Three Essays on International Trade

by

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Abstract

Chapter 1 investigates how tetracycline affects beef trade survival. We use United Nations Commodities Trade Statistics (UNComtrade): Harmonized System (HS) 020130 six-digit level of beef trade includes bovine cuts boneless, fresh or chilled, for 43 countries. From these data, we observed 7546 trade spells. The econometric model consists of Cox proportional hazard function with the classical variables included in the gravity model and other covariates that incorporate Bao and Chen (2013) model specification. The results suggest that, ceteris paribus, stricter tetracycline standards decrease beef trade duration. We suggest using the discrete choice version of the survival analysis model and accounting for missing values and trade values threshold for further studies.

In chapter 2, we use variants of the gravity model to assess the impact of Regional Trade Agreements (RTAs) on Trade. We investigate the effect of RTAs on developing countries trade and we contrast it with that of developed countries. We also investigate how RTAs affect trade, for agricultural products. We find that RTAs increase trade volume in US dollars among 110 countries. When trade partners are developing countries, it does not have any effect on trade value. The interaction of variables for developing country and RTAs has no effect on trade value. Trading agricultural products has no effect on trade value. Finally, the interaction between corruption index and RTA has a negative effect on trade. This paper sheds light on the disparities that may exist in the impact of RTAs on trade when trade partners are developing countries and commodities are agricultural products.

Chapter 3 focuses on assessing the determinants of the composition of intra-African trade. The objective is to test the significance of the variables used in the gravity model, as well as other variables of interest and see if they affect the likelihood of intra-African trade for several types of products over non-manufactured agricultural products made in Africa. Confirming previous literature, we find that, transportation/communication infrastructure and economic management have a positive on the likelihood of intra-African trade for products made outside Africa over NMAP from Africa. Opposite results were found for the presence of political tension. Finally, our results suggest that distance, exporting country Gross Domestic Product (GDP) as wells as importing country GDP are relevant in explaining the likelihood of intra-African trade for several types of products over NMAP from Africa, with the usual signs obtained in the gravity model. However, common language and Regional Trade Agreements were found not to affect the likelihood of intra-African trade for other types of products over NMAP from Africa.

Additional analyses using gravity model on eight categories of product suggest that the presence of political tensions in both importing and exporting countries have negative impact on infra-African trade. Improving economic management transportation and communication infrastructure in both importing and exporting countries. All the other variables of the gravity model have the expected sign.

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Introduction

Food safety is becoming more and more an important public health concern in international trade. The Codex Alimentarius Commission (Codex) has the responsibility to determine, in case of the Sanitary and Phytosanitary measures (SPS), the Maximum Residue Limits (MRLs) for any particular food. However, Countries and increasingly private firms set MRLs that are above what is stated in Codex. A special case of SPSs is the MRL of veterinary drugs. These chemical products may have negative effects on human health if their quantity is too high in the concerned animal meat. In fact, they can create drug-resistant bacteria, cause infections for which cures are challenging (World Health Organization, 1997). Because of all these reasons, MRLs may have an impact on trade flows and duration. There is a wide prevalence of Non –Tariff Barriers in meat trade (Cao & Johnson, 2004). In this paper, I focus on how tetracycline regulations affect beef trade duration. Tetracycline is used to stimulate animal growth and for prevention and treatment of disease (Wilson et al, 2003). This veterinary drug is one the most used according to the same author. For instance, more than 50% of manufactured antibiotics in the US are tetracycline (Botsoglou & Fletouris, 2001). A study on tetracycline residue levels on cattle meat, liver, and kidney reveals that 380 observations of their sample (500 observations) contain tetracycline products and 21.7% of the sample contains residue higher than the World Health Organization MRLs (Mesgari Abasi et al, 2009).

The World Trade Organization (WTO) members to reduce tariff levels in the past twenty years. The main objective of these measures is to increase trade (flows, and duration) between WTO members. For instance, there is a reduction of at least 26% of tariff line on imports of agricultural products in developed countries (Henson & Loader, 2001). Tetracycline regulations are considered Non-Tariff Measures (NTM) in international trade jargon. They are defined as any measures except from tariff that affect international trade. It is well known among economists that WTO members use more and more Non-Tariff Measures (NTM), mainly in the agricultural sector. According to the WTO, Sanitary and Phytosanitary measures (SPS) and Technical Barriers to Trade (TBT) are one the most important issues that agricultural exporters are facing nowadays.

Sanitary and Phytosanitary measures are the laws, rules, standards, and procedures that governments employ to protect humans, animals, and plants diseases pests, toxins and other contaminants. Technical Barriers to Trade (TBT) cover technical regulations, product standards, environmental regulation, and voluntary procedures relating to human health and animal welfare (Johnson , 2014).

Many studies report statistics about the extent to which WTO members use NTMs. For instance, 79% of European Union (EU) trade may be affected by Technical Barriers to Trade (TBT) in 1996 (Brenton et al, 2001). Between 1995 and 2009, 289 cases of SPS measures have been reported to the WTO. Among these cases, 139 were on meat, 49 on fruits and 27 on vegetable (Bradley & Lei ,2011). On average, countries impose SPS on 30% of their trade and TBT measures on 15% of their trade (Fugazza , 2013). About 40% of SPS at the WTO involve animal health and zoonotic diseases, 30% food safety, 26% plant health and other factors account for 6%. Between 1995 and 2012, 344 SPS complaints have also been reported. Among those complaints, 30% are on protection of human health and food safety, 15% on environment protection, 12% on prevention

of deceptive practices, 9% on consumer information and labelling and 1% on animal health protection (Johnson, 2014). These statistics support why economists are paying more and more attention to NTMs.

I hypothesize that tighter tetracycline regulation negatively affect trade duration. This hypothesis is based on the fact that supply is negatively affected by food safety measures while these measures increases demand for the good with tighter regulation. Food safety regulations often increase trade for countries already in relationship because these trade partners have considerably reduced procedure, formalities and tax regulations while it is not the case for countries with no partnership. Moreover, when two countries stop trading, resuming trade implies some cost (see Brenton et al (2010), Cadot et al (2013), Corcoles et al (2014), and Fu & Wu (2014)).

Most of the studies available at this point on NTMs focus on the impacts of NTMs on trade flows and welfare (Li & Beghin,2014, Bradley & Lei ,2011, Disdier & Marette, 2010, Disdier & van Tongeren 2 010, Prevost, 2010). The trade effects of any measures are of three types: the probability of trade, the volume of trade and trade sustainability. In this paper, the terms trade survival, trade duration and trade sustainability will be used interchangeably without distinction. Beef trade duration is defined as the number of consecutive years beef trade is different from zero.

Two important concepts are the survival and hazard function. The survival function is the probability that there is a non-zero trade beyond time t. The hazard function is the instantaneous rate of not trading at time t conditional to having traded until time t .

In the present paper, disaggregated data means beef trade flows at the HS six digit classification level. To the best of my knowledge, Bao & Chen (2013) is the only paper that

investigates the impact of NTMs on trade duration where trade duration is defined as the number of consecutive years two countries trade together. Specifically, they assess the effect of TBT on trade survival of manufactured products of 103 countries and regions from 1995 to 2008 using aggregated data. They find that TBT negatively affects trade duration for both developed and developing countries. They also think that focusing on disaggregated data may reveal more on NTMs impact on trade. The main difference between these two papers is that Obashi (2010) focused on countries which have some partnership via regional trade agreements while those in Bao and Chen (2013) includes many countries with no trade agreements. The sample used in the present study contains both countries with trade agreements and countries without trade agreements: 17% of the countries are not involved in trade agreements while 83% are.

The most important question at this point is: will using disaggregated data gives similar results as in Bao & Chen (2013)? There is an important gap to fill in the subfield of empirical trade analysis with disaggregated data (Gaulier & Zignago, 2010). It is difficult to get precise conclusions with theoretical analyses when dealing with NTMs (Dee & Ferrantino, 2005). In fact many strong assumptions on utility has to be made in order to simplify the model. This lead to results that are not generally applicable to all cases. The presence of multiple NTMs on a single product makes the investigation more challenging (Ferrantino, 2003). Many potentials trade relationships on a product-specific level are nonexistent (Rau & Schlueter, 2009). Consequently, investigating NTMs at the product level increases the understanding of these policy instruments.

I contribute to the literature on survival analysis and NTMs by assessing the impact of Maximum Residue Limits (MRL) of tetracycline on beef trade duration by working at the product level. The paper is organized as follows: I present an overview of the most important specifications of the gravity model, and the most recent developments on trade duration. A detailed section on

the econometric model specification follows the literature review. The last part of the paper consists of the results, discussion, and conclusion.

Literature review

Food standards and agricultural trade

Economists find that NTMs are one of the most challenging trade instruments to evaluate. The implications of NTMs on agricultural products trade has not extensively been assessed at a disaggregated level (Disdier & van Tongeren, 2010 and Grant & Dayton, 2008). TBTs are one of the most challenging NTMs to quantify because of their theoretical complexity (Bao & Qiu, 2010). NTMs are ambiguous and politically sensitive because regulations may address market failure but can also reduce imports from foreign countries (Beghin, 2008).

Most of the studies available at this point on NTMs focus on the impacts of NTMs on trade flows and welfare (Li & Beghin,2014, Bradley & Lei ,2011, Disdier & Marette, 2010, Disdier & van Tongeren 2 010, Prevost, 2010). The trade effects of any measures are of three types: the probability of trade, the volume of trade and trade sustainability. In this paper, the terms trade survival, trade duration and trade sustainability will be used interchangeably without distinction. (Otsuki et al, 2001) investigate the impact of European Union (EU) food safety standards on African exports. They find that implementing aflatoxin standards in the EU had a negative effect on African exports of cereals, dried fruits, and nut to Europe. The same authors published another paper in which they study the impact of EU harmonization of aflatoxin regulation on African groundnut exports. They find that a 10% stricter aflatoxin standard reduce edible groundnuts exports by 11%. Furthermore, these standards imply a decrease of 60% of trade volume in comparison to a context where Codex Alimentarius regulation has been followed.

(Otsuki et al 2001b). For Yue et al (2006), in a context of imperfect competition, it has been found that if Japanese TBT is removed, there is small export gain to the US.

NTMs could be the results of four different reasons: trade creation, trade reduction, trade prohibition, and trade diversion (Nadella & Boccaletti, 2005). As we can see, the trade duration effect of a NTM has not received much attention and is an important component of trade performance (Bao & Chen, 2013).

On one hand, it is well known among economists that safety standards increases demand because consumers are more confident in products quality. On the other hand, these measures negatively affect supply because they imply additional costs from firms involved in trade. The results of these two effects on trade is unknown. This makes the net effect of an NTM on any aspect of trade challenging to investigate.

Brief overview on the specification of the gravity model

The gravity model is a model developed from physics by Tinbergen (1962) to analyze trade volume pattern. In his model, trade volume depends on countries economic size and distance between countries. Anderson (1979) provides a bridge between empirical and theoretical analyses by deriving a theoretically consistent version of the gravity model. He argues that trade volume between two countries depends on their bilateral barriers relative to all the average barriers with the other partners. A set of covariates usually used to control for the different bilateral barriers have been included in the investigation, and the one I am focusing on is the tetracycline regulation.

I assume gravity model variables might have an impact on trade duration because they have been found successful in explaining trade volumes (Besedeš & Blyde, 2010). It is assumed in this paper that the more a country trades with its partner, the longer they trade. The econometric model

in this paper involves many of the variables in the gravity model. This model has extensively been used to investigate trade flow effects as a function of economic size of countries, and distance (bilateral costs) (Disdier & Marette, 2010, among others). The simplest specification of the gravity model is as follows:

$$T_{ij} = \alpha_0 {Y_i}^{\alpha_1} {Y_j}^{\alpha_3} D_{ij} X_{ij} \varepsilon_{ij},$$

where T_{ij} is the volume of trade between country i and country j , Y_i and Y_j are the Gross Domestic Products of the two trade partners, D_{ij} is the distance separating the countries, X_{ij} includes all the other variables that affect trade flows and ε_{ij} is the error term.

Many studies use the gravity model to assess trade effects of diverse instruments. Using direct Maximum Residue Limits (MRL) tends to overestimate the trade impeding effects than other measures and helps define clearer policy implications (Li & Beghin, 2014). On the specification of the gravity equation, using the log-linear form of the gravity model creates a biased estimator (Santos Silva & Tenreyro, 2006 and Baldwin & Taglioni ,2006). Santos Silva and Tenreyro (2006) suggest using the Pseudo-Poisson Maximum Likelihood (PPML) technique. This technique is robust and efficient in presence of heteroscedasticity (whether or not fixed effects are included in the model) and in presence of zero trade data. A good alternative in the presence of zero trade is to use the sample selection model introduced by Heckman (1979) or the tobit model.

On the best data to use when estimating a gravity model, panel data seems to be the best type of data because they give more robust results for the impacts of standards on trade (Wilson et al, 2003). Another important advantage of the panel data is that they solved the endogeneity issue of TBT by the use of time fixed and country effects (Baier & Bergstrand, 2007). A panel data should include year-specific importers fixed effects and year-sector specific exporter's fixed effects in the gravity model specific (Feenstra, 2003). Other forms of gravity equation specification

include fixed effects to control for importing and exporting countries specific characteristics that are not observable (Moenius, 2000) and time dummies to take into account the change in standards in the time (Wilson et al, 2003).

Survival analysis

Beef trade duration is defined as the number of consecutive years beef trade is different from zero. For Wooldridge (2002) economists assess trade duration with the hazard function:

$$\lambda(t) = \frac{f(t)}{S(t)} = \lim_{\Delta t \to 0} \frac{Pr[T+\Delta t > T > t | T > t]}{\Delta t},$$

where $f(t)$ is the density function corresponding to the probability distribution of duration $F(t) = Pr[T < t]$. It is the probability that the random variable T takes any value less than t. The survival function denoted $S(t)$ is the probability that T takes a value greater that t. In other words,$S(t) = 1 - F(t)$. Defined as such, the hazard function is the instantaneous rate of leaving the state t for the random variable T, conditional to having traded until time t. Applying this concept to beef trade, the termination event is zero trade in a particular year.

There are many functional forms for the hazard function, one of the most used has been introduced by Cox (1972) and is as follows:

$$\lambda(t) = \lambda_0(t) e^{X'\beta},$$

where $\lambda_0(t)$ is the base hazard function and is common to all units in the population, X the set of covariates that affect the hazard function and β the vector of coefficients corresponding to these covariates. In this particular specification, the covariates have a proportional impact on the hazard function. Some economists use this technique to assess the variables that affect trade survival (see (Besedeš & Blyde, 2010), (Besedeš & Prusa, 2006), (Nitsh, 2009) and (Obashi, 2010)). However, other argue that Cox model may reduce efficiency of estimators. They also argue that Cox model

is a continuous time model, and using this model with a discrete dependent variable may lead to serious bias in presence of multiple short spells ((Brenton et al, 2010), (Fugazza & Molina, 2011), and (Hess & Persson, 2011)). These authors also point out the fact that Cox model does not control for individual heterogeneity (denoted "frailty"). Finally Cox model does not take into account the differences at the country and product level. Hess & Persson (2011) suggest using tobit or logit models by incorporating product-country fix effects. Most of the time, duration starts at different times, it is advised to include indicators for different starting dates in the covariates. This helps control for seasonal differences in duration distribution (Wooldridge, 2002).

Many papers contribute to the economic literature on survival analysis. On the effects of markets access on firms' survival in foreign markets, the market access conditions influence export survival (Fugazza & McLaren, 2014). On the determinants of trade survival, ad valorem transportation costs have an impact on trade duration (Besedeš & Blyde, 2010). They also find that the elasticity of demand for goods increases the probability of exiting the export market whereas the size of the partner, common language and common border, presence of trade agreements, the size of the exports, depreciated exchange rate, and the presence of a well-organized financial system increase chances of staying on the market. Uncertainty in the formation of trade relationships could also explain failure to export markets (Besedeš, 2008).

The number of firms exporting diversified products affect survival analysis Survival after the first year is positively correlated to the survival during the first year (Cadot et al, 2013)**.** In the same logic, using Cox model to investigate the hazard effects of innovation on exports duration. The effects is stronger for differentiated products than for homogeneous products (Chen, 2012). Another paper strengthens the importance of the impact of product sophistication on trade survival. The authors find a positive impact of products sophistication as well as previous

export experience, and previous degree of integration in international scale networks on trade duration (Córcoles et al, 2014). Product diversification reduces the probability of trade failure (Hess & Persson, 2011 and Fugazza & Molina, 2009), where trade failure is defined as zero trade in a particular year. Foreign ownership is also an important variable that determines exports survival, and state ownership increases the risk of export survival (Fu & Wu, 2014). Investigating the determinants of trade survival for US fresh fruits and vegetable market other economists use the Cox model and Kaplan and Meier models as well as discrete time model (count data model) (Rudi & Peterson, 2012). They find that SPS measures positively impact trade duration whereas new market access issued during their study negatively impacts trade duration.

A stratified Cox proportional hazard at the product-country level has been used to assess the effect of trade costs, policy shocks, and export experience on trade survival for 53 African countries from 1995 to 2009 (Kamuganga, 2012). He finds that trade agreements decreases trade hazard and that the interaction between trade agreements variable and trade costs decrease the hazard rate. Other variables have been found not to affect trade duration. In fact, that exchange rate and membership of exporting country to the European Union (EU) have no impact on hazard rate (Nitsh, 2009).

The duration model used in this paper is similar to that used in Bao and Chen (2013), except that the present analysis focuses on the effect of tetracycline regulations on beef trade duration.

Econometric strategy

I use an extended version of the Cox proportional hazard function used in Bao & Chen (2013) to assess the effect of a NTM on trade survival. As stated in the previous section, the hazard function is:

$$\lambda(t) = \lambda_0(t)e^{X'\beta},$$

Table 1.1 summarizes the variables included in vector X.

As the model is in exponential form, the estimation yields coefficients in the form e^{β} and we take the natural log to get the estimate of the parameters. If the estimate is negative, the covariate decreases the probability of trade failure conditional to having traded until that moment. In other words, the exogenous variable increases trade duration between the two countries. If, on the contrary, the estimate is positive, the covariate increases the probability of trade failure conditional to having traded until that moment.

We expect tetracycline standards to be negatively correlated to trade duration because tighter standards implies less beef products eligible for importation in the country imposing the stricter tetracycline regime. In other words, we expect the coefficient on $TETRA_{ijt}$ to be positive.

Data

We use data from 1981 to 2013. The first step is to convert export and import data into spell. A spell is defined as consecutive years during which trade is non zero between two countries. For instance, US has been exporting or importing beef with Canada from 1981 to 2013 in our sample. In this case there is one spell of 23 years because there has been no trade gap during this period. This example is a one spell case. Let's take the case of beef trade from the US to Bulgaria during the same period. The sample data from UN Comtrade displays beef trade from US to Bulgaria in 1999, 2002, 2007, and 2010. The number of spells in this case is 4 of one year. This is relevant because we use UN Comtrade in the estimation, and it is well known that this database (which is one the most complete) may contain discrepancies between export value from an origin

country to a particular destination and import values reported by this destination for the same product and year. A good strategy to avoid recording zero trade is to compare these two values. When there are discrepancies between import and export values, we report import values because the importer is more likely to report the value of beef trade as it is imposing a tax on incoming beef from the exporter.

I use panel data because it has two advantages: (a) in a proportional hazard specification, it leads to easy methods for estimating flexible hazard functions, (b) it also allows an easy way to introduce time-varying covariates (Wooldridge, 2002).

The level of data aggregation is important in trade duration analysis (Besedes & Blyde, 2010). They argue that if the data is too aggregated, this may lead to continued trade because too many products will be included in categories. Consequently, the probability of failure will be low. On the other hand, if the data is too disaggregated, the probability of failure will be high. For this reasons, I use at the six-digit level HS aggregation data and analyze the effect of tetracycline standards on six digit of beef trade (HS 020130 that includes bovine cuts boneless, fresh or chilled). Data sources of the main variables are summarized in table 1.2.

The analysis has been conducted for 46 countries for which tetracycline regulations were available on the International Maximum Residue Level Database website : USA, Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Italy, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovenia, Spain, Sweden, UK, Argentina, Australia, Brazil, Canada, Chile, China, Dominican Republic, Egypt, Guatemala, Honduras, Hong-Kong, Indonesia, Japan, Kazakhstan, Korea, Malaysia, Peru, Philippines, Russia, South Africa, Taiwan, Thailand, Venezuela, Vietnam. In total, the study has been conducted on 7546 spells.

Despite the fact that we correct the data by contrasting exports and imports data, there was an absence of trade between some countries for one or two years, while these countries have been trading during the other years, even in absence of Foot and Mouth Disease (FMD) and/or Bovine Spongiform Encephalopathy (BSE). This suggests that missing values are present in the sample. In order to deal with this issue, we use a multiple imputation technique. This technique consists of using simulation to create a set of random variables that follow the same distribution as the spell distribution. As spells are count data, I assume they have a log-linear a priori distribution. Finally, the mean of each draw is computed and affected to one missing value. This operation is repeated for as many missing values as possible.

It is important to point out that trade duration is not always what is revealed in empirical analysis. In fact, there is a censoring issue in the data collection process. For instance, beef trade is reported as started in year 1995 between country A and country B and last for two years (1995 and 1996). In 1998, beef trade has resumed between the two countries. The absence of trade in 1997 may be due to an error or other reasons that we could not identify. Another type of data censoring occurs when we stop recording trade spells in 2013, which is the end of the analysis period. For instance, if trade has been reported from 2011 to 2013, we mark 3 spells (2011, 2012, and 2013). The censoring issue relates to the fact that trade may be present in 2014, 2015, etc., but the data were not available at the time the data were collected. Consequently, my estimates may be biased. A well-known strategy to overcome this issue is to use the Kaplan-Meier non-parametric estimator, which I use for the estimation.

Econometric models may be affected by endogeneity and/misspecification. This may be the result of omitted variables, measurement error or reverse causality. In order to test for endogeneity of model misspecification, I use the Haussman test. In order to do so, I include other

variables in the model. The F statistics is 8.19 with a p-value 0.557. As this probability is higher than 0.05, I conclude that there is neither misspecification error, nor endogeneity problem in the model (Table 1.3).

Results and Discussion

The estimate of interest is positive and significant (0.009) and the average spell is 2.99 years (Table 1.3). In other words, tighter standards in tetracycline increases the probability of beef trade failure conditional to having traded until a particular time. This could be explained by the fact that the average starting trade flows for the sample very low ($19,852). This has a negative impact on trade duration (Besedes, 2010). Another reason why this result is understandable is that most of the trade flows in the sample did not survive the first few years of trade. This has the consequence of increasing the probability of trade failure in the following years. 70% of our sample consists of spells where only a very specific product is exported or imported for the trade partner. This negatively affects trade survival beyond the first year (Cadot et al 2010).

As all the coefficients are significant, I compare their size and conclude that tighter tetracycline regulations affect trade survival but not as much as other covariates (distance, common language, for instance). Comparing this result to the one obtained in Bao & Chen (2013), working at a disaggregated data level did not affect the sign and significance of the impact of a NTM on trade survival.

Contrasting the estimate for tetracycline impact on beef trade duration with that of the gravity model in Wilson et al. (2003), whether the analysis is conducted for beef trade survival or beef imports, the results suggest that tighter tetracycline standards hinder both beef trade survival and imports.

Cox proportional hazard function is more efficient when using continuous independent variable. In the present case, the independent variable (time in years) is not continuous. As suggested in the literature, using discrete time version of the survival analysis will correct the error introduced in the results.

Finally, can any reported trade value be considered as spell? For some of the spells in the sample, we count a spell when trade is different from zero. As advised by Obashi (2010) and Corcoles et al. (2014), it may be interesting to assign a spell only to trade value higher or equal to a predefined threshold. Consequently, all trade values that are less or equal to the defined threshold will be not considered as spells.

Conclusion

This paper is the first to investigate the impact of an NTM (tetracycline) on an agricultural trade product (beef) survival at a disaggregated level. I assess how tetracycline maximum residue limits affect six digit HS 020130 that includes bovine cuts boneless, fresh or chilled. Data have been collected on 46 countries to get 7546 spells. The model is a Cox proportional hazard function with most of the classical variables included in a gravity model and follows Bao and Chen (2013). I find that tighter tetracycline standards negatively affect beef trade survival even if trade duration mean is almost 3 years in average. The results confirm that of Bao and Chen (2013) about the impact of NTM on trade duration and support the fact that working at a disaggregated or aggregated does not change the direction and significance of the impact. Moreover, the results also suggest that using survival model, tighter tetracycline standards hinder beef trade survival. A good extension of this paper is to use the same data to investigate the impact of tetracycline standards

on beef trade by using a discrete choice model, and specifying the threshold for trade values to be considered as spell.

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Appendix 1

Table 1.1: List of the endogenous variables

Variable	*Definition*
$GDP_{ex_{it}}$	Gross Domestic Product in billions US dollars of the year 2005 of exporting country i at time t
$GDP_{im_{jt}}$	Gross Domestic Product in billions US dollars of the year 2005 of importing country j at time t
$GDPPC_{ex_{it}}$	Gross Domestic Product Per Capita in billions US dollars of the year 2005 for the exporting country i at time t
$GDPPC_{im_{jt}}$	Gross Domestic Product Per Capita in billion US dollars of the year 2005 for the importing country j at time t
$Dist_{ij}$	Distance between country i and country j in kilometers
$Contig_{ij}$	Dummy variable for existence of common border between country i and country j (1=Yes, 0=No)
$Comlang_{ij}$	Dummy variable for existence of common official language between country i and country j (1=Yes, 0=No)
$Colony_{ij}$	Dummy variable for existence of colonial history between country i and country j (1=Yes, 0=No)
$Smctry_{ij}$	Dummy variable for existence of membership of trade partners i and j to the same group (1=Yes, 0=No)
RTA_{ijt}	Dummy variable for existence of membership of countries i and j to a Regional Trade Agreement at time t (1=Yes, 0=No)
$InExp_{ijt}$	Initial trade value in US dollars of the year 2005 between countries i and j at time t
r_{ijt}	Depreciated exchange rate between countries i and j at time t
$TETRA_{ijt}$	Tetracycline Maximum Residue Limits in parts per millions (ppm) for country j when importing from country i at time t
FMD_{ijt}	Dummy variable for presence of an outbreak of Food Mouth Disease (between 1999 and 2000) in country i when exporting to country j at time t (1=Yes, 0=No)
$MADCOW_{ijt}$	Dummy variable for presence of Bovine Spongiform Encephalopathy (BSE) in country i when exporting to country j at time t (1=Yes, 0=No)
$RuLaw$	Degree of country contract enforceability (1=Yes, 0=No)
$RTA * Dist_{ij}$	Composite variable for distance and membership in an RTA
$RTA * Contig_{ij}$	Composite variable for existence of common border between countries i and j and membership in an RTA
$RTA * Comlang_{ij}$	Composite variable for existence of common border between country i and country j and membership in an RTA
$RTA * Colony_{ij}$	Composite variable for existence of a colonial history between country i and country j and membership in an RTA
$RTA * Smctry_{ij}$	Composite variable for existence of membership of trade partners i and j to the same group and membership in an RTA

Table 1.2: Data source for the main variables

Variable	*Source*
$GDP_{ex_{it}}$	World development Indicator, World Bank (http://data.worldbank.org/indicator/NY.GDP.MKTP.CD)
$GDP_{im_{jt}}$	World development Indicator, World Bank (http://data.worldbank.org/indicator/NY.GDP.MKTP.CD)
$Dist_{ij}$	Centre d'Etudes Prospectives et D'Informations Internationale (CEPII) (http://www.cepii.fr/CEPII/fr/bdd_modele/presentation.asp?id=6)
$Contig_{ij}$	CEPII
$Comlang_{ij}$	CEPII
$Colony_{ij}$	CEPII
$Smctry_{ij}$	CEPII
RTA_{ijt}	WTO (http://rtais.wto.org/UI/PublicMaintainRTAHome.aspx)
$InExp_{ijt}$	UN Comtrade
r_{ijt}	International Monetary Fund (http://www.imf.org/external/pubs/cat/longres.aspx?sk=945)
$TETRA_{ijt}$	International Maximum Residue Level Database (https://www.globalmrl.com/db#query)
FMD_{ijt}	World Organization for Animal Health (http://www.oie.int/animal-health-in-the-world/fmd-portal/)
$MADCOW_{ijt}$	World Organization for Animal Health (http://www.oie.int/animal-health-in-the-world/official-disease-status/bse/list-of-bse-risk-status/)
$RuLaw$	International Country Risk Guide (ICRG) (https://www.prsgroup.com/about-us/our-two-methodologies/icrg)

Table 1.3: Summary of the results

Variable	Coefficients
$GDP_{ex_{it}}$	-0.071***
$GDP_{im_{jt}}$	-0.0055***
$GDPPC_{ex_{it}}$	-0.035**
$GDPPC_{im_{jt}}$	-0.008**
$Dist_{ij}$	1.022***
$Contig_{ij}$	-0.061***
$Comlang_{ij}$	-0.089***
$Colony_{ij}$	-0.071***
$Smctry_{ij}$	-0.039***
$\boldsymbol{TETRA_{ijt}}$	**0.009*** **
FMD_{ijt}	0.008***
$MADCOW_{ijt}$	0.0005***
$RuLaw$	0.0000002***
$RTA * Dist_{ij}$	-0.000000145***
$RTA * Contig_{ij}$	-0.000000085***
$RTA * Comlang_{ij}$	-0.0000000063***
$RTA * Colony_{ij}$	-0.000000000078**
$RTA * Smctry_{ij}$	-0.00000091***
RTA_{ijt}	-0.012*
Endogeneity Test	F=8.12, pvalue=0.557
Average Spell	2.99

NB: *, **, *** significant at 10%, 5%, and 1%, respectively

Chapter 2: Assessing the Impact of Regional Trade Agreements on Trade: A focus on developing countries and agricultural products

Introduction

Since the creation of the World Trade Organization (WTO), many Regional Trade Agreements (RTAs) have been concluded among various countries from different regions in the World. The main objective of these agreements is to reduce trade barriers among members. While trade agreements may positively affect trade among some members of the agreement, they may also have undesirable effect on others. Concerns were raised on the weakening effect of the multilateralism trading system of the RTAs. The concern is that RTAs will create some regionalism. Other concerns have been raised on the increasing tariff and non-tariff barriers effect of the RTAs. Some scholars agree on the trade enhancing effect of RTAs, others don't. The objective of this paper is not to provide evidence on which side is the correct, but to shed light on issues that have not been thoroughly addressed. Not only do I investigate how RTAs affect developing countries, we also contrast the effect of RTAs on developing countries to that on developed countries. Another important fact on international trade research trade is that there are more studies of non-agricultural products. The second contribution of this paper is to assess how the agricultural product differently affect trade between two developing countries.

We posit the following assumptions:

Hypothesis 1: RTAs between developing countries increase trade values among its partners.

Hypothesis 2: RTAs on agricultural products increase trade values among these partners.

The rest of the papers is a follows. Section 1 presents the background of the issue. Section 2 develops the main trend in the literature on the relationship between international trade agreements. Section 3 focuses on the econometric model and data used to investigate the hypotheses. Second 4 presents the results and discusses the results. Section 5 concludes.

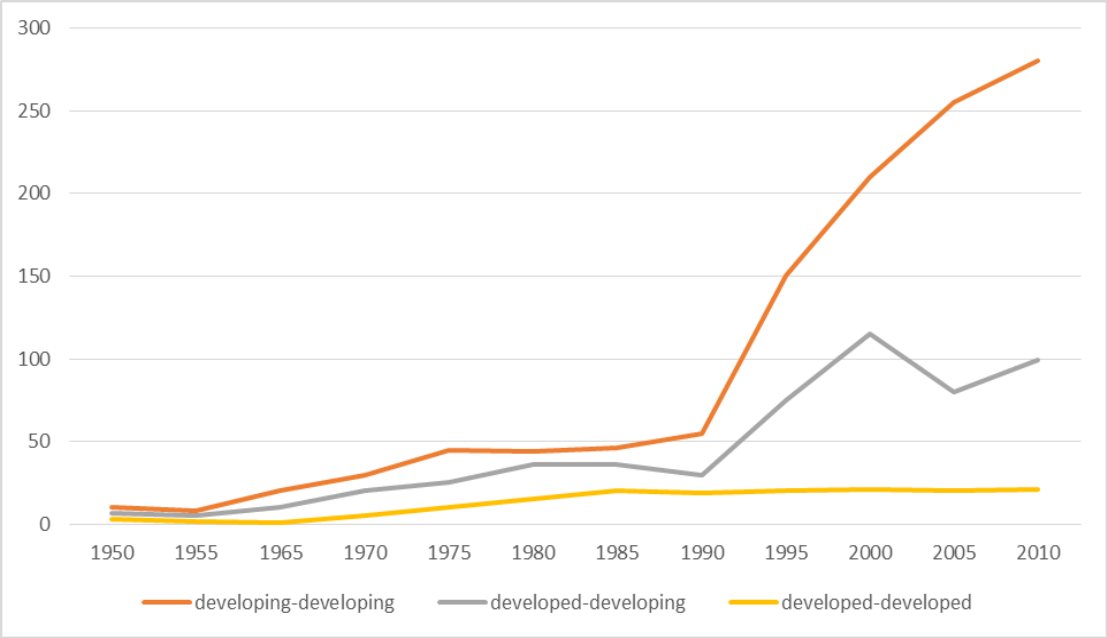
Background

RTAs

In the WTO, Regional Trade Agreements (RTAs) are defined as reciprocal trade agreements between two or more partners. They include free trade agreements and customs unions, common market, and economic union. In other words, a regional trading arrangement is an agreement among governments to liberalize trade and possibly to co-ordinate other trade related activities. RTAs also refer to free trade among a number of nations in a specified area or region. Regional trade agreements regulate more than one half of global trade (WTO, 2011). For instance, in 2008, the share in all countries of the world merchandise trade between RTAs partners was respectively 51% for exports and 49% for imports (Table 2.1).

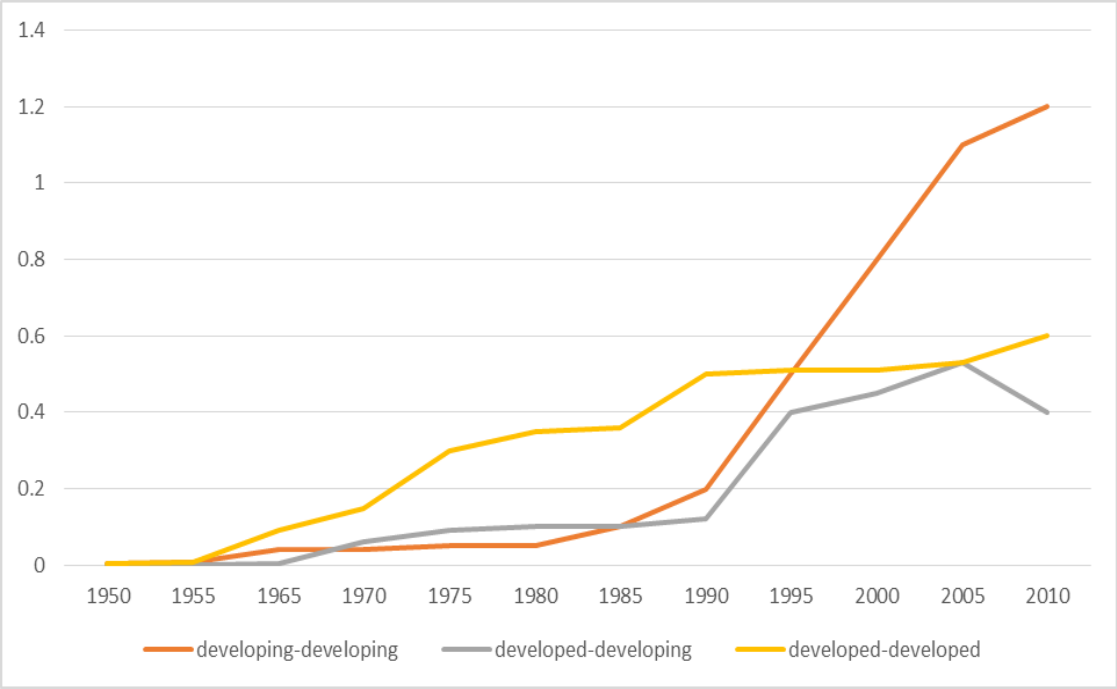
The number of RTAs between trade partners has been increasing over the years. Figures 2.1 and 2.2 summarize how the cumulative and average numbers of RTAs have evolved from 1950 to 2010. Overall, the graphs show that both the cumulative and the average numbers of RTAs are increasing.

Figure 2.1: Cumulative number of RTAs in force 1950-2010 by country group



Source: Adapted from WTO, 2011

Figure 2.2: Average number of RTAs in force per country group, 1950-2010



Source: Adapted from WTO, 2011

The WTO has been successful in increasing global trade volume. In fact, since 1950, there has been an increase in world trade by 27 times the volume of trade (WTO, 2011). The main reason of this result resides in the visible role in reducing trade barriers through successive rounds of negotiations. Will the RTAs be able to do the same?

Bhagwati's concern about regionalism appears justified to a degree as the number of such agreements is expanding rapidly. From the beginning of the GATT in 1947 to the end of 1994, 112 regional trade agreements were notified under Article XXIV of the GATT. From the beginning of 1995 to mid-1998, a further 45 new agreements were notified. There were also an estimated 62 agreements which had not been notified to the WTO by mid-1998. However, these are cumulative figures and some of these agreements have ceased to exist, so that, by mid-2008, there were 576 agreements in force (WTO, 2011).

Agricultural products

In this paper the term "agricultural products" means agricultural, horticultural, dairy products, livestock and the products thereof, the products of poultry and bee raising, the edible products of forestry, and any and all products raised or produced on farms and processed or manufactured. Any other product that does not satisfy this criterion is considered as non-agricultural products. Based on this definition, fish is treated as a non-agricultural product. Excluding fish from agricultural products is in line with the Uruguay Agreement on Agriculture. Agricultural products trade is more subject to RTAs than non-agricultural products. In 2008, 24.1% of agricultural trade was subject to RTAs while 15.9% of non-agricultural trade was subject to RTAs (Table 2.2). Also, 93% of agricultural RTAs are actually put into use while 87% of non-agricultural RTAs are used (Table 2.3).

Developing countries

Low-income economies are defined as those with a Gross National Income (GNI) per capita, calculated using the *World Bank Atlas* method, of $1,045 or less in 2014; middle-income economies are those with a GNI per capita of more than $1,045 but less than $12,736; high-income economies are those with a GNI per capita of $12,736 or more. Lower-middle-income and upper-middle-income economies are separated at a GNI per capita of $4,125. We use the IMF definition to separate developing countries from developed countries. The World Bank classifies all low- and middle-income countries as developing but notes, "The use of the term is convenient; it is not intended to imply that all economies in the group are experiencing similar development or that other economies have reached a preferred or final stage of development." (IMF, 2013)

We include specific analysis on developing vs developed countries because the WTO presence of these two groups of countries have been different.

Developing countries have fewer obligations to liberalize their trade because of the principle of special differential treatment. The reluctance of developing countries to take on obligations to liberalize under the WTO was codified under the principle of special and differential treatment (SDT), which has defined the terms of developing country participation or rather virtual non-participation. In terms of developing countries' own liberalization, SDT consists of two elements: First, developing countries have not, until the Uruguay Round, really participated in tariff liberalization in the various rounds. Until the Uruguay Round developing countries had "bound" less than a third of their tariff lines compared to nearly 85% for industrial countries. That is, developing countries had no commitments as regards to tariffs for over two-thirds of their imports. And even on the 30% of the bound lines, the commitments to liberalize were weak because the bound rate was well above the applied (the pre-negotiation) rate, typically by over 10

to 15 percentage points. Second, the permissiveness of the GATT toward developing countries extended not just to tariff liberalization but also the basic rules on non-tariff barriers, particularly their use of quantitative restrictions for balance of payments reasons that was sanctioned under Article XVIII: B of the GATT (Grant and Boys, 2013).

Developing countries have a higher number of RTAs in force. For instance, in 2008, developing countries have by far the highest number (135) of bilateral agreements (Table 2.4). Developing countries also have in that same year the highest number (145) of goods traded (Table 2.5).

Literature review

Rose (2004) investigates if membership in the WTO affects trade. He uses the gravity model on data comprised of 50 years and 175 countries, to find that there is little evidence that joining the WTO significantly affects trade. He also finds that the Generalized System of Preference has a strong effect on trade. This result was at the time of publication surprising in the sense that economists were unanimous on the trade increasing role of the WTO. Another paper that finds similar results is that of Grant and Lambert (2008). They use the gravity model to assess how Regional Trade Agreements (RTA) affect trade flows. In order to conduct their investigation, they use aggregate data from the Global Trade Analysis Project (GTAP) database. Their results contradict the commonly accepted opinion among economists that RTAs increase trade flows. In fact, their results suggest that the impact of RTA on trade depends on whether the product is agricultural or not. Their finding also depends on the type of agreements under investigation and the length of time the RTA members have been implementing the RTA. Soloaga and Winters (2001) assess how regionalism affect trade in the nineties. They use a modified version of the

gravity model that takes into account intra-bloc trade on both import and export sides. They find no significant impact of RTA on trade.

The next body of papers finds results that are different than Rose (2004). Subramanian and Wei (2007) use the gravity model and find that membership to the WTO encourages trade. More precisely, WTO membership implies 120% additional trade between the members. The level of trade depends on what the countries do with their membership and whom they negotiate. As industrialized countries participate more in negotiations, the WTO membership tends to have more impact on their trade than developing countries. Moreover, the WTO impact on trade was larger with countries that simultaneously liberalize their trade. Finally, the WTO membership impact on trade also depends on whether or not a particular sector liberalize trade. Carrere (2006), use a gravity model with panel data from 1962 to 1996 and 130 countries. She finds that using correct dummies to account for trade creation and diversion can significantly mitigate the endogeneity problem of the gravity model. She also finds that RTAs generate a significant increase in trade between members, often at the expense of the rest of the World. Grant and Boys (2012) also use the gravity model to find that the WTO has positively affected agricultural trade between its members. Their results are robust to different specification of the gravity model that takes into account the sample selection bias issue. The results of this paper are in the same line with Subramanian and Wei (2007). Similar results have been found in Baier and Bergstand (2002), Bergstrand (1985), Carrere et al. (2002), Deardoff (1998), Egger (2002), Egger and Pfaffermayr (2003), Matyas (1997), Lee and Shin (2006), Magee (2008), and Ghosh and Yamarik (2004). Another paper that finds positive impact of RTAs on trade is Robinson and Thierfelder (2002).The authors use a Computable General Equilibrium model to evaluate the effect of RTA on trade. They find that RTAs improve welfare and trade creation is higher than trade diversion. Their results are

also consistent with further multilateral trade. Another important result from the paper is that welfare is higher when the assumptions of the new trade theory are incorporated in the model (imperfect competition, increasing returns to scale, total factor productivity, and capital accumulation). An increase in the market size, market specialization, and efficient gain are also consequences of RTAs. The results in this paper contradict the idea of trade diversion effect developed in Yeats (1998), and multilateral trade effect described in Crawford and Laird (2001).

On the specification of the gravity model, Baeir and Bergstrand (2007) suggest using the gravity model to estimate how free trade agreements affect members' international trade. Their model account for time-invariant bilateral and country fixed-effects. They argue that these fixed-effects solve the issue of correlation between RTA and the error term. They also state that the fixed-effects are much more appropriate than the random effects because random effects assume no correlation between time-invariant bilateral variables and RTAs, which is less likely. The fixed-effects, on the opposite, allow for arbitrary correlation between time-invariant variables and RTA. To test for fixed versus random effects specification, it is advised to use Hausman test. For instance, using this method, Egger (2000) finds strong evidence to reject the random effects in favor of the fixed-effects model.

The literature presented above focused on manufactured products. In the following literature, the focus will be on agricultural products. Yeats (1998) assess the production efficiency due to RTAs. He finds that the Mercosur increases trade for agricultural goods in which member countries have a comparative advantage and do not export outside the group. This result is consistent with several publications in the field with the idea that RTAs have a trade diversion effect that may be positive or negative. It is important to point out that most of the literature on the impact of RTAs on trade focus on developed countries. Very few contribution has been made when

it comes to developing countries trade. Arvinda (2002) uses a qualitative approach to develop an overview of the RTAs that the European Union (EU) has with Developing Countries (DC). His main conclusion is that it is difficult to detect a positive effect of the RTA on DC. Moreover, due to the high number of RTAs that the EU has signed with other partners, the significance of these RTAs is questionable because an agreement with one partner may result in a disagreement to another partner. While Arvinda (2002) presented some facts about RTAs and developing countries' agricultural trade, he did not say how agricultural trade among developing countries is affected by RTAs.

My contribution to the economic literature is to focus on RTAs impact on both Developed and Developing countries and to compare how these two blocs are differently affected by these agreements. A second contribution of our work is to understand if agricultural versus non-agricultural trade is different.

Another category of contribution point out the possibility of political lobby on trade agreements. Laird (1999) assesses the process through which RTAs are not developed for trade reasons, but for political and security reasons. He finds that deeper integration may be better than the superficial. This paper adds to the thought on the relationship between RTAs and trade because it emphasizes the need to be careful about the contents of RTAs and the real reasons behind RTAs. Crawford and Laird (2001) investigate the spread of RTAs and the extent to which they are a threat to the multilateral trading system. They argue that RTAs may create some political lobby against multilateral trade and most of the RTAs are not consistent with WTO rules. The authors also assert that it may be easier for developed countries to afford costs related to RTAs negotiation, this may not be possible from developing countries. Another important finding of the paper is that the Most Favored Nation rule of the WTO, rather than being the rule is becoming the exception. In other

words, RTAs may change trade environment in a direction that is opposed to that of the WTO. Whalley (2008) argues that several reasons may be behind the decision of a country to be involved in a RTA. Some of them are strategic alliance for security reasons. Other countries use RTAs as a mean to impose a particular policy at the domestic level because being part of RTAs makes it more challenging to unilaterally reverse the policy. Other reasons involve using RTAs to influence WTO negotiations.

Econometric model and data

The main econometric framework we use to investigate how RTAs affect trade is the gravity model with time and bilateral fixed effects captured by effects that are specific to each pair of countries and common to all years: distance between trade partners (Dist), existence of a common border (Contig), existence of a common language (Comlang), and existence of colonial ties (Colony).

$$\ln(trade_{ijt}) = \alpha_0 + \alpha_t + \alpha_{ij} + \beta_1 \ln(GDP_{ex_{it}}) + \beta_2 \ln\left(GDP_{im_{jt}}\right) + \beta_3 \ln(GDPPC_{ex_{it}}) + \beta_4 \ln\left(GDPPC_{im_{jt}}\right) + \beta_5 Dist_{ij} + \beta_6 Contig_{ij} + \beta_7 Comlang_{ij} + \beta_8 Colony_{ij} + \beta_9 RTA_{ijt} + \beta_{10} \ln(IniTrade_{ijt}) + \beta_{11} Dping_{ij} + \beta_{12} Dped_{ij} + \beta_{13} Agri_t + \beta_{14} Corr_{it} + \beta_{15} Corr_{jt} + \beta_{16} Corr_{it} * Corr_{jt} + \beta_{17} RTA_{ijt} * Dping_{ij} + \beta_{18} RTA_{ijt} * Agri + \beta_{19} RTA_{ijt} * Dped_{ij} + \varepsilon_{ijt}.$$

The definition of the variables is summarized in table 2.6.

In order to specify the model, we use both forward selection, backward elimination, as well as stepwise selection. By using the AIC (Akaike Information Criterion), AICC (Akaike Information Criterion Corrected), and BIC (Bayesian Information Criteria) criteria, the model as specified has the lowest value for these criteria. In other words, the variables included in the model explained as substantial variation in the trade pattern.

As a robustness check, we run different version of the gravity model: the OLS, Poisson, negative binomial, Zero Inflated Poisson (ZIP), and Zero Inflated Negative Binomial (ZINB). The last two have the advantage of taking into account the issue of zero trade commonly found in trade data. In order to see which model performs the best, we use the cross-validation technique. This technique consists in dividing the sample into three parts, using one sub-sample to construct the model and then uses this model to predict the other two sub-samples. It turns out that the ZIP model has the lowest out of sample error. So we consider this model to be the best among all our specifications.

The analysis has been conducted for 110 countries for which trade data from 1990 to 2010 were available on the IMF website for both agricultural and non-agricultural products. The source of the data is summarized in table 2.7 (Appendix 2).

Econometric models may be affected by endogeneity and/misspecification. This may be the result of omitted variables, measurement error or reverse causality. In order to test for endogeneity of model misspecification, we use the Haussman test. The F statistics is 10.91 with a p-value 0.678. As this probability is higher than 0.05, we conclude that there is neither misspecification error, nor endogeneity problem in the model.

Results and Discussion

Table 2.8 summarizes the estimates results.

The sign and significance of the variables from GDP to Colony have the expected sign and significance. We focus on the variable we are interested in. The RTA coefficient is positive is significant at 0.001 level of significance whatever is the variant of model we run. In other words, when two countries are members of the same RTA, this increases trade value between the two countries. The variable Dping (Developing country dummy) is not significant. In other words, that

two trade partners are developing countries does not affect trade value between these countries. We have the opposite result when the two countries are developed. This means that when two developed countries have a trade agreement, trade value between these countries increases. Having a common border has a positive effect on trade value. In fact, sharing a border implies a small distance between the two countries. Trading an agricultural product does not have any effect on the trade value. When two countries have a trade agreement, this has a positive impact on trade values. If trade partners are developing countries (variable Dping) this has no impact on trade values. Also, corruption index negatively affects trade values. Surprisingly, the interaction of the variables for RTA and developing countries is not significant. This means that even if two developing countries have an agreement, nothing guaranties that trade value between them will increase. The interaction between RTA and Agricultural products has a positive and significant effect on trade value. This means that two countries, members of an RTA, are likely to increase trade value for agricultural products. The interaction between two RTA and Developed countries has a significantly positive effect on trade value. This means that developed countries seem to benefit more from RTAs than developing countries. This may be due the fact in many developing countries, border customs are not always transparent, and paper work may be cumbersome. This has been checked by using the World Bank corruption index as an element of non-transparency at borders. We divided the dataset into two sub-datasets: one for developing countries and one for developed countries. We also take out of the covariates, those that are irrelevant for each dataset. For instance, any variable containing Dped (Dping) is irrelevant for the developing (developed) sub-dataset. The results for the variables of interest are summarized in tables 2.9 and 2.10.

The results suggest that for a fixed value of the RTA variable (for instance RTA=1), developing countries corruption index has a negative impact on RTA marginal impact on trade.

This result is the same irrespective of whether the developing country is an exporter or an importer. For developed countries, none of these interactions is significant.

Conclusion

In this paper, we investigate how the developing status of two trade partners affect their trade value. We also investigate if the nature of the product affects trade. Specifically, we assess the effect of trading agricultural products on trade value. In order to conduct our investigation, we use five (5) variants of the gravity model: OLS, Poisson, Negative Binomial, Zero Inflated Poisson, and Zero Inflated Negative Binomial. The data has been extracted from 2013 IMF database. We find that when two countries are part of a trade agreement, trade values between these countries increases. We also find that when the two partners are developing countries, it does not have any effect on trade value. Trading agricultural products also has no effect on trade volume between two countries. When trade partners are developed countries, this has a positive effect on trade value. The same result has been found for the interaction between trade agreement and developed countries. In other words, developed countries seem to be taking more advantage of the RTAs than developing countries. Finally, our results also suggest that corruption may play a role in explaining why RTA between two countries may not affect trade in cases where at one of the countries is a developing country.

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Appendix 2

Table 2.1: World Merchandise trade between RTAs partners

	Value (Billions USD)		**Share in all reporting countries (%)**	
All commodities	Exports	Imports	Exports	Imports
	7897	7863	51	49

Source: Extracted from WTO, 2011

Table 2.2: Preferential Trade Agreements product group, 2008

Product Group	Preferential Trade	Non-Preferential Trade	MFN Zero	N/A
Agricultural Products	24.1	36.4	35.1	4.5
Non-Agricultural Products	15.9	29.8	53.3	1.1

Source: Extracted from WTO, 2011

Table 2.3: Preferential Utilization rate by product group 2008 (%)

	EU			US		
	PUR by import value	PUR by import duty	PUR - simple average	PUR by import value	PUR by import duty	PUR - simple average
Agricultural Products	93	96	69	99	99	91
Non Agricultural Products	87	90	44	91	93	68

Source: Extracted from WTO, 2011

Table 2.4: Number of RTAs in force in 2010 between different country groups

	Bilateral	Plurilateral	Plurilateral; at least one party in a PTA
Developed-Developed	6	9	8
Developed-Developing	29	6	41
Developing-Developing	135	36	18
Intra-Regional	81	39	26
Cross-Regional	89	12	41

Source: WTO, 2011

Table 2.5: Number of goods and services RTAs in force in 2010 by country groups

	Goods	Goods and Services	Services
Developed-Developed	13	9	1
Developed-Developing	36	40	0
Developing-Developing	145	41	1
Bilateral	104	64	0
Plurilateral	38	11	2
Plurilateral; at least 1 party is a PTA	52	15	0
Intra-regional	110	33	2
Cross-regional	84	57	0

Source: WTO, 2011

Table 2.6: List of the variables

Variable	***Definition***
$trade_{ijt}$	Trade value from country i to country j
α_0	Effect common to all years and pairs of countries (constant)
α_t	Effect specific to year t but common to all pairs of countries that captures time trend in trade and all shocks affecting trade in any particular year
α_{ij}	Bilateral specific effect
$GDP_{ex_{it}}$	Gross Domestic Product in billions US dollars of the year 2013 of Exporting country i
$GDP_{im_{jt}}$	Gross Domestic Product in billions US dollars of the year 2013 of importing country j
$GDPPC_{ex_{it}}$	Gross Domestic Product Per Capita in billions US dollars of the year 2013 for the exporting country i
$GDPPC_{im_{jt}}$	Gross Domestic Product Per Capita in billion US dollars of the year 2013 for the importing country j
$Dist_{ij}$	Distance between country i and country j in kilometers
$Contig_{ij}$	Dummy variable for existence of common border between country i and country j (1=Yes, 0=No)
$Comlang_{ij}$	Dummy variable for existence of common official language between country i and country j (1=Yes, 0=No)
$Colony_{ij}$	Dummy variable for existence of colonial history between country i and country j (1=Yes, 0=No)
RTA_{ijt}	Dummy variable for existence of membership of countries i and j to a Regional Trade Agreement at time t (1=Yes, 0=No)
$IniTrade_{ijt}$	Initial trade value in US dollars of the year 2013 between countries i and j
$Dping_{ij}$	Dummy variable specifying if the two countries are developing countries (1= i and j are developing countries, 0= One of them is a developing country)
$Dped_{ij}$	Dummy variable specifying if the two countries are developed countries (1= i and j are developed 0= One of them is a developing country)
$Agri_t$	Dummy variable specifying if the product is agricultural or not (1=Agricultural product, 0= Non-agricultural product)
	Corruption index of exporting country i
$Corr_{jt}$	Corruption index of importing country j
$Corr_{it} * Corr_{jt}$	Interaction between the corruption index of the two countries
$Corr_{it}^{dped} * RTA_{ijt}$	Interaction between corruption index of developed and exporting country i and its trade agreement with country j
$Corr_{jt}^{dped} * RTA_{ijt}$	Interaction between corruption index of developed and importing country i and its trade agreement with country i
$Corr_{it}^{dping} * RTA_{ijt}$	Interaction between corruption index of developing and exporting country i and its trade agreement with country j
$Corr_{jt}^{dping} * RTA_{ijt}$	Interaction between corruption index of developing and importing country i and its trade agreement with country i
$RTA_{ijt} * Dping_{ij}$	Interaction between Regional Trade Agreement and Being developing country

$RTA_{ijt} * Agri$	Interaction between Regional Trade Agreement and Agricultural product
$Dped_{ij} * RTA_{ijt}$	Interaction between Regional Trade Agreement and the fact that the two countries are developed countries

Table 2.7: Data source for the main variables

Variable	*Source*
GDP_{ex_i}	World development Indicator, World Bank (http://data.worldbank.org/indicator/NY.GDP.MKTP.CD)
GDP_{im_j}	World development Indicator, World Bank (http://data.worldbank.org/indicator/NY.GDP.MKTP.CD)
$Dist_{ij}$	Centre d'Etudes Prospectives et D'Informations Internationale (CEPII) (http://www.cepii.fr/CEPII/fr/bdd_modele/presentation.asp?id=6)
$Contig_{ij}$	CEPII
$Comlang_{ij}$	CEPII
$Colony_{ij}$	CEPII
RTA_{ij}	WTO (http://rtais.wto.org/UI/PublicMaintainRTAHome.aspx)
$IniTrade_{ij}$	IMF
$trade_{ij}$	IMF
$Dping_{ij}$	World Bank
Corr	World Bank

Table 2.8: Descriptive statistics

Variable	Mean	Median	Min	Max
GDP_EXP	6545.91	3231.21	300.01	63445.01
GDP_IMP	6964.53	3421.96	291.25	70544.08
GDPPC_EXP	151.41	71.21	17.36	755.29
GDPPC_IMP	162.23	80.37	18.47	8.4
DIST	8947.24	9231.49	747.04	174488.36
INITRADE	591.21	435.39	25.31	1024.41
CORR_i	2.31	3.49	1	5
CORR_j	2.11	4.12	1	5

Table 2.9: Results of the gravity model estimations with country fixed and marginal effects

Variable	*OLS*	*Poisson*	*NB*	*ZIP*	*ZINB*
Intercept	*0.852***	*0.750***	*1.45***	*1.452***	*1.78***
Time fixed effect	*32.25***	*78.14***	*71.01***	*25.43***	*65.43***
Bilateral fixed effect	*3945.23***	*180.75***	*504.19***	*615.08***	*315.78***
$GDP_{ex_{it}}$	*0.52***	*1.78***	*1.25***	*1.45***	*1.35***
$GDP_{im_{jt}}$	*0.78***	*1.91***	*1.02***	*1.36***	*1.96***
$GDPPC_{ex_{it}}$	*0.78***	*0.45***	*0.36***	*0.52***	*0.41***
$GDPPC_{im_{jt}}$	*0.452***	*0.123***	*1.45***	*1.025***	*1.74***
$Dist_{ij}$	*-1.25***	*-2.41***	*-2.47***	*-2.63***	*-2.58***
$Contig_{ij}$	*0.785***	*1.145***	*0.63***	*0.87***	*1.36***
$Comlang_{ij}$	*0.451***	*0.37***	*0.59***	*0.78***	*0.67***
$Colony_{ij}$	*0.23***	*0.48***	*0.58***	*0.89***	*0.73***
$\boldsymbol{RTA_{ijt}}$	***0.89****	***1.58****	***1.64****	***1.78****	***1.93****
$IniTrade_{ijt}$	*0.78***	*1.45***	*1.36***	*1.45***	*1.14***
$\boldsymbol{Dping_{ij}}$	***0.63***	***1.45***	***1.85***	***1.78***	***1.13***
$\boldsymbol{Dped_{ij}}$	***1.12****	***1.74****	***1.74****	***1.36****	***1.55****
$\boldsymbol{Agri_t}$	***0.147***	***0.418***	***0.78***	***0.99***	***0.78***
$Corr_{it}$	*-0.78***	*-0.45***	*-0.78***	*-0.71***	*-0.47***
$Corr_{jt}$	*-0.81***	*-0.96***	*-0.78***	*-0.89***	*-1.56***
$Corr_{it} * Corr_{jt}$	*-0.15***	*-0.48***	*-0.015***	*-0.45***	*-0.145***
$\boldsymbol{RTA_{ijt} * Dping}$	***0.145***	***0.541***	***0.451***	***0.715***	***0.621***
$\boldsymbol{RTA_{ijt} * Agri_t}$	***0.89****	***0.74****	***0.25****	***0.61****	***0.75****
$\boldsymbol{RTA_{ijt} * Dped_{ij}}$	***1.456****	***1.562****	***1.632****	***1.710****	***1.789****

NB: *, **, *** significant at 10%, 5%, and 1%, respectively

Table 2.10: Impact of the interaction between the corruption index and RTA on developed countries' trade

Variable	*OLS*	*Poisson*	*NB*	*ZIP*	*ZINB*
$\boldsymbol{Corr_{it}^{dped} * RTA_{ijt}}$	***0.89***	***1.78***	***1.75***	***1.99***	***1.23***
$\boldsymbol{Corr_{jt}^{dped} * RTA_{ijt}}$	***0.78***	***1.63***	***1.74***	***1.78***	***1.78***

Table 2.11: Impact of the interaction between the corruption index and RTA on developing countries' trade

Variable	*OLS*	*Poisson*	*NB*	*ZIP*	*ZINB*
$\boldsymbol{Corr_{it}^{dping} * RTA_{ijt}}$	***-1.27******	***-1.41******	***-1.24********	***-1.75******	***-1.36********
$\boldsymbol{Corr_{jt}^{dping} * RTA_{ijt}}$	***-1.85******	***-1.55******	***-1.71********	***-1.64******	***-1.74********

List of the countries

USA, Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Italy, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovenia, Spain, Sweden, UK, Argentina, Australia, Brazil, Canada, Chile, China, Dominican Republic, Egypt, Guatemala, Honduras, Hong-Kong, Indonesia, Japan, Korea, Malaysia, Peru, Philippines, Russia, South Africa, Taiwan, Thailand, Venezuela, Vietnam, Angola, Burundi, Bangladesh, Bhutan, Armenia, Benin, Burkina Faso, Ivory Coast, Cameroon, Congo, Djibouti, Ethiopia, Gabon, Ghana, Guinea, Gambia, Kenya, Madagascar, Mali, Mozambique, Rwanda, Somalia, Niger, Nigeria, Senegal, Sudan, Chad, Togo, Tanzania, Uganda, Zambia, Zimbabwe, Chile, Colombia, Costa Rica, Dominica, Ecuador, Guyana, Grenada, Honduras, Haiti, Jamaica, Mexico, Nicaragua, Panama, Peru, Paraguay, Venezuela, Nepal, Pakistan, Algeria, Greece, Iran, Iraq, Israel, Jordan, Kazakhstan, Kuwait, Morocco, Oman, Poland, Slovenia, Tajikistan, Tunisia, Turkey,

Chapter 3: Determinants of Intra-African Trade Commodities Composition

Introduction

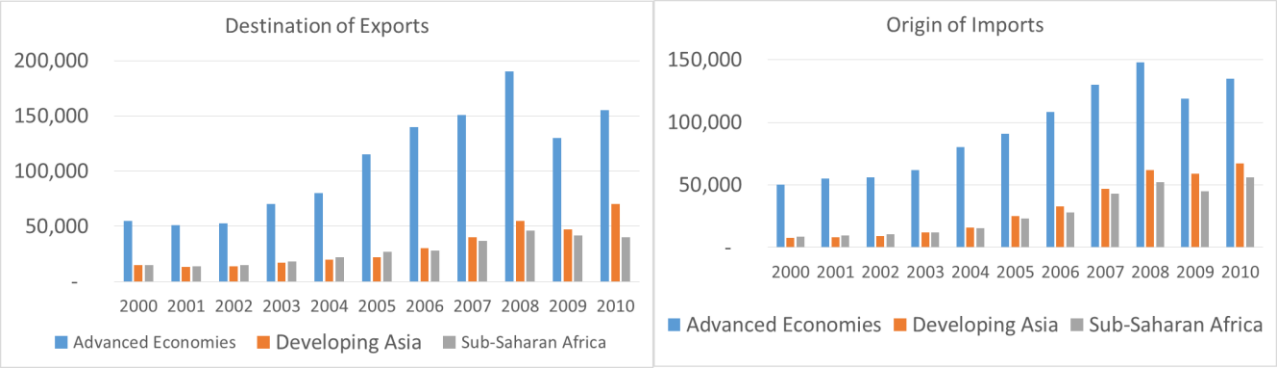
Trade economists consider African trade share low compared to the world trade. In this paper, we assess the determinants of intra-African trade to shed light on trade patterns that are not well understandood by economists. Reginal Trade Agreements are supposed to increase trade among its partners, but in Africa, trade agreements are hindered by complicated administrative process at the border as wells as corruption and lack of infrastructure (Daya et. al, 2016). The general objective of this paper is to identify the determinants of the likelihood of trading certain types of products (manufactured or not, agricultural or not, made in Africa or not) over a benchmark: Non Manufactured Agricultural products made in Africa. We are specifically interested in assessing the impact of transportation infrastructure, economic management, and political tension on the above likelihood.

Fewer researchers has assessed the determinants on intra-African trade composition. The majority of the scientific contribution on intra-African trade has focused on using the gravity model to assess the impact of diverse macroeconomic factors on African trade. This paper is the first to assess the determinants of intra-African trade using the multinomial logistic approach. The paper will be organized as follows. The first section presents few statistics and describe the most relevant scientific contributions related to the topic. Section two presents the econometric model. Section three presents the results and discussion. Section five concludes.

Literature review

We focus on few statistics available on intra-African trade, and scientific contributions that we think are closely related to the topic. According to IMF (2016), only 14% of African trade is internal. (Table 3.1). The main trade partners (exports and imports) of Africa are advanced economies Mwangi et al. (2010).

Figure 3.1: African destinations and origins of trade



Source: Mwangi et al. (2010)

Informal trade is present on the continent due to high administrative and transaction costs. The fact that this type of trade is not captured by the official data available makes it difficult to accurately access the level of Africa intra-trade compared to its overall trade. About three-fourths of Sub Saharan trade is done among South Africa, Nigeria, Kenya, Ivory Coast, Kenya, Zimbabwe, and Ghana. (Mwangi et al. 2010). The most traded products are petroleum, agricultural products (cotton, maize, cocoa, fish, vegetables, tea and sugar), live animals, and manufactured products. South Africa, the largest economy on the continent, is the one trading the most with its African partners (Table 3.2).

According to Longo (2004), three main factors affect intra-African trade: lack of diversification, lack of transportation infrastructures and political conflicts. Several African countries trade is dominated by natural resources: oil and gas. According to the Teravaninthorn

and Raballand (2009), less than 25% of African transportation infrastructures are suitable for intra-African trade. Finally, recurrent political tensions on the continent de not create healthy climate for investors interested in regional trade.

A 2017 report from the African Development Bank (AfDB)) reveals that intra-African trade has increased from 10% in 2000 to 16% in 2014. The report also specifies that there is a low manufacturing and processing capacity in Africa. African trade in manufactured products declined from 18% in 2005 to approximately 15% between 2010 and 2015 (AfDB, 2017). The same report also points out the fact that most African exports go through very little processing before being reported. For instance, from 2007 to 2015, the imports of Africa's light manufactured goods imports tripled to reach USD 260 billion (AfDB, 2017).

Few studies conducted on African trade because of its low share of the world trade. According to Ng and Yeats (1998), few papers focused on intra-African. Longo and Sekkat (2001) assessed the economic obstacles to expanding intra-African trade. They find that besides traditional gravity model variables, poor infrastructure, economic policy mismanagement, internal tensions have a negative impact on trade among African countries. Geda and Seid (2015) analyzed the potential for internal trade and regional integration in Africa. They found that intra-African trade is challenged by the lack of complementarity of exports to imports which in turn is the results of weak infrastructures, productivity, and trade facilitation. Oramah and Abou-Lehaf (1998) studied the commodity compositions of African trade and intra-African trade potential. The main objective of this paper is to assess the commodity composition of key items of exports of African countries. In other words, they were interested in assessing the reasons behind low intra-African trade by focusing on the complementarity between African exports and imports. They find that the number of countries with low trade potential of bilateral trade is greater than the number of

countries with same potential. In other words, African demand for good produced on the continent is low. According to the same authors, this may be due low production flexibility and high population growth.

Oramah and Abou-Lehaf (1998) assessed the correspondence of African trade demand to its supply, but did not identify factors determining the nature of the products African countries trade among each other.

Daya et al (2016) assess constraints limiting intra-African trade by focusing on South Africa. They find that South Africa trade relationship is dominated by exports to Africa with low level of imports. According to the same authors, South Africa exports products with added value while imports remain dominated by agricultural products. They also suggest that African countries should invest in infrastructure and create trade encouraging environment and diversify their production. Trade will improve their potential to supply of commodities and decreases trade imbalance between South Africa and the rest of the continent.

Econometric Strategy

In order to assess the determinants of the nature of the products African countries trade among each other, we use a multinomial logistic regression, which is logistic regression where the dependent variable can take more than two (2) values. Our dependent variable is the type of products African countries trade among each other.

There are two type of multinomial responses: the nominal and the ordinal. Assume there are K categories for the response variable.

- If the response is nominal, it is advised to use the baseline-category logit model.

$log\frac{p_j(x)}{p_k(x)}=\alpha_j+\beta_j x, j=1,2,\dots\dots,k-1$. The number of parameters is $2(K-1)$

- If the response is ordinal, the proportional odds model is more appropriate.

$logit[P(Y \leq j)] = \alpha_j + \beta x, j = 1,2, \ldots\ldots, K-1$. The number of parameters is K.

In cases where the proportional odds assumption does not hold, it is more appropriate to use the baseline-category logit model. In this paper, the response is not ordinal, so the proportional odds assumption will not be satisfied, and we use the baseline-category logit model.

The dependent variable in our case is the nature of the products African countries trade among each other.

Let ProdType be the nature of products African countries trade among each other. ProdType can take the following values:

- Manufactured Agricultural Products made in Africa;
- Manufactured Agricultural Products made outside of Africa;
- Non-Manufactured Agricultural Products made in Africa;
- Non-Manufactured Agricultural Products made outside Africa;
- Manufactured Non-Agricultural Products made in Africa;
- Manufactured Non-Agricultural Products made outside Africa;
- Non-Manufactured Non-Agricultural Products made in Africa;
- Non-Manufactured Non-Agricultural Products made outside Africa.

The explanatory variables include the classic variables of the gravity model as well as additional variables used in Longo (2004) and Longo and Sekkat (2001).

The model specification is as follows:

$$log\frac{P(ProdType=j)}{P(ProdType=r)}$$

$$= \alpha_j + \beta_{1j}GDP_{exp} + \beta_{2j}GDP_{imp} + \beta_{3j}Dist + \beta_{4j}Contig + \beta_{5j}Comlang$$

$$+ \beta_{6j}RTA + \beta_{7j}Infrast_{exp} + \beta_{8j}Infrast_{imp} + \beta_{9j}EconMan_{exp}$$

$$+ \beta_{10j}EconMan_{imp} + \beta_{11j}InterPoltens_{exp} + +\beta_{12j}InterPoltens_{imp}$$

Where r is the reference for the product type and j is any product type different from the reference. Because we have 8 product types in our model, j can only take values between 1 and 8, except 3, as 3 is the reference level for the dependent variable.

The data consist 41 African countries and 2,951 observations available from the World Trade Organization (WTO). The detail description of the variables as wells as the descriptive statistics are respectively summarized in tables 3.3 and 3.4.

Further Analysis

In order to identify the drivers of intra African trade by product category we conducted a gravity model analysis with fixed country effects and marginal effects (using the Pseudo-Poisson Maximum Likelihood estimation method) on different categories of products. The model specification is as follows:

$$\ln(trade_{ijt}) = \alpha_0 + \alpha_t + \alpha_i + \alpha_j + \beta_1 GDP_{imp_i} + \beta_2 GDP_{exp_j} + \beta_3 Dist_{ij} + \beta_4 Contig_{ij}$$

$$+ \beta_5 Comlang_{ij} + \beta_6 RTA_{ij} + \beta_{7j} Infrast_{exp_j} + \beta_8 Infrast_{imp_i}$$

$$+ \beta_9 EconMan_{exp_j} + \beta_{10} EconMan_{imp_i} + \beta_{11} InterPoltens_{exp_j}$$

$$+ +\beta_{12} InterPoltens_{imp_i} + \varepsilon_{ijt}$$

- Manufactured Agricultural Products made in Africa; (1)
- Manufactured Agricultural Products made outside of Africa; (2)

- Non-Manufactured Agricultural Products made in Africa; (3)
- Non-Manufactured Agricultural Products made outside Africa; (4)
- Manufactured Non-Agricultural Products made in Africa; (5)
- Manufactured Non-Agricultural Products made outside Africa; (6)
- Non-Manufactured Non-Agricultural Products made in Africa; (7)
- Non-Manufactured Non-Agricultural Products made outside Africa. (8)

The results for the 8 product categories are summarized in table 3.5.

Results and Discussion

The likelihood ratio significance test is significant at 0.001 level of significance. This means that overall the regressors included in the model explained the variability in the dependent variable.

The results of our analysis suggest that some variables usually significant in explaining trade volume in the gravity model, may not be important in explaining the likelihood of intra-African trade of certain types products over Non Manufactured Agricultural products made in Africa. In fact, having common language and being in a Reginal Trade Agreement does not have any impact on the likelihood of intra-African trade of all the other types of products over Non Manufactured Agricultural products made in Africa.

The distance between the trading partners decreases the likelihood of trading all the other types of products over Non Manufactured Agricultural products made in Africa. When the trading partners have a border together (contiguity), it increases the likelihood of trading all other types of products over Non Manufactured Agricultural products made in Africa.

The Gross Domestic Product for the exporting/importing country has a positive impact on the likelihood of trading all the types of products that are made outside the continent over Non Manufactured Agricultural products made in Africa. However, these two variables do not affect the likelihood of trading products made in Africa over Non Manufactured Agricultural products made in Africa.

Having a good transportation and communication infrastructure in the exporting or importing country increases the likelihood of trading products made outside of the continent over Non Manufactured Agricultural products made in Africa. However, these two variables do not affect the likelihood of trading products made in Africa over Non Manufactured Agricultural products made in Africa. This results confirm Longo (2004) and Longo and Sekkat (2001) results, that transportation infrastructure, economic management as well as economic tensions are important in explaining intra-African trade patterns.

Having a good economic management in the importing or exporting country increases the likelihood of trading products made outside of the continent over Non Manufactured Agricultural products made in Africa. However, these two variables do not affect the likelihood of trading products made in Africa over Non Manufactured Agricultural products made in Africa.

Having a political tension in the importing or exporting country decreases the likelihood of trading all type products over Non Manufactured Agricultural products made in Africa.

In the gravity models, the presence of political tensions in both importing and exporting countries have negative impact on infra-African trade. Improving economic management transportation and communication infrastructure in both importing and exporting countries. All the other variables of the gravity model have the expected sign.

Conclusion

In this paper, we investigate factors affecting intra-African trade of certain products over Non Manufactured Agricultural products made in Africa. We use a multinomial logistic regression approach that incorporates the most important variables of the gravity model plus the presence of appropriate transportation infrastructure, good economic management and the presence of political conflict. We find that Distance and Contiguity is important in explaining the likelihood of trading other types of products over Non Manufactured Agricultural products made in Africa. Surprisingly, when trading partners have a common language or have a trade agreements, it has no impact on the likelihood of trading other type of products over Non Manufactured Agricultural products made in Africa. Finally, the presence of a good economic management and political tension play an important role in explaining the likelihood of trade other type of products over Non Manufactured Agricultural products. The study also suggests that African countries are in general not more likely to trade among each other products made on the continent, which suggests that the majority of the trade between African countries is made of trade on Manufactured or Non Manufactured, Agricultural or Non Agricultural products produced outside the continent. In other words, the added value of intra-African trade is not captured on the continent, but outside Africa. The continent needs to improve its infrastructure, economic management, and reduce political tension to increase chances to sells diverse type of products made on the continent. The results suggest that the presence of political tensions in both importing and exporting countries have negative impact on infra-African trade. Improving economic management transportation and communication infrastructure in both importing and exporting countries. All the other variables of the gravity model have the expected sign. Additional analyses using gravity model on eight categories of product suggest that the presence of political tensions in both importing and exporting

countries have negative impact on infra-African trade. Improving economic management transportation and communication infrastructure in both importing and exporting countries. All the other variables of the gravity model have the expected sign.

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Appendix 3

Table 3.1: Intra-African trade as a percentage of total African trade (2002-2014)

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Percentage	10	9	9-10	8-10	8-10	9	9-10	10-11	10-11	12	13	14	16

Source: IMF (2016)

Table 3.2: Main African countries trading with their African trade partners (millions of USD)

Export to the Rest of Africa		Imports to the Rest of Africa	
Country	Value	Country	Value
South Africa	12,097.61	South Africa	7,059.620
Nigeria	7,599.004	Zambia	3,319.483
Cote d'Ivoire	3,663.154	Ghana	3,261.322
Egypt	2,896.594	Zimbabwe	2,859.942
Kenya	1,953.564	Cote d'Ivoire	2,563.625
Angola	1,803.363	Nigeria	2,404.335
Algeria	1,381.670	Democratic Republic of Congo	2,157.381
Zambia	1,368.961	Kenya	1,933.762
Democratic Republic of Congo	1,228.230	Mali	1,757.390
Morocco	1,059.572	Morocco	1,604.929

Source: Mwangi (2010)

Table 3.3: Summary of the variables

Variable	*Definition*
ProdType Reference: (3)	Type of product sold between African countries. • Manufactured Agricultural Products made in Africa (1) • Manufactured Agricultural Products made outside of Africa (2) • Non-Manufactured Agricultural Products made in Africa (3) • Non-Manufactured Agricultural Products made outside Africa (4) • Manufactured Non-Agricultural Products made in Africa (5) • Manufactured Non-Agricultural Products made outside Africa (6) • Non-Manufactured Non-Agricultural Products made in Africa (7) • Non-Manufactured Non-Agricultural Products made outside Africa (8)
GDP_{exp}	Gross Domestic Product in billions US dollars of the year 2016 of the exporting country
GDP_{imp}	Gross Domestic Product in billions US dollars of the year 2016 of the importing country
$Dist$	Distance between the two countries in kilometers
$Contig$ Reference: 0=No	Dummy variable for existence of common border between the two countries (1=Yes, 0=No)
$Comlang$ Reference: 0=No	Dummy variable for existence of common official language between the two countries (1=Yes, 0=No)
RTA Reference: 0=No	Dummy variable for existence of membership of the two countries to a Regional Trade Agreement at time t (1=Yes, 0=No)
$Infrast_{exp}$ Reference: 0=Poor	Quality of Trade Infrastructure in the Exporting country (0= Poor, 1 = Good, 2 = Excellent)
$Infrast_{imp}$ Reference: 0=Poor	Quality of Trade Infrastructure in the Importing country (0= Poor, 1 = Good, 2 = Excellent)
$EconMan_{exp}$ Reference: 0=Poor	Quality of Economic Management in the Exporting country (0= Poor, 1 = Good, 2 = Excellent)
$EconMan_{imp}$ Reference: 0=Poor	Quality of Economic Management in the Importing country (0= Poor, 1 = Good, 2 = Excellent)
$InterPoltens_{exp}$ Reference: 0=No	Existence of political tension in the Exporting country (1=Yes, 0=No)
$InterPoltens_{imp}$ Reference: 0=No	Existence of political tension in the Importing country (1=Yes, 0=No)

Table 3.4: Descriptive statistics

Variables	Mean	Median	Min	Max
GDP_{exp}	851.42	1295.21	110.25	30004.25
GDP_{imp}	736.57	1011.25	115.30	50544.71
$Dist$	1347.51	2545.07	10.35	3499.25
$Infrast_{exp}$	0.55	0.33	0	2
$Infrast_{imp}$	0.41	0.45	0	2
$EconMan_{exp}$	0.33	0.61	0	2
$EconMan_{imp}$	0.23	0.11	0	2
$InterPoltens_{exp}$	0.71	0.55	0	1
$InterPoltens_{imp}$	0.66	0.43	0	1

Table 3.5: Econometric results

Variables	Coefficients	Significance
Intercept_1	0.0015000	
Intercept_2	0.0789000	*
Intercept_4	0.0036740	*
Intercept_5	0.0000741	
Intercept_6	0.0006324	*
Intercept_7	0.0008520	
Intercept_8	0.0035410	*
GDP_exp_1	1.851120	
GDP_exp_2	1.4504879	***
GDP_exp_4	1.2541369	***
GDP_exp_5	1.3698741	
GDP_exp_6	1.1475320	***
GDP_exp_7	1.4569850	
GDP_exp_8	1.7532100	***
GDP_imp_1	1.0042330	
GDP_imp_2	1.9102369	***
GDP_imp_4	1.1478520	***
GDP_imp_5	1.1346970	
GDP_imp_6	1.2494200	***
GDP_imp_7	1.9941236	
GDP_imp_8	1.7412300	***
Dist_1	-0.9945120	***
Dist_2	-1.3674150	***
Dist_4	-1.7425800	***
Dist_5	-1.8524260	***
Dist_6	-1.2458780	***
Dist_7	-1.4123650	***
Dist_8	-1.1123650	***
Contig_1_1	0.5698500	***
Contig_1_2	0.4163200	***
Contig_1_4	0.7412530	***
Contig_1_5	0.8536000	***
Contig_1_6	0.3698500	***
Contig_1_7	0.4102530	***
Contig_1_8	0.5879896	***
Comlang_1_1	0.6354123	
Comlang_1_2	0.7542200	
Comlang_1_4	0.6521300	
Comlang_1_5	0.5465241	
Comlang_1_6	0.7896542	

Comlang_1_7	0.8452550	
Comlang_1_8	0.1256300	
RTA_1_1	0.3584000	
RTA_1_2	0.4565000	
RTA_1_4	0.7895000	
RTA_1_5	0.3574100	
RTA_1_6	0.1596300	
RTA_1_7	0.3246970	
RTA_1_8	0.4136980	
Infrast_exp_1_1	1.3601000	
Infrast_exp_1_2	-1.0003658	***
Infrast_exp_1_4	1.7895423	***
Infrast_exp_1_5	-1.4563250	
Infrast_exp_1_6	1.3652410	***
Infrast_exp_1_7	-1.8524660	
Infrast_exp_1_8	1.9745260	***
Infrast_exp_2_1	0.9900010	
Infrast_exp_2_2	-0.8795230	***
Infrast_exp_2_4	0.8415260	***
Infrast_exp_2_5	-0.5523600	
Infrast_exp_2_6	0.6632541	***
Infrast_exp_2_7	-0.9412300	
Infrast_exp_2_8	0.7452136	***
Infrast_imp_1_1	1.0254123	
Infrast_imp_1_2	-1.0746580	***
Infrast_imp_1_4	1.2365489	***
Infrast_imp_1_5	-1.4123650	
Infrast_imp_1_6	1.3546520	***
Infrast_imp_1_7	-1.4123563	
Infrast_imp_1_8	1.6123500	***
Infrast_imp_2_1	1.0000236	
Infrast_imp_2_2	-1.0048580	***
Infrast_imp_2_4	0.9945240	***
Infrast_imp_2_5	-0.7802332	
Infrast_imp_2_6	0.8524123	***
Infrast_imp_2_7	-0.6325412	
Infrast_imp_2_8	0.7777320	***
EconMan_exp_1_1	0.0002500	
EconMan_exp_1_2	0.0008542	***
EconMan_exp_1_4	0.0000741	***
EconMan_exp_1_5	0.0003685	
EconMan_exp_1_6	0.0000754	***
EconMan_exp_1_7	0.0000459	

EconMan_exp_1_8	0.0421200	***
EconMan_exp_2_1	0.0004500	
EconMan_exp_2_2	0.3685000	***
EconMan_exp_2_4	0.0025410	***
EconMan_exp_2_5	0.0007897	
EconMan_exp_2_6	0.0007564	***
EconMan_exp_2_7	0.0003165	
EconMan_exp_2_8	0.0001739	***
EconMan_imp_1_1	0.0074568	
EconMan_imp_1_2	0.0035269	***
EconMan_imp_1_4	0.2514796	***
EconMan_imp_1_5	0.0321480	
EconMan_imp_1_6	0.0000125	***
EconMan_imp_1_7	0.7895211	
EconMan_imp_1_8	0.0004897	***
EconMan_imp_2_1	0.0002485	
EconMan_imp_2_2	0.0002585	***
EconMan_imp_2_4	0.0087463	***
EconMan_imp_2_5	0.0002574	
EconMan_imp_2_6	0.0002575	***
EconMan_imp_2_7	0.0027985	
EconMan_imp_2_8	0.0799543	***
InterPoltens_exp_1_1	-0.4562000	
InterPoltens_exp_1_2	-1.1150400	***
InterPoltens_exp_1_4	-0.6985420	***
InterPoltens_exp_1_5	-0.7458690	
InterPoltens_exp_1_6	-0.7854630	***
InterPoltens_exp_1_7	-0.7456210	
InterPoltens_exp_1_8	-0.8452560	***
InterPoltens_imp_2_1	-0.3985462	
InterPoltens_imp_2_2	-0.5274562	***
InterPoltens_imp_2_4	-0.5879560	***
InterPoltens_imp_2_5	-0.4256321	
InterPoltens_imp_2_6	-0.2542563	***
InterPoltens_imp_2_7	-0.5456210	
InterPoltens_imp_2_8	-0.1326524	***

Table 3.6: Results of the gravity model analysis for all product categories

Variable	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***
Intercept	0.85***	0.79***	0.45***	0.12***	0.96***	0.43***	0.51***	0.75***
Time fixed effect	*41.15***	*31.25***	*21.99***	*12.37***	*11.47***	*51.22***	*22.43***	*17.95***
Exporting country fixed effect	*2512.03***	*2815.96***	*1995.74***	*1892.52***	*1721.12***	*1535.25***	*1801.85***	*1692.41***
Exporting country fixed effect	*4513.14***	*3975.96***	*2885.08***	*3001.45***	*3255.74***	*2941.85***	*1815.02***	*1792.71***
GDP_{exp}	*0.71***	*0.47***	*0.31***	*0.97***	*0.11***	*0.27***	*0.36***	*0.53***
GDP_{imp}	*0.85***	*0.97***	*0.53***	*0.67***	*0.71***	*0.31***	*0.43***	*0.51***
$Dist$	*-2.30***	*-3.41***	*-2.07***	*-2.41***	*-4.33***	*-5.99***	*-4.87***	*-2.71***
$Contig$	*0.61***	*0.73***	*0.53***	*0.42***	*0.68***	*0.79***	*0.41***	*0.99***
$Comlang$	*0.39***	*0.45***	*0.59***	*0.66***	*0.43***	*0.31***	*0.21***	*0.71***
RTA	*0.73***	*0.86***	*0.99***	*0.75***	*1.31***	*2.45***	*1.73***	*0.21***
$Infrast_{exp}$	*0.99***	*1.31***	*2.43***	*0.89***	*0.78***	*0.65***	*1.99***	*1.37***
$Infrast_{imp}$	*1.33***	*2.45***	*1.75***	*3.01***	*0.89***	*1.01***	*1.28***	*1.19***
$EconMan_{exp}$	*1.89***	*1.99***	*2.31***	*2.49***	*0.99***	*0.89***	*1.33***	*1.55***
$EconMan_{imp}$	*1.55***	*1.77***	*2.01***	*2.31***	*1.35***	*1.27***	*1.45***	*1.79***
$InterPoltens_{exp}$	*-2.07***	*-2.31***	*-2.47***	*-3.01***	*-4.11***	*-2.53***	*-2.96***	*-2.08***
$InterPoltens_{imp}$	*-3.11***	*-2.48***	*-2.53***	*-3.15***	*-4.37***	*-3.99***	*-4.01***	*-2.95***