Structural and policy determinants of export diversification in Africa: A bilateral panel approach using Bayesian Model Averaging

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Abstract

Economic diversification plays a crucial role in fostering economic growth. Export diversification policies attempt to defy an existing comparative advantage in low value-added goods to promote transformation. Many structural, general policy, and trade-related determinants of export diversification have been identified as important in the literature. This paper provides a literature review on the determinants of export diversification, and applies Bayesian Model Averaging (BMA) to tackle model uncertainty stemming from the vast number of possible determinants. The paper assesses the relevance and impact of up to 46 factors for export diversification of up to 47 African countries and 123 trading partners from 1995 to 2018. It finds that exporter, importer and bilateral characteristics are important determinants. Notably, African countries' structural features and trade policies significantly determine diversification. The analysis shows further that the trading partner's characteristics also can impact diversification patterns. The findings highlight the potential of the African Continental Free Trade Area (AfCFTA) to foster export diversification. Additionally, the findings suggest that the goal to diversify exports at the extensive and intensive margins might not be achievable via the same policy options, or might even be competing policy goals in the short run. Lastly, education, the quality of institutions, and a better-developed service sector as non-trade policy variables are important for diversification.

Keywords: Export diversification, Export variety, African economies, Economic growth

JEL: F14, O19, O24, O25, C23

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1 Introduction

A move towards higher productivity exports and a more diversified economic structure is crucial for Africa and, in particular, its resource-dependent economies. Economic diversification plays a decisive role in fostering economic growth and combating global poverty. In this regard, it should be noted that Sustainable Development Goal (SDG) 8.2 aims to improve productivity through diversification, technological upgrading, and innovation. Often limited to exporting low productivity and low value-added goods, export diversification policies of developing countries attempt to defy their existing comparative advantage to promote economic transformation (Lectard and Rougier, 2018; Mania and Rieber, 2019). For the endeavor towards more diversified exports resulting in growth, it is crucial to understand why countries have relatively concentrated export baskets. Therefore, this paper examines structural and policy determinants of export diversification in Africa, the world's least export diversified region.

A significant strand of literature is concerned with the relationship between export diversification and economic growth. Many studies find a positive relationship between export diversification and economic growth, especially in the earlier stages of development (Herzer and Nowak-Lehnmann, 2006; Mau, 2016). [1] Some papers also focus on identifying export diversification as having a positive impact on economic growth causally (Gözgör and Can, 2017). The empirical evidence of the positive impact of diversification on growth is strong. However, there is no clear consensus about the homogeneity of the relationship between economic growth and diversification at different stages of development, where results are more mixed. Imbs and Wacziarg (2003) were the first to identify a "hump-shape" relationship between the two variables. They observed a positive relationship between diversification of production and growth at an early stage of development, followed by a trend of re-concentration in the later development phases. This evolution over the development path can be explained by new products being added at low levels of development, and other products being discontinued to be exported at later development stages, as products are now further away from a country's endowment of production factors or can no longer be produced competitively (Cadot et al., 2011a; Aditya and Acharyya, 2013). However, the case for a re-concentration of exports is contested, though there is consensus that economies seem to diversify more at earlier development stages (Parteka, 2010; Parteka and Tamberi, 2013; Mau, 2016). Additionally,

[1] See also Sarin et al. (2020) for an overview of the literature on export diversification and economic growth.

economic diversification and increasing economic complexity can also promote social and sustainable development (Ferraz et al., 2021).

Two channels linking diversification to sustainable economic growth are identified, namely reduced volatility, and changes in the productive structure (Acemoglu and Zilibotti, 1997; Mania and Rieber, 2019). Notably, many developing countries struggle with volatile gross domestic product (GDP) growth, as they often specialize in fewer, more volatile and shock-prone sectors (Koren and Tenreyro, 2007). Therefore, changes in commodity prices, demand shocks, and exchange rate volatility prove challenging to manage, and bring about more volatile production growth (Gelb, 2010). Geographic export diversification (existing products to new markets), product export diversification (new products to existing/new markets), and diversification at the intensive margin (existing products to existing markets) can help mitigate this volatility (Kramarz et al., 2020; Rondeau and Roudaut, 2014; Brenton and Newfarmer, 2007). Mitigating these risks is especially relevant for volatility created by trade openness, particularly for rarely diversified economies (Balavac and Pugh, 2016; Haddad et al., 2013). Therefore, export diversification effectively increases macroeconomic stability and fosters economic growth through a portfolio effect (Agosin, 2009; IMF, 2014).

A second source of growth through diversification is an economy's changing productive structure. The basket of products that are exported or produced by an economy is strongly path-dependent (Hausmann et al., 2007; Hidalgo et al., 2007). Market imperfections, such as discovery costs or high fixed-costs, might initially prevent countries from producing goods that could be competitively produced after the introduction to the export basket (Hausmann et al., 2007). Furthermore, spillovers of finance and technology – e.g., learning by exporting – can boost economic growth. The literature around economic complexity concept takes a more detailed look at the relatedness and complexity of products added to production. Export diversification, in this view, should be targeted at more complex products, and in a "denser" part of the product space to substantially promote growth and development (Freire, 2021). Hence, the "quality" of diversification is important for changes in the productive structure (Mania and Rieber, 2019). Overall, empirical studies confirm the positive effect of export diversification on productivity growth (Akram and Rath, 2017; Feenstra and Kee, 2008). In summary, the extensive margin is more relevant than the intensive margin for the productivity channel.

In Africa, export diversification could be a significant driver of productivity and production growth (Ben Hammouda et al., 2010; Cabral and Veiga, 2010; Calderón et al., 2020)[2]. Africa lags behind in economic activity compared to the continent's size. The continent is marked by low intra-regional trade and the concentration of export baskets to non-African countries, particularly for natural resources (Olney, 2021). UNCTAD's *Commodities and Development Report 2021* shows how commodity-dependent developing countries failed to follow the growth in labor productivity of non-commodity-dependent developing countries. Concentration of production is contributing to the fragility and volatility of growth in Africa's poorly-diversified economies, and is also hindering productivity gains from structural change (Ben Hammouda et al., 2010). Hence, export diversification is key to promoting economic growth in Africa, especially for resource-dependent countries struggling with diversification (Hodey et al., 2015). Furthermore, employment opportunities in Africa improve through export diversification, which is crucial given the high rate of unemployment and informal employment (UNCTAD, 2018).

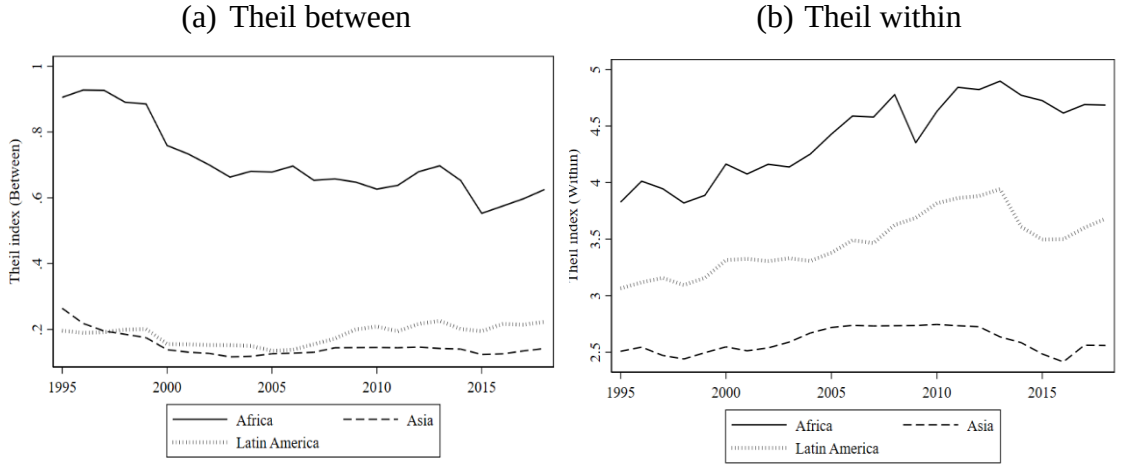
In comparison to Asia or Latin America, exports of African countries are more concentrated. Figure 1 presents the trend of the two components of the Theil index for Africa compared to the Asian and Latin American regions from 1995 to 2018. While the Theil concentration index as a common indicator for export concentration[3] will be discussed in more detail later in this paper, the between component relates to the extensive margin of trade (distribution of products), and the within component to the intensive margin of trade (distribution over trade value). Hence, a large value for the Theil between indicator shows that only a few products are exported, while a large value for Theil within indicator suggests that a large part of the export value is realized from a few products. The figure shows that African exports are much less diversified than exports in Latin America and Asia, both at the intensive and the extensive margins. This observation is applicable when comparing only African least developed countries (LDCs) to non-African LDCs (Figure 2). This comparison considers the regional composition of countries at different stages of development. Concentration at the extensive margin is considerably higher comparing the full African sample with the LDC sample. At the same time, the distance to the non-African LDC sample is much smaller in comparison to the other regions in Figure 1. However, overall, exports of African LDCs are much more concentrated compared to other

[2] Findings of Mania and Rieber (2019) find a less robust effect of export diversification on growth of Sub-Saharan African countries for a more recent sample. However, they also find a modest positive effect for diversification at the extensive margin on sustainable growth.

[3] The index is defined as a concentration index, i.e. larger values indicating higher concentration. However, due to its usage in the literature on diversification, it is at times also referred to as index of export diversification.

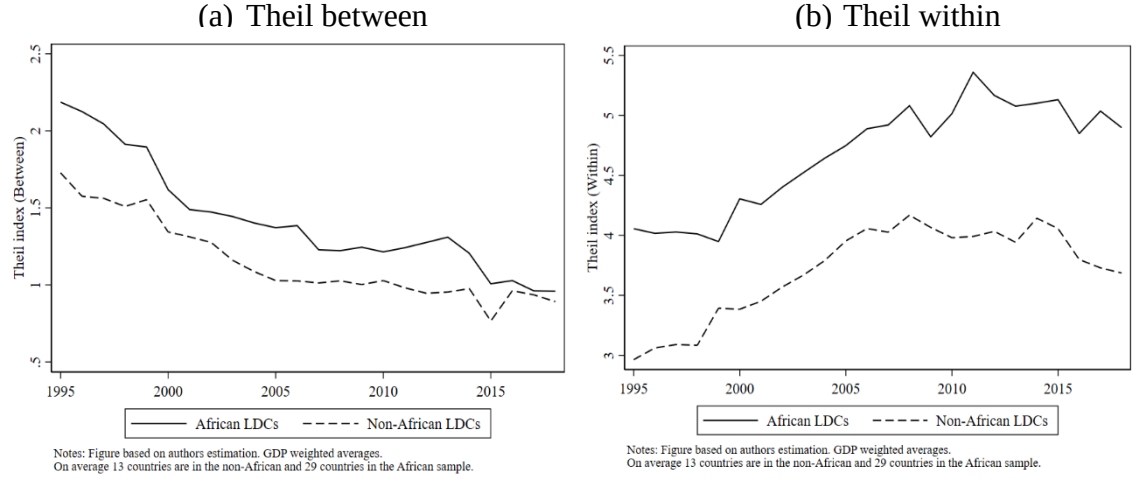
regions. Consequently, African countries are exposed to increased volatility and cannot fully tap into their potential growth by changing their productive structure to more complex goods. Therefore, it is highly relevant for Africa's development to determine policy drivers that can foster export diversification and identify structural factors hindering it.

Figure 1: Theil index components for different world regions



Notes: Figure based on author's estimation. GDP weighted averages. High income countries excluded. On average, 31 Asian countries, 17 Latin American countries and 47 African countries are included.

Figure 2: Theil index components for African and non-African LDCs



Notes: Figure based on author's estimation. GDP weighted averages. On average 13 countries are in the non-African and 29 countries in the African sample.

This paper contributes in two distinct ways. First, it will present a review of covariates found to be significant determinants of export diversification in the literature. However, as the literature

finds a multitude of determinants to be important, a major problem with model uncertainty arises. Secondly, this paper applies Bayesian Model Averaging (BMA) to tackle that challenge empirically and assesses the most relevant factors for export diversification in developing countries.

Closest to the BMA analysis of this study is the work of Jetter and Hassan (2015). The authors use BMA for a cross-section of 105 developing and developed countries to identify determinants of (unilateral) export diversification. School enrollment and natural resources were the strongest predictors of export diversification, investigating 36 potential determinants. In contrast, the presented analysis in this paper is focused on Africa and distinguishes between diversification at the extensive and intensive margin of trade. Moreover, it is focused on export diversification in a bilateral and unilateral panel structure.

There are three particular benefits of the additional focus on a bilateral panel. (1) Amurgo-Pacheco and Pierola (2008) show that destination-specific factors matter, and export diversification often appears in geography rather than in products. It is not merely important to discover new products, but to also export them to other markets via geographical diversification (Brenton and Newfarmer, 2007). An analysis of bilateral diversification measures is well suited to investigate geographical diversification. (2) A bilateral panel allows a closer analysis of direct trade policy changes. For example, Cadot et al. (2011b) find a diversifying effect of trade liberalization. Many regional integration patterns play a crucial role in the African setting. Therefore, the approach adopted here allows for an investigation into intra-African trade and Regional Trade Agreements (RTAs), which might also provide interesting insights into the ambitions of AfCFTA. (3) Africa faces several structural challenges, such as fractionalization or far distances. Identifying the effects of these challenges may improve the understanding of the differences in diversification compared to other world regions and develop policies which, if implemented, could better mitigate these challenges. The bilateral approach allows to control for variables, such as tariffs, distance, common language or trade costs that are particularly important to Africa. Nonetheless, results on determinants for unilateral diversification measures will be presented for completeness.

The remainder of the paper is structured as follows: Section 2 will review the existing literature on the determinants of export diversification. The empirical strategy will be laid out in Section 3, where the main measure of export diversification – the Theil index – will be discussed and some theoretical reflections on the empirical strategy will be presented. Also, the BMA

methodology will be introduced and the data used will be described. The results of the analysis are presented in Section 4. The focus will be on the full sample of African trading partners, followed by only intra-African trade flows. Additional extensions on regional integration and robustness checks will be provided. Section 5 outlines the key conclusions of the paper.

2 Literature Review

Many determinants of export diversification have been identified.[4] For this study, determinants are divided into three groups: Structural determinants, general economic policy variables and trade policy variables. In this section, the paper will first discuss determinants of export diversification in general before turning to the literature on Africa specifically. Table 1 contains an overview of determinants of export diversification studied in the literature and presents an assessment of the evidence regarding the impact on export diversification. Table A4 in the Appendix lists all studies considered concerning each determinant.

Structural factors significantly determine export diversification. Most studies on structural factors are conducted unilaterally by estimating the effect on the number of exported products, at the extensive margin of trade. Regolo (2013) marks a notable exception in investigating determinants of export diversification using a bilateral Theil index. Typical determinants are classical gravity model variables, such as distance to trading partners and markets, or being landlocked. These factors are expected to increase both trade costs and export concentration (Feenstra and Kee, 2008; Dutt et al., 2013). On the other hand, factors facilitating trade – common cultural factors and sharing a common border – diversify exports (Amighini and Sanfilippo, 2014; Beverelli et al., 2015; Regolo, 2013). Economic remoteness (distance weighted by GDP) and differences in endowments of trading partners have a negative effect on diversification (Agosin et al., 2012; Regolo, 2013). More populated countries tend to have more diversified structures (Lectard and Rougier, 2018). While policies can influence population growth, population size is categorized in this paper as a structural variable, as it is hard to influence in the short or medium-term. A resource curse mechanism is also found to be relevant for export diversification. Countries with higher rents from natural resources are more concentrated in their product baskets (Bahar and Santos, 2018). Overall, structural features

[4] For a first overview, see also Cadot et al. (2013).

might significantly hinder diversification in Africa, especially as the continent is fractionalized, distances to markets are large, and many countries depend on commodity exports.

Table 1: Determinants of Export Diversification in the Literature

Determinant	*Evidence*	*Determinant*	*Evidence*
Structural		Market Entry Cost	-
Colony	+	Poverty	-
Common Colonizer	+	Prices	-
Common Language	+	Productivity	+
Common Religion	+	R&D	**0**
Contiguity	+		
Differences in Endowments	-	**Policy (trade)**	
Distance	-	Age of existing products	+
Land Area	-	Aid for Trade	**0**/+
Landlocked	-	Capital Account Openness	+
Natural Resources	-	Centrality of RCA	-
Population	+	Exchange rate depreciation	+
Remoteness	-	Exchange rate misalignment	**0**
Spatial Spillovers	**0**/+	Exchange rate volatility	weakly -
Policy (general)		FDI	+
Agriculture	**0**	Exported Distance to endowments	mixed
Aid	**0**/+	Imports from other dev. countries	+
Development	+	International standard harmonization	+
Differences in GDP	+	Market Access (other measures)	+
Differences in TFP	-	Market Access (PTAs)	+
Financial Development	weakly +	Market Access (Tariffs faced)	-
Human Capital	+	Market Access (Trade openness)	**0**/+
Inflation	**0**/-	Tariffs imposed (on imports)	+
Infrastructure	weakly +	Terms of Trade	**0**/-
Institutions	+	Trade Facilitation	+
Interest rate	**0**	Trade with developed country	+
Investment	weakly +	Unilateral standards	-
Manufacturing	+	WTO membership	weakly +

Notes: **For a detailed list** that **includ**es **the studies summarized, see Table A4 in the Appendix.**

The second group of determinants incorporates general economic factors that policies could (at least partly) influence, not including trade-related factors. The most discussed relationship is between development (usually measured by GDP per capita) and export diversification. Overwhelming evidence for a positive impact of GDP per capita on diversification is found (Parteka and Tamberi, 2013). Other factors that influence export diversification positively are increased productivity (Cieślik and Parteka, 2021), e.g., through the accumulation of human

capital (Jetter and Hassan, 2015) or the reduction of production costs, e.g., by the reduction of market entry costs (Dennis and Shepherd, 2011). Furthermore, weaker evidence is found for a positive influence of better infrastructure (Elhiraika and Mbate, 2014), more developed financial markets (Nieminen, 2020), and higher investments (Tadesse and Shukralla, 2013).

On the other hand, higher prices and inflation seem to harm diversification (Dennis and Shepherd, 2011). While a higher share of manufacturing activities in the structure of an economy is favorable for variety (Tadesse and Shukralla, 2013), a higher share of agricultural activities has no effect (Parteka and Tamberi, 2013). Weak institutions and higher poverty rates appear to concentrate exports (Gnangnon, 2020). The investigated studies did not find interest rates, research and development (R&D), and aid to be significant and robust determinants of export diversification.

Lastly, trade-related determinates are also investigated. For example, market access, measured by tariffs faced by the exporter, preferential or free trade agreement membership fosters diversification (Nicita and Rollo, 2015). However, Dennis and Shepherd (2011) find that higher imposed tariffs on imports increase export variety. While tariff measures are well studied, non-tariff measures are understudied determinants of export diversification. Only Shepherd (2015) investigates the fixed-cost effect of (voluntary) standards on diversification. He finds that product standards overall hinder export diversification, although internationally harmonized standards can mitigate this effect. Differing effects stem from the exchange rate. A weaker exchange rate for exports seems to increase export variety by making exports more competitive (Goya, 2020). However, multiple studies show that an exchange rate misalignment, i.e., an overvaluation or undervaluation, does not affect export diversification (Sekkat, 2016). The evidence for the effects of exchange rate volatility shows a weak significant impact (Goya, 2020).

A significant driver of export diversification is trade facilitation. Multiple studies have found reducing trade cost also reduces product concentration, as expected (Feenstra and Ma, 2014). Meanwhile, the evidence on Aid for Trade (AfT) disbursements as a determinant is mixed. While Gnangnon (2019) finds a positive impact on diversification, Kim (2019) finds no significant impact, as most aid is primarily invested in already well-performing activities. Similarly, the evidence on foreign direct investment (FDI) as a relevant determinant of export diversification is mixed and rather suggests no significant effect (Amighini and Sanfilippo, 2014). Lastly, product variety can also be explained by product characteristics, i.e., product age,

distance to endowments, and comparative advantage (Lectard and Rougier, 2018; Minondo, 2011; Regolo, 2017).

This review also finds that bilateral factors of two trading partners determine export diversification. These may be differences in development and productivity, market access between the two, as well as cultural or geographical features. This further motivates the bilateral nature of this study.

Several empirical studies investigate determinants of export diversification in Africa, specifically. Mostly policy variables, general and trade-related, are found to be the most important determinants in the African setting. Fosu and Abbas (2019) find domestic credit to be the most critical Africa-specific determinant. Moreover, they find human capital, governance, and structural geographic factors, such as being landlocked, to be relevant. In a similar vein, Elhiraika and Mbate (2014) highlight the importance of public investment, human capital and the institutional framework. However, they also stress the importance of per capita income and infrastructure for export diversification. Similarly, Cabral and Veiga (2010) found human capital and better governance as central determinants. The analysis from Osakwe (2007) finds that aid, infrastructure and resource endowments are robust predictors of diversification. Furthermore, he does not find geographical features to be significant. In addition, Mosley (2018) identifies input subsidies as a catalyst for policies to promote diversification successfully.

Several studies highlight the importance of trade-related determinants. Fonchamnyo and Akame (2017) use a fractionalized logit model, and find that diversification is promoted through trade openness, FDI, and the economy's share of value-added in agriculture and manufacturing, while GDP is found to deter diversification. According to Masunda (2020), AfT improves export diversification, especially when invested in productive capacity. The African Growth and Opportunity Act (AGOA) tariff preference scheme also improves export diversification (Cook and Jones, 2015; Tadesse and Fayissa, 2008; Frazer and Van Biesebroeck, 2010). Nicita and Rollo (2015) show the broad importance of market access conditions in the form of tariffs and regional trade agreements (RTAs) as diversification determinants. An UNCTAD (2018) report underlines the relevance of integration into global value chains, as well as the importance of regional initiatives. However, the report also finds many other determinants to be relevant.

This literature review highlights an important contribution of this study. Even though many studies find human capital, institutions and market access variables to be significant, clear policy

priorities are hard to determine due to the multitude of findings. In addition, differences in the intensive and extensive margin of diversification are rarely considered.

3 Empirical Strategy and Data

This section lays out the approach to identifying relevant determinants. First, the measure of diversification used in the study is the Theil index. A brief theoretical foundation for the analysis is given, and the resulting estimation equation is presented. The paper then summarizes the Bayesian Model Averaging (BMA) method to deal with model uncertainty and many potential determinants. Finally, the variables and data used are presented.

3.1 Theil Index

This study uses the Theil index as the measurement of export diversification. The Theil index is a measure of concentration. Higher index values indicate concentration, while values closer to zero indicate a more diversified export basket. The benefit of the Theil index's is that it is decomposable into a ***between*** and a ***within*** component. The overall index and two sub-indices for a particular country are given by Cadot et al. (2011a; 2013):

$$T = \frac{1}{n} \sum_{k=1}^{n} \frac{x_k}{\mu} \ln\left(\frac{x_k}{\mu}\right) \qquad (1a)$$

$$T^{Between} = \sum_{j=0}^{J} \frac{n_j}{n} \frac{\mu_j}{\mu} \ln\left(\frac{\mu_j}{\mu}\right) \qquad (1b)$$

$$T^{Within} = \sum_{j=0}^{J} \frac{n_j}{n} \frac{\mu_j}{\mu} T_j \qquad (1c)$$

where k is a specific product line of all product lines, n; $x_k$is the value of the exports in a specific product line, μ is the average product line value: J is the number of partitions of all exports into subgroups; and T_j is the Theil total index for group j.

The Theil between (equation 1b) gives an index of the number of active export lines. It relates well to the concept of the extensive margin of trade. Therefore, a lower value of the between Theil indicates a larger variety of goods being exported. On the other hand, the within component (equation 1c) relates to the intensive margin of trade. It indicates the distribution of trade value among active lines. A lower value for the Theil within is equivalent to a more even and diversified distribution of existing trade, less dominated by large trade flows in only a few products. In conclusion, the Theil within is more relevant to the policy goal of macroeconomic

stability as it indicates a dependency on some few large exports. At the same time, the Theil between is more relevant to the goal of a more complex production structure as it indicates the capability of producing different goods.

Since the two components measure different concepts, the paper will focus only on the separate components, not the Theil total. It also should be noted that changes in the indices might not always be straightforward to interpret. For example, the intensive margin could become more equally distributed through rather adverse events, like price changes or export lines with large value becoming less competitive. Hence, a diversifying effect on the Theil within must not strictly be a positive outcome. Changes in the Theil between are clearer to judge.[5] A decrease in the Theil between represents more products being exported, and thus, more complex production capabilities. Additionally, the number of exported products will be considered to check for robustness at the extensive margin.[6]

A further distinction has to be made between the interpretation of the indices for the bilateral panel approach in contrast to a unilateral panel. While a decreasing Theil between index indicates new products being added to the country's overall export basket, this is not true for the bilateral analysis. Here, the decreasing Theil between index indicates that a new product is added to the export basket to a specific country. This product might have been exported to other countries before. Therefore, the bilateral investigation focuses more on a geographical dimension of diversification. To get a complete picture, the paper will provide results using a unilateral panel for African exporters, following the analysis using the bilateral panel.

3.2 Econometric Specification

For the bilateral case, a theoretical foundation for the analysis can be drawn from Eaton and Kortum (2002). They describe the share of goods π_{ji} that an exporter *i* provides to an importer *j* as a function of characteristics of the exporter, the importer and the rest of the world:

$$\pi_{ji} = \frac{T_i(c_i d_{ji})^{-\theta}}{\sum_{k=1}^{N} T_k(c_k d_{jk})^{-\theta}} \qquad (2)$$

[5] This is true for countries that are not diversified, and therefore, are not yet benefiting from re-specialization. See the discussion on the ”hump-shape” in the Introduction.

[6] A difference in the number of observations of the Theil between and the number of exported products exist. This difference stems from missing bilateral trade data. While missing trade will result in a zero for the number of products exported, these observations can not be used to calculate the Theil index as ln(0) is not defined.

where T_i is productivity parameter, c_i are input costs, d_{ji} are "iceberg" trade costs, θ is a distribution parameter, and N is the number of all countries.

Therefore, the share of bilaterally exported goods is determined by exporter-specific covariates regarding productivity and input costs, a bilateral trade-costs term, and importer characteristics, compared to the rest of the world. The latter will be proxied by including the same variables for the importer that are included for the exporter and a GDP-weighted distance of the importer to the rest of the world (referred to as market proximity from here on). As equation (2) suggests, both exporter and importer characteristics are relevant. Therefore, data for both countries will be used on possible determinants from the literature.

Hence, the following estimation equation for bilateral export diversification arises:

$$y_{ijt} = \beta_1 E_{it} + \beta_2 D_{jt} + \beta_3 Z_{ijt} + \gamma_i + \delta_j + \eta_t + \epsilon_{ijt} \qquad (3)$$

where *i* refers to an African exporter, *j* refers to an importer of the global sample or African sample respectively, y_{ijt} is a measure of bilateral export diversification, E_{it} are exporter-specific variables, D_{jt} are importer-specific variables, Z_{ijt} are bilateral trade costs variables, γ_i are exporter-fixed effects, δ_j are importer-fixed effects, η_t are time-fixed effects, and ϵ_{ijt} is the error term. Included are the various fixed effects controls for unobserved exporter-specific, importer-specific effects, and time trends.

3.3 Bayesian Model Averaging

The literature review of determinants of export diversification above suggests a multitude of covariates to be included for E_{it}, D_{jt} and Z_{ijt}, even though the review does not claim to be comprehensive. This gives rise to the question of which variables to include and which not to, i.e., the problem of model uncertainty. Most studies focus on a particular founding factor and only include a few other principal covariates. However, the question arises if the determinant is still a statistically significant factor if all other determinants are included. Including all other potential determinants is usually unfeasible, as collinearity becomes an issue adding more and more variables. Another important question is the ranking of importance of the investigated variables.

Instead of choosing the single best model by using a relatively arbitrary criterion, the paper will resort to BMA.[7] BMA addresses the particular problem of model uncertainty and has been applied empirically (see Fernandez et al., 2001; Sala-i-Martin et al., 2004; Moral-Benito, 2012). The method uses posterior model probabilities (PMP) as weights to average the coefficient estimates over models and parameters (Steel, 2020). There are several advantages to model averaging procedures. Model averaging makes use of all models available, and is therefore more robust and outperforms relying on a single, potentially misleading model (Raftery et al., 1997). Even more, it gives a sense of how certain or uncertain estimates are. In contrast, model selection or optimization by the researcher might give false confidence, as no information is given on how estimates behave in the second or third best model. Signaling the regressors' relevance (model selection) also makes the results more informative compared to weighted-average least squares or other frequentist model averaging approaches.[8]

To illustrate the method, suppose there is a set $M = \{M_1, \dots, M_I\}$ of models considered. As K is the number of possible covariates that can be included or excluded, the model space consists of 2^K models (therefore I $\in [1,2^K]$). We are interested in the posterior distribution of our parameter vector β given our data D ($p(\beta|D)$). This posterior distribution is the parameter estimates of each model $p(\beta \mid M_k, D)$ weighted with the model fit, i.e., the PMP of the respective model $\mathrm{p}(M_k \mid D)$:

$$\mathrm{p}(\beta \mid D) = \sum_{k=1}^{2^K} p(\beta \mid M_k, D)\mathrm{p}(M_k \mid D) \quad (4)$$

The posterior model probability is directly proportional to the marginal likelihood of the model $p(D \mid M_k)$, i.e., the probability of the data given the respective model, and the prior model probability $p(M_k)$[9], which represents the researcher's beliefs about how probable the model is:

$$p(M_k \mid D) \propto p(D \mid M_k)\, p(M_k) \quad (5)$$

The estimation of the marginal likelihood depends on Zellner's g-prior on the parameters and the model priors. Determining the posterior model probabilities depends crucially on the choice

[7] Dynamic model averaging will not be considered, as the analysis is focused on general relationships rather than structural breaks in the relationships.

[8] Steel (2020) gives an excellent introduction and overview for model averaging in economics.

[9] For readability, only the general idea of BMA is presented and the paper obstains from extensively covering a comprehensive and technical explanation of BMA. See Hasan et al. (2018) for a full and well structured display of the technical structure of BMA.

of both priors. Usually, parameter estimates are quite robust to prior choice; PMPs are, in contrast, quite sensitive to prior choice (Steel, 2020). Smaller values for g represent the researcher's prior beliefs of the coefficients being zero, while a large g gives a lot of weight to the coefficients of the first-best model (Feldkircher and Zeugner, 2012). Instead of setting a fixed g-prior for all models, one can also use a flexible prior like the empirical Bayes local (EBL) prior or hyper-g prior. Feldkircher and Zeugner (2012) show that flexible priors are the preferred option with questionable or low data quality, as the g-prior may adjust for each model. The EBL prior will be used as it produces similar results from the hyper-g prior (Feldkircher and Zeugner, 2009). The modelling via g-priors is also reducing the problem of multicollinearity (Robert, 2007).

The model prior refers to the probability of inclusion of each variable. Setting the model prior to a uniform prior assumes a probability of 0.5 if a covariate should be included and is therefore agnostic. The robustness of the results is checked using other priors, i.e., the beta-binomial prior proposed by Ley and Steel (2009). This prior is even more agnostic and represents a lack of prior knowledge. However, the results remain mostly unchanged.

Computationally, it would become unfeasible to estimate each model when investigating numerous explanatory variables. Therefore, a Markov Chain Monte Carlo (MCMC) sampler is deployed to sample the model space and approximate the PMP of the most likely models. A new model is proposed in each step and compared to the current model.[10] Thus the analysis makes use of a birth-death sampler.[11] If the new model has a higher PMP, it becomes the current model. If rejected, the "old" model is kept and compared against a new iteration. Both models are compared, and the algorithm decides if it accepts the new variable. With more iterations, the number of times a model is kept converges to the distribution of PMPs. The PMP will be calculated precisely for the best model draws and compared to the approximation values from the MCMC procedure. Zeugner (2011) gives a value of 0.9 as a reasonable degree of convergence.

An important metric for studying the importance of particular covariates is the posterior inclusion probability (PIP). The PIP gives the mass of models that include a particular regressor

[10] The R package BMS is used for this paper, as it offers a multitude of prior choices and sampling methods.

[11] The birth-death sampler is preferred over a reversible-jump sampler in this study since the obtained results are similar, but convergence performance is slightly worse for the reversible-jump sampler.

and therefore is well-suited to study sets of determinants. It is calculated as the sum of the PMPs of models that include the variable. Threshold values for a covariate regarded to have effects are given by Kass and Raftery (1995) and Eicher et al. (2012). PIPs smaller than 0.5 are seen as not impactful. PIPs give weak evidence for an effect between 0.5 and 0.75, positive evidence between 0.75 and 0.95, strong evidence between 0.95 and 0.99, and decisive evidence greater than 0.99.

A significant limitation of employing this methodology and therefore, of this study, is the question of causality. There might be concerns that determinants – e.g. GDP per capita – and export diversification might be biased due to endogeneity. An instrumental approach is not practicable to control this issue, as finding valid instruments for all determinants employed is not feasible. Hence, the results have to be considered with caution. However, the paper argues that the issue of reversed causality is less severe for analyzing bilateral diversification. It is unlikely that one bilateral trade relationship of a country highly influences the country's overall GDP, for example. Furthermore, all determinants enter the model lagged by one period to reduce endogeneity concerns. Therefore, the results can be interpreted as an attempt to rank different determinants found to be significant in the literature. Investigations on causal relationships of individual determinants are better placed in individual studies that are able to tackle causality issues more appropriately.

3.4 Data

Data availability proves challenging, given the large number of variables considered. The estimation sample consists of 36 African exporters[12], up to 123 importing countries, and spans from 1995 to 2018. Missing data in one of the many variables that leads to the observation being dropped entirely from the estimation. Hence, the selection of variables and datasets used tries to balance the inclusion of as many relevant factors as possible and the loss of too many observations. Table A1 in the Appendix displays all variables used, their definitions and data sources. Considering the bilateral panel structure, 47 variables on exporter, importer or bilateral characteristics are used. Descriptive summary statistics of the bilateral estimation sample are given in Table A2. The following section provides an overview of the utilized variables.

[12] See Table A3 in the Appendix for a list of the exporting countries of the sample.

The CEPII BACI (2021) dataset is utilized to construct the various Theil indices. BACI provides a relevant improvement on the raw COMTRADE dataset. The original dataset is mirrored, and reported trade volumes are harmonized considering the data reliability of the respective reporter.

For structural determinants, the CEPII's (2021) Gravity and GeoDist databases provide information on bilateral distance, contiguity and common cultural features, such as language and religion. Moreover, data on population is used from these datasets. As described in the theory section, a measure for the importer's proximity to world markets is calculated from the data by weighting distances by GDP. This variable controls how competitive the target market is for the exporter, i.e., the proximity of the target market to economic powerhouses. Lastly, data on resource rents are taken from the World Bank's World Development Indicators (2021) to proxy the endowments of natural resources.

A large set of the included general policy variables is retrieved from the World Development Indicators (WDI) – particularly, GDP per capita controls for the level of development. Education is proxied by the gross secondary school enrollment rate. Infrastructure and digital infrastructure are measured by access to electricity and mobile cellular subscriptions, respectively. Data for gross capital formation is used for investments. The GDP deflator data measuring inflation is also taken from the WDI. Furthermore, data on financial development and the share of the service sector as important input, and the share of manufacturing in an economy is included. Institutional quality is proxied by using the first principal component of the six dimensions of the World Bank's World Governance Indicators (WGI). The Polity 5 (2020) dataset provides data on state institutions. Inward FDI stocks per capita retrieved from UNCTADstat (2021) mark the last general policy variable considered.

Trade-related policy variables are of particular interest as potential determinants of export diversification. Data on the general trade openness of an economy is again taken from WDI. Data on Aid for Trade disbursements is only available from 2002. This would reduce the sample investigated significantly; hence data on aid focused on trade is included in the form of AfT commitments. Exchange rate data is taken from the International Monetary Fund (IMF; 2022). The DESTA database of Dür et al. (2014) provides a dummy for any regional trade agreement. The effect of Regional Economic Communities (RECs) is of particular interest, as it could provide an insight into the potential benefits of the recently founded African Continental Free Trade Area (AfCFTA).

Tariff-related trade costs are accounted for in various forms. First, the trade-weighted average of the bilateral tariff rates that the exporting country faces on goods exported to the importing country is included. However, the indirect effects of import tariffs imposed by the exporting country might also be relevant. Increasing input costs by charging higher tariffs on said inputs could be considered. Therefore, import tariffs on intermediates, capital goods and raw materials are included in the estimations. All tariff data comes from UNCTAD TRAINS (2021) retrieved via World Bank's World Integrated Trade Solution (WITS) and are linearly interpolated to reduce missings. Non-tariff-related trade costs are proxied by the trade costs measured from the UN ESCAP (2021) database. Lastly, the data on exchange rate stability is taken from Aizenman et al. (2013).

Other variables that may be included have been considered. Some of these variables are the real effective exchange rate or other schooling measures, such as primary or tertiary enrollment. However, data on the variables covers few countries and years or contains too many missing elements. A problem also arises with coverage of UN ESCAP's trade cost data, which reduces the sample considerably. However, it proves to be a strong predictor of diversification when included. This highlights a second key limitation of this study. To put it frankly, what is not included in the estimations cannot be part of the outcome. Hence, the analysis must also be considered against the background of investigated variables and data availability. Each country pair is observed on average for 8.6 years in the estimation sample, and the average country has 79 trading partners over the sample period.

4 Empirical Evidence

The estimation results for the bilateral (i.e., geographical) diversification will be presented for the full and intra-African sample. The results for the extensive margin (Theil between and number of products) and the intensive margin (Theil within) are discussed. As argued above, both components measure a distinct form of diversification – new products versus an equal distribution of trade value. Hence, results for the combined total Theil are hard to interpret.[13] After discussing the baseline results of bilateral diversification, this section continues with the results for a unilateral diversification measure, as most of the literature is concerned with the

[13] Nonetheless, regression results for the Theil total are available upon request.

structure of the whole economy, rather than with bilateral trade relations. Finally, the heterogenous effect of Africa's RECs in light of export diversification is assessed.

Results presented include only covariates with a PIP greater than 0.5 to improve readability, but full results are reported in Table A5 to Table A12 in the Appendix. Furthermore, coefficients have been standardized to allow some interpretation of the impact size. Interpretation of the effects on the Theil index is not straightforward since the changes in the index have no natural interpretation, and the size of the determinates varies significantly. An exception to this procedure are the coefficients for the estimation on the number of products to allow for a more simple interpretation.

4.1 Bilateral Diversification Results – Full Sample

All baseline results presented are based on BMA estimates using an EBL prior, a uniform g-prior, and a birth-death MCMC-sampler. The model space comprises $2^{46} \approx$ seventy trillion (10^{12}) models using 46 Variables. Five hundred thousand burn-in draws and one million iterations lead to a good convergence of the PMPs.

Extensive margin

Table 2 below presents the baseline results for bilateral diversification on the extensive margin considering all trading partners of African exporters. The Theil between (column 1 of Table 2) and the number of products exported (column 2 of Table 2) are used as the measure relating to a change in an African country's export structure. The results show that significant determinants are diverse and cover characteristics of the exporting country, the importing country, bilateral factors, and structural and policy variables.

All bilateral structural factors prove to be highly significant predictors of bilateral export diversification at the extensive margin. Sharing common cultural features, such as language, colonizer or religion, are factors that are almost always included with a PIP equal to one. Exports of culturally close trading partners are much more diversified according to the Theil between, and trade a larger number of products. All other bilateral structural factors, except the common colonizer dummy, show large coefficients for the number of products, ranging from an increase of 24 products if the two countries share a common religion, and an increase of up to 173 products exported when sharing the same language. As expected, sharing a common border diversifies exports, and increases the number of products exported sharply by 248 products. Doubling the distance (increase of 100 per cent) between 2 countries reduces the products

exported by 152. The positive coefficient confirms the concentrating and significant effect in the estimation on the Theil between regressions. These bilateral structural factors are among the determinates with the largest impact on the number of products exported and Theil between. This highlights the importance of factors influencing export diversification that are not influenceable by policymakers.

Table 2 - Determinants of Bilateral Diversification - Extensive Margin

	Theil Between			**Number of Products**		
	PIP	Post Mean	Post SD	PIP	Post Mean	Post SD
Common Colonizer	**1.00**	-0.037	0.004	**1.00**	-95.04	6.25
Common Language	**1.00**	-0.125	0.005	**1.00**	173.33	5.54
Contiguity	**1.00**	-0.102	0.004	**1.00**	247.87	9.75
ln(GDPpc) - Exporter	**1.00**	-0.323	0.036	0.32	12.03	20.87
ln(GDPpc) - Importer	**1.00**	-0.266	0.051	0.07	0.12	5.66
REC	**1.00**	-0.050	0.004	**0.89**	24.80	12.19
Trade Costs	**1.00**	0.174	0.004	**0.89**	0.04	0.02
Institutions - Importer	**1.00**	-0.177	0.028	**0.99**	22.61	6.32
ln(Distance)	**1.00**	0.282	0.006	**1.00**	-152.17	4.33
Market Proximity - Importer	**1.00**	-0.199	0.043	0.15	-6.70	21.54
Common Religion	**1.00**	-0.016	0.004	**0.86**	24.13	13.28
Tariffs Intermediate Goods (imposed)	**0.98**	0.027	0.007	**0.81**	-1.83	1.12
Polity - Exporter	**0.98**	-0.038	0.012	0.31	0.64	1.14
Investments - Importer	**0.92**	-0.019	0.008	0.07	0.00	0.12
FDI - Importer	**0.80**	0.014	0.009	0.25	-0.01	0.02
Resource Rents - Exporter	**0.78**	0.019	0.012	0.14	-0.08	0.28
ln(Population) - Importer	**0.77**	-0.208	0.140	0.09	1.40	11.40
Services - Importer	**0.76**	-0.024	0.016	0.11	-0.05	0.24
Digital Infrastructure - Importer	0.49	-0.011	0.013	**0.74**	0.22	0.16
Financial Development - Exporter	0.18	0.005	0.014	**1.00**	-1.07	0.27
Infrastructure - Exporter	0.08	0.002	0.012	**0.76**	0.98	0.69
Exchange Rate	0.08	0.000	0.001	**1.00**	-0.02	0.00
Financial Development - Importer	0.04	0.000	0.003	**0.53**	-0.15	0.17
Corr PMP		0.99			0.93	
No. Obs.		24,617			25,384	

Note: Only explanatory variables with a PIP > 0.5 are presented. For the full table, see Table A5 in the Appendix. Standardized coefficients. Beta coefficients for number of products. Draws: 1,000,000; Burn-ins: 500,000; g-prior: EBL, model prior: uniform.

A relevant structural exporter-related factor are resource rents with a PIP of 0.78. Exporter countries in Africa with higher resource rent, a proxy for resource abundance, have more concentrated exports. This is in line with the literature (Bahar and Santos, 2018) and partly

confirms the resource curse argument. Despite this, no meaningful relevance for the number of products is found.

Other exporter-specific, but policy-related, determinants showing evidence of determining diversification are GDP per capita[14], polity, financial development and infrastructure. While the first two show decisive and strong evidence for diversification in the Theil between regression, they do not suggest to be strong determinants in the regression on the number of products. The opposite is true for the latter two regarding relevance. Financial development seems to reduce the number of products exported slightly, while a better infrastructure increases it. As argued above, even if endogeneity should be less of an issue for the bilateral panel and lagged terms being used, the caveat of not being able to control fully for potential reverse causality has to be acknowledged especially for the relationship between export diversification and GDP per capita.

A multitude of importer-related factors is found to be important. Starting with the most robust finding, better institutions in the importing country diversify the bilateral export structure significantly, and increase the number of products exported. The larger the importing country (in terms of population size and GDP per capita), the less concentrated trade becomes. Among other characteristics of the importing country relevant for the Theil between of African countries are investments, FDI and the service sector. However, the relevance of these determinants is rather small considering impact sizes and the lack statistical significance for the number of products. A higher share of mobile subscriptions, as a proxy for digital infrastructure and a less developed financial sector in the importing country are correlated with the higher number of exported products. But again, the economic significance is rather minimal, and no relevance for the estimation on the Theil index is found, which is why the paper refrains from further interpretation here. Overall, the analysis shows how characteristics of the importing country can be important determinants for geographical diversification depending on the measure used. Hence, the results show that not only "what you export matters" (Hausmann et al., 2007), but also the choice of trading partners is relevant, confirming the conclusions of Regolo (2013).

The last group of determinants is made up of factors regarding trade. Trade-related determinates are among the robust and economically significant influences regarding the extensive margin.

[14] A squared term for GDP per capita is not included, as all countries do not exceed the usual turning points for re-concentration found in the literature, and the inclusion of squared terms did not change results meaningfully while the coefficients on the squared terms were not significant.

Decisive evidence is found that exports between two countries that are members of a REC are more diversified; the estimations also confirm this result regarding the number of products. Furthermore, higher tariffs on intermediates imposed by the exporting country also reduce the number of exported goods and increase the concentration index. This hints at better integration into value chains through reduced sourcing costs, and subsequently being able to tap competitively into new export markets. Furthermore, not only do RTAs cover tariff-free trade, but also other areas of cooperation that are important drivers. These could be areas such as mutual recognition of standards, NTM provisions or regional trade facilitation measures that might have a large impact on trade structures. Lowering non-tariff trade costs seems important for diversification of the between component in particular. Therefore, trade facilitation is an important measure to further facilitate export diversification in Africa. Lastly, the exchange rate is always included in the model explaining the number of products. However, the impact is economically negligible.

In summary, the analysis reveals that structural factors are among the most significant drivers of geographical diversification at the extensive margin. Apart from this, to diversify African economies, it seems critical to reduce trading costs via lowering tariff and non-tariff barriers, and investing in trade infrastructure to reduce the non-tariff costs of trade. The trading partner is also relevant for diversifying the bilateral export structure. Significantly, the quality of institutions in the importing country is important.

Intensive margin

Moving away from the structural change perspective, the estimation results on the within component of the Theil index are presented in below. Table 3 reports that structural and trade-related factors are again among the most important determinants of diversification, this time at the intensive margin. However, it is striking that the signs of the posterior means have predominantly the opposite signs compared to the extensive margin. A possible explanation could lie simply in the mechanics of the decomposed measure. Adding a new product to your export portfolio will automatically increase concentration if that newly exported product is not exported with at least the average export volume of existing exports. However, it also leads to the suspicion that the two policy goals, export diversification for macroeconomic stability and export diversification for changes in the productive structure, cannot be reached with the same policy instruments. Maybe even stronger, the goal to change the productive structure of a country's economy by adding new products or exporting to new markets and achieving more

macroeconomic stability might not be achievable in the short run at the same time, and policymakers have to set a priority.[15]

Table 3 – Determinants of Bilateral Diversification – Intensive Margin

		Theil Within	
	PIP	Post Mean	Post SD
Common Language	**1.00**	0.079	0.007
Contiguity	**1.00**	0.066	0.006
REC	**1.00**	0.040	0.006
Trade Costs	**1.00**	-0.223	0.007
ln(Distance)	**1.00**	-0.173	0.009
ln(GDPpc) - Exporter	**1.00**	0.243	0.060
Common Religion	**1.00**	0.023	0.006
Market Proximity - Importer	**1.00**	0.250	0.063
Tariffs (faced)	**0.96**	-0.017	0.006
Common Colonizer	**0.94**	0.020	0.008
Institutions - Importer	**0.84**	0.102	0.059
Institutions - Exporter	**0.83**	0.053	0.031
Exchange Rate	**0.78**	0.012	0.008
Financial Development - Exporter	**0.77**	0.056	0.039
Trade Openness - Exporter	**0.64**	-0.021	0.019
Corr PMP		0.95	
No. Obs.		23,678	

Note: Only explanatory variables with a PIP > 0.5 are presented. For the full table, see Table A6 in the Appendix. Standardized coefficients. Draws: 1,000,000; Burn-ins: 500,000; g-prior: EBL, model prior: uniform.

Cultural and geographical proximity seems to concentrate export volumes at the intensive margin. This finding could be reasoned in more integrated regional value chains. While the proximity leads to more exports (possibly in both number and volume), it could also foster cooperation, and hence, specialization amongst regionally and globally competitive products. A similar line of argument could apply to the findings that a better developed financial sector and better institutions in the exporting country concentrate export value. Financial services and a more stable business environment might enable competitive producers to increase exports, while smaller producers might not be constrained in the same way. With opportunities to grow, these

[15] Usually, the effect on the overall Theil is dominated by the effect on the between component. However, changes on the Theil total are hard to interpret as the components cover different economic channels as discussed. Hence, it is more compelling to infer from the decomposed indices. Results for the Theil total are available upon request.

products might become more dominant in the export basket and concentrate export values. Indirect effects from mining and fuel-related activities could be an additional channel to explain the findings for the financial sector. These sectors have high capital demands and might therefore develop the financial sector while at the same time concentrating exports. Exploring this possible simultaneity issue is beyond the scope of this study.

Three new trade-related variables enter the determinants showing at least weak evidence. Bilateral tariffs faced by the exporter (imposed by the importing country) are among the strong determinants when turning to the within measure. Higher bilateral tariffs result in more evenly distributed trade volumes among existing exports. There might be several reasons for this. At the multilateral level, tariffs imposed on natural resources are the lowest, followed by manufacturing and agriculture products. Tariff peaks tend to be concentrated in agriculture as well as apparel and textiles. Furthermore, tariff escalation, higher tariffs on final goods than on raw materials or intermediates, is noticeable in many countries (UNCTAD, 2020b). All these stylized facts might also hint that countries with higher tariffs engage less in raw material and fuel exports, and are therefore more diversified. Another reason for this may be that trade policy on a more disaggregated level could be targeted at exports of competitive goods. Lastly, a depreciation of the exchange rate concentrates trade values, while an increase in overall trade openness diversifies trade values.

4.2 Bilateral Diversification Results – Intra-Africa

Intra-African trade is significantly different and much more diversified than the continent's trade with the rest of the world (Olney, 2021). Moreover, the aspirations of regionalization in Africa have reached a new level with the most recent commencement of the AfCFTA. Hence, the paper analyzes determinants of export diversification for only intra-African trade in the following. Tables 4 and 5 correspond to the previous tables, analyzing diversification at the extensive and intensive margin, respectively. As many effects remain similar to the baseline estimation covering all trading partners, the focus is on the significant findings compared to Tables 2 and 3. Burn-in draws have been increased to 1,000,000 and iterations up to 3,000,000, as convergence was harder to achieve.

Extensive margin

Many bilateral structural factors have a larger impact on diversification in the intra-African context (see Table 4). For example, doubling the distance between African exporter and importer

countries decreases the number of products exported by additional 46 products compared to the global sample of import partners. Coefficient sizes on common cultural features increase notably. While the reduced sample size also increases the standard deviation, the resulting confidence intervals around the posterior mean still suggest stronger effects.

Table 4 - Determinants of Bilateral Diversification – Intra-Africa - Extensive Margin

	Theil Between			Number of Products		
	PIP	Post Mean	Post SD	PIP	Post Mean	Post SD
Common Colonizer	**1.00**	-0.066	0.009	**1.00**	-213.30	13.17
Common Language	**1.00**	-0.137	0.009	**1.00**	369.79	12.47
Contiguity	**1.00**	-0.125	0.007	**1.00**	180.29	14.03
ln(GDPpc) - Exporter	**1.00**	-0.386	0.064	0.17	9.81	29.16
REC	**1.00**	-0.043	0.008	**0.62**	19.85	18.79
Trade Costs	**1.00**	0.178	0.008	**1.00**	-0.17	0.04
ln(Distance)	**1.00**	0.390	0.012	**1.00**	-198.22	8.87
Institutions - Importer	**1.00**	-0.145	0.027	**0.97**	43.13	15.07
Tariffs (faced)	**0.99**	0.023	0.007	0.14	0.07	0.24
Common Religion	**0.85**	0.024	0.013	0.14	-4.21	14.83
Services - Exporter	**0.62**	-0.023	0.021	0.09	-0.01	0.32
Resource Rents - Exporter	**0.55**	0.023	0.024	0.13	-0.14	0.56
ln(GDPpc) - Importer	**0.54**	-0.083	0.090	0.09	-1.17	16.15
Exchange Rate	0.38	0.005	0.008	**1.00**	-0.04	0.01
Financial Development - Importer	0.25	0.015	0.030	**0.72**	-1.20	0.92
FDI - Importer	0.09	-0.001	0.004	**0.51**	-0.26	0.31
Digital Infrastructure - Exporter	0.08	-0.001	0.007	**0.70**	0.62	0.49
Corr PMP		0.98			0.97	
No. Obs.		7255			7465	

Note: Only explanatory variables with a PIP > 0.5 are presented. For the full table, see Table A7 in the Appendix. Standardized coefficients. Beta coefficients for number of products. Draws: 1,000,000; Burn-ins: 3,000,000; g-prior: EBL, model prior: uniform.

Bilaterally faced tariffs and the services sector in the exporting country show to be important determinants in the intra-African setting, but only significant in the regressions on the Theil between. Higher tariffs imposed by the importing country on the traded goods of the exporting country lead to a concentration of the Theil between. A better-developed services sector, on the other hand, diversifies exports.

The results for being part of a REC, GDP per capita and financial development for the importer, and digital infrastructure for the exporter stay mostly similar. FDI of the importing country now

shows some weak evidence for reducing the number of products. However, the impact size is not economically significant.

Intensive margin

Table 5 presents the results for the Theil within index. Again, the overall picture from the full sample is confirmed.[16] Most determinants have a similar coefficient (contiguity, trade costs and common language) or a larger coefficient (tariffs and distance). The quality of institutions of the importing country has a smaller effect, and sharing a common colonizer becomes less important. African countries sharing the same religion have a more equally distributed trade relationship at the intensive margin.

Table 5 - Determinants of Bilateral Diversification – Intra-Africa - Intensive Margin

		Theil Within	
	PIP	Post Mean	Post SD
Contiguity	**1.00**	0.070	0.011
Tariffs (faced)	**1.00**	-0.063	0.010
Trade Costs	**1.00**	-0.210	0.013
ln(Distance)	**1.00**	-0.279	0.017
Common Language	**1.00**	0.079	0.016
Common Religion	**1.00**	-0.057	0.015
Digital Infrastructure - Importer	**0.71**	0.063	0.051
ln(Population) - Importer	**0.70**	-0.482	0.392
Institutions - Importer	**0.59**	0.049	0.050
Common Colonizer	**0.58**	0.019	0.020
Corr PMP		0.91	
No. Obs.		7018	

Note: Only explanatory variables with a PIP > 0.5 are presented. For the full table, see Table A8 in the Appendix. Standardized coefficients. Draws: 1,000,000; Burn-ins: 3,000,000; g-prior: EBL, model prior: uniform

In summary, structural and trade-related variables have a more pronounced impact when only considering intra-African trade. This might explain the more concentrated export baskets in Africa compared to other world regions. Furthermore, the analysis shows that trade policy variables are significant in the subsample. Being part of a REC has positive effects on the

[16] To note some exceptions, the importer's digital infrastructure seems to have a slightly concentrating effect, while a larger population of the importing country diversifies trade values. The paper refrains from an interpretation of the results as the effect is rather small. The REC dummy also plays a smaller role at the intensive margin of intra-African export diversification.

extensive margin, but the current intra-African tariff schedules seem to hinder export diversification. This emphasizes the need for deeper integration through the AfCFTA. Lastly, developing the services sector diversifies intra-African exports. Similar to the finding that higher tariffs on intermediates hinder diversification, this could show the importance of value chain integration to promote exports.

4.3 Unilateral Diversification Results

Thus far, the analysis has been conducted using a bilateral panel. However, analyzing determinants at a bilateral level has a drawback. Changes in the number of products being exported bilaterally and changes in the Theil indices represent a more geographical component of diversification, but the interpretation of the results is not straightforward with regards to overall diversification. Therefore, in this subsection, the findings for the bilateral panel are accompanied by estimations on the unilateral country level. This results in all bilateral determinants being dropped from the analysis. Here, 100,000 burn-in draws and 500,000 iterations are used.

This section focuses on the results obtained for the full sample, and reports the results in Tables 6 and 7, and only discusses the main findings for the intra-African sample.[17] The results confirm most of the findings of the bilateral panel approach. As expected, GDP per capita and population diversify exports for the Theil between and the number of exported products. However, in these regressions, endogeneity concerns are more severe, and thus, the results should be taken with caution, particularly for the GDP coefficient.

Resource rents are among the structural variable left in the analysis. A difference to bilateral analysis is that resource rents are not found to have a concentrating effect for the extensive margin in the unilateral setting. At the same time, it concentrates the Theil within index. Hence, commodity-dependent economies are more shock prone due to concentrated export values and face a more difficult challenge to diversify exports.

Findings for trade-related determinants are consistent with the bilateral analysis, too. Higher tariffs on intermediates reduce the number of exported products. However, now the effect for the Theil between is not found to be important, and a diversifying effect for higher tariffs is

[17] The results when including only African export destinations of African exporters are given in Tables A11 and A12 in the appendix.

found on the intensive margin. Moreover, the finding that a depreciation of the exchange rate to the dollar leads to a concentration on the intensive margin is confirmed. Another difference to the previous findings is that trade openness has a robust diversifying effect on both measures for the extensive margin and are not relevant determinants at the intensive margin. Emerging as a newly relevant determinant of unilateral diversification at the intensive margin is FDI. Also, import tariffs imposed by the exporting country on capital goods seem to concentrate the Theil within.

Table 6 - Determinants of Unilateral Diversification - Extensive Margin

	Theil Between			**Number of Products**		
	PIP	Post Mean	Post SD	PIP	Post Mean	Post SD
ln(GDPpc) - Exporter	**1.00**	-0.509	0.117	**0.99**	404.16	115.71
Schooling - Exporter	**0.99**	-0.128	0.035	0.07	0.05	0.41
Institutions - Exporter	**0.99**	-0.181	0.051	**1.00**	182.98	30.22
Trade Openness - Exporter	**0.97**	-0.098	0.034	**0.98**	3.10	0.95
Digital Infrastructure - Exporter	**0.59**	0.061	0.060	0.09	0.07	0.34
ln(Population) - Exporter	**0.56**	-0.507	0.535	**1.00**	1139.64	223.60
Services - Exporter	0.21	-0.007	0.018	**0.98**	9.05	2.76
Tariffs Intermediate Goods (imposed)	0.10	0.001	0.008	**0.81**	-9.80	5.82
Corr PMP		0.998			0.9995	
No. Obs.		521			521	

Note: Only explanatory variables with a PIP > 0.5 are presented. For the full table, see Table A9 in the Appendix. Standardized coefficients. Beta coefficients for number of products. Draws: 500,000; Burn-ins: 100,000; g-prior: EBL, model prior: uniform.

The unilateral analysis unveils some additional general policy determinants with at least weak evidence. First, education is emerging as a strong predictor for diversification as a policy determinant, especially for the extensive margin. Education being an important determinant for export diversification confirms the findings from Jetter and Hassan (2015) and shows that increasing human capital is an essential prerequisite to building more complex economic structures and therefore producing a larger variety of goods. Jolo et al. (2022) emphasize that education is also a decisive determinant for resource-rich countries. Next, better institutions have a robust diversifying effect on both measures for the extensive margin and are not relevant determinants at the intensive margin. The share of services has a diversifying effect with regards to the number of exported products.

Table 7 - Determinants of Unilateral Diversification - Intensive Margin

		Theil Within	
	PIP	Post Mean	Post SD
FDI - Exporter	**1.00**	-0.119	0.023
ln(Population) - Exporter	**1.00**	2.235	0.492
Resource Rents - Exporter	**1.00**	0.147	0.037
Infrastructure - Importer	**0.93**	0.305	0.129
Dollar Exchange Rate	**0.93**	0.094	0.042
Schooling - Exporter	**0.73**	0.076	0.057
Polity - Exporter	**0.61**	-0.065	0.063
Digital Infrastructure - Exporter	**0.61**	0.077	0.076
Tariffs Capital Goods (imposed)	**0.60**	0.048	0.049
Tariffs Intermediate Goods (imposed)	**0.57**	-0.045	0.048
Corr PMP		0.996	
No. Obs.		521	

Note: Only explanatory variables with a PIP > 0.5 are presented. For the full table, see Table A10 in the Appendix. Standardized coefficients. Draws: 500,000; Burn-ins: 100,000; g-prior: EBL, model prior: uniform.

Regarding the intra-African sample, the results presented in the appendix are quite similar to the full sample. Decisive evidence now finds that better schooling diversifies exports, and the coefficient size doubles. Resource rents in the African context also are a robust cofounder to reducing the number of products and concentrating export baskets. With the imposed tariff on raw materials by the exporting country now also showing a concentrating effect, evidence for all three included import tariff measures for the exporting country are found relevant. Once again, this underlines the importance of trade policy variables. Lastly, the share of manufacturing in the exporting economy increases the number of exported products in the intra-African setting.

4.4 Extension and Robustness Checks

After discussing the main results, the results for one extension and some robustness checks are presented. The extension investigates heterogeneity among the different regional integration projects, while the robustness checks are mainly concerned with the consistency of the prior choice of the BMA analysis.

Determinants of Bilateral Diversification – RECs

Heretofore, REC membership was assumed to be homogenous by using a single dummy for all African RECs. However, RECs in Africa are diverse and at different integration levels. Table 8 presents the results using individual dummies for each REC. The EAC and SADC (and SACU)[18] have the most robust diversifying influence at the extensive margin. This is, showing at least positive evidence to diversify the Theil between and increase the number of products exported. Evidence for COMESA even points to reducing the number of products being exported. This could be reasoned in the larger distances between the integration partners or in overlapping and conflicting memberships. Overall, this exercise shows that not all RECs have been equally successful in promoting export diversification. Hence, free trade and harmonization of standards and procedures might be an opportunity for countries not yet benefiting from regional integration with the pan-African integration under AfCFTA.

Table 8 - Determinants of Bilateral Diversification - RECs

	Theil Between			**Number of Products**			**Theil Within**		
	PIP	Post Mean	Post SD	PIP	Post Mean	Post SD	PIP	Post Mean	Post SD
REC - COMESA	0.24	-0.002	0.004	**1.00**	-257.06	16.18	0.23	0.002	0.005
REC - EAC	**0.98**	-0.013	0.004	**0.99**	119.19	32.25	0.12	-0.001	0.002
REC - ECOWAS	**1.00**	-0.026	0.005	0.14	-2.18	7.06	**1.00**	0.036	0.007
REC - SADC	**1.00**	-0.020	0.004	**1.00**	340.68	19.28	0.13	0.001	0.003
Corr PMP		0.96			0.91			0.871	
No. Obs.		24,617			25,384			23,678	

Note: Only coefficients for RECs are presented. Standardized coefficients. Beta coefficients for number of products. Draws: 1,000,000; Burn-ins: 500,000; g-prior: EBL, model prior: uniform.

Larger country sample

Section 3.4 discussed the challenges regarding data availability. The inclusion of the 47 potential determinants led to a sample consisting of only 36 of the 54 African countries. To check the robustness of the results to all African countries, the number of variables included is reduced by the least available ones. Reducing the variable count to 33 variables increases the country sample to 47 countries.[19] The estimation results are available on request. At the extensive margin and

[18] EAC: East African Community, SADC: South African Development Community, SACU: South African Customs Union.

[19] A list of the variable and country samples used is provided in Tables A1 and A3 in the Appendix.

especially the results for the Theil between remain similar overall. Likewise, there are only a few changes in unilateral estimations. However, more changes appear in the estimations for the Theil within index. As mentioned before, the Theil within is more difficult to interpret than the Theil between. Along with omitted variable bias in the large sample, one should be cautious about interpreting the results. Nevertheless, the changes in the coefficient estimates for the Theil within also highlight that countries with lower quality and quantity of trade data seem to be structurally different, causing some non-robustness of the results

Robustness Checks

Finally, Tables A13 and A14 display the results of the BMA for different choices of priors for the baseline results at the extensive and intensive margin.[20] To make sure that the priors chosen in this analysis do not solely drive the results, the priors are separately set to a random model prior and a BRIC g-prior. The results largely confirm the findings. Only a few determinants, showing relatively weak evidence in the previous analysis, lose their relevance when using the BRIC prior. For example, this is the case for the financial development of the importing country. Hence, the main findings are found to be robust to changing priors.

5 Conclusion

Export diversification is an important policy goal for developing countries, particularly for countries with a highly concentrated export basket that depends on resources. Hence, it is crucial to know which policy and structural variables foster diversification. This paper adds to the literature in multiple ways. The paper discusses determinants of export diversification found in the literature and presents an overview of these determinants. However, model uncertainty becomes an important issue, as many possible determinants are identified. The literature dealing with model uncertainty in the context of determinants of export diversification is quite scarce besides the study of Jetter and Hassan (2015).

This paper employs BMA methods for up to 47 African countries and 123 trading partners from 1995 to 2018, containing up to 46 possible determinants to identify the most robust and relevant determinants in a bilateral and unilateral panel setting. Overall, this study shows that many factors influence how many products are exported (to a specific destination). In this light, the

[20] Results of the robustness checks using different priors for all other estimations are available on request.

paper uncovers which factors and variables are more robust and impactful in determining diversification. This study considers the relative importance of determinates in the bigger picture, hence it is constrained by not investigating causality of single determinants. Furthermore, data availability limits the scope of determinants and countries studied. Therefore, the findings have to be considered in the light of which countries and determinates are included, and the evidence on causality from previous results of the literature.

The analysis finds that exporter, importer, and bilateral characteristics are important determinants. African countries' structural features and trade policies are particularly significant in determining diversification. Moreover, the characteristics of the trading partner can significantly impact diversification efforts. The analysis often shows an opposing impact of many determinants on diversification, depending on whether the extensive and intensive margin of trade is investigated. Hence, diversifying export values among existing products to increase macroeconomic stability and diversifying export product baskets to foster structural change might not be achievable via the same policy options or even competing policy goals in the short run.

More specifically, common cultural factors and closer distances significantly increase the number of products exported. African exporters with higher revenues from natural resources have more concentrated exports overall. Trade policy is a critical policy tool to diversify exports. While tariffs imposed on intermediate goods by African exporters hinder diversification in the global sample of importers, higher bilateral tariffs matter especially in the intra-African sample and are an obstacle for diversification. Together with the strong evidence of REC membership on diversification, this finding highlights the potential of the AfCFTA to foster export diversification for its economies. Non-trade-related policy determinants are found to be important as well. In particular, the unilateral results show that education and the quality of institutions are important for diversification. There is also evidence that a better-developed service sector can contribute to exporting new products (or to new destinations) throughout the analysis.

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Appendix

Table A1: Definition of Variables and Data Sources

Variable	Description	Source
Theil	Index of overall export diversification	own calculation; data: CEPII BACI (2021)
Theil Within	Index of export diversification at the intensive margin	
Theil Between	Index of export diversification at the extensive margin	
Number of Products	Number of products at the HS-6-digit level that is exported	
Common Colonizer	Dummy = 1 if countries share history with a common colonizer	CEPII (2021)
Common Language	Dummy = 1 if countries share a common language	
Common Religion	Dummy = 1 if countries share a common religion	
Contiguity	Dummy = 1 if countries share a common border	
Distance	Distance between most populated cities, in km	
Population	in thousands	
Market Proximity - Importer	GDP-weighted distance of the importer to the rest of the world	own calculation; data: CEPII (2021)
Exchange Rate	For bilateral estimations: LCU (Exporter) per LCU (Importer). For unilateral estimations: LCU/US Dollar.	IMF (2022)
Exchange Rate Stability	Index between 0 and 1 which measures the annual standard deviations of the monthly exchange rate between the home country and a base country.	Aizenman et al. (2013)
Trade costs*	All additional costs other than tariff costs involved in trading goods bilaterally rather than domestically following Novy (2012)	UN ESCAP (2021)
Polity*	Combined Polity score that ranges from +10 (strongly democratic) to 10 (strongly autocratic)	Polity5 (2020)
Institutions	First principal component of the World Governance Indicators (WGI)	Kaufmann et al. (2010
RTA	Dummy = 1 if a WTO listed PTA relationship exists	Dür et al. (2014)
AfT commitments	in current million USD	OECD (2021)
FDI pc stock	inward FDI per capita stock (in current million USD)	UNCTADstat (2021)
Import Tariffs Capital Goods	trade-weighted imposed tariffs on imports of capital goods; linear interpolated	UNCTAD TRAINS (2021)
Import Tariffs Intermediate Goods	trade-weighted imposed tariffs on imports of intermediate goods; linear interpolated	
Import Tariffs Raw Materials	trade-weighted imposed tariffs on imports of raw materials; linear interpolated	
Tariffs (faced)	trade-weighted faced bilateral tariffs on exports; linear interpolated	

Digital infrastructure	Mobile cellular subscriptions (per 100 people)	World Bank WDI (2021)
Schooling*	School enrollment, secondary (% gross)	
Financial development*	Domestic credit to private sector (% of GDP)	
GDPpc	GDP per capita (in current thousands US$)	
Inflation	Inflation, GDP deflator (annual %)	
Infrastructure	Access to electricity (% of population)	
Investment*	Gross capital formation (% of GDP)	
Manufacturing*	Manufacturing, value added (% of GDP)	
Resource rents	Total natural resources rents (% of GDP)	
Services	Services, value added (% of GDP)	
Trade openness*	Trade (% of GDP)	

Note: Asterisk indicates variables not included in the reduced determinants sample.

Table A2: Descriptive Statistics of Estimation Sample

	count	mean	sd	min	max
Theil	24,617	6.897	1.17	2.1	8.52
Theil Within	23,678	2.038	1.10	4.5e-07	6.73
Theil Between	24,617	4.937	1.82	.13	8.52
Common Colonizer	24,617	0.156	0.36	0	1.00
Common Language	24,617	0.271	0.44	0	1.00
Common Religion	24,617	0.166	0.21	0	0.99
Contiguity	24,617	0.045	0.21	0	1.00
Infrastructure - Importer	24,617	51.022	31.90	2.3	100.00
Infrastructure - Exporter	24,617	82.650	28.64	2.3	100.00
Aid for trade % of GDP - Exporter	24,617	0.008	0.01	1.4e-07	0.06
Investments % of GDP - Exporter	24,617	24.156	8.89	5	61.05
Investments % of GDP - Importer	24,617	24.109	7.00	5	61.05
Schooling - Exporter	24,617	99.918	17.69	35	149.27
Schooling - Importer	24,617	102.420	12.38	35	165.65
Exchange Rate Stability - Exporter	24,617	0.510	0.22	.005	1.00
Exchange Rate Stability - Importer	24,617	0.576	0.30	.005	1.00
FDI % of GDP - Exporter	24,617	30.878	30.61	.5	299.20
FDI % of GDP - Importer	24,617	50.589	134.31	.5	1,986.49
Financial Development - Exporter	24,617	33.763	36.10	2.2	160.12
Financial Development - Importer	24,617	66.599	49.35	.19	255.31
Exchange Rate	24,617	228.625	823.18	3.1e-06	24,648.38
Inflation - Exporter	24,617	6.624	8.97	-27	94.19
Inflation - Importer	24,617	4.885	7.13	-27	115.52
ln(GDPpc) - Exporter	24,617	1.175	0.91	-.7	3.12
ln(GDPpc) - Importer	24,617	2.472	1.23	-.7	4.86
ln(Population) - Exporter	24,617	9.678	1.17	6.2	12.13
ln(Population) - Importer	24,617	9.894	1.46	6.1	14.15
Manufacturing - Exporter	24,617	12.185	5.80	.23	49.19
Manufacturing - Importer	24,617	14.276	5.81	.23	49.19
Digital Infrastructure - Exporter	24,617	61.000	43.02	0	163.88
Digital Infrastructure - Importer	24,617	88.912	44.09	0	212.64
Polity - Exporter	24,617	2.620	5.05	-6	10.00
Polity - Importer	24,617	5.632	5.57	-10	10.00
REC	24,617	0.051	0.22	0	1.00
Resource Rents - Exporter	24,617	9.124	8.21	.0012	56.93
Resource Rents - Importer	24,617	5.689	8.84	.00019	58.98
Services - Exporter	24,617	48.126	8.78	25	77.02
Services - Importer	24,617	54.957	10.10	25	79.33
Tariffs (faced)	24,617	5.522	9.08	0	393.60
Tariffs Capital Goods (imposed)	24,617	7.169	4.20	.13	37.91
Import Tariffs Raw Materials (imposed)	24,617	7.536	6.72	0	45.01
Trade Openness - Exporter	24,617	67.326	25.87	21	165.06
Trade Openness - Importer	24,617	78.904	44.80	21	408.36
Trade Costs	24,617	268.891	145.56	19	1,517.72
Institutions - Exporter	24,617	-1.035	1.33	-3.7	2.18
Institutions - Importer	24,617	0.713	2.29	-4.2	4.88
ln(Distance)	24,617	8.499	0.77	4.7	9.85
Market Proximity - Importer	24,617	16.462	0.60	15	17.98

Table A3: List of countries (ISO3 code)

AGO	CPV	(LBR)	NER	TGO
BDI	DZA	LSO	NGA	TUN
BEN	EGY	MAR	RWA	TZA
BFA	(ETH)	(MDG)	(SDN)	UGA
BWA	(GAB)	MLI	SEN	ZAF
CAF	GHA	MOZ	SLE	ZMB
CIV	GIN	MRT	(STP)	ZWE
CMR	GMB	MUS	(SWZ)	
COG	(GNB)	(MWI)	(SYC)	
(COM)	KEN	NAM	TCD	

Note: Countries in parentheses are only included in the reduced determinants sample.

Table A4: Determinants of Export Diversification in the Literature (detailed)

Determinant	Evidence	Studies
Structural		
Area	-	Beverelli et al. (2015)
Colony	+	Beverelli et al. (2015), Dutt et al. (2013), Felbermayr and Kohler (2010), Persson (2013)
Common Colonizer	+	Dutt et al. (2013), Felbermayr and Kohler (2010)
Common Language	+	Beverelli et al. (2015), Dutt et al. (2013), Feenstra and Ma (2014), Felbermayr and Kohler (2010), Helpman et al. (2008), Persson (2013), Regolo (2013), Regolo (2017)
Common Religion	+	Helpman et al. (2008)
Contiguity	+	Beverelli et al. (2015), Dutt et al. (2013), Feenstra and Ma (2014)*, Felbermayr and Kohler (2010), Persson (2013), Regolo (2013), Regolo (2017)
Differences in Endowments	-	Regolo (2013)
Distance	-	Amurgo-Pacheco and Pierola (2008), Beverelli et al. (2015), Dennis and Shepherd (2011), Dutt et al. (2013), Feenstra and Kee (2008), Feenstra and Ma (2014), Felbermayr and Kohler (2010), Mau (2016)*, Osakwe et al. (2018)*, Parteka and Tamberi (2013), Persson (2013), Regolo (2013), Regolo (2017), Tadesse and Shukralla (2013), UNCTAD (2020a)
Landlocked	-	Amighini and Sanfilippo (2014)*, Beverelli et al. (2015), Fosu and Abass (2019), Persson (2013), Tadesse and Shukralla (2013)
Natural Resources	-	Amighini and Sanfilippo (2014), Bahar and Santos (2018), Elhiraika and Mbate (2014), Giri et al. (2019), Gnangnon (2020), Jetter and Hassan (2015), Lectard and Rougier (2018), Parteka and Tamberi (2013)*, UNCTAD (2020a)
Population	+	Basile et al. (2018), Cadot et al. (2011b), Cieślik and Parteka (2021)*, Elhiraika and Mbate (2014)*, Feenstra and Ma (2014), Giri et al. (2019), Gnangnon (2019)*, Gnangnon (2020), Lectard and Rougier (2018), Mau (2016), Parteka and Tamberi (2013), Persson (2013), Persson and Wilhemsson (2016), Tadesse and Shukralla (2013), UNCTAD (2020a)
Remoteness	-	Agosin et al. (2012), Cadot et al. (2011b), Lectard and Rougier (2018), UNCTAD (2020a)
Spatial Spillovers	**0**/+	Basile et al. (2018), Parteka and Tamberi (2013)
Policy (general)		
Agriculture	**0**	Dennis and Shepherd (2011), Parteka and Tamberi (2013), UNCTAD (2020a)
Aid	**0**/+	Elhiraika and Mbate (2014), Gnangnon (2020)
Development	+	Amighini and Sanfilippo (2014), Amurgo-Pacheco and Pierola (2008), Basile et al. (2018), Beverelli et al. (2015), Cadot et al. (2011b), Dennis and Shepherd (2011), Elhiraika and Mbate (2014), Feenstra and Ma (2014), Fosu and Abass (2019), Giri et al. (2019), Gnangnon (2019)*, Gnangnon (2020)*, Jolo et al. (2022)*, Mau (2016), Osakwe et al. (2018)*, Parteka and Tamberi (2013), Persson (2013), Persson and Wilhemsson (2016), Sekkat (2016), UNCTAD (2020a)
Differences in GDP	+	Regolo (2013)
Differences in TFP	-	Regolo (2013)
Financial Development	weakly +	Agosin et al. (2012)*, Elhiraika and Mbate (2014)*, Fosu and Abass (2019), Giri et al. (2019), Gnangnon (2019), Gnangnon (2020), Jolo et al. (2022), Nieminen (2020)
Human Capital	+	Agosin et al. (2012)*, Cadot et al. (2011b), Elhiraika and Mbate (2014), Fosu and Abass (2019), Gnangnon (2019), Jetter and Hassan (2015), Jolo et al. (2022), Lectard and Rougier (2018)*, Osakwe et al. (2018), Parteka and Tamberi (2013)*
Inflation	**0**/-	Amighini and Sanfilippo (2014), Giri et al. (2019)
Infrastructure	weakly +	Cadot et al. (2011b), Elhiraika and Mbate (2014), Fosu and Abass (2019), Giri et al. (2019), Lectard and Rougier (2018)*, Osakwe et al. (2018)*
Institutions	+	Amighini and Sanfilippo (2014), Cadot et al. (2011b), Elhiraika and Mbate (2014)*, Fosu and Abass (2019), Giri et al. (2019), Giri et al. (2019)*, Gnangnon (2019)*, Gnangnon (2020), Jolo et al. (2022), Lectard and Rougier (2018), Omgba (2014), Osakwe et al. (2018), Parteka and Tamberi (2013)*, Sheng and Yang (2015), Tadesse and Shukralla (2013)*, UNCTAD (2020a)
Interest rate	**0**	Dennis and Shepherd (2011)
Investment	weakly +	Amighini and Sanfilippo (2014)*, Elhiraika and Mbate (2014), Jolo et al. (2022), Tadesse and Shukralla (2013)
Manufacturing	+	Dennis and Shepherd (2011), Parteka and Tamberi (2013)*, Tadesse and Shukralla (2013)
Market Entry Cost	-	Dennis and Shepherd (2011)
Poverty	-	Gnangnon (2020)
Prices	-	Dennis and Shepherd (2011)
Productivity	+	Cieślik and Parteka (2021), Parteka (2020)
R&D	**0**	Parteka and Tamberi (2013)

Policy (trade)		
Age of existing products	+	Regolo (2017)
Aid for Trade	**0**/+	Gnangnon (2019), Kim (2019)
Capital Account Openness	+	Giri et al. (2019)
Centrality of RCA	-	Minondo (2011)
Distance of products exported to endowments	mixed	Lectard and Rougier (2018)
Exchange rate depreciation	+	Amurgo-Pacheco and Pierola (2008), Elhiraika and Mbate (2014)*,Goya (2020), Nicita and Rollo (2015), Tadesse and Shukralla (2013)
Exchange rate misalignment	**0**	Agosin et al. (2012), Giri et al. (2019), Sekkat (2016)
Exchange rate volatility	weakly -	Agosin et al. (2012), Goya (2020)
FDI	+	Amighini and Sanfilippo (2014), Fonchamnyo and Akame (2017), Giri et al. (2019)*, Jolo et al. (2022)*, Lectard and Rougier (2018), Munemo (2011), UNCTAD (2020a)*
Imports from other developing countries	+	Amighini and Sanfilippo (2014)
International standard harmonization	+	Shepherd (2015)
Market Access (other measures)	+	Beverelli et al. (2015), Cadot et al. (2011b), Dutt et al. (2013), Gnangnon (2019), Parteka and Tamberi (2013), Persson and Wilhemsson (2016)
Market Access (PTAs)	+	Amurgo-Pacheco and Pierola (2008), Beverelli et al. (2015), Cadot et al. (2011b), Dutt et al. (2013)*, Feenstra and Kee (2008, Feenstra and Ma (2014)*, Felbermayr and Kohler (2010), Giri et al. (2019)*, Helpman et al. (2008), Nicita and Rollo (2015), Parteka and Tamberi (2013), Regolo (2013), Regolo (2017), Tadesse and Shukralla (2013), UNCTAD (2020a)*
Market Access (Tariffs)	-	Dennis and Shepherd (2011)*, Feenstra and Kee (2008), Feenstra and Ma (2014), Nicita and Rollo (2015), Nicita and Rollo (2015), Osakwe et al. (2018), Persson (2013)*
Market Access (Trade openness)	**0**/+	Agosin et al. (2012)*, Fosu and Abass (2019), Giri et al. (2019), Gnangnon (2020)*, Lectard and Rougier (2018), Tadesse and Shukralla (2013)
Own import tariffs	**0**/+	Dennis and Shepherd (2011)
Product standards	-	Shepherd (2015)
Terms of Trade	**0**/-	Agosin et al. (2012), Amighini and Sanfilippo (2014), Elhiraika and Mbate (2014), Fosu and Abass (2019), Giri et al. (2019), UNCTAD (2020a)
Trade Facilitation	+	Beverelli et al. (2015), Dennis and Shepherd (2011), Feenstra and Ma (2014), Giri et al. (2019), Persson (2013)
Trade with developed country	+	Amurgo-Pacheco and Pierola (2008), Feenstra and Ma (2014)
WTO membership	weakly +	Dutt et al. (2013), Felbermayr and Kohler (2010)

Notes: * other or no effect found

Table A5 – Determinants of Bilateral Diversification – Extensive Margin (full)

	Theil Between			Number of Products		
	PIP	Post Mean	Post SD	PIP	Post Mean	Post SD
Common Colonizer	**1.00**	-0.037	0.004	**1.00**	-95.04	6.25
Common Language	**1.00**	-0.125	0.005	**1.00**	173.33	5.54
Contiguity	**1.00**	-0.102	0.004	**1.00**	247.87	9.75
ln(GDPpc) - Exporter	**1.00**	-0.323	0.036	0.32	12.03	20.87
ln(GDPpc) - Importer	**1.00**	-0.266	0.051	0.07	0.12	5.66
REC	**1.00**	-0.050	0.004	**0.89**	24.80	12.19
Trade Costs	**1.00**	0.174	0.004	**0.89**	0.04	0.02
Institutions - Importer	**1.00**	-0.177	0.028	**0.99**	22.61	6.32
ln(Distance)	**1.00**	0.282	0.006	**1.00**	-152.17	4.33
Market Proximity - Importer	**1.00**	-0.199	0.043	0.15	-6.70	21.54
Common Religion	**1.00**	-0.016	0.004	**0.86**	24.13	13.28
Tariffs Intermediate Goods (imposed)	**0.98**	0.027	0.007	**0.81**	-1.83	1.12
Polity - Exporter	**0.98**	-0.038	0.012	0.31	0.64	1.14
Investments % of GDP - Importer	**0.92**	-0.019	0.008	0.07	0.00	0.12
FDI % of GDP - Importer	**0.80**	0.014	0.009	0.25	-0.01	0.02
Resource Rents - Exporter	**0.78**	0.019	0.012	0.14	-0.08	0.28
ln(Population) - Importer	**0.77**	-0.208	0.140	0.09	1.40	11.40
Services - Importer	**0.76**	-0.024	0.016	0.11	-0.05	0.24
Digital Infrastructure - Importer	0.49	-0.011	0.013	**0.74**	0.22	0.16
Polity - Importer	0.47	-0.013	0.016	0.11	0.12	0.50
Exchange Rate Stability - Importer	0.35	-0.005	0.009	0.08	0.55	4.02
Exchange Rate Stability - Exporter	0.28	-0.003	0.005	0.08	-0.42	3.50
Institutions - Exporter	0.22	-0.006	0.013	0.25	2.30	4.86
Financial Development - Exporter	0.18	0.005	0.014	**1.00**	-1.07	0.27
Inflation - Exporter	0.17	-0.001	0.003	0.08	0.01	0.06
Infrastructure - Importer	0.17	-0.007	0.020	0.09	-0.02	0.15
Trade Openness - Exporter	0.14	0.002	0.006	0.08	0.00	0.05
Digital Infrastructure - Exporter	0.14	0.002	0.007	0.50	0.16	0.19
Resource Rents - Importer	0.13	0.002	0.008	0.08	-0.01	0.19
Aid for trade % of GDP - Exporter	0.12	-0.001	0.003	0.08	7.80	89.48
Tariffs (faced)	0.09	0.000	0.002	0.07	0.00	0.06
Import Tariffs Raw Materials (imposed)	0.09	0.001	0.003	0.09	0.00	0.17
Services - Exporter	0.08	-0.001	0.003	0.08	-0.01	0.13
ln(Population) - Exporter	0.08	-0.008	0.038	0.41	-38.13	54.54
Infrastructure - Exporter	0.08	0.002	0.012	**0.76**	0.98	0.69
Tariffs Capital Goods (imposed)	0.08	0.001	0.003	0.27	-0.49	0.97
Manufacturing - Exporter	0.08	-0.001	0.004	0.13	0.11	0.41
Exchange Rate	0.08	0.000	0.001	**1.00**	-0.02	0.00
Schooling - Exporter	0.07	-0.001	0.003	0.37	-0.19	0.29
Schooling - Importer	0.06	0.000	0.002	0.23	0.11	0.25
Manufacturing - Importer	0.05	0.000	0.003	0.08	-0.02	0.30
Trade Openness - Importer	0.05	0.000	0.004	0.10	0.01	0.06
Investments % of GDP - Exporter	0.05	0.000	0.001	0.15	-0.06	0.20
Inflation - Importer	0.05	0.000	0.001	0.07	0.01	0.08
FDI % of GDP - Exporter	0.04	0.000	0.001	0.12	-0.01	0.04
Financial Development - Importer	0.04	0.000	0.003	**0.53**	-0.15	0.17
Corr PMP		0.99			0.93	
No. Obs.		24,617			25,384	

Note: Standardized coefficients. Beta coefficients for number of products. Draws: 1,000,000; Burn-ins: 500,000; g-prior: EBL, model prior: uniform

Table A6 - Determinants of Bilateral Diversification – Intensive Margin (full)

		Theil Within	
	PIP	Post Mean	Post SD
Common Language	**1.00**	0.079	0.007
Contiguity	**1.00**	0.066	0.006
REC	**1.00**	0.040	0.006
Trade Costs	**1.00**	-0.223	0.007
ln(Distance)	**1.00**	-0.173	0.009
ln(GDPpc) - Exporter	**1.00**	0.243	0.060
Common Religion	**1.00**	0.023	0.006
Market Proximity - Importer	**1.00**	0.250	0.063
Tariffs (faced)	**0.96**	-0.017	0.006
Common Colonizer	**0.94**	0.020	0.008
Institutions - Importer	**0.84**	0.102	0.059
Institutions - Exporter	**0.83**	0.053	0.031
Exchange Rate	**0.78**	0.012	0.008
Financial Development - Exporter	**0.77**	0.056	0.039
Trade Openness - Exporter	**0.64**	-0.021	0.019
Digital Infrastructure - Importer	0.39	0.011	0.017
Exchange Rate Stability - Exporter	0.37	0.005	0.008
Digital Infrastructure - Exporter	0.31	0.010	0.018
ln(GDPpc) - Importer	0.29	0.037	0.071
Exchange Rate Stability - Importer	0.26	0.005	0.010
FDI % of GDP - Exporter	0.24	0.004	0.008
Polity - Importer	0.23	0.007	0.015
Financial Development - Importer	0.21	0.006	0.015
Polity - Exporter	0.19	0.004	0.011
Manufacturing - Exporter	0.19	-0.004	0.010
Resource Rents - Importer	0.18	-0.004	0.011
Schooling - Exporter	0.18	-0.003	0.008
Infrastructure - Importer	0.17	0.009	0.025
Inflation - Exporter	0.17	-0.001	0.004
Investments % of GDP - Importer	0.15	0.002	0.005
Tariffs Capital Goods (imposed)	0.14	0.002	0.005
Services - Importer	0.12	0.002	0.008
Aid for trade % of GDP - Exporter	0.12	0.001	0.003
Trade Openness - Importer	0.11	-0.002	0.010
Import Tariffs Raw Materials (imposed)	0.11	-0.001	0.004
ln(Population) - Importer	0.11	-0.013	0.058
ln(Population) - Exporter	0.11	-0.010	0.059
Investments % of GDP - Exporter	0.10	0.000	0.004
Resource Rents - Exporter	0.10	-0.001	0.005
Services - Exporter	0.09	0.000	0.004
Tariffs Intermediate Goods (imposed)	0.08	0.000	0.003
Infrastructure - Exporter	0.08	-0.001	0.012
Schooling - Importer	0.08	0.000	0.003
Manufacturing - Importer	0.08	0.000	0.005
Inflation - Importer	0.08	0.000	0.002
FDI % of GDP - Importer	0.08	0.000	0.003
Corr PMP		0.95	
No. Obs.		23,678	

Note: Standardized coefficients. Draws: 1,000,000; Burn-ins: 500,000; g-prior: EBL, model prior: uniform

Table A7 - Determinants of Bilateral Diversification – Intra-Africa - Extensive Margin (full)

	Theil Between			Number of Products		
	PIP	Post Mean	Post SD	PIP	Post Mean	Post SD
Common Colonizer	**1.00**	-0.066	0.009	**1.00**	-213.30	13.17
Common Language	**1.00**	-0.137	0.009	**1.00**	369.79	12.47
Contiguity	**1.00**	-0.125	0.007	**1.00**	180.29	14.03
ln(GDPpc) - Exporter	**1.00**	-0.386	0.064	0.17	9.81	29.16
REC	**1.00**	-0.043	0.008	**0.62**	19.85	18.79
Trade Costs	**1.00**	0.178	0.008	**1.00**	-0.17	0.04
Institutions - Importer	**1.00**	-0.145	0.027	**0.97**	43.13	15.07
ln(Distance)	**1.00**	0.390	0.012	**1.00**	-198.22	8.87
Tariffs (faced)	**0.99**	0.023	0.007	0.14	0.07	0.24
Common Religion	**0.85**	0.024	0.013	0.14	-4.21	14.83
Services - Exporter	**0.62**	-0.023	0.021	0.09	-0.01	0.32
Resource Rents - Exporter	**0.55**	0.023	0.024	0.13	-0.14	0.56
ln(GDPpc) - Importer	**0.54**	-0.083	0.090	0.09	-1.17	16.15
Polity - Exporter	0.50	-0.022	0.026	0.13	0.32	1.24
Trade Openness - Importer	0.50	0.018	0.021	0.10	0.01	0.14
Exchange Rate	0.38	0.005	0.008	**1.00**	-0.04	0.01
Infrastructure - Exporter	0.28	0.025	0.047	0.11	0.08	0.42
Digital Infrastructure - Importer	0.26	-0.010	0.020	0.39	0.25	0.37
Financial Development - Importer	0.25	0.015	0.030	**0.72**	-1.20	0.92
Tariffs Intermediate Goods (imposed)	0.20	0.004	0.009	0.31	-0.93	1.69
Schooling - Importer	0.19	-0.005	0.012	0.16	0.11	0.35
Institutions - Exporter	0.16	-0.006	0.017	0.10	0.16	4.17
ln(Population) - Exporter	0.15	0.036	0.109	0.41	-89.97	128.49
Polity - Importer	0.13	-0.003	0.010	0.09	0.03	0.74
Investments % of GDP - Importer	0.12	-0.002	0.006	0.15	-0.14	0.47
FDI % of GDP - Exporter	0.12	0.002	0.005	0.37	-0.16	0.25
Tariffs Capital Goods (imposed)	0.12	0.002	0.006	0.11	0.07	0.84
Inflation - Exporter	0.11	-0.001	0.003	0.09	0.01	0.16
Import Tariffs Raw Materials (imposed)	0.11	0.001	0.005	0.11	0.03	0.40
ln(Population) - Importer	0.10	0.016	0.077	0.10	-4.13	36.74
Schooling - Exporter	0.09	-0.001	0.007	0.09	-0.01	0.19
Exchange Rate Stability - Importer	0.09	0.001	0.003	0.09	-0.48	8.33
FDI % of GDP - Importer	0.09	-0.001	0.004	**0.51**	-0.26	0.31
Investments % of GDP - Exporter	0.08	0.001	0.004	0.30	-0.42	0.79
Manufacturing - Exporter	0.08	-0.001	0.006	0.10	0.10	0.66
Digital Infrastructure - Exporter	0.08	-0.001	0.007	**0.70**	0.62	0.49
Services - Importer	0.08	-0.001	0.004	0.15	-0.16	0.55
Market Proximity - Importer	0.08	-0.004	0.027	0.10	6.57	45.68
Infrastructure - Importer	0.07	-0.002	0.014	0.12	0.09	0.48
Aid for trade % of GDP - Exporter	0.06	0.000	0.002	0.09	-26.96	238.01
Exchange Rate Stability - Exporter	0.06	0.000	0.002	0.11	-2.13	10.85
Financial Development - Exporter	0.06	0.001	0.008	0.27	-0.29	0.58
Inflation - Importer	0.06	0.000	0.002	0.10	0.02	0.17
Manufacturing - Importer	0.06	0.000	0.004	0.13	-0.22	0.89
Resource Rents - Importer	0.06	0.000	0.004	0.10	0.06	0.43
Trade Openness - Exporter	0.06	0.000	0.004	0.10	0.00	0.14
Corr PMP		0.98			0.97	
No. Obs.		7255			7465	

Note: Standardized coefficients. Beta coefficients for number of products. Draws: 1,000,000; Burn-ins: 3,000,000; g-prior: EBL, model prior: uniform

Table A8 - Determinants of Bilateral Diversification – Intra-Africa - Intensive Margin (full)

	Theil Within		
	PIP	Post Mean	Post SD
Common Language	**1.00**	0.079	0.016
Common Religion	**1.00**	-0.057	0.015
Contiguity	**1.00**	0.070	0.011
Tariffs (faced)	**1.00**	-0.063	0.010
Trade Costs	**1.00**	-0.210	0.013
ln(Distance)	**1.00**	-0.279	0.017
Digital Infrastructure - Importer	**0.71**	0.063	0.051
ln(Population) - Importer	**0.70**	-0.482	0.392
Institutions - Importer	**0.59**	0.049	0.050
Common Colonizer	**0.58**	0.019	0.020
Institutions - Exporter	0.45	0.032	0.043
REC	0.41	0.009	0.013
Trade Openness - Importer	0.36	-0.016	0.026
Aid for trade % of GDP - Exporter	0.29	0.006	0.012
Resource Rents - Importer	0.26	-0.009	0.020
Infrastructure - Exporter	0.24	-0.025	0.061
Inflation - Exporter	0.23	-0.003	0.008
FDI % of GDP - Exporter	0.22	-0.004	0.011
ln(GDPpc) - Exporter	0.20	0.025	0.066
ln(Population) - Exporter	0.18	-0.052	0.152
Manufacturing - Importer	0.18	0.005	0.015
Market Proximity - Importer	0.17	0.022	0.071
ln(GDPpc) - Importer	0.16	0.016	0.055
Investments % of GDP - Importer	0.15	0.002	0.009
Schooling - Exporter	0.15	-0.003	0.012
Financial Development - Exporter	0.15	0.007	0.025
Polity - Exporter	0.15	0.004	0.014
Tariffs Intermediate Goods (imposed)	0.15	0.002	0.009
Exchange Rate Stability - Exporter	0.14	0.001	0.006
Digital Infrastructure - Exporter	0.14	0.004	0.015
Resource Rents - Exporter	0.14	-0.003	0.011
Tariffs Capital Goods (imposed)	0.14	0.002	0.008
Investments % of GDP - Exporter	0.13	-0.001	0.007
Exchange Rate	0.13	-0.001	0.004
Inflation - Importer	0.13	0.001	0.005
Polity - Importer	0.13	0.003	0.013
Services - Importer	0.13	-0.002	0.009
Infrastructure - Importer	0.12	0.004	0.027
Schooling - Importer	0.12	0.001	0.010
Exchange Rate Stability - Importer	0.12	0.001	0.005
Manufacturing - Exporter	0.12	-0.002	0.009
FDI % of GDP - Importer	0.11	0.000	0.006
Financial Development - Importer	0.11	0.000	0.018
Services - Exporter	0.11	0.001	0.007
Import Tariffs Raw Materials (imposed)	0.11	0.000	0.005
Trade Openness - Exporter	0.11	0.000	0.008
Corr PMP		0.91	
No. Obs.		7018	

Note: Standardized coefficients. Draws: 1,000,000; Burn-ins: 3,000,000; g-prior: EBL, model prior: uniform

Table A9 - Determinants of Unilateral Diversification – Extensive Margin (full)

	Theil Between			Number of Products		
	PIP	Post Mean	Post SD	PIP	Post Mean	Post SD
ln(GDPpc) - Exporter	**1.00**	-0.509	0.117	**0.99**	404.16	115.71
Schooling - Exporter	**0.99**	-0.128	0.035	0.07	0.05	0.41
Institutions - Exporter	**0.99**	-0.181	0.051	**1.00**	182.98	30.22
Trade Openness - Exporter	**0.97**	-0.098	0.034	**0.98**	3.10	0.95
Digital Infrastructure - Exporter	**0.59**	0.061	0.060	0.09	0.07	0.34
ln(Population) - Exporter	**0.56**	-0.507	0.535	**1.00**	1139.64	223.60
Manufacturing - Exporter	0.32	0.022	0.038	0.09	0.42	1.95
Polity - Exporter	0.30	0.019	0.035	0.08	0.38	2.08
FDI % of GDP - Exporter	0.29	0.010	0.019	0.11	0.07	0.28
Dollar Exchange Rate	0.27	-0.013	0.026	0.30	0.01	0.03
Import Tariffs Raw Materials (imposed)	0.23	0.007	0.017	0.07	-0.04	0.78
Services - Exporter	0.21	-0.007	0.018	**0.98**	9.05	2.76
Financial Development - Exporter	0.16	0.011	0.034	0.08	-0.09	0.54
Inflation - Exporter	0.12	-0.001	0.006	0.08	0.06	0.39
Tariffs Intermediate Goods (imposed)	0.10	0.001	0.008	**0.81**	-9.80	5.82
Resource Rents - Exporter	0.10	0.002	0.012	0.16	-0.76	2.17
Tariffs Capital Goods (imposed)	0.09	0.001	0.008	0.29	-2.95	5.39
Infrastructure - Importer	0.09	-0.003	0.028	0.09	0.15	0.83
Investments % of GDP - Exporter	0.09	0.001	0.007	0.07	0.08	0.65
Aid for trade % of GDP - Exporter	0.09	0.001	0.005	0.10	-171.40	729.46
Exchange Rate Stability - Exporter	0.08	0.000	0.005	0.08	-4.01	22.29
Tariffs (faced)	0.08	0.000	0.004	0.20	-1.28	3.06
Corr PMP		0.998			0.9995	
No. Obs.		521			521	

Note: Standardized coefficients. Beta coefficients for number of products. Draws: 500,000; Burn-ins: 100,000; g-prior: EBL, model prior: uniform

Table A10 - Determinants of Unilateral Diversification – Intensive Margin (full)

	Theil Within		
	PIP	Post Mean	Post SD
FDI % of GDP - Exporter	**1.00**	-0.119	0.023
ln(Population) - Exporter	**1.00**	2.235	0.492
Resource Rents - Exporter	**1.00**	0.147	0.037
Infrastructure - Importer	**0.93**	0.305	0.129
Dollar Exchange Rate	**0.93**	0.094	0.042
Schooling - Exporter	**0.73**	0.076	0.057
Polity - Exporter	**0.61**	-0.065	0.063
Digital Infrastructure - Exporter	**0.61**	0.077	0.076
Tariffs Capital Goods (imposed)	**0.60**	0.048	0.049
Tariffs Intermediate Goods (imposed)	**0.57**	-0.045	0.048
Tariffs (faced)	0.31	0.010	0.018
Aid for trade % of GDP - Exporter	0.31	0.010	0.019
Manufacturing - Exporter	0.23	-0.015	0.036
Exchange Rate Stability - Exporter	0.22	-0.006	0.016
Trade Openness - Exporter	0.15	0.005	0.020
Import Tariffs Raw Materials (imposed)	0.14	-0.003	0.013
Financial Development - Exporter	0.12	0.005	0.028
Services - Exporter	0.11	-0.001	0.012
Investments % of GDP - Exporter	0.11	0.001	0.009
Inflation - Exporter	0.11	0.000	0.005
Institutions - Exporter	0.11	-0.001	0.020
ln(GDPpc) - Exporter	0.10	0.005	0.046
Corr PMP		1.00	
No. Obs.		521	

Note: Draws: Standardized coefficients. 500,000; Burn-ins: 100,000; g-prior: EBL, model prior: uniform

Table A11 - Determinants of Unil. Diversification – Intra-Africa - Extensive Margin (full)

	Theil Between			Number of Products		
	PIP	Post Mean	Post SD	PIP	Post Mean	Post SD
Schooling - Exporter	**1.00**	-0.142	0.033	0.08	0.04	0.49
ln(GDPpc) - Exporter	**1.00**	-0.481	0.123	**0.99**	497.70	143.32
Resource Rents - Exporter	**0.99**	0.119	0.033	**0.79**	-7.99	5.22
Trade Openness - Exporter	**0.97**	-0.101	0.035	**1.00**	4.11	0.99
Institutions - Exporter	**0.96**	-0.156	0.056	**0.99**	137.50	40.58
Import Tariffs Raw Materials (imposed)	**0.66**	0.033	0.028	0.09	0.10	1.08
Financial Development - Exporter	0.29	0.028	0.053	**0.69**	-3.27	2.66
Polity - Exporter	0.25	0.015	0.032	0.10	0.59	2.73
FDI % of GDP - Exporter	0.23	0.007	0.017	0.08	0.03	0.23
Digital Infrastructure - Exporter	0.22	0.014	0.033	0.32	0.59	1.03
ln(Population) - Exporter	0.19	-0.096	0.258	0.37	221.22	343.82
Dollar Exchange Rate	0.16	-0.005	0.017	0.10	0.00	0.01
Tariffs Capital Goods (imposed)	0.15	0.004	0.013	**0.80**	-13.88	9.04
Tariffs Intermediate Goods (imposed)	0.14	0.003	0.012	**0.71**	-10.30	8.24
Investments % of GDP - Exporter	0.14	0.003	0.012	0.09	-0.13	0.85
Inflation - Exporter	0.13	-0.002	0.006	0.18	0.36	0.95
Tariffs (faced)	0.10	-0.001	0.006	0.15	-0.83	2.63
Aid for trade % of GDP - Exporter	0.10	0.001	0.006	0.11	-194.05	825.44
Manufacturing - Exporter	0.10	-0.002	0.013	**0.72**	10.08	7.76
Infrastructure - Importer	0.09	-0.004	0.029	0.10	0.23	1.13
Services - Exporter	0.09	0.000	0.008	0.41	2.64	3.72
Exchange Rate Stability - Exporter	0.08	0.000	0.005	0.12	-9.29	35.39
Corr PMP		0.998			0.9960	
No. Obs.		521			521	

Note: Standardized coefficients. Beta coefficients for number of products. Draws: 500,000; Burn-ins: 100,000; g-prior: EBL, model prior: uniform

Table A12 - Determinants of Unil. Diversification – Intra-Africa - Intensive Margin (full)

	Theil Within		
	PIP	Post Mean	Post SD
Aid for trade % of GDP - Exporter	**1.00**	0.129	0.031
Services - Exporter	**0.55**	0.050	0.057
Manufacturing - Exporter	0.45	0.053	0.075
Dollar Exchange Rate	0.36	0.027	0.047
Digital Infrastructure - Exporter	0.33	-0.035	0.067
Infrastructure - Importer	0.32	0.066	0.131
Inflation - Exporter	0.29	-0.009	0.019
Tariffs (faced)	0.28	0.010	0.023
Polity - Exporter	0.28	0.023	0.053
ln(Population) - Exporter	0.21	0.109	0.376
Resource Rents - Exporter	0.21	-0.009	0.033
ln(GDPpc) - Exporter	0.21	-0.033	0.115
Institutions - Exporter	0.20	0.013	0.046
Exchange Rate Stability - Exporter	0.20	0.005	0.019
Tariffs Capital Goods (imposed)	0.18	0.005	0.021
Import Tariffs Raw Materials (imposed)	0.18	0.004	0.018
Tariffs Intermediate Goods (imposed)	0.18	0.004	0.020
Financial Development - Exporter	0.17	-0.010	0.050
FDI % of GDP - Exporter	0.17	0.003	0.016
Schooling - Exporter	0.17	0.000	0.024
Investments % of GDP - Exporter	0.16	0.001	0.016
Trade Openness - Exporter	0.16	0.000	0.022
Corr PMP		0.97	
No. Obs.		521	

Note: Standardized coefficients. Draws: 500,000; Burn-ins: 100,000; g-prior: EBL, model prior: uniform

Table A13 - Determinants of Bilateral Diversification – Extensive Margin - Robustness

	g=EBL, model = uniform				g=EBL, model=random				g=BRIC, model = uniform			
	Theil Between		**Number of Products**		**Theil Between**		**Number of Products**		**Theil Between**		**Number of Products**	
	PIP	Post Mean	PIP	Post Mean	PIP	Post Mean	PIP	Post Mean	PIP	Post Mean	PIP	Post Mean
Common Colonizer	**1.00**	-0.037	**1.00**	-95.04	**1.00**	-0.185	**1.00**	-95.2	**1.00**	-0.185	**1.00**	-96.6
Common Language	**1.00**	-0.125	**1.00**	173.33	**1.00**	-0.512	**1.00**	173.4	**1.00**	-0.513	**1.00**	174.5
Common Religion	**1.00**	-0.016	**0.86**	24.13	**1.00**	-0.142	**0.73**	20.7	**0.99**	-0.141	0.23	6.4
Contiguity	**1.00**	-0.102	**1.00**	247.87	**1.00**	-0.893	**1.00**	248.2	**1.00**	-0.895	**1.00**	250.8
Infrastructure - Importer	0.17	-0.007	0.09	-0.02	0.14	0.000	0.04	0.0	0.01	0.000	0.01	0.0
Infrastructure - Exporter	0.08	0.002	**0.76**	0.98	0.06	0.000	**0.71**	1.0	0.01	0.000	**0.61**	0.9
Aid for trade % of GDP - Exporter	0.12	-0.001	0.08	7.80	0.10	-0.153	0.04	4.7	0.02	-0.030	0.01	0.8
Investments % of GDP - Exporter	0.05	0.000	0.15	-0.06	0.04	0.000	0.09	0.0	0.01	0.000	0.02	0.0
Investments % of GDP - Importer	**0.92**	-0.019	0.07	0.00	**0.90**	-0.005	0.04	0.0	**0.63**	-0.004	0.01	0.0
Schooling - Exporter	0.07	-0.001	0.37	-0.19	0.06	0.000	0.26	-0.1	0.01	0.000	0.07	0.0
Schooling - Importer	0.06	0.000	0.23	0.11	0.05	0.000	0.14	0.1	0.01	0.000	0.02	0.0
Exchange Rate Stability - Exporter	0.28	-0.003	0.08	-0.42	0.24	-0.018	0.04	-0.2	0.04	-0.003	0.00	0.0
Exchange Rate Stability - Importer	0.35	-0.005	0.08	0.55	0.29	-0.028	0.05	0.3	0.03	-0.002	0.01	0.0
FDI % of GDP - Exporter	0.04	0.000	0.12	-0.01	0.04	0.000	0.07	0.0	0.01	0.000	0.01	0.0
FDI % of GDP - Importer	**0.80**	0.014	0.25	-0.01	**0.73**	0.000	0.17	0.0	0.25	0.000	0.03	0.0
Financial Development - Exporter	0.18	0.005	**1.00**	-1.07	0.15	0.000	**0.99**	-1.0	0.03	0.000	**0.93**	-0.9
Financial Development - Importer	0.04	0.000	**0.53**	-0.15	0.03	0.000	0.37	-0.1	0.01	0.000	0.08	0.0
Exchange Rate	0.08	0.000	**1.00**	-0.02	0.07	0.000	**1.00**	0.0	0.01	0.000	**1.00**	0.0
Inflation - Exporter	0.17	-0.001	0.08	0.01	0.14	0.000	0.04	0.0	0.02	0.000	0.01	0.0
Inflation - Importer	0.05	0.000	0.07	0.01	0.04	0.000	0.05	0.0	0.00	0.000	0.01	0.0
ln(GDPpc) - Exporter	**1.00**	-0.323	0.32	12.03	**1.00**	-0.645	0.21	8.0	**1.00**	-0.638	0.03	1.4
ln(GDPpc) - Importer	**1.00**	-0.266	0.07	0.12	**1.00**	-0.394	0.04	0.2	**1.00**	-0.400	0.01	0.1
ln(Population) - Exporter	0.08	-0.008	0.41	-38.13	0.07	-0.011	0.36	-36.8	0.01	-0.002	0.21	-25.2
ln(Population) - Importer	**0.77**	-0.208	0.09	1.40	**0.75**	-0.253	0.05	1.0	**0.57**	-0.222	0.01	0.3
Manufacturing - Exporter	0.08	-0.001	0.13	0.11	0.07	0.000	0.07	0.1	0.01	0.000	0.01	0.0
Manufacturing - Importer	0.05	0.000	0.08	-0.02	0.04	0.000	0.05	0.0	0.01	0.000	0.01	0.0
Digital Infrastructure - Exporter	0.14	0.002	0.50	0.16	0.12	0.000	0.43	0.1	0.02	0.000	0.21	0.1
Digital Infrastructure - Importer	0.49	-0.011	**0.74**	0.22	0.45	0.000	**0.60**	0.2	0.15	0.000	0.34	0.1
Polity - Exporter	**0.98**	-0.038	0.31	0.64	**0.97**	-0.014	0.20	0.4	**0.86**	-0.012	0.03	0.1
Polity - Importer	0.47	-0.013	0.11	0.12	0.41	-0.004	0.06	0.1	0.08	-0.001	0.01	0.0
REC	**1.00**	-0.050	**0.89**	24.80	**1.00**	-0.413	**0.78**	21.6	**1.00**	-0.415	0.26	7.0
Resource Rents - Exporter	**0.78**	0.019	0.14	-0.08	**0.74**	0.004	0.08	0.0	0.40	0.002	0.01	0.0
Resource Rents - Importer	0.13	0.002	0.08	-0.01	0.13	0.001	0.04	0.0	0.06	0.000	0.00	0.0
Services - Exporter	0.08	-0.001	0.08	-0.01	0.08	0.000	0.04	0.0	0.01	0.000	0.01	0.0
Services - Importer	**0.76**	-0.024	0.11	-0.05	**0.71**	-0.004	0.06	0.0	0.24	-0.001	0.01	0.0
Tariffs (faced)	0.09	0.000	0.07	0.00	0.08	0.000	0.04	0.0	0.01	0.000	0.00	0.0
Tariffs Capital Goods (imposed)	0.08	0.001	0.27	-0.49	0.07	0.000	0.22	-0.5	0.02	0.000	0.12	-0.3
Tariffs Intermediate Goods (imposed)	**0.98**	0.027	**0.81**	-1.83	**0.98**	0.010	**0.81**	-1.9	**0.98**	0.011	**0.84**	-2.2
Import Tariffs Raw Materials (imposed)	0.09	0.001	0.09	0.00	0.08	0.000	0.05	0.0	0.02	0.000	0.01	0.0
Trade Openness - Exporter	0.14	0.002	0.08	0.00	0.13	0.000	0.04	0.0	0.05	0.000	0.01	0.0
Trade Openness - Importer	0.05	0.000	0.10	0.01	0.04	0.000	0.05	0.0	0.01	0.000	0.01	0.0
Trade Costs	**1.00**	0.174	**0.89**	0.04	**1.00**	0.002	**0.77**	0.0	**1.00**	0.002	0.21	0.0
Institutions - Exporter	0.22	-0.006	0.25	2.30	0.20	-0.008	0.16	1.5	0.12	-0.006	0.02	0.2
Institutions - Importer	**1.00**	-0.177	**0.99**	22.61	**1.00**	-0.142	**0.98**	22.6	**1.00**	-0.149	**0.92**	21.4
ln(Distance)	**1.00**	0.282	**1.00**	-152.17	**1.00**	0.669	**1.00**	-152.0	**1.00**	0.671	**1.00**	-152.2
Market Proximity - Importer	**1.00**	-0.199	0.15	-6.70	**1.00**	-0.606	0.08	-3.1	**1.00**	-0.659	0.01	-0.1
Corr PMP	0.9873		0.9309		0.9926		0.982		0.9993		0.9985	
No. Obs.	24,617		25,384		24,617		25,384		24,617		25,384	

Note: Standardized coefficients. Beta coefficients for number of products. Draws: 1,000,000; Burn-ins: 500,000; g-prior: EBL, model prior: uniform

Table A14 - Determinants of Bilateral Diversification – Intensive Margin - Robustness

	g=EBL, model = uniform		g=EBL, model=random		g=BRIC, model = uniform	
			Theil Within			
	PIP	Post Mean	PIP	Post Mean	PIP	Post Mean
Common Colonizer	**0.94**	0.020	**0.93**	0.062	**0.60**	0.040
Common Language	**1.00**	0.079	**1.00**	0.185	**1.00**	0.197
Common Religion	**1.00**	0.023	**0.99**	0.118	**0.87**	0.103
Contiguity	**1.00**	0.066	**1.00**	0.341	**1.00**	0.348
Infrastructure - Importer	0.17	0.009	0.13	0.000	0.01	0.000
Infrastructure - Exporter	0.08	-0.001	0.05	0.000	0.00	0.000
Aid for trade % of GDP - Exporter	0.12	0.001	0.09	0.096	0.01	0.015
Investments % of GDP - Exporter	0.10	0.000	0.06	0.000	0.01	0.000
Investments % of GDP - Importer	0.15	0.002	0.10	0.000	0.01	0.000
Schooling - Exporter	0.18	-0.003	0.12	0.000	0.02	0.000
Schooling - Importer	0.08	0.000	0.06	0.000	0.00	0.000
Exchange Rate Stability - Exporter	0.37	0.005	0.29	0.021	0.05	0.004
Exchange Rate Stability - Importer	0.26	0.005	0.15	0.009	0.01	0.001
FDI % of GDP - Exporter	0.24	0.004	0.11	0.000	0.01	0.000
FDI % of GDP - Importer	0.08	0.000	0.05	0.000	0.00	0.000
Financial Development - Exporter	**0.77**	0.056	**0.63**	0.001	0.22	0.000
Financial Development - Importer	0.21	0.006	0.16	0.000	0.02	0.000
Exchange Rate	**0.78**	0.012	**0.98**	0.000	**0.81**	0.000
Inflation - Exporter	0.17	-0.001	0.10	0.000	0.01	0.000
Inflation - Importer	0.08	0.000	0.05	0.000	0.00	0.000
ln(GDPpc) - Exporter	**1.00**	0.243	**1.00**	0.292	**1.00**	0.315
ln(GDPpc) - Importer	0.29	0.037	0.22	0.026	0.09	0.014
ln(Population) - Exporter	0.11	-0.010	0.06	-0.003	0.01	-0.001
ln(Population) - Importer	0.11	-0.013	0.06	-0.002	0.00	0.000
Manufacturing - Exporter	0.19	-0.004	0.14	-0.001	0.02	0.000
Manufacturing - Importer	0.08	0.000	0.05	0.000	0.00	0.000
Digital Infrastructure - Exporter	0.31	0.010	0.15	0.000	0.02	0.000
Digital Infrastructure - Importer	0.39	0.011	0.49	0.000	0.14	0.000
Polity - Exporter	0.19	0.004	0.14	0.001	0.02	0.000
Polity - Importer	0.23	0.007	0.17	0.001	0.02	0.000
REC	**1.00**	0.040	0.07	0.000	0.01	0.000
Resource Rents - Exporter	0.10	-0.001	0.13	0.000	0.02	0.000
Resource Rents - Importer	0.18	-0.004	**1.00**	0.108	**1.00**	0.109
Services - Exporter	0.09	0.000	0.05	0.000	0.00	0.000
Services - Importer	0.12	0.002	0.09	0.000	0.01	0.000
Tariffs (faced)	**0.96**	-0.017	**0.93**	-0.002	**0.65**	-0.001
Tariffs Capital Goods (imposed)	0.14	0.002	0.09	0.000	0.01	0.000
Tariffs Intermediate Goods (imposed)	0.08	0.000	0.06	0.000	0.00	0.000
Import Tariffs Raw Materials (imposed)	0.11	-0.001	0.08	0.000	0.01	0.000
Trade Openness - Exporter	**0.64**	-0.021	**0.51**	-0.001	0.13	0.000
Trade Openness - Importer	0.11	-0.002	0.11	0.000	0.01	0.000
Trade Costs	**1.00**	-0.223	**1.00**	-0.002	**1.00**	-0.002
Institutions - Exporter	**0.83**	0.053	**0.80**	0.042	**0.65**	0.037
Institutions - Importer	**0.84**	0.102	**0.83**	0.050	**0.54**	0.035
ln(Distance)	**1.00**	-0.173	**1.00**	-0.243	**1.00**	-0.245
Market Proximity - Importer	**1.00**	0.250	**1.00**	0.510	**1.00**	0.575
Corr PMP		0.9607		0.9908		0.9992
No. Obs.		23,678		23,678		23,678

Note: Standardized coefficients. Beta coefficients for number of products. Draws: 1,000,000; Burn-ins: 500,000; g-prior: EBL, model prior: uniform