Nontariff Barriers as Bridge to Cross[f]

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Abstract

This research assesses the effects of sanitary and phytosanitary (SPS) standards in international trade by introducing a new concept, *bridge to cross* (BTC), with product standards. The BTC in this paper is the regulatory gap between the exporting and importing countries with regard to any particular SPS measure. Assuming that each country's standard is binding in its own domestic markets, the standard of the importing country emerges as an effective trade barrier only when it exceeds the standard in the domestic market of the exporting country. Given the need to account for unobserved heterogeneity (multilateral resistance) in empirical trade models; in reduced form gravity models, the effect of regulation cannot be identified as it varies at the level of importing country over time. This happens because correct accounting for multilateral resistance mandates exporter x time and importer x time fixed effects. However, the effect of BTC can still be identified because it varies over time by the pair of countries involved in trade. As an application we apply the method to an SPS regulation relating to aflatoxin contamination in maize. In our empirical analysis we find that the effect of BTC is higher for poorer countries. The results have a significantly different policy implication for market access of poor countries. Not only weaker standards in the importing country but tighter standards in domestic markets of exporters could have a significant positive effect on exports.

Keywords: sanitary and phytosanitary standards, gravity model, multilateral resistance, bridge to cross

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1. INTRODUCTION

This paper assesses the effects of nontariff barriers on trade, in particular the sanitary and phytosanitary (SPS) measures. According to the World Trade Organization (WTO) rules, countries can choose their own SPS standards to protect human, animal, and plant health—along with other objectives such as protection of environment—as long as they are nondiscriminatory and can be justified by science. The near-perfect sovereignty in choosing SPS measures has meant that several disputes under the SPS and Technical Barriers to Trade (TBT) agreements have occurred (see Josling et al 2004). Yet, a scant literature exists on the assessment of the effects of standards on trade, owing to various reasons that have been cited in Clougherty and Grajek (2008), the most important of those being measurability, especially in a form that captures the intensity of product standards. Deardorff and Stern (1998) list standards as the most difficult nontariff barriers to quantify. The Deardorff and Stern (1998) argument has been seconded by several other studies (for example, Laird and Yeats 1990; Maskus, Wilson, and Otsuki 2001; Blind 2004; Shepherd 2007). In the absence of a quantifiable measure to capture the SPS regulation, most studies use an inventory approach, that is, one that counts the number of standards, the number of documents, or the number of import refusals while accessing the export markets (Clougherty and Grajek 2008; Baylis, Nogueira, and Pace 2010). This approach is obviously inadequate to capture the intensity of product standards across markets.

In the reduced-form empirical trade models, the now-well-established need to account for unobserved multilateral resistance requires inclusion of exporter x time and importer x time fixed effects. With the inclusion of these fixed effects, the effect of any covariate that does not vary by trading pairs over time cannot be identified. National treatment rule under the WTO mandates that each importing country applies the same standards to all exporters. An importing country regulation would be subsumed in importer x time fixed effects in a well specified gravity model thereby precluding identification of its effects on trade.

A handful of papers that have looked at the effects of SPS measures have focused only on importing country regulations and used various proxies of SPS measures. Baylis, Nogueira, and Pace (2010), for example, show that a greater number of import refusals at the European ports has a negative effect on trade flows. They account for the multilateral resistance in their gravity specification (as import refusals vary over time) by adding importer and exporter fixed effects. Their analysis has two basic problems. First, the nature of their data does not allow accounting for zero trade (import refusals can occur only when trade happens), which makes their results susceptible to sample selection bias and bias from firm selection into exporting. Second and more importantly, if fixed effects methodology is to be employed properly to account for multilateral resistance, exporter x time fixed effects would absorb all the refusals and the identification would break down. Aside, the number of import refusals is an imperfect measure of the intensity of SPS measures because they are driven by several other factors including reputation of the exporter.

This paper proposes an alternative method for assessing the impacts of product standards by introducing a trading-pair-time varying measure of product standards in the form of a regulatory gap. The basic principle behind this measure of SPS regulation is that the gap between the importing country standards and the domestic standards is what determines the burden on the exporters. With this idea we term the regulatory gap in its empirically applied form a bridge to cross (BTC). Being a regulatory gap, there are two time varying nodes in the BTC measure, one related to the importer and other to the exporter. With added dimensionality, the scope for variation is higher in this measure compared to something that is importer specific. Further, the BTC measure turns out to be distinct from either exporter x time or importer x time fixed effects both of which are the ideal fixed effects to control for multilateral resistance. Apart from this technical rationale, we think that a BTC measure in regulation has an intuitive appeal. Conditional on domestic standards in the exporting country being binding why should a comparatively weak regulation in the importing country (vis-à-vis the exporting country) hurt exports? Only when there is a bridge to cross we should expect SPS regulation to translate into a trade barrier.

Some papers have posed another empirical challenge in the assessment of the effect of product standards on trade i.e. the issue of reverse causality (Casella 1996; Blind 2002). The BTC measure as defined above is less likely to be subject to such concerns. For the bilateral BTC measure to be endogenous with exports, it must be true that changes in pair-specific trade flows have an effect on the standard chosen by the exporter, by the importer, or by both and, in turn, on BTC. However, such induced change in regulation in one county would affect its BTC with all its trading pairs. The fact that standards, even if chosen in response to increases or decreases in trade flows, would apply to all countries implies that such induced variation in BTC is not likely to be systematic. Thus, suppose any country j (exporting or importing country) does change its SPS regulation in response to its trade with country i. This change will affect its BTC not only with country i but also with all other countries k that country j trades with. A systematic causality in the direction from trade flow to BTC could be less likely in this case.

Recall, our variable of interest in the analysis is the BTC term as distinct from the importing country regulation per se. Assuming that stricter standards are achieved with higher costs, the level of trade barrier because of BTC in accessing markets will vary positively with the size of the bridge.

This paper is closest in spirit to Moenius (2004, 2006), which assess the effect of bilaterally shared and country-specific standards. Moenius (2004) focuses on industrial products in 12 countries during the period 1980–1995, while in Moenius (2006) the focus is on SPS measures in agricultural trade during the same time period.

The specification in both Moenius papers (2004, 2006) measures harmonized versus country-specific standards in terms of an indicator variable. Thus, there is no role of exporting country standards when the standard is import-country specific (and not harmonized with the exporter). This is in sharp contrast to the formalization in this paper, where BTC figures in all cases, regardless of whether the standards are harmonized or not. In this paper harmonized standards translate to eliminating the regulatory gap, that is, drawing the BTC measure to zero while country-specific standards could imply either a nonzero BTC for exporting country or a BTC that equals zero (when the importing country standard is weaker). Further, as a measure of regulatory barrier, the indicator variable for harmonization cannot capture the intensity when country-specific standards exist, but the BTC measure captures the intensity of standards in all cases.

Another difference yet is in the identification strategy in this paper, where the variation that is being exploited is across trading pairs for the same product over time. The effects in Moenius (2004, 2006) are also identified using pairwise variation, that is, whether the importing and exporting country standards are shared or not, but the variation that it used for identification is across different products.

We apply the method of BTC to the case of regulations related to aflatoxin (a type of mycotoxin) contamination in maize to illustrate its applicability.[1] There are several reasons for this choice of product and SPS regulation. Summary evidence exists on the market losses following greater stringency of mycotoxin regulations. Thailand, for example, was at one time among the world's leading corn exporters, regularly ranking among the top five exporters during the 1970s and 1980s. But partly due to aflatoxin problems, Thai corn regularly sold at a discount on international markets, costing Thailand about $50 million per year in lost export value (Tangthirasunan 1998).

[1] Aflatoxins are highly toxic metabolites produced by the soilborne fungi Aspergillus flavus that, when in food supply, contribute to developmental delays, morbidity, and mortality in humans and domestic animals. The Food and Agriculture Organization of the United Nations (FAO) estimates that 25 percent of the world food exports are affected by mycotoxins each year (Scholthof 2004).

According to the Food and Agriculture Organization of the United Nations (FAO), the direct costs of mycotoxin contamination of corn and peanuts in Southeast Asia (Thailand, Indonesia, and the Philippines) amounted to several hundred million dollars annually (Bhat and Vasanthi 1999). Total peanut meal imports by the European Union (EU) member countries fell from more than one million tons in the mid-1970s to just 200,000–400,000 tons annually after 1982, when the mycotoxin regulations were tightened in the EU.

Further, standards related to aflatoxin contamination are specified in parts per billion and hence represent one of the few exceptions where intensity of standards is directly measured. Secondly, in the literature as well as in policy discourses, the potential of these standards to limit trade has been widely discussed (Otsuki et al 2001a, 2001b). In 2001, then Secretary General of the United Nations Kofi Anan had the following remark on European harmonization of aflatoxin standards, the ex-ante effect of which was assessed in Otsuki et al (2001a, 2001b): "A World Bank study has calculated that the European Union regulation on aflatoxins costs Africa $750 million each year in exports of cereals, dried fruit and nuts. And what does it achieve? It may possibly save the life of one citizen of the European Union every two years … Surely a more reasonable balance can be found."[2],[3]

These widely cited figures were based on a basic gravity model that ignored some fundamental specification requirements viz. accounting for multilateral resistance and adjustments for zero trade (Anderson and van Wincoop (2003) and Helpman, melitz and Rubeinstein (2008). ,

[2] Kofi Anan (2001) – UN conference on Least Developed Economies, 2001.

[3] Otsuki et al (2001a) explored the trade effect of the European Commission (EC) proposal to harmonize aflatoxin standards, announced in 1998, that would tighten the average level of aflatoxin standards in the EU. It was later implemented in 2002. The paper predicted the trade effect of setting aflatoxin standards under three regulatory scenarios: standards set at pre-EU harmonized levels (status quo), the harmonized EU standard adopted across Europe, and a standard set by the Codex. Their findings suggested that the trade of nine African countries would potentially decline by $400 million under the proposed stringent new EU standards, whereas this trade would have increased by $670 million had the EU based its new harmonized standards on Codex guidelines that were less stringent. A second study, focusing only on edible groundnut exports from Africa by the same authors, estimated that the new EU standard for aflatoxin would result in an 11 percent decline in EU imports from Africa and a trade flow some 63 percent lower than it would have been had the Codex standards been adopted (Otsuki et al 2001b).

Anderson and van Wincoop (2003) show that trade costs have to be measured as a "multilateral resistance" term (as opposed to a bilateral cost), a term that is reflected in exporter and importer price indices (in fact an ideal price index of composite goods).

Also, zero trade is an extremely important feature of data on trade flows. Both at the product and at the aggregate level many countries do not trade with each other on a sustained basis. Following Melitz (2003) and Helpman et al (2008), gravity models of international trade have been derived that can accommodate the presence of zero trade flows between countries. With the product level analysis here, the presence of zero trade flows is ubiquitous.

We believe such a framework that incorporates zero trade is a clear improvement in empirical analysis of trade flows. Hence, the empirical model that we use for estimation is based on Melitz (2003); Helpman, Melitz, and Rubinstein (2008); and Djankov, Freund, and Pham (2010), all of which consider the fixed costs of exporting. In our case we assume that the level of these costs of exporting vis-à-vis aflatoxin regulations is a function of the level of regulation.

Our BTC measure, particularly for the poor countries and for African exporters shows a significant negative effect on exports. Compared with the global sample, the effects of the BTC are greater in case of poor and African countries.

The paper is organized as follows. The next section outlines the methodology for estimating the effect of SPS measures as a bridge to cross. Section 3 presents details on data and descriptive statistics related to these data. Section 4 presents the results of regression analysis, and Section 5 concludes and provides the possible policy implications.

2. METHODOLOGY FOR ESTIMATING THE EFFECTS OF SPS REGULATIONS ON TRADE (EXPORTS)

The basic specification in this paper for assessing the effects of sanitary and phytosanitary (SPS) standards on trade is presented as a two-stage Heckman estimation process as given in equations (1) and (2),

$$T_{ijt} = \gamma_1 + \pi_{it} + \tau_{jt} + \mathbf{Z}_{ijt}\boldsymbol{\theta} + \rho H_{ijt} + \varphi BTC_{ijt} + \varepsilon_{ijt}, \quad (1)$$

$$X_{ijt} = \gamma_2 + \pi_{it} + \tau_{jt} + \alpha BTC_{ijt} + \mathbf{Z}_{ij}\boldsymbol{\theta} + \vartheta \mu_{ij} + \varepsilon_{ijt}, \quad (2)$$

where T_{ijt} is a binary variable that equals 1 if the maize exports from country j to country i at time t is nonzero and equals 0 otherwise, and X_{ijt} is the value of export from country j to country i at time t. The intercepts are γ_1 and γ_2; the importer x time and exporter x time fixed effects are π_{it} *and* τ_{jt} respectively; $\mathbf{Z}_{ij}$ is a vector of pair-varying controls such as bilateral distance and other measures of trade costs (for example, common border, common language, whether or not the trading partners belong to the World Trade Organization, whether or not the two countries belong to the same legal origin, and partnerships in a preferential trading arrangement); H_{ijt} is the exclusion variable that does not enter the second-stage regression (more on this later); and μ_{ij} is the inverse Mills ratio from the first stage. Note that the importer x time and exporter x time fixed effects control for multilateral resistance and are likely determinants of both propensity to export as well as the actual value of realized exports. Furthermore, the selection equation also includes the time and pair-varying bridge to cross (BTC) variable.

Being a more appropriate control for multilateral resistance, these fixed effects account for important country specific events over time such as the Starlink controversy in maize trade. StarLink, a trademark for a variety of bio-engineered maize was approved in 1998 by the authorities in the United States but only for animal feed and non-food purposes. However, when traces of

Starlink were found in food in 2000, first in the US and then in Japan, it had a strong negative effect on imports of US maize by Japan and South Korea. There was a shift by these countries towards non-GM maize producers in South America. Similarly, on the exporter side, changes in biofuel mandates such as in the US or the Common Agricultural Policy (CAP) in the European Union that have significant effect on maize and other prices are controlled for with exporter x time fixed effects.

The first stage of the regression models whether or not countries trade with each other is specified as a probit regression. The second stage models the value of trade flows, taking into account the selection into trading captured in the first stage (by adding the inverse Mills ratio as one of the regressors in the second stage).

If fixed costs are to be incurred that are monotonic with the size of BTC, the marginal effect of BTC can be hypothesized to be greater for the smaller producers. The smaller producers are more likely in case of poor countries. A negative and significant sign on the coefficient α would imply that larger is the size of the bridge to cross in accessing markets, smaller is the value of trade flows.

As for the excluded variable in the Heckman regressions, it is challenging to find variables that are highly correlated with a country's propensity to export and not significantly correlated with the actual levels of exports.[4] The exclusions variable that we employ is historical frequency of nonzero trade with respect to time t (H_{ijt}), that is, a proportion of years in a moving window that the two countries traded with each other. Thus, for 1995, the historical frequency of positive trade for any trading pairs will be given by the proportion of years in the five-year window beginning 1988

[4] Most variables that affect whether or not two countries trade are also likely to affect the amount of trade between them. Different exclusion variables have been used in the literature. Helpman, Melitz, and Rubinstein (2008), in their pioneering work on deriving the empirical specifications of the gravity model from theory, use common religion as an exclusion variable. But common religion, like common language, can reduce trade costs and hence can affect both the outcomes—that is, whether a pair of countries trade or not—and the value of trade that is realized.

that nonzero trade occurred. Subsequently, for 1996, the window would start in 1989. The premise is that higher is the frequency of positive trade in the past, the greater is the likelihood of two countries having a nonzero trade flow in a specific current period. This fraction of positive trade in the past moreover can be argued to affect the likelihood of trade but not necessarily the current level of trade flows.

Equations (1) and (2) are thus a standard gravity model, at the product or sector level. Estimation of trade flows with a gravity model is usually subject to two kinds of biases (Helpman, Melitz, and Rubinstein 2008). The first is the standard sample selection problem in a regression such as in equation (2), where the sample of nonzero exports is nonrandom. The Heckman correction through the inclusion of the inverse Mills ratio as a regressor in the second stage has been employed for addressing this bias in the coefficients in the second stage.

Another bias that relates to the extensive margins in trade, where not accounting for the number of firms exporting within an industry, results in omitted variable bias (Helpman, Melitz, and Rubinstein 2008). The number of firms exporting is jointly determined by the bilateral fixed costs of exporting and the productivity distribution of firms. Owing to the fixed costs, only firms with a level of productivity beyond a threshold end up exporting. In our setting, SPS standard and by extension the BTC would directly result in introducing fixed costs in exporting and thereby affect the extensive margin of trade. In models like Krugman-Dixit-Stiglitz, with fixed costs of exporting, the size of the extensive margin of trade, however, is a direct function of the elasticity of substitution across varieties in a sector that tends to be high in agriculture.

Belenkiy (2009) decomposes the biases in gravity models in the manufacturing, mining, and agriculture industries and shows that the extensive margin correction bias in standard gravity models does not hold uniformly across all industries. In agriculture, characterized by high elasticity of substitution between the exported varieties, the extensive margin correction is not a significant determinant of trade flows. At the same time, Belenkiy (2009) finds that the nonrandom selection (Heckman) correction is significant in agricultural exports. The estimation strategy in equations (1) and (2) is in line with these findings.

Finally, note that the identification strategy for the effects on trade is based on exploiting cross-sectional trading pairwise variation over time. Recall that standards tend to be sluggish over time. As argued above, the construction of the non-tariff barrier as a BTC mitigates this problem by adding nodes over which the variation can occur. If in case importing country regulation is languid, BTC could still have variation via the changes in exporting country regulation. For this reason, our empirical strategy allows identification of the effects of non-tariff barrier without compromising on the propriety of specification of the gravity model.

3. DATA AND DESCRIPTIVE STATISTICS

As discussed above, we chose to study aflatoxin regulation because of its uniqueness as a continuous measure of sanitary and phytosanitary (SPS) standards. Maize trade is chosen because it is one of the most highly traded staples in the world, both as food as well as feed. Globally, more than one third of cereals trade comprises maize. Maize is moreover highly prone to mycotoxin (including aflatoxin) contamination, and regulations apply to both food and feed trade. Wu (2008) points out that the issue of mycotoxins has been historically observed for a long time but the real recognition came from the 1960 discovery of aflatoxins in the United Kingdom that resulted in the deaths of 100,000 turkeys. Wu (2008) further points out that now several dozen mycotoxins have been identified. This paper focuses only on aflatoxins, which has drawn the maximum attention with regard to food safety. The SPS regulations related to food and feed in aflatoxin contamination, however, are different among countries, and in some cases quite significantly. In this paper we try to account for this distinction.

According to Dohlman (2003), food contaminated with mycotoxins, and particularly with aflatoxins, can cause acute illness that is sometimes fatal and are associated with increased cancer risk. Dohlman (2003) further states that diverging perceptions of tolerable health risks—associated largely with a nation's level of economic development and susceptibility of crops to contamination—have led to widely varying standards among different national or multilateral agencies. Considering a set of 48 countries with established limits for total aflatoxins in food, Dohlman (2003) states that standards varied widely, ranging from 0 to 50 parts per billion.

This paper uses secondary data from several sources. Data on maize trade flows is obtained from United Nations Comtrade database. Agricultural trade is often subject to seasonal fluctuations. We therefore average the data over five years to control for the possibility of abnormal trade flows.

The level of mycotoxin regulations is obtained from two publications from the Food and Agriculture Organization of the United Nations (FAO) titled *Worldwide Regulations for Mycotoxins in Food and Feed*—one in 1995 (FAO 1997) and the other in 2003 (FAO 2004). The data on the regulations are from the responses to queries that were sent to different governments. Note that some countries in the dataset at some points followed the Codex standard.[5] For those countries, the Codex standard was assigned to the countries. Also, a good number of low-income countries do not have any official aflatoxin regulations. Another set of countries includes those that did not respond to the query sent by FAO/WHO (World Health Organization). The regulation data are missing for these countries and hence we do not include them in our sample.

As discussed above, even though the aflatoxin regulations constitute a continuous measure of regulation (as opposed to count measures in inventory approaches), the construction of the SPS measure as a trade barrier needs some explanation. The aflatoxin regulations are specified as permissible limits in terms of parts per billion or micrograms per kilogram. Suppose the permissible limit in country i is μ_i. We define the regulation in country i to equal $(1/\mu_i)$; that is, the smaller the permissible limit of contamination, the tighter the standard. We then assign a value equal to 0 for countries that have reported to the FAO/WHO inquiry stating that they do not have any restriction on the permissible limits. Defined in this way, our regulation variable takes a value between 0 and 1 (with 1 being the lowest permissible limit in parts per billion in the data and the most stringent regulation, and 0 depicting the weakest regulation). There is significant variation in the data on regulation; see the example of a few countries in Table 1.

[5] The Codex standard is specified only for the aggregate level of mycotoxins and not specifically aflatoxins. Assuming a 60 percent share of aflatoxins in total mycotoxins, the level employed is $6\mu g/kg$.

Moreover, the stringency of regulations in different countries has changed over time. The European Union (EU) harmonized their regulation in 2002. After that, as new members joined the EU, they were required to apply the regulation that existed as per the harmonized regulations. When the new members joined the EU, it changed their regulation usually towards more stringency. In our five-year slabs, this factor is particularly important for countries joining the EU in 2004. In the Czech Republic, for example, the permissible limits on aflatoxins went down to 2, from 5 (the limit when it was not a member of the EU). Hence, both the harmonization of standards in 2002 as well as entry of new members into the EU implies that globally the average level of regulation related to aflatoxins would have scaled up. Since our data on trade flows is until 2008, we do not make adjustments for Bulgaria and Romania joining the EU in the dataset.

Apart from the regulation in the importing country, our modified SPS measure captures a bridge to cross (BTC) in terms of the regulatory gap. The regulatory gap is the difference in the aflatoxins standard between the importing country and the exporting country. In construction of the *BTC* variable we follow the scheme as given in Table 2, which lists the combination of possible scenarios regarding the regulatory situation in the exporting and importing countries and the corresponding BTC that it leads to.

The bridge as defined in Table 2 has the following features. It equals zero if the exporting and importing countries have the same standard, including no regulation in both countries. In situations where the importing country has a regulation but the exporting country has no regulation, we define the importing country standard as the bridge. Finally, in other cases it is the difference between the importing and exporting country standards with the proviso that the bridge is zero if the importing country has a laxer standard than the exporter. The BTC measure constructed like this increases with the stringency of the standard in the importing country relative to the exporting country and is bound between 0 and 1.

The BTC variable as constructed has the feature of capturing the benefits of the harmonization of standards between the exporting and importing countries as in Moenius (2004) and other papers. At the same time, the BTC variable mitigates the problem in harmonization measures where an even lower standard in the importing country would imply a trade barrier. With BTC, SPS measure becomes a trade barrier only when it is more stringent than the one in the exporting country. Harmonization equaling a reduction in barriers could be plausible in some cases (mainly where standards impose horizontal differentiation, that is, not high or low standards but different standards; for example, left-side drive versus right-side drive vehicles), it is certainly not suitable in most SPS measures. In SPS measures, the more stringent the regulation, the higher the cost of compliance and consequently greater in effect is the trade barrier. In this situation, we would argue that BTC is the logical measure for capturing the effect of SPS regulations on trade.

An important point to note particularly in maize trade is the distinction between traded maize with different end uses i.e. as food and as feed. A large portion of global trade in maize is in fact as feed. Globally, around 460 million tonnes, or 65 percent, of total world maize production is used for feed purposes while around 15 percent is used for food and the remaining mainly destined for various types of industrial uses (FAO 2006). The regulations between maize as food and as feed are different in all countries that report permissible limits. In the feed category, regulations vary as well. For example, feed for very young animals are often subject to a tighter regulation than feed for matured animals. We choose the weakest regulation among feed for the importing country where available.

The Comtrade data do not make a distinction between the two types of maize. Since the maize trade flow data are aggregated between food and feed, it is difficult to say what the relevant regulation is for recorded trade. In the absence of such a distinction in the trade flows data, we draw from FAOSTAT, the FAO agricultural and food database, which gives the share of maize production for food and for feed in most countries. We have no way of dividing the trade into food and feed components and to subject them to different standards; therefore, we create a new regulation variable by taking a weighted average of regulation for food and for feed, where the weight is the food-to-feed ratio in the exporting country.

Figure 1 shows the distribution of the ln(BTC) variable for countries where the variable takes a nonzero value. Since $\mathrm{BTC} \in (0,1]$, ln(BTC) plotted in Figure 1 takes on negative values. Where BTC equals zero we assign a value equal to 0.0001 such that log of BTC is defined. The frequency of country pairs is high with bigger regulatory gaps, which comes from a large set of countries with notifications of no regulation.

In our empirical analysis we are interested in effects across three samples, namely, global, low-income exporters, and African countries. In the first and third case we also look at samples without USA and South Africa respectively given their importance in exports in the relevant sample. Note that given the two-stage specification, the sample in the second-stage regression is much smaller because it includes only nonzero exports.

Table 3 presents the summary statistics from the maize trade data. A large number of bilateral pairs do not involve trade in maize. Globally, 24 percent of trading pairs have maize trade, but only 18 percent and 14 percent in the case of poor countries and African exporters, respectively.

According to FAO (2006), the structure of the world maize market can be characterized as one with a high level of concentration in terms of exports but very low concentration on the side of imports.[6] The main reason for this is that few countries usually have a significant maize surplus for exports, while many rely on international markets to meet their needs mostly for domestic animal feeding purposes by importing maize, a primary feed ingredient (FAO 2006). The United States is

[6] In terms of volume, aggregate imports by countries in Asia make up over one-half of total world maize imports. Japan is usually the world's leading importer followed by the Republic of Korea. Other major importers in Asia include Indonesia, Islamic Republic of Iran, Malaysia and Saudi Arabia. Egypt is Africa's top importer in spite of being also the third largest producer after South Africa and Nigeria. In 1994, with the signing of NAFTA, there was a significant boost to maize exports from US to Mexico (FAO 2006).

the world's largest maize exporter and accounts for roughly 60 percent of the global share (in 2006), down from more than 70 percent a decade ago, followed by Argentina and China. Brazil, the Republic of South Africa, and Ukraine are among a few other countries that often have surplus for exports. This structure of world maize trade leads us to consider effects in a global sample without USA and a sample of African exporters without South Africa in assessing the average effect of BTC on maize trade flows.

The regulation regarding permissible limits is on average weakest in Africa, followed by other poor countries relative to the world as a whole. These countries while exporting to developed natiosn would face bigger BTC barriers. On a worldwide basis, at least 99 countries had mycotoxin regulations for food, feed, or both in 2003—an increase of approximately 30 percent compared with 1995. In fact, in 2003 , all countries with mycotoxin regulations have regulatory limits at least for Aflatoxin B1 or the sum of Aflatoxins B1, B2, G1, and G2 (other mycotoxins) in food, feed, or both.

The number of countries regulating mycotoxins has significantly increased over the years. Only 15 African countries have any regulation. Thus, in terms of the BTC, to meet the regulation of the trading partner, poor countries in general and particularly in Africa have longer bridges to cross vis-à-vis the rest of the world. Note that African countries have on average nearly equal bridges to cross as other poor country exporters (Table 4).

Figures 2 and 3 present the exports of maize from low- and middle-income countries and from Sub-Saharan Africa. As discussed above, given the importance of production shocks in agriculture, we take the average of five years of maize trade to suppress any annual fluctuations because of weather shocks.[7] For brevity, the figures for least-developed countries are not presented

[7] There are several exogenous factors that can cause significant production shocks in maize. For example, one factor is the occurrence of El Niño, a weather phenomenon which is associated with significant abnormal warming of sea-surface temperatures in the Pacific Ocean. During El Niño events of the 1980s and 1990s, for example, maize production in the South

here; but the pattern is that the relatively well-off nations export to both poor and rich countries, while the poorer countries are confined mostly to exporting to low- and middle-income economies. Thus, poor exporters could have a small BTC if only non-zero trade sample were considered, but taking into account the lost trade, the BTC could be much larger for poorer countries.

In addition to the variables related to the maize sector, several trade and other economic variables were used in the analysis. Several of those variables were obtained from the *World Development Indicators* publication of the World Bank. The distance between the trading partners and whether or not countries share a common border have also been obtained from the CEPII dataset. Similar pairwise variables include shared ethnicity; colonial link or heritage; whether the pair contains both landlocked countries, both coastal countries, both with the same legal origin, and both being members in a currency union; and, finally, whether the countries had ever been involved in a conflict with each other at a particular time.

Africa fell by as much as 40 to 60 percent. Brazil is another significant southern hemisphere maize producer which has suffered from floods and drought driven by El Niño situations in the past (FAO 2006).

4. RESULTS

It is important to start the analysis with the traditional gravity model regressions that have been used to estimate the effect of SPS regulations on trade. These models typically include only the importing country regulation. In their primitive form they do not include any fixed effects to account for multilateral resistance terms and exclude zero trade values which are extremely common at the disaggregated level. In many cases the importing country regulation tends to get subsumed in the importer fixed effect since often there is little variation in standards over time. Owing to this reason, to keep uniformity we include importer income group fixed effects as opposed to importer fixed effects in all regressions listed in table 5. Just because the SPS issue related to aflatoxins has been analyzed with gravity models of pre Anderson and van Wincoop (2003) and Melitz (2003) vintage, we list the results from the naïve gravity models as well in table 5.[8] Subsequently, we build on this basic specification modifying our regulation measure to be BTC and also include exporter x time and importer x time fixed effects in a two stage model including zero trade values.

In both its most primitive form as well as in a heckman specification that controls for multilateral resistance by including importer and exporter fixed effects, results in table 4 show no effect of importing country regulation. The results hold for global sample as well as different sub-samples that we are interested in. The specification because of the nature of variable of interest accounts for multilateral resistance by including exporter and importer fixed effects.

Different explanations can be made for this lack of significant marginal effect of SPS barrier on trade. Most importantly, if the exporters are disadvantaged in meeting the standard for a whole range of regulations, then at the margin the standards might not have any effect on trade. Diaz Rios

[8] The Otsuki, Wilson, and Sewadeh (2001a) paper on trade-inhibiting effects of SPS regulations that received a lot of attention in the press (see the discussion above), and subsequently also in the literature (with more than 40 citations), was based on this naïve empirical model of trade. Though the sample and the product in our case are different from both Otsuki, Wilson, and Sewadeh (2001a) and Otsuki, Wilson, and Sewadeh (2001b), we do not find any significant negative effect on trade from importing country regulation.

and Jaffee (2008) highlight this point in case of groundnut exports from Africa into European Union where the intercepted consignments had excessively high contamination relative to European standards. A slightly weaker regulation would not result in any significant increase in trade implying that the marginal effect of standards on trade could turn out to be not significant. .

A further reason could be lack of sufficient variation in the regulation measure as used in regressions in table 4. This lack of variation in the NTBs as well as the contamination regulation wedge lead us into conceptualizing regulation as a BTC from the point of view of it being a trade barrier. Results below will show that even though in a model with importing country regulation, there are no effects on trade, in a well specified gravity model, the BTC measure does have negative and significant effects on trade in different cases.

Table 5 presents the results of our main specification with BTC as the measure of non-tariff barrier. With the coefficient of interest being that of BTC, we add more appropriate controls for multilateral resistance. Except for the naïve model (the column with OLS regressions), all other Heckman regressions incorporate exporter x time and importer x time fixed effects. For brevity we have suppressed the results of the full global sample including the United States. There is no significant effect of BTC on trade flows in the global sample that includes US, the largest maize exporter in the world.

Akin to the exclusion of the United States in the global sample, exclusion of South Africa from the sample of African countries also turns out to be important. As it is in the global sample, among African exporters South Africa has a highly disproportionate share of total maize exports in the continent.

Apart from BTC measure, the regressions in both tables 4 and 5 include several pair varying variables. These variables are same as the ones employed in Helpman, Melitz and Rubeinstein (2008) which provides the most comprehensive list of such variables to be used in gravity regressions.

As we move successively across samples with smaller and poorer exporters we find that BTC begins to have more significant and quantitatively larger effects on trade. By just excluding US from the global sample, significant effect of BTC on trade flows is obtained. In a global sample excluding the United States, a 1 percent increase in the BTC is associated with a 0.07 percent reduction in the value of trade measured in constant dollars. Results show stronger effects in a sample of poor country (low income exporters based on World Bank definition) exporters. A 10 percent increase in BTC for the low income exporters is associated with as much as 4.4 percent reduction in exports. Note that this sample includes many of the African countries. Focusing only on African exporters, the corresponding reduction in exports equals 3.2 percent. In a sample of poor country exporters this effect corresponds to about one fifth the effect of bilateral distance.

In all these regressions, we do not find any significant effect of BTC on whether or not the countries trade in the first place (the first stage of heckman regressions). Given that BTC_{ij} is likely to be associated with fixed costs of exporting from j to i, a priori we hypothesized that it would have a negative effect on the probability of non-zero exports from j to i. The results however do not provide evidence supporting this hypothesis. The effect of BTC on the extensive margin turns out to be not significant.

Which margin gets affected by BTC depends on the types of costs involved in mitigating aflatoxins contamination. The first line of defense against the introduction of mycotoxins is at the farm level and starts with implementation of good agricultural practices to prevent infection. Preventive strategies should be implemented from pre- through postharvest (Murphy et al 2006).[9]

Preharvest strategies include maintenance of proper planting/growing conditions (for example, soil testing, field conditioning, crop rotation, irrigation), antifungal chemical treatments (for example, proprionic and acetic acids), and adequate insect and weed prevention. Harvesting strategies include use of functional harvesting equipment clean and dry collection/transportation equipment, and appropriate harvesting conditions (low moisture and full maturity). Postharvest measures include use of drying as dictated by moisture content of the harvested grain, appropriate storage conditions, and use of transport vehicles that are dry and free of visible fungal growth (CAC 2003,Quillien 2002). In addition there are biological control measures and transgenic approaches all of which could have different fixed and variable costs implications.

In all heckman regressions there is strong evidence for possibility of selection bias by excluding zero trade. Our exclusion variable i.e. historical frequency of non-zero trade performs well ex post. It has a strong positive association with emergence of non-zero values of current trade in the first stage of the heckman regressions. The correlation of historical frequency of non-zero trade with binary variable for existence of trade is high (0.71) while it is low with values of trade flows (0.15). The strongest effect of historical frequency of non-zero trade on probability of current trade flow to be different from zero happens in case of poor countries.

5. CONCLUSIONS AND POLICY IMPLICATIONS

In this paper we introduced the concept of a *bridge to cross* (BTC) for estimating the effects of sanitary and phytosanitary (SPS) regulations measures. Our gravity model specification incorporates the recent developments in the empirical trade literature to mitigate the problem of biased estimates in gravity models by including the "best practice" controls for multilateral resistance in gravity models. These controls are exporter x time and importer x time fixed effects in the reduced form models of trade. With their inclusion, BTC turns out to be the plausible way of specifying NTB barriers such that their effects are still identifiable. BTC as constructed we feel is also a more reasonable way of modeling regulations as trade barriers since only when importing country imposes standards more stringent than the exporting country, one would expect them to be trade inhibiting. This obviously depends on exporting country standard to be binding in the domestic markets and the importing country standards to be enforced.

We apply the proposed method of looking at NTBs as a BTC to aflatoxin regulations to illustrate an application. With the proper specification of the gravity model and improved data, we find evidence that the BTC measure does have a significant negative effect on trade flows particularly in a sample of poor countries. These results are in sharp contrast with lack of any significant effect of importing country regulation per se. The reduced form model used for assessing the effect of importing country regulation suffers inherently from mis-specification.

We would like to argue that although importing country regulation can be a rigid policy measure for the exporting country, the regulatory gap could be an actionable variable for the exporting country itself. This is so because an effective regulatory gap contains the domestic standard as well. In many developing countries, the two (their standard and that of importers) diverge; and consequently the burden of the regulatory gap is enhanced. Further, in these countries de facto standards could be much less stringent in practice and BTC could in effect be higher.

Our idea of BTC thus has significantly different policy implications than studies that focus on importing country regulation, the effects of which we have argued in general are difficult to identify. Even though importing country standards may not be altered, altering the size of the bridge by varying the regulation in domestic markets of exporting countries could bring in benefits. Improving domestic standards (in line with the health and other benefits) could thus be one prescription for countries to reduce the effective barrier from SPS measures.

We have proposed the idea in terms of the regulatory gap with regard to contaminants or pollutants. In these cases, a modified BTC as a gap between contamination and regulation could also be considered. The benefits could be clear in terms of reduced contamination—many countries, given their contamination levels, have a very long bridge to cross, implying that those exporters do not find it worthwhile to incur the costs of crossing the bridge and then exporting. To the extent that contamination in an exporting country is a function of the prevailing standards, the BTC as a regulatory gap would overlap with the BTC in terms of the regulation–contamination gap.

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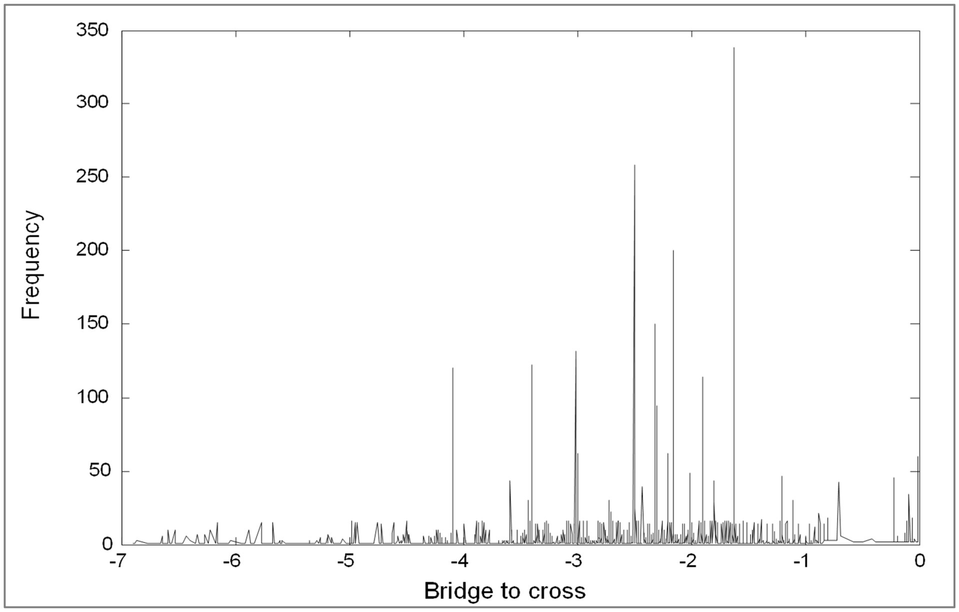
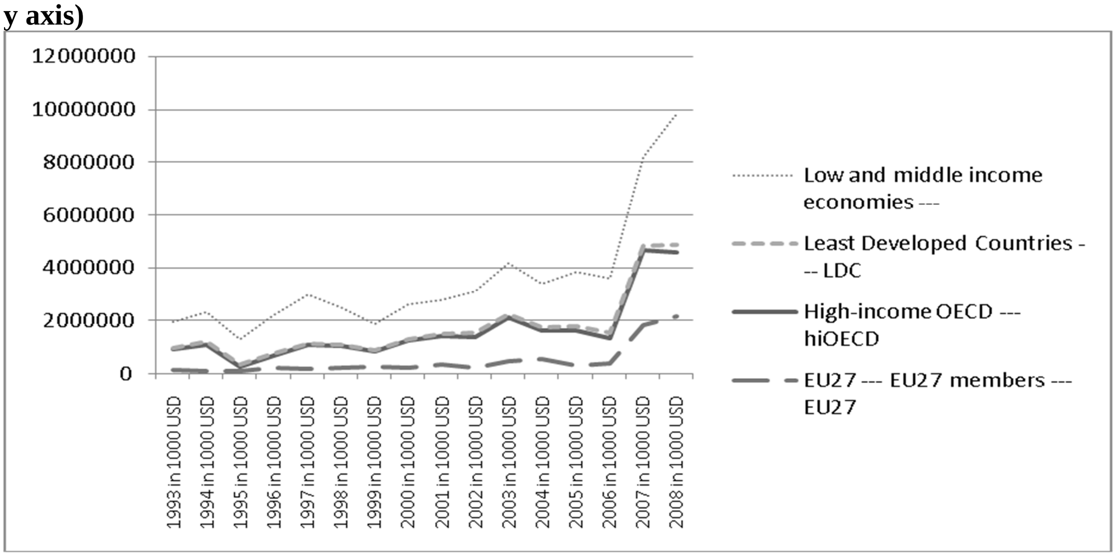
Figures

Figure 1: Distribution of log(BTC)



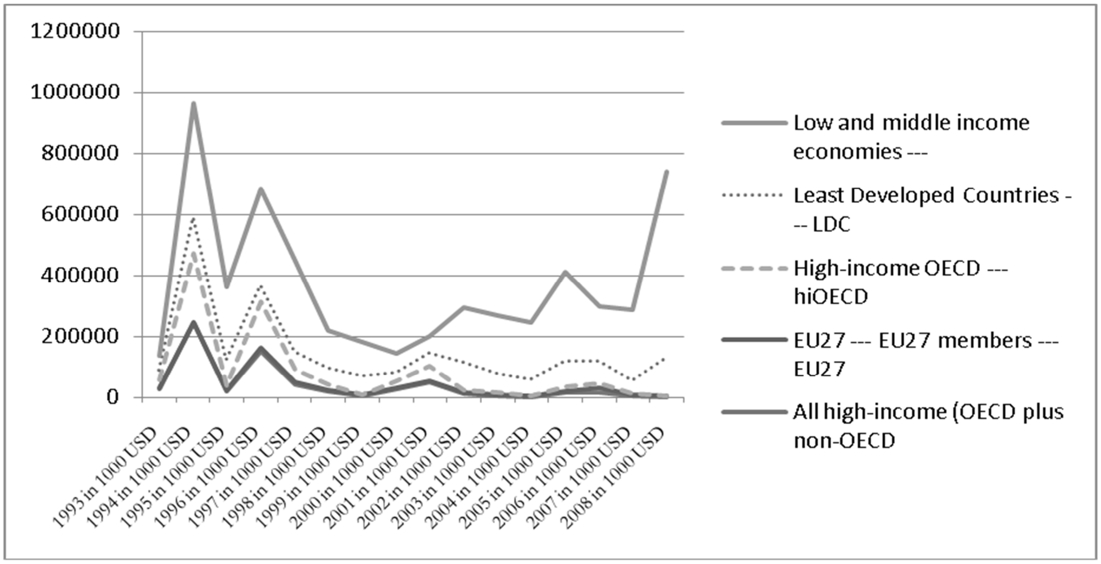
Source: Based on mycotoxins regulation data.

Figure 2: Maize exports of low- and middle-income economies (exports in thousand US dollars, y axis)



Source: UN Comtrade data.

Figure 3: Maize exports of Sub-Saharan African countries (exports in thousand US dollars, y axis)



Source: UN Comtrade data.

Tables

Table 1: Aflatoxin standards in select countries, 2003

Country/Region	Aflatoxins limit in human food (parts per billion)	Standard regulation defined in the paper
Australia	5	0.2
China	20	0.05
European Union	4*	0.25
Guatemala	20	0.05
India	30	0.03
United States	20	0.05

Source: Wu and Bryden (2009).
Notes: * applies to cereals and cereal products, nuts not subject to further processing and dried fruit.

Table 2: Scheme for construction of bridge to cross (BTC) based on regulatory gap

Regulation in		Bridge to cross
exporting country	importing country	
√	×	= 0
×	√	= import country standard
√	√	= (importer standard – exporter standard) if difference > 0 = 0, if difference ≤0
×	×	= 0

Source: Author's creation.
Note: (×) denotes no regulation, (√) denotes presence of regulation.

Table 3: Summary statistics for maize trade

All countries	Full sample (N=17,038)		Nonzero trade (N=4055)	
	Mean	Standard deviation	Mean	Standard deviation
Proportion of sample with nonzero trade	0.238	0.426	1.000	0.000
Bilateral maize trade (in 1,000 US deflated dollars)	1,191.988	25,712.250	5,008.408	52,528.540
Historical frequency of nonzero maize trade	1.296	3.146	5.129	4.625
Regulation index of importing countries	0.126	0.140	0.135	0.120
Regulation index of exporting countries	0.134	0.165	0.140	0.151
Pairwise bridge to cross (BTC)	–4.817	2.364	–4.973	2.290

Low income (poor) exporters	Full sample (N=10,681)		Nonzero trade (N=1,965)	
	Mean	Standard deviation	Mean	Standard deviation
Proportion of sample with nonzero trade	0.184	0.387	1.000	0.000
Bilateral maize trade (in 1,000 US deflated dollars)	468.399	7,011.131	2,546.043	16,186.780
Historical frequency of nonzero maize trade	0.822	2.444	4.243	4.197
Regulation index of importing countries[a]	0.115	0.153	0.118	0.135
Regulation index of exporting countries	0.134	0.165	0.139	0.150
Pairwise bridge to cross (BTC)[b]	–4.607	2.389	–4.656	2.348

African exports	Full sample (N=3,210)		Nonzero trade (N=447)	
	Mean	Standard deviation	Mean	Standard deviation
Proportion of sample with nonzero trade	0.139	0.346	1.000	0.000
Bilateral maize trade (in 1,000 U.S. deflated dollars)	128.435	2,355.873	922.317	6,260.972
Historical frequency of nonzero maize trade	0.518	1.813	3.416	3.638
Regulation index of importing countries	0.103	0.107	0.122	0.081
Regulation index of exporting countries	0.134	0.165	0.129	0.110
Pairwise bridge to cross (BTC)	–4.595	2.410	–4.944	2.346

Source: Author's estimation.

Notes: (a) The regulation indexes are calculated as weighted average of regulation for food and feed, where the weight is the proportion of food to feed production ratio. Also, these indices have the range 0.001 to 1. (b) The BTC variable is in log. The range of this variable is –6.908 to –0.001.

Table 4: Effect of importing country regulation on trade flows

	Full sample w|o US			Low income countries			Africa			Africa w|o South Africa		
		Heckman			Heckman			Heckman			Heckman	
VARIABLES	OLS	2nd stage	1st stage	OLS	2nd stage	1st stage	OLS	2nd stage	1st stage	OLS	2nd stage	1st stage
Importer country regulation specified in parts per billion	0.0056 (0.041)	0.016 (0.13)	0.077 (0.05)	-0.098 (0.112)	0.187 (0.76)	0.222 (0.33)	0.108 (0.101)	0.194 (0.41)	0.209 (0.21)	-0.072 (0.105)	-0.99 (0.61)	0.401 (0.26)
Log of GDP of importing country	-0.014 (0.043)	0.229 (0.36)	-0.01 (0.15)	-0.436 (0.531)	1.596 (1.29)	1.3*** (0.52)	0.5*** (0.170)	-0.63 (0.97)	0.370 (0.39)	-0.9*** (0.252)	-0.08 (1.05)	0.82* (0.43)
Exporter and importer share a common border		1.242*** (0.19)	0.490*** (0.15)		0.645 (0.73)	-0.81 (0.65)		0.941 (0.67)	-0.49 (0.52)		1.061 (0.72)	-0.48 (0.58)
Trading pair has ethnic and language commonality		0.356** (0.16)	0.268*** (0.06)		0.771 (0.64)	0.463 (0.28)		0.600 (0.56)	0.073 (0.21)		0.823 (0.58)	0.013 (0.22)
Trading pair has colony ties	-0.094 (0.247)	-0.36 (0.26)	0.218 (0.14)	1.8*** (0.706)	2.37* (1.37)	1.6** (0.74)	1.27** (0.641)	0.404 (1.09)	1.060** (0.47)	1.35** (0.595)	-0.01 (1.13)	1.1** (0.49)
Both countries landlocked		-2.6* (1.48)	0.130 (0.86)		-1.94 (12.2)	-3.67 (114)		4.154 (6.87)	-3.93 (2.72)		3.373 (8.49)	-6.3** (2.71)
Both countries have coasts		3.2** (1.45)	0.013 (0.84)		0.675 (12.0)	4.795 (114)		-6.2 (6.80)	4.200 (2.71)		-4.83 (8.41)	6.6** (2.70)
Same legal structure		0.364*** (0.11)	0.168*** (0.04)		-0.30 (0.56)	0.089 (0.22)		0.197 (0.38)	0.425*** (0.14)		0.592 (0.40)	0.408*** (0.15)
Trading partners in currency union		1.639*** (0.31)	0.130 (0.22)			-2.63 (0)			-4.82 (0)			-4.52 (0)
Trading pair has history of conflict		-0.07 (0.39)	0.470 (0.29)		-2.27 (2.83)	-2.44 (20.4)		0.194 (1.90)	5.570 (0)		-7.2** (2.94)	5.655 (0)

Both countries in trading pair in GATT		1.836*** (0.48)	0.302* (0.17)		1.850 (3.66)	-0.56 (1.89)		-6.58 (5.54)	0.668 (0.88)		-1.37 (7.09)	0.599 (1.15)
log of bilateral distance	-0.848*** (0.060)	-1.210*** (0.08)	-0.539*** (0.03)	-1.4*** (0.278)	-1.085** (0.49)	-1.135*** (0.25)	-0.835*** (0.240)	-1.236*** (0.41)	-0.562*** (0.15)	-1.419*** (0.250)	-0.729* (0.43)	-0.508*** (0.16)
Inverse mills Ratio		-1.445*** (0.10)			-1.580*** (0.44)			-1.226*** (0.40)			-1.526*** (0.44)	
Historical frequency of non-zero trade			0.523*** (0.01)			1.519*** (0.13)			0.914*** (0.07)			1.110*** (0.09)
Constant	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Importer income group FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Time FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Exporter FE		yes	yes		yes	yes		yes	yes		yes	yes
Importer FE		yes	yes		yes	yes		yes	yes		yes	yes

Notes- The coefficient is that of log of importer regulation. Terms in parentheses denote standard errors. *-significant at 10 percent level, **-significant at 5 percent level, ***-significant at 1 percent level. Standard errors are clustered at the trading pair level. In the African exporter sample, the Maximum Likelihood estimates did not converge with clustering. Hence the standard errors in this case are not clustered

Table 5: Effect of BTC on trade flows in a gravity model with time varying multilateral resistance

	Full sample w|o US			Low income countries			Africa			Africa w|o South Africa		
		Heckman			Heckman			Heckman			Heckman	
VARIABLES	OLS	2nd stage	1st stage	OLS	2nd stage	1st stage	OLS	2nd stage	1st stage	OLS	2nd stage	1st stage
ij BTC (log)	-0.0208	-0.0722*	-0.0214	-0.225***	-0.443***	0.0372	-0.420***	-0.273**	0.0412	-0.246***	-0.321**	0.0666
	(0.0283)	(0.0432)	(0.0171)	(0.0823)	(0.162)	(0.0926)	(0.0747)	(0.132)	(0.0583)	(0.0726)	(0.152)	(0.0659)
common border	2.199***	1.272***	0.462***	1.607**	1.124	0.498	2.709***	1.357**	-0.425	2.163***	1.748**	-0.232
	(0.287)	(0.217)	(0.165)	(0.668)	(0.701)	(0.991)	(0.690)	(0.628)	(0.651)	(0.625)	(0.696)	(0.768)
Trading pair has ethnic and language commonality	-0.0729	0.389**	0.283***	-0.183	0.753	0.619*	0.113	0.481	-0.00595	0.169	0.848	-0.172
	(0.184)	(0.167)	(0.0626)	(0.453)	(0.589)	(0.358)	(0.380)	(0.542)	(0.237)	(0.376)	(0.574)	(0.258)
Trading pair has or had colonial ties	-0.466	-0.288	0.178	1.618**	2.880**	2.421**	1.209*	1.028	1.585***	1.353**	0.603	1.778***
	(0.343)	(0.279)	(0.168)	(0.731)	(1.217)	(0.977)	(0.688)	(1.035)	(0.582)	(0.613)	(1.092)	(0.615)
Both countries landlocked	0.563	-5.989***	-0.524*	-0.640	-8.225	-5.442	-0.594	-12.51***	-1.249	-0.432	-5.338*	3.916
	(0.633)	(1.481)	(0.285)	(0.806)	(6.465)	(810.9)	(0.881)	(3.125)	(1.139)	(0.758)	(2.734)	(4,899)
Both countries have coasts	0.721***	6.610***	0.600***	0.285	6.925	7.282	0.0663	10.06***	1.530	-0.468	3.630	-3.572
	(0.200)	(1.400)	(0.217)	(0.423)	(6.209)	(810.9)	(0.413)	(2.975)	(1.071)	(0.393)	(2.533)	(4,899)
Same legal structure	0.658***	0.438***	0.156***	0.552	0.194	0.183	0.671*	0.246	0.509***	0.682*	0.669*	0.519***
	(0.156)	(0.118)	(0.0436)	(0.463)	(0.530)	(0.277)	(0.393)	(0.372)	(0.160)	(0.394)	(0.395)	(0.170)
Trading partners in currency union	2.424***	1.527***	0.0851	0		1.093	0		-4.728	0		-4.610
	(0.370)	(0.340)	(0.241)	(0)		(0)	(0)		(0)	(0)		(0)
Trading pair has history of conflict	-0.193	-0.0699	0.418	-0.170	-2.639	-4.488	-0.248	-0.315	4.959	-8.229***	-7.202***	5.197
	(0.538)	(0.441)	(0.303)	(2.993)	(2.566)	(0)	(1.993)	(1.777)	(0)	(2.850)	(2.771)	(0)
Both countries in trading pair in GATT	-0.0807	2.444***	0.161	0.221	1.345	1.164	0.543	6.385**	-4.134***	0.242	-1.245	-3.439
	(0.220)	(0.561)	(0.237)	(0.615)	(3.254)	(1.590)	(0.566)	(2.713)	(0.920)	(0.591)	(2.611)	(4,899)
log of bilateral distance	-0.432***	-1.336***	-0.491***	-1.416***	-1.119**	-1.382***	-0.692***	-1.313***	-0.642***	-1.071***	-0.600	-0.618***
	(0.0864)	(0.0992)	(0.0341)	(0.277)	(0.510)	(0.343)	(0.252)	(0.408)	(0.174)	(0.250)	(0.448)	(0.190)
Inverse mills Ratio		-1.541***			-1.631***			-1.246***			-1.692***	
		(0.118)			(0.492)			(0.458)			(0.513)	
Historical frequency of non-zero			0.571***			2.440***			1.125***			1.397***

trade			(0.0290)			(0.224)			(0.0963)			(0.120)
Year FE	yes	no	no	yes	no	no	Yes	no	no	yes	no	no
Eporter*time FE	no	yes	yes	no	yes	yes	No	yes	yes	no	yes	yes
Importer*time FE	no	yes	yes	no	yes	yes	No	yes	yes	no	yes	yes
clusterSE	yes	yes	yes	no	no	no	No	no	no	no	no	no
R-square	0.421	0.735	.	0.506	0.793	.	0.421	0.754	.	0.470	0.767	.
MSE	3.591	2.563	.	2.884	2.570	.	3.241	2.786	.	2.732	2.523	.
Observations	3,579	16,881	16,881	267	2,531	2,531	397	3,217	3,217	277	3,028	3,028
N-censored		13302	13302		2264	2264		2820	2820		2751	2751

Source: Author's estimations. Note: Each regression includes a constant. GATT-General Agreement on Tariffs and Trade. IMR- Inverse Mills Ratio, MSE=Root Mean Square Error,