Pseudo-Maximum Likelihood (PPML)
- Country sample: 133 exporters and 154 importers
- Trade data, weighted average of export and import figures
- Exporter fixed effects capture simultaneously price and production variables
- Trade costs variables:
 - Bilateral tariffs (correction for endogeneity, MAcMap)
 - Distances (CEPII), borders, common language, Southern-hemisphere dummy
 - Conflict measure (Heidelberg Institute)
- Output:
 - Analysis of residuals: fitted values vs actual values



Trade data, weighted average of export and import figures

Indicators of consistency of Trade Statistics

Discrepancies between countries' export statistics and their mirror estimates

Country		Export value reported by country (A)	Number of partner countries	Exports reported by country going to other reporting countries (B)	Number of partner countries reporting data	Non exporters as % of total exports	Mirror estimates - Value (C)	Mirror estimates - Number of partners	Measure of discrepancy = (C-B)	Relative measure of discrepancy (-100, 100%) = $100 * \frac{(C-B)}{(C+B)}$	Measure of discrepancy - from detail (0-100 %) ▼
<u>Aruba</u>	+	79,661	43	64,442	32	80.9	2,508,032	45	2,443,590	95.0	99.1
<u>Niger</u>	+	278,835	51	210,972	34	75.7	293,353	54	82,381	16.3	99.0
<u>Saudi Arabia</u>	+	125,997,724	7	77,492,399	1	61.5	109,842,318	122	32,349,919	17.3	94.1
<u>Burkina Faso</u>	+	393,448	44	343,915	36	87.4	369,962	55	26,047	3.7	94.0
<u>Anguilla</u>	+	5,696	17	2,574	13	45.2	7,550	25	4,976	49.2	93.3
<u>Samoa</u>	+	85,427	21	83,386	14	97.6	80,227	30	-3,159	-1.9	92.8
<u>Montserrat</u>	+	4,215	11	3,118	7	74.0	4,325	28	1,207	16.2	91.7
<u>Gambia</u>	+	18,045	23	16,342	16	90.6	38,409	52	22,067	40.3	90.5
<u>Turks and Caicos Islands</u>	+	12,186	3	12,129	1	99.5	29,649	29	17,520	41.9	85.6
<u>Burundi</u>	+	82,697	32	75,123	24	90.8	34,865	41	-40,258	-36.6	82.5
<u>Saint Vincent and the Grenadines</u>	+	36,595	24	32,738	18	89.5	252,690	40	219,952	77.1	82.0
<u>Oman</u>	+	14,061,371	123	3,447,140	85	24.5	12,009,164	91	8,562,024	55.4	78.6
<u>Venezuela</u>	+	38,001,084	114	6,597,237	91	17.4	37,424,627	108	30,827,390	70.0	73.7
<u>Zambia</u>	+	1,461,478	70	1,342,976	49	91.9	1,439,324	61	96,348	3.5	68.1
<u>Belarus</u>	+	13,751,687	129	13,537,509	98	98.4	11,730,019	90	-1,807,490	-7.2	67.6
<u>Madagascar</u>	+	426,616	93	370,549	68	86.9	1,323,864	83	953,315	56.3	65.2

Example of an output table: Benin – China trade

Exporter	Rank	Importer	Rank	Sector	Current Exports 2002-2003	share in BEN 's exports of sector, in %	Relative Trade Potential	Tariff applied by importer, in %
Benin	3	China		TOTAL	25,302	9.7%	1. Very strong current trade (above predicted)	
Benin	3	China	1	Agriculture and hunting	24,731	15.8%	1. Very strong current trade (above predicted)	5 to 10%
Benin	3	China	2	Rubber and plastic products	403	58.3%	2. Strong current trade (above predicted)	15 to 20%
Benin	3	China	3	Wood and wood products	63	0.9%	4. Untapped trade potential	5 to 10%
Benin	3	China	4	Electrical and electronic equipment	40	3.6%	3. Predicted = Current or low values	0 to 5%
Benin	3	China	5	Textiles, clothing and leather	35	0.3%	3. Predicted = Current or low values	15 to 20%
Benin	3	China	6	Forestry and Fishing (products)	16	0.7%	3. Predicted = Current or low values	5 to 10%
Benin	3	China	7	Metal and metal products	14	0.1%	4. Untapped trade potential	5 to 10%
Benin	3	China	8	Mining and quarrying	0	0.0%	3. Predicted = Current or low values	0 to 5%
Benin	3	China	9	Petroleum	0	0.0%		0 to 5%
Benin	3	China	10	Food, beverages and tobacco	0	0.0%	5. High untapped trade potential	20 to 25%
Benin	3	China	11	Machinery and equipment	0	0.0%	3. Predicted = Current or low values	5 to 10%
Benin	3	China	12	Precision instruments	0	0.0%	3. Predicted = Current or low values	5 to 10%
Benin	3	China	13	Motor vehicles and other transport equipment	0	0.0%	3. Predicted = Current or low values	15 to 20%
Benin	3	China	14	Other manufacturing	0	0.0%	3. Predicted = Current or low values	10 to 15%
Benin	3	China	15	Recycling	0	0.0%	3. Predicted = Current or low values	0 to 5%

Interpretation: for agriculture and hunting, most of the trade concerns cotton. The models tells us actually what would be the expected direction trade in case of a more diversified export basket, at the industry-level.



Forthcoming:

- Analysis at a more disaggregated level (4 & 6 digit level of the HS)
- Inclusion of more commodity-specific factors:
 - Sanitary & Phyto-sanitary measures
 - Seasonal factors ("contre-saison")
- More accurate measures of trade costs



Dilemma

- ❑ The economic analysis of Sub-Saharan African trade requires to work at a disaggregated level
- ❑ Less data are available for those countries at a disaggregated level

Reasons to be optimistic: 10 years ago, not half of Sub-Saharan African countries reported trade data consistently. Most of them do now.