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Abstract

Rules of origin (ROO) are criteria determining when goods are eligible for trade preferences. A common feature of ROO is to require that products embody a minimum share of value originating in the exporting country or group of beneficiary countries. Using disaggregated trade data we estimate the levels of restrictiveness of ROO that maximise the domestic or regional value-added embedded in African preferential exports. We uncover significant heterogeneity in estimates of such ROO, ranging from a 26 percent domestic content rule for Uganda and Kenya to 78 percent in South Africa. Building on these results, we use firm-level trade and domestic transactions data for Uganda to assess the restrictiveness of ROO in the EU and African Continental Free Trade Area (AfCFTA). We find that both ROO regimes require levels of domestic content in Uganda's exports that are too high. A reduction of ROO requirements would increase the total domestic value-added embedded in Uganda's preferential exports to the EU and within AfCFTA.

Keywords

Rules of origin, preferential trade, African Continental Free Trade Area, Uganda

JEL codes

F13, F14, F15

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1 Introduction

In a world of global supply chains with increasing vertical specialization, using the value of exports as a metric for how much trade benefits the exporting country can be highly misleading, particularly in small countries with a lower share of domestic value-added embedded in their exports (Johnson, 2014). Policies such as preferential market access regimes that unambiguously boost exports can hurt development if they simultaneously reduce the share of domestic value-added embedded in exports.

Rules of origin (ROO) are an essential component of any preferential trade arrangement, whether accorded on a non-reciprocal basis to developing countries or reciprocal free trade agreements. They constitute criteria that determine whether a product originates in the exporting country and is eligible for trade preferences. ROO often require that products embody a minimum share of value that originates in the exporting country. The primary purpose of ROO is to determine eligibility for trade preferences and prevent trade deflection (the sourcing of imports from third countries through a member of a free trade agreement with the lowest tariff) or circumvention (importing goods from a non-eligible country and re-exporting them to a preference granting jurisdiction free of duty.

ROO can also be used as a protectionist instrument, by impeding the ability of eligible foreign firms to benefit from trade preferences by conditioning duty-free access on performance requirements that are difficult to satisfy.[1] Conversely, restrictive ROO may be used as an instrument of industrial policy by incentivizing exporters to source from local input suppliers or to increase domestic processing of exported products above levels that would occur if a firm was unconstrained in their ability to use imported inputs in production for export. This could ultimately lead to productive upgrading, as firms move up the value chain and undertake activities that otherwise would occur in foreign markets, and develop the capacity

[1] A classic example is a 1904 trade agreement between Germany and Switzerland. Germany committed itself to reducing its tariffs on 'large dapple mountain cattle reared at a spot at least 300 meters above sea level and having at least one month grazing each year at a spot at least 800 meters above sea level' (Curzon, 1965, p. 60.

to produce more differentiated goods.[2] At the level of the economy as a whole, increasing domestic value added will support economic development and be reflected in new employment opportunities (demand for workers) and higher national income.

An extensive literature shows that restrictive ROO (i.e., requiring a relatively high level of domestic value added) erode beneficiaries' preferential market access and attenuate the effect of liberalization in reducing tariff escalation in major import markets.[3] Arguably, the more interesting question is how the the value-added embedded in preferential exports is affected by rules of origin. The literature on this question is scant, but it tends to suggest that the answer is not straightforward. Head et al. (2024) develop a conceptual framework that shows that the value-added content of beneficiaries' preferential exports has a non-monotonic relationship with ROO restrictiveness.[4] They call this the ROO Laffer curve because it has an inverted-U shape. Starting from very liberal ROO, an increase in domestic content requirements increases the value-added content of preferential exports. Conversely, high domestic content requirements reduce the value-added content of preferential exports. The mechanisms are straightforward. Without any ROO requirement, the value-added embedded in exports will be sourced from the cheapest suppliers, which may be producers that are not part of the preferential trade arrangement. If so, as domestic value requirements are increased this hurts exports but increases demand for domestic suppliers. When ROO become too restrictive, many firms may be unable to qualify for preferential access. Preferential exports shrink even though those that are sustained have a high domestic content.[5]

[2]This, of course, abstracts from considerations related to the availability of domestic inputs of sufficient quality and their cost.

[3]see, e.g., Hoekman, 1993; Brenton and Manchin, 2003; Cadot et al., 2007; Cadot and de Melo, 2008; Crivelli and Inama, 2021; Francois, Hoekman and Manchin, 2006; Sytsma, 2022).

[4]Their conceptual framework builds on Grossman (1981) who shows that the sign of the impact of an increase in domestic content requirements on exporters' value-added is ambiguous and depends on the sign of the elasticity of substitution between domestic factors of production and intermediate imported inputs. If domestic factors of production and imported intermediate inputs are complements (and the share of imported intermediate inputs in total value-added is large) an increase in domestic content requirements raises the production cost of the final good disproportionately, leading to a reduction in the total domestic value-added content of exports.

[5]There are other potential rationales for ROO that have been identified in the literature. For example, Ornelas and Turner (2024) argue ROO can help solve hold-up problems in settings where input suppliers must invest to meet specific requirements of buyers and contracts are incomplete. Strict(er) ROO can help both parties in such situations by solving the under-investment problem. In this paper we limit attention to the industrial policy motivation for ROO.

Head et al. (2024) estimate the impact of increasing the regional content requirement for automobiles from 62.5 percent to 75 percent in 2020 when NAFTA ROO were renegotiated.[6] Contrary to the purported intent of increasing regional employment in the automobile sector, the more restrictive ROO led to lower employment in the automobile sector due to higher production costs. This suggests that the increase in regional content requirement occurred on the wrong side of the Laffer curve. Kniahin and Olarreaga (2023) build on Head et al. (2024) to estimate the level of ROO restrictiveness that maximises value-added embedded in preferential exports of Generalized System of Preference (GSP) beneficiaries to the European Union (EU), using a dataset of EU GSP tariff preferences, applicable ROO, and preferential imports. Their estimates indicate that value added maximizing ROO are similar to those applied in the EU GSP scheme.

In this paper, we build on the methodology developed by Kniahin and Olarreaga (2023) to use tariff line level trade data to estimate the level of ROO restrictiveness that maximises domestic value-added in beneficiaries' exports. We contrast estimates for African exporting countries with those for all GSP beneficiaries as a group, highlighting the heterogeneity of ROO that maximize domestic value added across exporting countries of different size. Larger economies with a more diversified production base are more likely to be able to satisfy more stringent rules of origin. We assess the robustness of our results by using Ugandan data on firm-level exports and firm-to-firm transactions obtained from value-added-tax records to calculate the actual, as opposed to estimated, domestic value-added content of exports and compare these with the current restrictiveness of ROO in the EU and the AfCFTA regimes.

The paper proceeds as follows: Section 2 presents the conceptual framework and empirical methodology used by Kniahin and Olarreaga (2023) to estimate the level of ROO restrictiveness that maximises beneficiaries value-added in preferential exports using tariff line data. Section 3 discusses data sources and presents descriptive statistics. Section 4 reports the empirical results for African countries in our sample. Section 5 replicates the analysis using firm-level data for Uganda to assess the robustness of our trade data based findings. Section

[6]They focus on regional content as opposed to domestic value added because of their focus on the trade agreement between Canada, Mexico and the US which defines ROO on the basis of regional content.

6 offers concluding remarks and draws out some implications for policy regarding the design and evaluation of ROO.

2 Conceptual framework and empirical methodology

The value-added embedded in beneficiaries' preferential exports is given by:[7]

$$\text{BVA}(r) \equiv \alpha(r)\, x(r) \tag{1}$$

where BVA is beneficiaries' value-added in preferential exports, α is the share of beneficiaries' value-added in preferential exports, x is the value of preferential exports and r is the minimum level of beneficiaries' value-added required by ROO. The equation is defined in terms of value added produced in beneficiaries' to capture the fact that preferential rules of origin may allow for cumulation across a set of eligible countries. Such cumulation will at a minimum generally be bilateral as inputs sourced from the preference granting jurisdiction are regarded as originating. In trade agreement contexts ROO may be defined as a regional value content requirement. Equation (1) is defined in terms of beneficiaries' value-added rather than domestic value-added to reflect the fact that ROO may allow beneficiaries to cumulate value-added across different countries within the same preferential scheme or trade agreement.

Equation (1) is an identity. It illustrates Head et al. (2024) Laffer curve of ROO. To see this note that α and x depend on r; α monotonically increases with r when the ROO is binding. If ROO become more restrictive, there will be more domestic or regional value-added embedded in each dollar of preferential exports because this is required for firms to be able to continue exporting under the preferential regime. The value of preferential exports (x) decline with r. This is because a more restrictive ROO increases production costs when ROO are binding as firms are induced to source from higher cost domestic or regional suppliers.[8]

[7] This section borrows extensively from Kniahin and Olarreaga (2023).

[8] There is a vast empirical literature measuring the impact of (changes in) ROO on exports and preference

If we combine these two opposing effects, we obtain the non-monotonic relationship between BVA and r in the form of an inverted-U (Laffer) curve. In the presence of very lenient ROO there is no impact on domestic/regional value-added embodied in preferential exports because of trade deflection.[9] All value-added is produced elsewhere and $\alpha = 0$ implying BVA $= 0$. Similarly, with prohibitive ROO, there are no preferential exports, i.e., $x = 0$, and therefore BVA $= 0$ also. Somewhere in the middle, there is a level of ROO restrictiveness that maximises BVA, as long as ROO are binding for some firms.[10]

The ROO that maximizes domestic/regional value added is obtained by taking the derivative of (1) with respect to r, and then solving for $r^\star$:

$$r^\star = \underset{r}{\text{argsolve}} \; 1 + \frac{\alpha}{\alpha'}\frac{x'}{x} = 0 \tag{2}$$

where $\alpha' = \partial\alpha/\partial r$ and $x' = \partial x/\partial r$. To estimate equation (2) and derive the BVA-maximising r, we confront the problem that data on bilateral trade flows to not provide information on beneficiaries' value-added in preferential exports (BVA) or its share in preferential exports (α). We only observe preferential exports x. To address this issue firm-level information is needed, but comparable data for a broad set of countries is not available.[11] In the absence of detailed firm-level data on value added, Kniahin and Olarreaga (2023) suggest two alternative

utilization (e.g., Crivelli and Inama, 2023).

[9]The implicit assumption here is that exports from the cheapest source will be redirected through the beneficiary leaving little or no domestic value-added in the beneficiary's exports.

[10]If ROO are never binding then changes in their restrictiveness will have no impact.

[11]In Section 5 below we use such data for the case of Uganda.

assumptions regarding the relationship between α and r:[12]

$$\alpha = r \quad \text{Linear function} \tag{3}$$

$$\alpha = \sqrt{r} \quad \text{Square root function} \tag{4}$$

Replacing equation (3) and (4) and their derivatives with respect to r into (2), and solving for r, we obtain the BVA-maximizing ROO:

$$r^{\star} = -\frac{x}{x'} \quad \text{Linear function} \tag{5}$$

$$r^{\star} = \sqrt{-\frac{x}{x'}} \quad \text{Square root function} \tag{6}$$

where x' stands for $\partial x/\partial r$. x is observable in the data. and x'/x is therefore the semi-elasticity of preferential exports with respect to r. It can, therefore, be estimated using data on x and r. To do so, Kniahin and Olarreaga (2023) use the gravity model of trade that explains the variation in bilateral trade between the EU and preference beneficiaries, using supply and demand factors as well as bilateral trade costs. They use a Poisson estimator to address the presence of zero trade flows, which, in the presence of heteroskedasticity, can lead to biased estimates when variables are log-linearized (Santos-Silva and Tenreyro, 2006). More formally, they estimate the following equation:

$$x_{xpt} = e^{\beta_{xt}+\beta_{pt}+\beta_{xp}+\beta^{T} ln\frac{1+T_{pt}}{1+t_{xpt}}+\beta^{\alpha}\alpha_{xpt}} + \epsilon_{xpt} \tag{7}$$

where x_{xpt} are preferential exports from country x to the EU of product p at time t, β_{xt}, β_{pt} and β_{xp} are exporter×, product×time and exporter×product fixed effects, respectively, and ϵ_{xpt} is an i.i.d error term. The fixed effects address omitted variable concerns that could

[12]Kniahin and Olarreaga (2023) also consider logarithmic and geometric functions. As these imply relationships that lie between the linear and square root functions, we limit the analysis to these two extremes. The functions have five desirable properties. First, $\alpha \geq r \quad \forall r$, meaning that the share of beneficiaries' value-added embedded in preferential exports needs to be larger or equal than required by ROO. Second, $0 \leq \alpha \leq 1$, to exclude cases that would make no economic sense. Third, $\lim_{r\to 0} \alpha(r) = 0$, assuming that in the absence of any ROO restriction, arbitrage across markets will lead to preferential exports being completely sourced from lower-cost producers in the rest of the world. Fourth, the parameters of the function need to cancel out in the first order condition, as we are not able to identify the parameters of the α function without data on α. Finally, the second-order condition for existence of a maximum is satisfied.

explain both the restrictiveness of ROO and bilateral exports.

The model includes two bilateral trade cost variables: the preferential tariff margin, captured by the ratio of Most Favoured Nation (MFN) to preferential tariffs ($(1+T_{pt})/(1+t_{xpt})$),[13] and the share of value-added in preferential exports (α_{xpt}). The latter is the variable of interest that we do not observe but is a function of r_{xpt}. Thus we replace α_{xpt} with each of the functional forms in equations (3) and (4), and introduce them into equation (7) to obtain:

$$x_{xpt} = e^{\gamma_{xt}+\gamma_{pt}+\gamma_{xp}+\gamma^T ln\frac{1+T_{pt}}{1+t_{xpt}}+\gamma^r r_{xpt}} + \mu_{xpt} \quad (8)$$

$$x_{xpt} = e^{\psi_{xt}+\psi_{pt}+\psi_{xp}+\psi^T ln\frac{1+T_{pt}}{1+t_{xpt}}+\psi^r \sqrt{r_{xpt}}} + \omega_{xpt} \quad (9)$$

where γ^r, and ψ^r are the parameters of interest (equal to β^α).

The semi-elasticities of preferential exports with respect to r are then given by:

$$\frac{x'}{x} = \gamma^r \qquad \text{if } \alpha = r \quad (10)$$

$$\frac{x'}{x} = \psi^r \frac{1}{2\sqrt{r}} \qquad \text{if } \alpha = \sqrt{r} \quad (11)$$

Substituting equation (10) into equation (5) and equation (11) into equation (6) we obtain the value added maximizing ROO, $r^\star$, under the two different functional forms:

$$r^\star = -\frac{1}{\gamma^r} \qquad \text{if } \alpha = br \quad (12)$$

$$r^\star = \sqrt{\left(-\frac{1}{\psi^r}\right)} \qquad \text{if } \alpha = b\sqrt{r} \quad (13)$$

The standard error (se) of $r^\star$ in equations (12)-(13) is calculated using a first-order Taylor

[13] Note that t_{xpt} are bilateral preferential tariffs, and T_{pt} is the MFN tariff.

series approximation of $r^{\star}$ around its mean.[14]

$$se\left(r^{\star}\right) = se\left(\gamma^{r}\right)\frac{1}{\left(\widehat{\gamma^{r}}\right)^{2}} \tag{14}$$

$$se\left(r^{\star}\right) = se\left(\psi^{r}\right)\left(\frac{1}{2\left(-\widehat{\psi^{r}}\right)^{\frac{3}{2}}}\right) \tag{15}$$

In equations (8)-(9), the parameters in front of r are identified using the variation across years within exporter×product, across exporters within product×year, and across products within exporter×year. Thus, to identify the semi-elasticity of preferential exports with respect to rules of origin, we need to have variation in ROO along these three dimensions. This implies that we need to have changes in ROO across time (within products×exporter). The EU is both a major donor in terms of preferential market access and has implemented significant ROO reforms over time that have made ROO less strict.[15] In the absence of time variation, ROO will be perfectly collinear with the exporter×product fixed effects and we would not be able to identify our parameters of interest. Variation in ROO across exporters (within product×year) is also required, implying the need to consider more than one preferential scheme. The EU's nonreciprocal preference regime has such variation: the standard GSP, the GSP+, and the Everything But Arms (EBA) regime for LDCs.[16] Finally, there needs to be variation across products.[17] Otherwise, the ROO will be perfectly co-linear with the exporter×year fixed effect. The EU's GSP has sufficient variation across tariff lines, unlike other countries' GSP regimes, such as Australia, New Zealand, or Taiwan, which apply a 50 percent beneficiary value-added requirement across all products.

In the results section we report estimates of equation (8)-(9) for the entire sample of GSP-

[14] see Kniahin and Olarreaga (2023).

[15] The average value added requirement in the first year of our sample was 58 percent. This fell to 34 percent in the last year of the sample.

[16] As can be seen from the descriptive statistics in Table 1, the average ROO tends to be significantly lower for EBA beneficiaries. We cannot estimate equations (8)-(9) using data for EBA beneficiaries only, as all EBA exporters would face the same ROO, which will be perfectly co-linear with the product×year fixed effects.

[17] In 2019, the highest value-added requirement in the GSP regime was 60 percent for imports of textile products (HS630790), and the lowest was 30 percent for vehicles (HS870340).

eligible exporters for African exporters. This allows us to estimate the value added maximizing ROO for the two different groups of countries and explore potential heterogeneity across these groups. We also estimate equations (8)-(9) by African country. To do so we relax the set of fixed effects as there is now only one exporter and one importer, and therefore only control for year fixed effects. The estimated coefficients (γ^r and ψ^r) are identified for each African exporting country using the variation in ROO and preferential exports across products. Finally, we focus on the case of Uganda, using actual data on foreign value added embodied in exports. This provides both a robustness check for the trade data based estimation and illustrates the use that can be made of administrative micro data to evaluate how binding a given ROO is.

3 Data

We use the same dataset as in Kniahin and Olarreaga (2023). It covers the period from 2008 to 2019 and is disaggregated at the six-digit level of the Harmonized System (HS). Below, we provide data sources and descriptive statistics for ROO, tariffs, trade, and preference utilization data.

3.1 Rules of origin

Data for ROO are available for all preferential trade schemes from the International Trade Centre (ITC)–World Customs Organization (WCO)–WTO Rules of Origin Facilitator database. This is coded on the basis of notifications made by preference granting countries.[18] The value-added criterion is frequently used to determine origin, expressed as the minimum share of beneficiaries' value-added that needs to be embedded in preferential exports to confer origin and benefit from preferential access.[19] It is the criteria on which we focus our discussion in

[18]See Kniahin et al., 2019 and `https://www.trademap.org/stDataAvailability.aspx`.

[19]Value added is only one criterion used by preference granting states. Other commonly used criteria include product-specific rules and whether processing of a product in the exporting country results in a

the results section.

Columns 1 and 2 in Table 1 provide summary statistics for the value-added criteria of ROO faced by EU's GSP beneficiaries (top panel) and African beneficiaries only (bottom panel). For the period under examination, the average value-added criteria in ROO faced by GSP exporters to the EU is 46 percent, whereas African exporters face a lower threshold of 41 percent on average. The median value-added criteria faced by GSP beneficiaries is significantly higher than those faced by African beneficiaries, at 50 and 30 percent, respectively. Thus, at the median African exporters face a 30 percent regional value content requirement in Europe, which is 40 percent lower than the requirement imposed on the median GSP exporter.

3.2 Tariff data

Data on EU MFN and GSP preferential tariffs under different regimes (LDC, GSP+, and standard GSP) were obtained from the ITC Market Access Map. The tariff data is collected directly from national authorities by the ITC every year and was downloaded from `https://www.macmap.org/en/download`. In the case of specific duties (e.g. 5 USD per 1 liter) or tariff rate quotas, the ITC performs a conversion into an ad-valorem equivalent using a methodology described in World Tariff Profiles (2008). The preference margin is constructed $(1+T)/(1+t)$ where T is the MFN tariff and t is the preferential tariff. In the absence of preferences, the preference margin equals 1 and is higher otherwise. Column 3 in Table 1 provides summary statistics for the log of the preference margin granted to all of the EU's GSP beneficiaries (top panel) and African beneficiaries only (bottom panel). The average and median preference margin during the period under examination is 4 percent for GSP and African beneficiaries, and it varies between 0 and 15 percent.[20]

change in the tariff heading for the processed good. See Gourdon et al. (2023) for a description of the relative importance of different ROO criteria in preferential agreements. The value-added criteria is used as one of the potential criteria to establish origin in at least 40 percent of tariff lines.

[20]The average preference margin for beneficiaries of the EU standard GSP regime is 2.1 percent. This rises to 5.3 percent for LDCs as a result of duty-free, quota-free access for almost all products. The EU GSP in contrast excludes 11 percent of dutiable tariff lines. See UNCTAD (2023).

3.3 Exports

Data on preferential and non-preferential exports are available through the WTO's Integrated Data Base's Tariff Analysis Online facility, which is accessible at `https://tao.wto.org`. The data is provided by WTO member states every year and it provides a breakdown by preferential regime. In the case of the EU, the preference utilization data is provided by EUROSTAT. Columns 4 to 6 in Table 1 provide summary statistics for total exports, preferential exports, and non-preferential exports at the six digit level of disaggregation for all EU GSP beneficiaries (top panel) and African beneficiaries only (bottom panel). The descriptive statistics reveal that average export values at this fine grained level of product classification are very small and that for many bilateral trade pairs beneficiary exports are zero.

GSP beneficiaries' average preferential exports are USD 0.16 million. Non-preferential exports are, on average, USD 0.11 million for total exports of USD 0.27 million per exporter, year and HS 6-digit tariff line. Thus, on average, during the period under examination, 59 percent of GSP beneficiaries' exports to the EU enter preferentially. In the case of African beneficiaries, only 8 percent of exports enter the EU preferentially, suggesting that notwithstanding more lenient ROO the preferential regime is demanding for African exporters to satisfy.

4 Results

We report the results of the estimation of equations (8)-(9) for preferential exports of GSP beneficiaries to the EU, as well as a subsample of African exporters. Table 2 reports results using data at the 4-digit HS level. We report results at the 4-digit level because this is the level of aggregation at which ROO is set in the EU, i.e., there is no variation in ROO restrictiveness within HS 4-digit products. The first two columns reproduce the results in Kniahin and Olarreaga (2023) for the full sample. The last two columns present the results for the African subsample. The first and third columns assume there is a linear relationship

between α and r. Columns (2) and (4) present results assuming a square root relationship.

The estimated coefficients for ROO in Table 2 have the expected sign and are statistically significant at the 1 percent level when using the full sample. However, in the sub-sample of African exporters, the preference margin has a negative sign, indicating that as the preference margin increases, preferential exports are smaller. This could be due to reverse causality as preference margins can be more generous in sectors where African exporters have little export capacity. The coefficients on ROO have the right sign. More stringent ROO requirements reduce preferential exports.[21]

Using these estimated coefficients, we compute the value added maximizing ROO, $r^\star$ given by equations (12)-(13) and calculate their standard errors using equations (14)-(15). Table 3 provides the values of value added maximizing ROO under the two different functional form assumptions for the full GSP sample and the sub-sample of African exporters. Using the assumption of a linear relationship between α and r, we obtain $r^\star = 0.41$ in the full sample. In the subsample of African exporters, $r^\star = 0.18$, less than half the value obtained for the full sample. Similarly, when using the assumption of a square root relationship between α and r, we obtain $r^\star = 0.57$ in the full sample, and $r^\star = 0.38$ in the sub-sample of African exporters. Although all the estimates are statistically different from 0 and 1 at the 10 percent level of significance, they are all estimated with a relatively large standard error. Therefore, we cannot reject the null hypothesis that the ROO are equal between the two country samples or across functional form assumptions. Nevertheless, the point estimates clearly suggest that increasing the regional content of African exporters to the EU calls for a much lower regional content requirement than for the full sample of GSP exporters. This finding is not surprising as African economies tend, on average, to be smaller and less diversified than many of the economies in the larger GSP sample. Their capacity to incorporate domestic (or regional) value-added in exports is lower than in Asia or Latin America. .

Within Africa, we also expect significant heterogeneity. Large countries with developed and diversified industrial sectors will be better able to satisfy restrictive ROO than African LDCs.

[21]Note that in the square root specification, the coefficient is not statistically significant.

These tensions are apparent in the AfCFTA ROO negotiations. To assess the implications of such heterogeneity within Africa we estimate equations (8)-(9) for each African country individually, now only controlling for year fixed-effects. In these exporter-specific regressions, the coefficients are identified using the variation across products. We then use (12)-(13) to calculate $r^{\star}$. Results are reported in Table 4 for each of the African countries for which there was enough variation in the ROO data across products.

Using the linear function assumption, the estimates range from 9 percent regional value content in Uganda and Kenya to 50 percent in South Africa. If we use the square root function assumption, the estimates range from 20 percent of regional value content in Mauritius to 72 percent in South Africa. As expected, there is a positive relationship with the size of the exporting country. Figure 1 illustrates this. While the relationship is not precisely measured, as can be seen from the 95 percent confidence intervals, it is upward-sloping.[22] We also plot the relationship between the estimated value added maximizing ROO with imports and the stock of foreign direct investment (FDI), both measured as a share of GDP. Figure 2 shows that the larger the dependence on imports, the lower the ROO requirement should be, reflecting the higher cost of switching to more suppliers from eligible countries. Conversely, Figure 3 reveals a positive association with the stock of FDI. This is intuitive. As FDI boosts productive capacities, this can be expected to be associated with an increase in domestic value added. In both cases, South Africa is an outlier, reflecting its high capacity, diversified economy and relatively low import dependence.

The most important policy implication is that, contrary to what is sometimes argued, the relationship between domestic-cum-regional value-added embedded in preferential exports and the restrictiveness of ROO is non-monotonic. Whether countries should invest their negotiating capital in pushing for more or less restrictive ROO is country-partner and product specific. At low levels of ROO restrictiveness, it is likely that stricter ROO may increase the domestic/regional value-added embedded in preferential exports. At high levels of ROO restrictiveness, a move to more lenient criteria can increase the domestic/regional value-

[22]We also explore the heterogeneity across products but could not disentangle any economically or statistically significant differences across broad product categories.

added embedded in preferential exports.

5 Robustness: Firm-level data for Uganda

The absence of cross-country data on the magnitude and origin of value-added embedded in preferential exports has limited the foregoing analysis to disaggregated export data. These required making assumptions on the relationship between domestic/regional value-added and the level of ROO restrictiveness. These assumptions clearly matter for the magnitude of the estimated value added maximizing ROO. There is a 16 percentage point difference in the estimate between the the linear and square root assumptions in the full sample of GSP exporters (41 versus 57 percent, respectively), The difference increases to 20 percentage points for the sub-sample of African exporters (18 versus 38 percent, respectively). For individual countries, the differences vary from 12 percentage points in Gambia (36 versus 48 percent) to 22 percentage points in South Africa (50 percent versus 72 percent). In other words, functional form uncertainty clearly is an issue. One solution is to provide interval predictions as suggested by Manskin (2011). This is the reason why we provide estimates for both functional form assumptions as well as their standard errors.

An alternative is to try to use some moments of the data to try to disentangle between the different functional forms assumptions. To do so, we can combine the average or median level of ROO restrictiveness faced by an exporter to the EU with the share of domestic value-added embedded in their exports to the EU. If they are approximately equal, then the linear functional form assumption matches the data. If the share of domestic value-added embedded in exports to the EU is significantly higher than what is required by rules of origin, the square root functional form assumption is more appropriate.

To visualise this, we plot the linear and square root functions of α for different levels of r in Figure 4. The linear relationship clearly implies that the rule of origin is always binding, whereas under the square root functional form assumption α can be much larger than r. In

order to determine which of these two functional form assumptions better matches the data we need to combine information on the restrictiveness of ROO with data on the share of domestic value-added that is actually embedded in preferential exports.

We can obtain the latter by exploiting administrative micro data on firms operating in beneficiary countries. In this section we combine data on firm-level transactions and exports contained in value-added-tax collection and customs clearance datasets for Uganda. We use these to compute the share of domestic value-added embedded in Uganda's exports to the EU and to African countries.

The share of domestic value-added in total sales of firm i is given by:

$$\alpha_i = \frac{s_i - m_i}{s_i} \tag{16}$$

where s_i are total sales of firm i and m_i are total intermediate input imports by firm i. Equation (16) controls for the foreign value-added that is directly imported by firm i. A large share of foreign value-added embedded in firm i sales can be embedded in the purchases from other domestic firms that themselves import a large share of goods. If we take this reasoning to the limit, we need to invert the Leontief matrix of input-output coefficients. However, ROO practice is limited to certifying agencies determining that a sufficient share of the inputs directly purchased by the exporting firm are domestically produced. In order to do so we recalculate α as follows:

$$\alpha_i = \frac{s_i - m_i - \sum_j a_{ij} m_j}{s_i} \tag{17}$$

where a_{ij} is the share of inputs firm i purchases from firm j (the input-output coefficient) and m_j are imports of intermediate inputs by firm j. Because we do not have information regarding the production function of firms, we need to assume that the same α_i applies to sales in all markets. However, because different firms sell in different markets, we can

compute the median α_i for each market.

Using equation (17), the median value of α_i for Ugandan exporters to the EU is 49 percent. Around half of the value-added of what is exported to the EU has been produced in Uganda.[23] We can compare this to the ROO requirement Ugandan exporters face in the EU preferential schemes, which at the median equals 30 percent. Thus the median α is 64 percent higher than the median r. Examining Figure 2, we see that when $r = 0.30$, the assumption of a linear relationship between α and r implies that $\alpha = 0.30$ also. With the assumption of a square root relationship between the two, when $r = 0.30$ we then have $\alpha = 0.55$. With α estimated at 49 percent, the data better matches the square root functional form assumption than the linear one for Uganda, suggesting that more weight should be put on the former estimates.

The domestic value added maximizing ROO reported in Table 4 for Uganda using the square root functional form assumption is 26 percent. This is lower than the median ROO faced by Uganda in the EU, which equals 30 percent. Notably, the most restrictive ROO applied in the EU is 60 percent (See Table 1). This clearly is too restrictive if the objective is to maximise Ugandan value-added in preferential exports. A reduction in such peak ROO should increase Ugandan value-added embedded in its preferential exports and increase preference utilisation.

We can also use the current share of domestic value-added embedded in Ugandan exports to African countries to assess the level of restrictiveness of ROO negotiated in the AfCFTA, using equation (17). The median ROO requirement (r) is 40 percent when calculated over the 2610 HS 6-digit tariff lines on which a regional value-added requirement has been agreed. The mean and minimum ROO is also 40 percent. There are only 36 HS 6-digit tariff lines with a value added requirement above 40 percent, but the highest for fabric and yarn (85 percent). This contrasts with an average share of domestic value-added embedded in exports of Ugandan firms to African countries of 18 percent. This exercise indicates AfCFTA rules

[23]The domestic value-added might differ across export categories. For instance, one might be concerned about the domestic value added embedded in manufacturing exports, which may impede Uganda's exports of manufacturing goods to the EU. Our calculations, however, show that the median value added for the domestic value-added in manufacturing exports is about 48 percent, which is well above the median ROO requirement that Ugandan exporters face in the EU preferential schemes.

of origin are too restrictive for regional exporters to benefit from them. As suggested by the estimates in Table 4, the current levels could make sense for South Africa given that it has a large and diversified economy, but if Uganda and similar smaller and less diversified economies are to take advantage of AfCFTA, much lower ROO requirements need to be applied.

6 Concluding remarks

Perhaps surprisingly, many beneficiaries of preferential market access arrangements have been asking for less restrictive ROO (e.g., the LDC group in the WTO) and others for more restrictive ROO (e.g., the US in the USMCA context). In both instances, the argument is that the suggested change in ROO will help create more jobs and domestic value-added. It seems like at least one of these positions must be wrong, given the similarity in the proffered rationale. In principle, both arguments can potentially be right or wrong given that the relationship between domestic value-added and the restrictiveness of ROO is non-monotonic (Head et al. 2024). Thus, what matters is what part of the ROO Laffer curve countries are on. GSP beneficiaries are very diverse, spanning economies of very different size, economic development and levels of diversification. ROO that apply across different regions and countries will therefore have different implications for the incentives confronting firms when they decide on the sourcing of the inputs they need to produce products for export under preferential access regimes.

We find that the regional value added maximizing ROO for African exporters is 64 percent lower than for the average GSP exporter. African exporters could therefore benefit from less restrictive rules of origin in the EU, or at least the elimination of ROO peaks which can reach value added requirements of 60 percent in the EU. This average result masks important heterogeneity within Africa. Small countries with a more concentrated production structure would benefit from a reduction in ROO requirements, whereas larger diversified economies more likely to benefit from more restrictive ROO. This divergence is illustrated in

our estimate of regional value added maximizing ROO for Uganda of 26 percent, as compared to 72 percent for South Africa. Using data for nine African countries, we find an upward-sloping relationship between the the appropriate ROO in exports and the economic size of the exporter.

A major impediment in assessing the effects of ROO and efforts to determine the domestic value added maximizing ROO is the lack of data on the magnitude and source of value added embedded in exported products. This requires the use of assumptions on the relationship between the share of domestic (regional) value-added in preferential exports and the threshold level of value-added required by ROO. Estimates based on the associated assumptions will be subject to error. Our use of Ugandan micro data, combining actual data on firm-level value-added and customs transactions data, provides a robustness check for the estimates using trade data only. The median current level of ROO restrictiveness faced by Ugandan exporters to the EU is 30 percent and 40 percent for exports within AfCFTA. This compares to an average level of domestic value-added of 49 percent when exporting to the EU and 18 percent when exporting to Africa. These findings suggest that While Uganda would benefits from relaxation of peaks in the EU GSP ROO, which can reach 65 percent, on average ROO are not a binding constraint. However, in the case of AfCFTA, ROO requiring a median of 40 percent regional content appear too restrictive for Ugandan exporters.

Several caveats apply to our findings. As noted, we limit attention to value added rules whereas in practice, other types of ROO are applied by importing nations. These include a maximum value of imported materials and product-specific ROO. The former are expected to be less restrictive by being simpler to calculate and easier to document, whereas the latter may be more restrictive as the associated sectors often are more sensitive. To some extent this dynamic is reflected in our analysis of value added criteria, which as mentioned include some 'peak' ROO that apply to textiles. Whatever the specific ROO that applies, however, a common feature is that they will be associated with a value added equivalent.

In addition, as discussed in the text, the approach used to estimate value added in exports takes into account that ROO allow for bilateral cumulation as well, depending of the pref-

erence regime, regional cumulation. As a result our analysis focused on beneficiaries' value added (BVA), not domestic value added in the country of export. BVA will include domestic value added but also value added imported from other beneficiary countries, including in the case of EU regimes, European firms. An implication of this is that the domestic value added requirement in practice may be less constraining than our estimates suggest. Of course, this does not necessarily mean that the ROO is less costly to exporting firms as they may prefer to source inputs from cheaper, non-eligible, companies that would be associated with higher profits. Such trade-offs only arise insofar as the associated higher costs do not erode the value of the preferential margin that applies to a particular product and market. A related caveat is that we do not consider the cost of certifying compliance with ROO. This is non-zero, implying that the incentive for firms to utilize preferences is not only a function the restrictiveness of the ROO but also the processes used by importing jurisdictions to determine compliance. The implication here is that our estimates are upper bounds.

From a policy perspective the observed heterogeneity in the estimates of value added maximizing ROO raises the question why preferential trade arrangements tend to impose a uniform and common ROO thresholds for broad groups of beneficiaries. If the objective is to maximise domestic value-added embedded in preferential exports, our analysis suggests the restrictiveness of ROO should vary with economic size and level of development of beneficiaries. While there are practical constraints associated with too much differentiation in applicable ROO in a trade agreement such as the AfCFTA, our results make clear that a one size fits all approach is likely to have significant effects on smaller, less developed, economies.

Another policy implication of our analysis concerns the importance that governments use available micro data when designing and adjusting ROO, and to evaluate the effects on domestic/regional value added content shares in exports, including changes over time. While we were forced to use extant trade data as the basis for our analysis, Uganda is not an outlier in having data that can be used to track actual value added in exports. Many countries have value added tax data that can be used to evaluate ROO. What is needed is to utilize such data.

References

[1] Brenton, P. and M. Manchin, 2003. Making EU trade agreements work: The role of rules of origin. The World Economy 26(5), 755-769. https://doi.org/10.1111/1467-9701.00545

[2] Brenton, P., 2005. Enhancing trade preferences for LDCs: Reducing the restrictiveness of rules of origin. In Newfarmer, R. (Ed.): Trade, Doha, and Development: A Window into the Issues. World Bank Publication, 281-287. http://hdl.handle.net/10986/7135

[3] Cadot, O. and J. de Melo, 2008. Why OECD countries should reform rules of origin. World Bank Research Observer 23(1), 77-105. https://doi.org/10.1093/wbro/lkm010

[4] Cadot, O., J. de Melo and A. Portugal, 2007. Rules of Origin for Preferential Trading Arrangements: Implications for the ASEAN Free Trade Area of EU and US Experience. Journal of Economic Integration 22(2), 288-319.

[5] Crivelli, P. and S. Inama, 2021. Improving market for LDCs: The impact of the EU Reform of ROO on Utilization Rates and Trade Flows under the Everything But Arms Initiative. Working Paper UNCTAD.

[6] Curzon, Gerard. 1965. Multilateral Commercial Diplomacy. London: Michael Joseph.

[7] Francois, J.,B. Hoekman and M. Manchin, 2006. Preference erosion and multilateral trade liberalization. The World Bank Economic Review, 20(2), 197-216.

[8] Gourdon, K., J. Gourdon and J. de Melo, 2023. A (more) systematic exploration of the trade effect of product specific rules of origin. World Trade Review 22(3-4), 421-435. https://doi.org/10.1017/S1474745623000125

[9] Grossman, G., 1981. The theory of domestic content protection and content preference. Quarterly Journal of Economics 96(4), 583-603. https://doi.org/10.2307/1880742

[10] Head, K., T. Mayer and M. Melitz, 2024. The Laffer curve for rules of origin. Journal of International Economics 150, 103911. https://doi.org/10.1016/j.jinteco.2024.103911

[11] Hoekman, B. (1993). Rules of origin for goods and services. Journal of World Trade, 27(4), 81-100.

[12] Johnson, R., 2014. Five facts about value-added exports and implications for macroeconomics and trade research. Journal of Economic Perspectives 28(2), 119-142. https://doi.org/10.1257/jep.28.2.119

[13] Kniahin, D. and M. Olarreaga, 2023. Rules of origin and exporters' value-added. Heliyon 9(11), e21090. https://doi.org/10.1016/j.heliyon.2023.e21090

[14] Kniahin, D., D. Dinh, X. Pichot, M. Mimouni, 2019. Global Landscape of ROO: Insights From The New Comprehensive Database. GTAP Conference Paper. https://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=5827

[15] Manskin, Ch., 2011. Policy analysis with incredible certitude. Economic Journal 121(554), F261-F289. https://doi.org/10.1111/j.1468-0297.2011.02457.x

[16] Ornelas, E. and J. Turner, 2024. The costs and benefits of ROO in modern free trade agreements. Journal of International Economics 147, 103874, https://doi.org/10.1016/j.jinteco.2023.103874

[17] Santos Silva, J.M.C, and Silvana Tenreyro, 2006. The log of gravity. Review of Economics and Statistics 88(4), 641-658. https://doi.org/10.1162/rest.88.4.641

[18] Sytsma, T., 2022. Improving Preferential Market Access through ROO: Firm-Level Evidence from Bangladesh. American Economic Journal: Economic Policy 14(1), 440-472. https://doi.org/10.1257/pol.20200257

[19] UNCTAD, 2023. The Generalized System of Preferences: How much does it matter for developing countries? Geneva: UNCTAD.

Table 1: Summary statistics for EU preferential access regimes[a]

	Value-added ROO (%) (1)	Preference margin (2)	Total exports (3)	Preferential exports (4)	Non-Pref. exports (5)
			Top panel		
			All GSP beneficiaries		
Mean	0.46	1.04	0.27	0.16	0.11
Standard deviation	0.13	0.02	8.27	5.22	3.95
Median	0.50	1.04	0.00	0.00	0.00
Minimum	0.30	1.00	0.00	0.00	0.00
Maximum	0.60	1.14	1810	983	826
			Bottom panel		
			African beneficiaries only		
Mean	0.41	1.04	0.90	0.07	0.83
Standard deviation	0.13	0.03	52.3	2.39	52.0
Median	0.30	1.04	0.00	0.00	0.00
Minimum	0.30	1.00	0.00	0.00	0.00
Maximum	0.60	1.15	98700	244	98600

[a]In the top panel, we report summary statistics in the full sample for all GSP beneficiaries and in the bottom panel for only LDC beneficiaries. The data spans the period 2008-2019. Preference margins are defined as $(1+T)/(1+t)$ where T is the MFN rate and t the preferential rate, both at the 6 digit HS level. This takes the value 1 in the absence of a margin ($t = T$) and a value larger than 1 in the presence of a preference margin ($t < T$).Exports are in USD million. The averages are calculated at the HS 6-digit level.

Table 2: Value-added ROO and GSP exports to the EU[a]

	All GSP exporters		African exporters	
	Linear	Square root	Linear	Square root
	$\alpha = br$	$\alpha = b\sqrt{r}$	$\alpha = br$	$\alpha = b\sqrt{r}$
	(1)	(2)	(3)	(4)
Preference margin	6.088*	6.088*	-20.393$^{\circledast}$	-20.016$^{\circledast}$
	(1.441)	(1.441)	(8.191)	(8.215)
ROO	-2.467*	-3.096*	-5.606†	-6.981
	(0.761)	(0.955)	(3.362)	(4.978)
Observations	10361	10361	2133	2133
Pseudo R^2	0.991	0.991	0.953	0.953

[a]Note: All regressions use a pseudo Poisson maximum likelihood estimator and contain exporter×year, product×exporter, and product×year fixed effects. Statistical significance is indicated with superscript $\star$ for p-value< 0.01, $\circledast$ for p-value< 0.05, and $\dagger$ for p-value< 0.10. In all regressions, standard errors are clustered at the 4-digit of the HS product×year level to account for the fact that this is the level at which ROO are set in the EU. The first two columns provide results for the full sample of GSP exporters and represent the results in Kniahin and Olarreaga (2023), and the last two columns focus on the sub-sample of African exporters. Columns (1) and (3) assume a linear relationship between α and r, and columns (2) and (4) a square root relationship.

Table 3: Value added maximizing ROO ($r^\star$)[a]

	All GSP exporters	African exporters only
Assumption $\alpha = f(r)$	$r^\star$	$r^\star$
	(1)	(2)
Linear function[b]	0.41	0.18
	(0.13)	(0.11)
Square root function[c]	0.57	0.38
	(0.09)	(0.14)

[a]The first column uses the estimates in the first two columns of Table 2. The second column applies the estimates in the last two columns in Table 2. Each row uses a different assumption regarding the relationship between α and r corresponding to the columns in Table 2. The first row uses a linear function, and the second row a square root function. Numbers in parentheses are standard errors.

[b]See equation (12) for the value added maximizing ROO and equation (14) for the standard error.

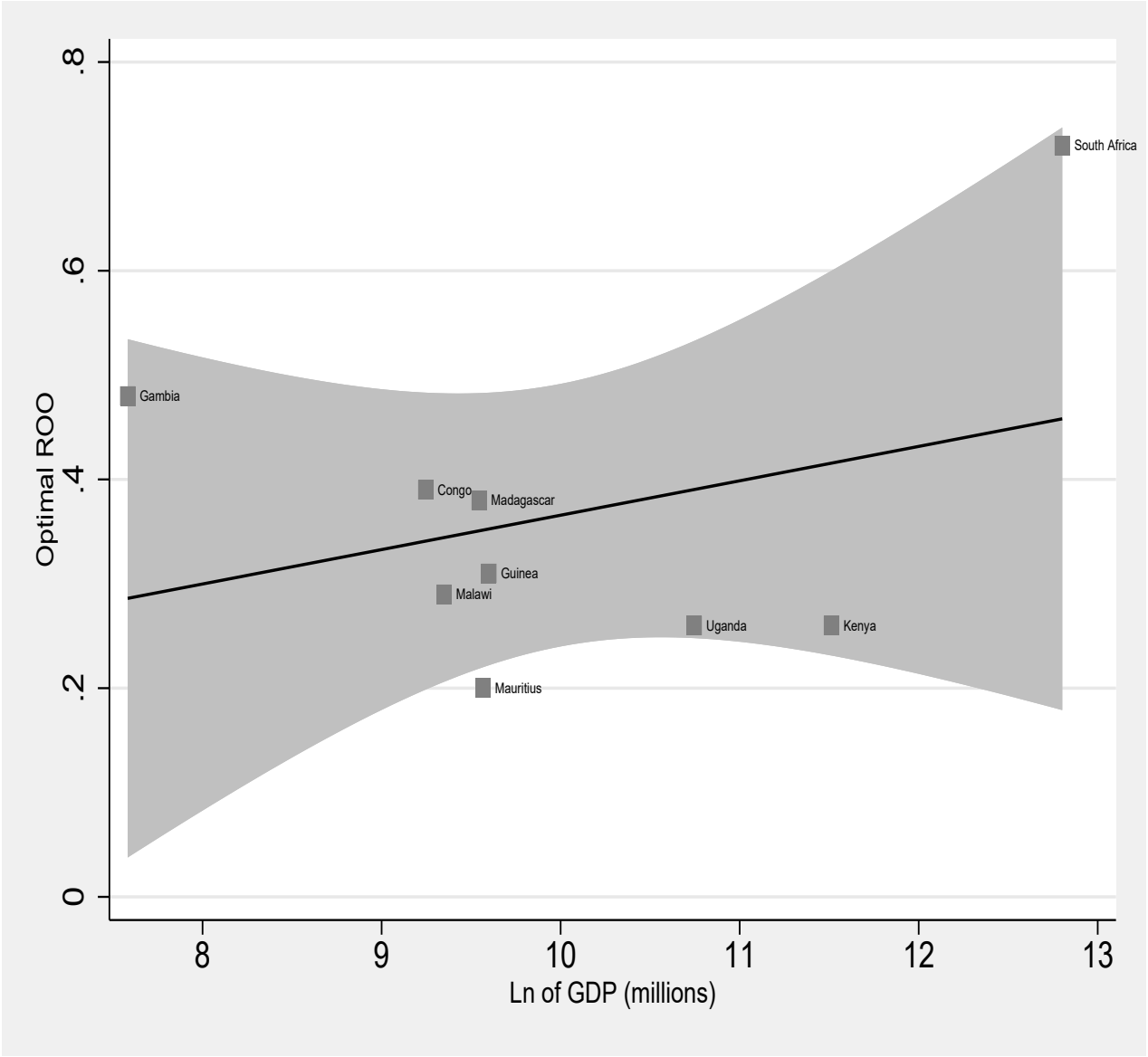
[c]See equation (13) for the value added maximizing ROO and equation (15) for the standard error.

Table 4: Value added maximizing ROO by African country[a]

Country	Linear function	Square root function
	(1)	(2)
Congo	0.20	0.39
	(0.14)	(0.14)
Gambia	0.36	0.48
	(0.27)	(0.16)
Guinea	0.14	0.31
	(0.15)	(0.17)
Kenya	0.09	0.26
	(0.05)	(0.07)
Madagascar	0.17	0.38
	(0.14)	(0.20)
Mauritius	0.05	0.20
	(0.04)	(0.08)
Malawi	0.13	0.29
	(0.21)	(0.24)
South Africa	0.50	0.72
	(0.65)	(0.65)
Uganda	0.09	0.26
	(0.04)	(0.06)

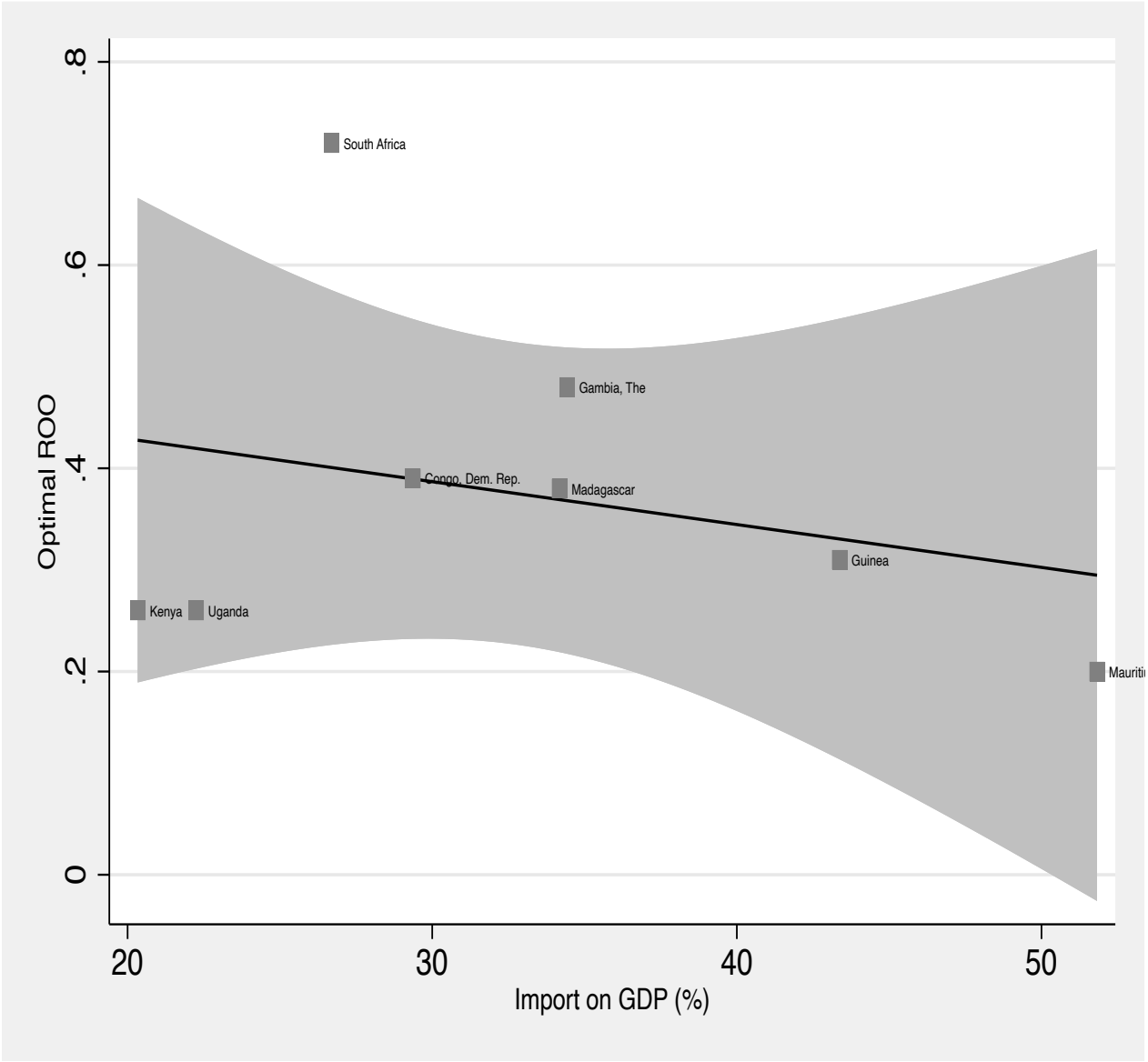
[a]The first column assumes a linear relationship between α and r; the second column assumes a square root relationship between α and r. Standard errors in parentheses.

Figure 1: value added maximizing ROO ($r^{\star}$) and country size



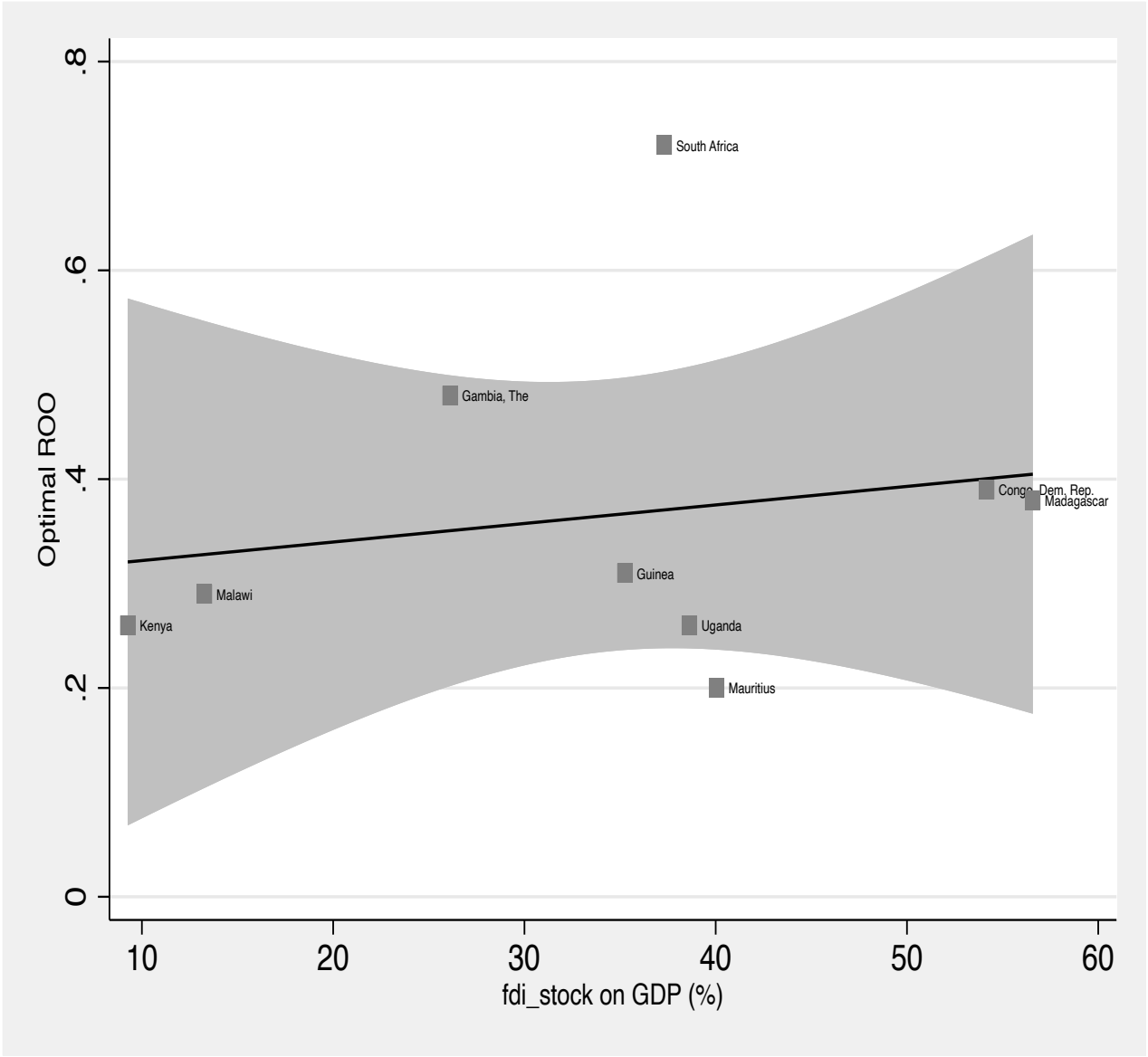
Note: The y-axis reports the value of the value added maximizing ROO using the square root function assumption reported in the second column of Table 4. The x-axis is the natural log of GDP measured in millions of 2015 USD obtained from the World Development Indicators.

Figure 2: value added maximizing ROO ($r^{\star}$) and country's import



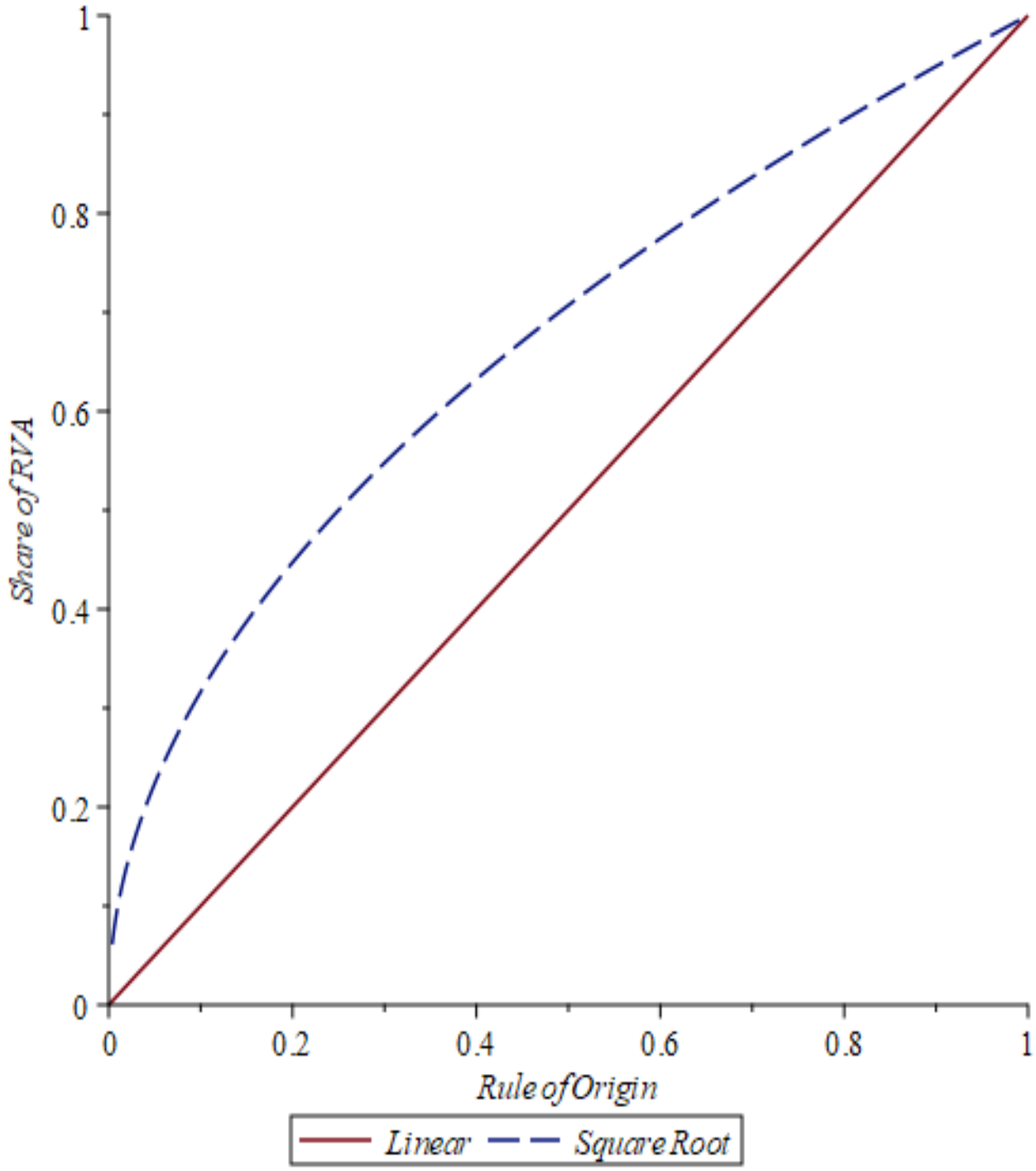
Note: The y-axis reports the value of the value added maximizing ROO using the square root function assumption reported in the second column of Table 4. The x-axis is the share of imports on GDP in 2019, obtained from the World Development Indicators.

Figure 3: value added maximizing ROO ($r^{\star}$) and country's FDI



Note: The y-axis reports the value of the value added maximizing ROO using the square root function assumption reported in the second column of Table 4. The x-axis is the share of the FDI Stock on GDP in 2019, sourced from the UNCTAD World Investment Report.

Figure 4: Relationship between share of Beneficiaries Value-Added (α) and ROO (r)



Note: The linear relationship assumes $\alpha = r$, and the square root relationship assumes $\alpha = \sqrt{r}$.

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