A matching approach to study the impact of agoa on Sub-Saharan African countries

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A matching approach to studying the impact of *agoa* on Sub–Saharan Africa

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Abstract: The impact of the USA's agoa preferences on SSA countries is studied using a matching approach. The results indicate that agoa beneficiaries have exported less to the USA compared to their matched controls. However, this has not been the case for their exports to the EU which has seen a higher share of exports relative to the control group. In addition, the results show that, in the short–run the SSA countries reduce exports to the EU in order to take advantage of agoa. Thus, due to capacity constraints these countries switched exports from the EU to the USA market. China, OECD, European and other developed countries are excluded from the control group used in the analysis. We therefore do not expect the strengths of these economies to be driving any of our results.

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1 Introduction

The importance of trade in fostering the growth of developing countries cannot be overemphasised (Frankel and Romer, 1999; Neuhaus, 2005). The experience of the *East Asian miracle* countries as well as China and India in Asia are interesting examples in this case. A proliferation of studies showing that trade provides an additional source of growth beyond what exist under the tradional Solow model include Frankel and Romer (1999); Neuhaus (2005) among others. It is based on this that the study of *agoa* provided by the USA for Sub Saharan African (SSA) countries to promote their exports to the USA is important. The provision of these preferences is expected to spur exports to the USA and have a direct and indirect feedback effect on their respective economies. The direct effects would be the increased jobs and opportunities created by the increased access to the USA market. The indirect effects on the other hand, would be other opportunities and the service industry that arise to support the increased economic activity as a result of increased exports.

There exists a considerable number of studies studying the impact of *agoa* on the beneficiaries (for example, Collier and Venables, 2007; Condon and Stern, 2011; Seyoum, 2007; Frazer and Van Biesebroeck, 2010; Tadesse and Fayissa, 2008; Tadesse et al., 2008; Nouve and Staatz, 2003; Nouve, 2005). We add to this literature by trying to estimating the impact of *agoa* on beneficiary countries using a novel methodological approach that is becoming popular in the economic literature. Existing studies base their analysis on traditional econometrics (these include, Lederman and Özden, 2007; Nouve, 2005; Seyoum, 2007) while others use the evaluation methodology (for instance, Collier and Venables, 2007; Frazer and Van Biesebroeck, 2010). In this paper, we attempt to use a matching approach to carry out the analysis. The problem in studying the impact is that the counter-factual is not available. Thus matching is a way of constructing a counter-factual to measure the impact.

In matching *agoa* countries to other developing countries we use a vector of variables containing characteristics of both countries to make the match. It is assumed that there is independence between the treatment and the controls. Previous studies (for example Collier and Venables, 2007; GAO, 2008; USITC, 2007) point to large increases in the exports of *agoa* beneficiaries to the USA. One could therefore compare the exports to the USA by *agoa* recipients to the counter-factual to test whether there was a significant increase compared to *non–agoa* countries. Nevertheless, the coefficients of both regressions can be compared to observe the size of the changes compared to *non–agoa* recipients

The main question asked in this paper is *"Whether there has been an observed increase in the exports of agoa recipients to the USA compared to the counter-factual (other non–agoa countries)?"* A related question is, whether exports to the European Union decreased in response to the *agoa* adoption compared to the counter-factual countries. To start us off in answering this question we consider the following objectives:

- To provide appropriate matching and evaluation frameworks for the *agoa* countries exporting to the USA to provide a causal explanation of any increase in exports.
- Match *agoa* countries to other developing countries using identifiable characteristics and features such as economic size, distance to international markets, common colonial heritage, common language, religion, capital/labour intensities and cultural background among others.

The two main hypotheses to be tested in the paper are

- *agoa* countries export less to the USA than other developing countries after controlling for similar characteristics.
- *agoa* exports have displaced apparel and textile exports to the European Union.

The rest of the paper is organised as follows. The next section presents some of the basic stylised facts of our export data. The third section discusses the data and methodology used, followed by a discussion of the results obtained. The final section concludes the paper.

2 Exploring the Data

Figure (1) plots the share of exports to the USA against the share of exports to the EU for selected *agoa* countries. The size of the bubbles represent total exports for each country. The graphs show some observable decrease in the share of exports to the EU and a slight increase in the share of exports to the USA. Figures (2) – (3) plot the trends in the share of exports to the USA. Due to the larger shares of Lesotho and Nigeria, they are shown in a separate diagram. The share of exports have increased in certain cases but has not been sustained throughout the period. In addition, the impact of *agoa* has a lagged effect in increasing the share of exports to the USA. The two remaining figures in this section, Figures (4) – (5) show the trends in actual exports to the USA. In all six cases, exports to the USA have increased post *agoa*. Nigeria, by far shows the highest increase in the value of its exports to the USA. This indicates an increase in exports to the USA by *agoa* beneficiaries. However, these increases are not reflected in the shares of their exports to the USA out of total exports. This might point towards the positive impact found in the *agoa* impact literature which use the value of exports to the USA as the dependent variable. The shares of exports to the USA might tell a different story if used in the analysis presented in the literature so far.

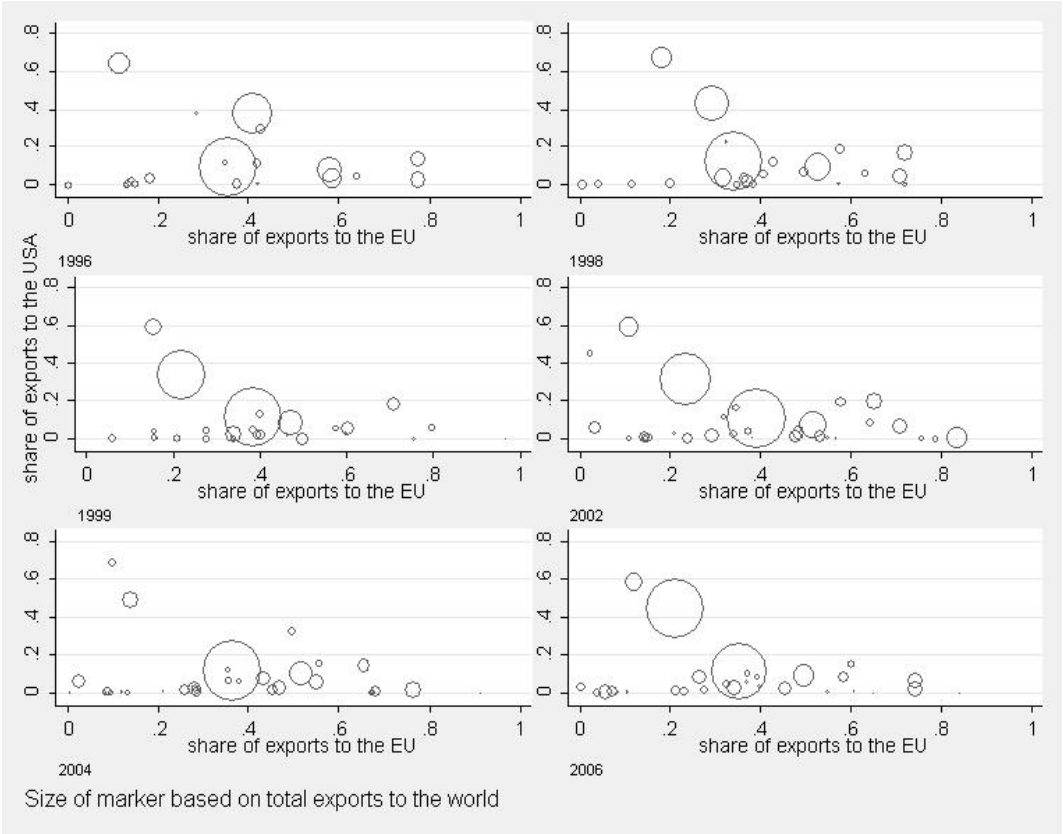

Figure 1: Export shares to the EU and USA — selected year

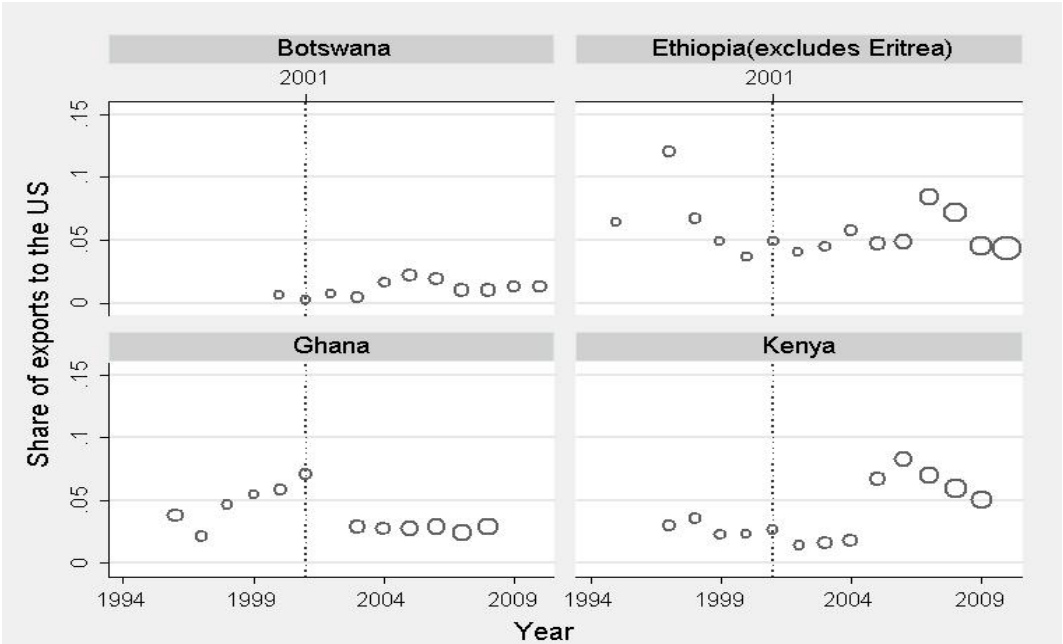

Figure 2: Share of Exports to the USA — 1993 – 2010

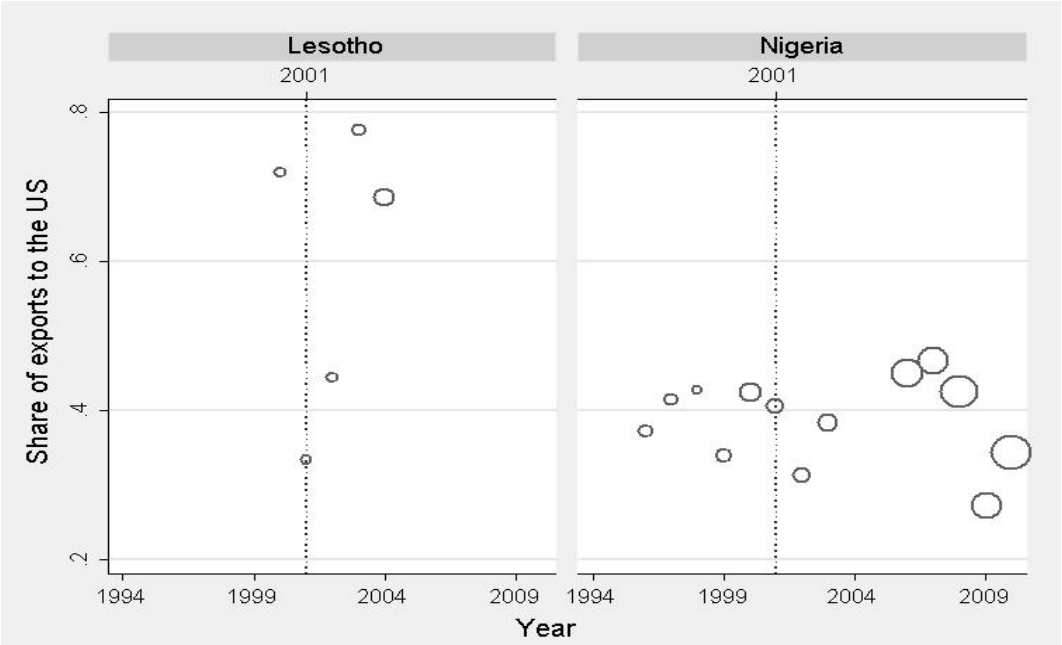

Figure 3: Share of Exports to the USA — 1993 – 2010

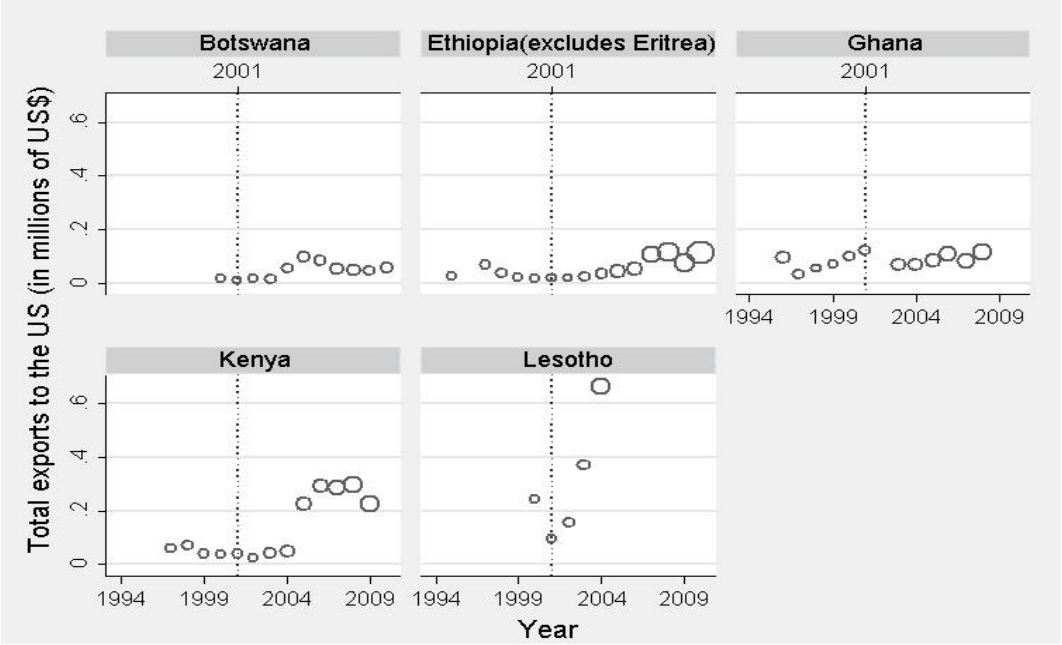

Figure 4: Total Exports to the USA — 1993 – 2010

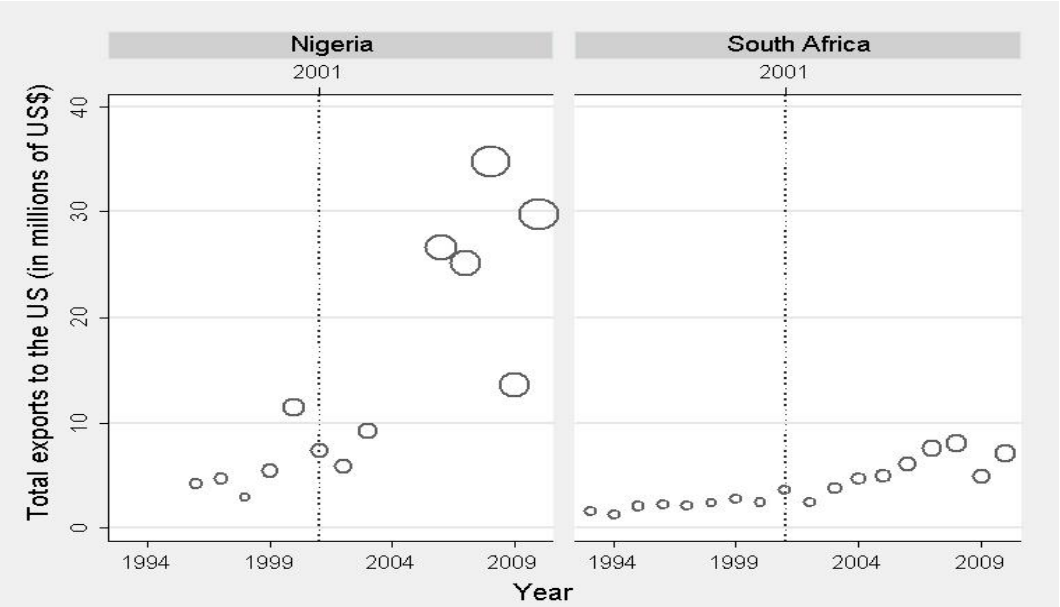

Figure 5: Total Exports to the USA — 1993 – 2010

3 Data and Econometric Approach

The matching approach is expected to provide a causal explanation to whatever increases in exports of *agoa* countries we observe. Since we do not observe what the exports of these countries would be after the enactment of *agoa*, we use countries that were not provided these preferences as the counter–factual. The assumption is that these countries would provide us with the trend in exports that we would have observed in our preference beneficiaries. Thus, after matching—an increase in exports of preference beneficiaries would imply that the preferences have contributed to higher exports from the beneficiary countries. We can therefore attribute this difference, to their preferential status. However, if there is no difference in exports, then the preferences might not have been the main instrument in the export performance of the preferential beneficiaries. Matching is done on similar economic, political, cultural and other factors in order to limit the influence of these characteristics in driving our results.

$$E[y^1 - y^0 | X = 1] = E[y^1 | z, X = 1] - E[y^0 | z, X = 1] \tag{1}$$

$$S(z) = Pr(X = 1 | z) \tag{2}$$

$$P(agoa) = F(z) \tag{3}$$

$$agoa = \begin{cases} 1 & \text{if } agoa\ beneficiary \\ 0 & otherwise \end{cases}$$

$$\kappa^{ssa,dev} = arg\ min\ |\hat{P}^{ssa} - \hat{P}^{dev}| \tag{4}$$

Where: X is the *agoa* treatment, y is either the share of USA or EU exports in the total exports of country j and z - is a vector of variables used in estimating the propensity score for matching *agoa* beneficiaries to *non-agoa* developing countries. This vector includes economic variables, political

variables, country characteristics and other variables such as latitude, landlocked, physical capital per worker, land per worker among others. The t subscript is not shown in order not to clutter the equations above and for ease of exposition.

Equation (1) defines the problem at hand. We seek to find the difference between the outcome variable before and after the treatment. However, it is difficult to observe $E[y^0|z,X=1]$ — the counter-factual. Hence, the counter-factual is constructed by selecting countries with characteristics similar to our treated countries — $E[y^0|z,X=1] = E[y^0|z,X=0]$. The countries are matched based on the vector z—allowing us to select countries that are very similar prior to the treatment. When matching is done well it allows for a causal inference to be made (Yasar and Rejesus, 2005). This allows a comparison to be made and thus any difference in the outcome variables can be attributed to the preference[1]. The vector y^1 is the outcome variable for the treated group (*agoa* beneficiaries) and y^0 is that of the control group created (that is, our manufactured counter-factual for the *agoa* group of countries). Equation (2) is the propensity score in general form estimated conditional on the vector of characteristics. This is estimated via a logit regression (Equation (3) and the predictions from this regression becomes our propensity score used for matching *agoa* recipients to *non-agoa* countries. Equation (4) specifies that countries with propensity scores ($\hat{P}$) close to each other are matched together—as they are similar, based on the covariates chosen.

In matching, it is often difficult obtaining a match. In order to avoid this problem, we could match our propensity score using the *nearest neighbour matching* or the *caliper matching* methods. In the nearest neighbour, preference beneficiaries and non preference beneficiaries are randomly ordered and the non preference beneficiaries with the score closest to the beneficiary is selected. The caliper matching on the contrary, requires us to define a region of *common support*–(δ) and randomly select non preference beneficiaries that have a similar propensity score. We would experiment with calipers in the region of 0.5, 0.1, 0.05 and 0.005 to check the sensitivity of our results to the caliper chosen. The caliper match is given as, $\delta > |\hat{P^{ssa}} - \hat{P^{dev}}| = arg\ min\ |\hat{P}^{ssa} - \hat{P}^{dev}|$, where dev and ssa are as defined earlier above.

Data is obtained from several sources. The World Development Indicators and IMFs International Financial Statistics databases provide macroeconomic indicators (such as, gross domestic product, inflation, population, value-added (in industry, manufacturing, agriculture, construction, services, etc), interest rates, exchange rates among others) for the purposes of matching similar countries. Additionally, Kaufmann's Global Governance[2], Database of Political Institutions[3], Polity IV and Bates et al (2005)[4] databases provide political, cultural and religious data to augment our vector of control variables needed to perform a realistic match.

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[1] Some of the literature on matching include Rosenbaum and Rubin (1983); Caliendo and Kopeinig (2008); Heckman et al. (1997); Imbens and Angrist (1994); Hirano et al. (2003); Rosenbaum and Rubin (1985); Imbens (2010)

[2] www.worldbank.org/wbi/governance/

[3] Thorsten Beck, George Clarke, Alberto Groff, Philip Keefer, and Patrick Walsh, 2001. "New tools in comparative political economy: The Database of Political Institutions." 15:1, 165-176 (September), World Bank Economic Review.

[4] Robert Bates ; Karen Feree; James Habyarimana; Macartan Humphreys ; Smita Singh, "Other Political Data (updated 2005)", http://hdl.handle.net/1902.1/14977 UNF:5:XzsUmjt4AZzpm9JB3hO6pA== Murray Research Archive [Distributor] V1 [Version]

Our data is a panel of 40 treated countries from SSA and some 80 – 90 control countries (developing countries in Asia, Latin America and the Caribbean as well as North Africa) for the years 1991 – 2010. Nielsen and Sheffield (2009) note that longitudinal data can create problems for matching—this is due to what they call the, *"double dimensionality of panel data"*. They also discuss some of the ways in which researchers have attempted to get around the problem. The matching is done in three different ways based on the data available taking into account the concerns of Nielsen and Sheffield (2009). The three approaches undertaken here allow us to check the sensitivity and robustness of the results as well as get around the problem due to the longitudinal data.

1. Matching is performed on the longitudinal data available. In this case, data for our propensity score covariates for the pre-agoa years (1991 – 2000) are used in creating the match. And the matches are used in analysing data for the post agoa years for our outcome variables—share of USA exports in total exports (and share of EU exports in total exports for comparison)

2. Matching is done on the data individually for each year and combined. The matched dataset is then used on data for the post agoa years on the outcome variables.

3. Matching is done on a cross-section. Here the pre-agoa and post agoa periods are aggregated into single periods by taking the means for the time series for each country. Then the pre-agoa controls are used in matching the data. The matched data is then used in analysing the outcome variables.

4 Discussion of Results

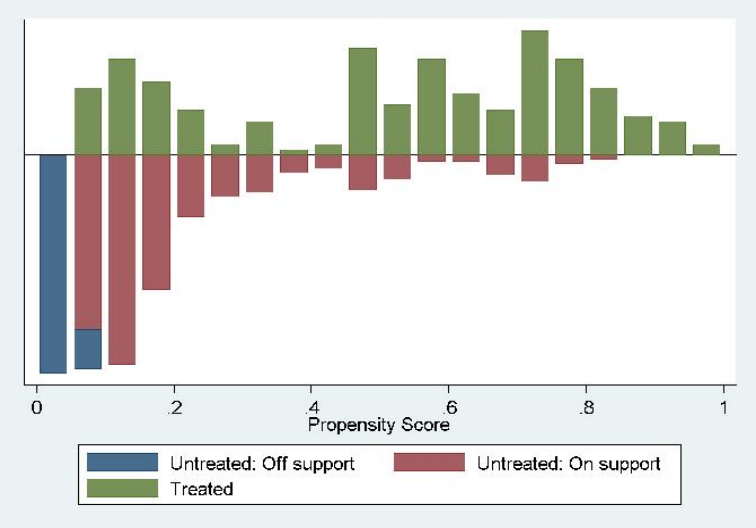
The results indicate that *agoa* beneficiaries have exported less to the USA compared to their matched controls. However, this has not been the case for their exports to the EU which has seen a higher share of exports relative to the control group. In addition, the results show that, in the short–run the SSA countries reduce exports to the EU in order to take advantage of *agoa*. Thus, due to capacity constraints these countries switched exports from the EU to the USA market. China, OECD, European and other developed countries are excluded from the control group used in the analysis. We therefore do not expect the strengths of these economies to be driving any of our results. The results are discussed in detail in the next three sub–sections.

Panel Analysis

The results so far point to a negative impact of AGOA. Essentially, after controlling for particular characteristics agoa beneficiaries tend to export a lesser share of their exports to the USA compared to their control groups of other developing countries. Various tests for our models are passed. For instance, the balancing property for each covariate in each block is passed. In addition, all matching is done on common support (that is, the overlapping region of the two distributions are used in the match).

Table (1) shows the results in the longitudinal case. Here we match based on a panel of data prior to *agoa* (1991–2000). The matches created are then used on data from 2001 – 2010 to calculate the *average treatment effect* of *agoa*. From the table, all the USA results point to lower

exports out of total exports to the USA. In the unmatched sample the difference is 10.4% lower, while in the matched sample the *average treatment effect on the treated (ATT)* ranges from 4.5% – 6.6%. The difference between the *agoa* and *non-agoa* countries are not significant in the third row (here the matching covariates are different). However, in the first case these are significant. For exports to the EU the differences are significant in both cases and we see a higher export to the EU compared to the control group. The *ATT* varies from 8.5% – 11.9%.



matching covariates are log of the real exchange rate; military state (0,1); log of physical capital per worker; and land per worker

Figure 6: Common support for case 1

Table 1: Average Treatment Effect

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat	Treated[a]	Untreated[a]
Exports to USA/Total[b]	Unmatched	.068	.172	-.104	.013	-8.24	222	575
	ATT	.068	.134	-.066	.024	-2.76	222	575
Exports to EU/Total[b]	Unmatched	.378	.242	.136	.016	8.35	222	575
	ATT	.391	.273	.119	.030	3.91	222	575
Exports to USA/Total[c]	Unmatched	.068	.171	-.103	.013	-8.13	561	233
	ATT	.067	.114	-.045	.0234	-1.92	561	233
	ATU	.177	.104	-.074			561	233
	ATE			-.065			561	233
Exports to EU/Total[c]	Unmatched	.378	.246	.132	.016	8.09	561	233
	ATT	.382	.297	.085	.035	2.44	561	233
	ATU	.255	.458	.204			561	233
	ATE			.169			561	233

[a] Observations on common support.
[b] Matching covariates: real gdp per capita; openness; shares of consumption, investment and government spending out of gdp; services growth; trade growth; gdp growth; military rule.
[c] real gdp per worker (chain); real gdp per worker (Laspeyres); services growth; and gdp growth.
ATE = Average treatment effect; ATT = average treatment on the treated; ATU = average treatment on the untreated.
Note: S.E. for ATT does not take into account that the propensity score is estimated.

Table (2) carries out the analysis for each year separately and combines the estimated propensity into a panel and then the analysis is carried out on the *post-agoa* years. Again we find results consistent with Table (1). The USA *ATT* results are again negative and vary between 5.6% and 10.6%. The EU results are also positive varying between 7.9% and 12.8%. In the table an attempt is made to use three different matching methods.

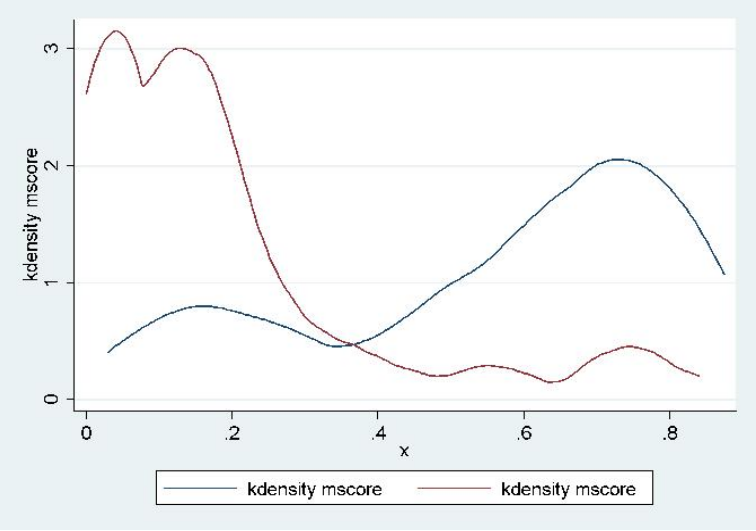
- Kernel matching - this uses a kernel to define the match and allows one to define various bandwidths within which to allow matches.
- Nearest neighbourhood matching - finds the nearest control country with the closest propensity score as the agoa country.
- Radius matching - matching is carried out based on a defined radius and control and treated countries falling within this radius are matched.

In the table, various bandwidths and radii are used to check the sensitivity of the results. Again the results are quite close to each other and there are no sign reversals. Additionally, all results are significant.

Table 2: Average treatment effect on the treated — ATT

country	# treated	# of controls	ATT–coefficient	std. error[a]	t-stat	matching method	bandwidth/radius
EU	216	396	.093	.028	3.373	Kernel	bandwidth=0.01
EU	216	396	.099	.027	3.616	Kernel	bandwidth=0.06
EU	216	101	.079	.031	2.526	Nearest Neighbour	
EU	216	396	.128	.02	6.26	Radius	radius=0.05
EU	172	354	.127	.028	4.501	Radius	radius=0.005
EU	216	396	.122	.018	6.616	Radius	radius=0.5
EU	216	396	.127	.021	6.116	Radius	radius=0.1
USA	216	396	-.056	.019	-2.991	Kernel	bandwidth=0.01
USA	216	396	-.063	.018	-3.603	Kernel	bandwidth=0.06
USA	216	101	-.073	.021	-3.456	Nearest Neighbour	
USA	216	396	-.1	.012	-8.05	Radius	radius=0.5
USA	172	354	-.106	.019	-5.507	Radius	radius=0.005
USA	216	396	-.103	.014	-7.488	Radius	radius=0.1
USA	216	396	-.105	.014	-7.543	Radius	radius=0.05

[a] Bootstrapped standard errors with 250 replications reported.



matching covariates are real gdp per worker (chain); real gdp per worker (Laspeyres); income group (WB definition); religion and log of area

Figure 7: Common support for case 2 (Table (2))

Yearly Analysis

Tables (3) – (4) provide annual results. The trend of results is similar to that reported earlier. The exports to the USA again (see Table 3), show that *agoa* recipients exported significantly less than their matched control countries. A few years display a positive albeit insignificant coefficient of the *ATT*. A large number of the years are significant but the earlier years (prior to 2004) do show a number of significant results compared to later years. Table (4) on the other hand, reports results for exports to the EU. There are more significant and positive results reported here. A difference is that later years (2009 & 2010) are significantly negative. This could be due to several reasons. For example, this is the period of the credit crunch which affected exports of developing countries as well as the ability of EU and the USA to keep imports at the previous levels.

Table 3: Calculated Yearly Treatment Effects — Exports to the USA/Total Exports

year	measure	obs	# of matches	coefficient	std. error	z	prob>z	95% conf.	interval
2001	SATE	82	1	-.11	.068	-1.62	0.105	-.242	.023
2001	SATT	82	1	.049	.047	1.02	0.305	-.044	.142
2001	SATC	82	1	-.183	.081	-2.26	0.024	-.341	-.024
2002	SATE	84	1	-.16	.123	-1.3	0.194	-.402	.081
2002	SATT	84	1	.163	.064	2.55	0.011	.038	.289
2002	SATC	84	1	-.305	.147	-2.08	0.038	-.593	-.017
2003	SATE	86	1	-.135	.128	-1.05	0.293	-.387	.117
2003	SATT	86	1	.116	.113	1.02	0.306	-.106	.337
2003	SATC	86	1	-.263	.156	-1.68	0.093	-.569	.043
2004	SATE	89	1	-.301	.096	-3.15	0.002	-.489	-.114
2004	SATT	89	1	-.228	.095	-2.39	0.017	-.415	-.041
2004	SATC	89	1	-.337	.117	-2.87	0.004	-.567	-.107
2005	SATE	88	1	-.301	.414	-0.73	0.468	-1.111	.51
2005	SATT	88	1	.205	.631	0.32	0.746	-1.033	1.442
2005	SATC	88	1	-.536	.373	-1.44	0.151	-1.267	.195
2006	SATE	87	1	-.197	.141	-1.4	0.161	-.473	.079
2006	SATT	87	1	.041	.093	0.44	0.659	-.141	.223
2006	SATC	87	1	-.299	.177	-1.69	0.092	-.646	.049
2007	SATE	80	1	-.12	.078	-1.53	0.126	-.274	.034
2007	SATT	80	1	-.144	.042	-3.44	0.001	-.227	-.062
2007	SATC	80	1	-.109	.101	-1.08	0.28	-.308	.089
2008	SATE	74	1	-.062	.219	-0.28	0.777	-.491	.368
2008	SATT	74	1	.013	.191	0.07	0.945	-.361	.388
2008	SATC	74	1	-.094	.268	-0.35	0.726	-.618	.431
2009	SATE	65	1	-.065	.071	-0.91	0.361	-.204	.074
2009	SATT	65	1	-.037	.035	-1.03	0.302	-.106	.033
2009	SATC	65	1	-.075	.092	-0.82	0.414	-.256	.105
2010	SATE	29	1	-.049	.072	-0.68	0.496	-.191	.092
2010	SATT	29	1	.039	.073	0.53	0.593	-.104	.183
2010	SATC	29	1	-.089	.078	-1.14	0.256	-.242	.065

Matching variables: real gdp per worker (Laspeyres); real gdp per worker (chain); services growth; distance to international markets; landlocked; latitude; longitude; income group (based on WB classification); religion; log of area

Bias-adj variables: real gdp per worker (Laspeyres); real gdp per worker (chain); services growth; distance to international markets; landlocked; latitude; longitude; income group (based on WB classification); religion; log of area

SATC: Average Treatment for the Controls; SATE: Average Treatment Effect; SATT: Average Treated for the Treated

Table 4: Calculated Yearly Treatment Effects–Exports to the EU/Total Exports

year	measure	obs	# of matches	coefficient	std. error[a]	z	prob>z	95% conf.	interval
2001	SATE	82	1	.564	.323	1.75	0.081	-.069	1.197
2001	SATT	82	1	.235	.15	1.57	0.117	-.059	.528
2001	SATC	82	1	.717	.425	1.69	0.092	-.116	1.55
2002	SATE	84	1	.485	.154	3.15	0.002	.183	.786
2002	SATT	84	1	.126	.089	1.41	0.158	-.049	.301
2002	SATC	84	1	.645	.185	3.49	0	.283	1.007
2003	SATE	86	1	.197	.131	1.5	0.134	-.06	.455
2003	SATT	86	1	-.077	.13	-0.59	0.555	-.331	.178
2003	SATC	86	1	.336	.153	2.21	0.027	.038	.635
2004	SATE	89	1	.138	.165	0.84	0.403	-.185	.462
2004	SATT	89	1	-.299	.287	-1.04	0.296	-.861	.262
2004	SATC	89	1	.35	.106	3.3	0.001	.142	.557
2005	SATE	88	1	-4.42	6.62	-0.67	0.504	-17.395	8.555
2005	SATT	88	1	-.019	1.348	-0.01	0.989	-2.66	2.623
2005	SATC	88	1	-6.474	9.565	-0.68	0.498	-25.222	12.273
2006	SATE	87	1	.06	.249	0.24	0.81	-.428	.547
2006	SATT	87	1	.177	.151	1.18	0.239	-.118	.472
2006	SATC	87	1	.01	.326	0.03	0.976	-.63	.649
2007	SATE	80	1	.145	.079	1.83	0.068	-.01	.3
2007	SATT	80	1	.131	.083	1.59	0.113	-.031	.293
2007	SATC	80	1	.15	.094	1.6	0.109	-.034	.335
2008	SATE	74	1	1.252	1.721	0.73	0.467	-2.121	4.625
2008	SATT	74	1	.226	.184	1.23	0.22	-.135	.586
2008	SATC	74	1	1.687	2.228	0.76	0.449	-2.68	6.053
2009	SATE	65	1	.314	.168	1.87	0.061	-.015	.644
2009	SATT	65	1	-.263	.15	-1.75	0.079	-.557	.031
2009	SATC	65	1	.536	.162	3.3	0.001	.218	.853
2010	SATE	29	1	-.187	.225	-0.83	0.407	-.629	.255
2010	SATT	29	1	.284	.148	1.93	0.054	-.005	.573
2010	SATC	29	1	-.399	.244	-1.64	0.102	-.877	.079

[a] Bootstrapped standard errors reported above with 50 replications.
Matching variables: real gdp per worker (Laspeyres); real gdp per worker (chain); services growth; distance to international markets; landlocked; latitude; longitude; income group (based on WB classification); religion; log of area
Bias-adj variables: real gdp per worker (Laspeyres); real gdp per worker (chain); services growth; distance to international markets; landlocked; latitude; longitude; income group (based on WB classification); religion; log of area
SATC: Average Treatment for the Controls; SATE: Average Treatment Effect; SATT: Average Treated for the Treated

Cross-Section Analysis

The final set of tables, Table (5) and (6) present results for the constructed cross-section data. Exports to the USA is negative and significant in Table (5) but that of the EU is positive and insignificant. Table (6) carries out the analysis by varying the matching covariates. The USA result are consistently negative but significant in the second row of the table and insignificant in the remaining two entries. Similarly, the EU results are positive and significant in the first row but insignificant in the remaining rows. In the third row, however, the EU results become negative although they are insignificant. This might be due to the sample size and combination of matching covariates. However, this does not take much away from the present results as the EU and USA results have been consistent in all tables and have been robust to various sensitivity and robustness analysis carried out.

Table 5: Calculated Treatment Effects — Cross-section

Outcome	measure	obs	# of matches	coefficient	std. error[a]	z	prob>z	95% conf.	interval
Exports to USA/Total	SATE	90	1	-0.211	0.120	-1.76	0.078	-0.446	0.024
Exports to EU/Total	SATC	90	1	.270	.206	1.31	0.190	-0.134	0.673

[a] Bootstrapped standard error with 100 replications.
Matching variables: real gdp per worker (Laspeyres); real gdp per worker (chain); services growth; distance to international markets; landlocked; latitude; longitude; income group (based on WB classification); religion; log of area
Bias-adj variables: real gdp per worker (Laspeyres); real gdp per worker (chain); services growth; distance to international markets; landlocked; latitude; longitude; income group (based on WB classification); religion; log of area
SATC: Average Treatment for the Controls; SATE: Average Treatment Effect; SATT: Average Treated for the Treated

Table 6: Average treatment effect on the treated — Share of exports

country	# treated	# of controls	ATT–coefficient	std. error[a]	t-stat
EU	33	44	0.019	0.086	0.22
USA	33	44	-0.160	0.086	-1.856
EU	26	12	-0.025	0.148	-0.169
USA	26	12	-0.167	0.122	-1.369
EU	33	44	0.031	0.117	0.262
USA	33	44	-0.173	0.113	-1.538

[a] Bootstrapped standard errors with 100 replications reported.
Rows 1 & 2 matching variables: real gdp per worker (chain); real gdp perworker (Laspeyres); services growth; landlocked; income group (WB classification); religion
Rows 3 & 4 matching variables: real gdp per worker (chain); real gdp perworker (Laspeyres); services growth; income group (WB classification); religion; human capital; land per person; log of area; log of physical capital per worker
Rows 5 & 6 matching variables: real gdp per worker (chain); real gdp perworker (Laspeyres); services growth; income group (WB classification); religion; consumption, investment and government spending shares in gdp; openness; log of real exchange rate

Finally, the graphs below show the degree of overlap between our treated and control countries for the other cases where we varied the matching covariates. They do show a reasonable degree of overlap and support the tests of common support that were passed in all six cases.

(a) Case A (b) Case B - CS (c) Case C - CS

(d) Case D - CS (e) Case E - CS (f) Case F - CS

Graphs showing other combinations of covariates. Not all results are shown above. Cases B - F are based on the cross-section constructed, see Table (5).

Figure 8: Common Support for other cases

5 Conclusion

The results presented so far imply that *agoa* beneficiaries have exported less to the USA compared to their matched controls. However, this has not been the case for their exports to the EU which has seen a higher share of exports relative to the control group. Initial implications from the result could be that, the shorter distance to the EU compared to *non-agoa* countries makes the EU a much better export destination for their exports. This probably is what is showing in the positive *ATT* estimates for the share of EU exports. Distance might not be the only factor at work here, but also the composition of exports. The EU allows a much varied array of exports from African Caribbean and Pacific countries under their various preferential programmes—this might be what is driving the positive coefficient. Moreover, the exports of *agoa* beneficiaries to the USA are mainly driven by apparel and textile products as well as energy products. Thus several *agoa* beneficiaries that do not export these products might be driving the negative coefficient as well as the nearness of Latin American and Caribbean countries to the USA market. China, OECD, European and other developed countries were excluded from the control group of countries. We therefore do not expect the strengths of these economies to be driving any of our results.

A caveat to the results is that the estimates are all intention to treat estimates. Further analysis needs to be done to capture the actual *average treatment effects* for the exports to the USA. This would be done with data on USA imports obtained from the USITC website.

There are a few more things to be done. (1) Incorporating a *matched — difference-in-difference* approach on the matched units; (2) Varying the outcome variables to include other definitions, such as *gsp* imports into the USA/total imports into the USA; total non-preferential imports/total imports into the USA; and sectoral level variable definitions (e.g., apparel, textiles, WTO agricultural exports; Industrial exports and comesa-cet1 exports out of total sector or total exports); (3) Including corruption indicators. These additional analysis would be helpful in further ensuring the robustness of our results and provide us with more information on the impact of *agoa*. It would also make it possible to show both the short and long–run effects of the *agoa* preference as well as provide information as to which sectors have benefited the most and how countries have re-organised their exports. At the least, the present paper has started a debate into trying out new methods of analysing *agoa* to show some consistent results.

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