THREE ESSAYS ON REGIONAL TRADE AGREEMENT

By

Belayneh Kassa Anagaw

THESIS

Submitted to

KDI School of Public Policy and Management

in partial fulfillment of the requirements

for the degree of

DOCTOR OF PHILOSOPHY

IN DEVELOPMENT POLICY

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ABSTRACT

THREE ESSAYS ON REGIONAL TRADE AGREEMENTS

By

Belayneh Kassa Anagaw

In this paper, we investigated three different distinct issues related to Regional Trade Agreements(RTAs) in three separate chapters.

In the first chapter, we investigates the impact of formation of free-trade areas (FTAs) on the use of contingent protection between competing exporters. We develop a dynamic model similar to the competing-importers one of Tabakis (2015), in which countries are limited to self-enforcing cooperative multilateral trade agreements and the economic environment is characterized by trade-flow volatility. Our analysis demonstrates that the findings of Tabakis (2015) extend to our competing-exporters case. In particular, the parallel formation of different FTAs results countries to cooperate multilaterally and hence, a gradual but permanent easing of multilateral trade tensions, especially as far as contingent protection is concerned. Thus, our results highlights formation of FTAs has a building-block effect on multilateral trade cooperation.

In the second chapter, we analyze the impact of historical conflict on duration of trade negotiation. The world has witnessed an unprecedented proliferation of regional trade agreements (RTAs) since the early 1990s, which has prompted a heated debate among trade economists and policymakers about the implications of RTAs for the multilateral trading system. Besides the standard economic gains from regional integration, RTAs can produce significant political gains for their

member countries, chief among which is the reduction in interstate conflict between RTA members (peace-creation effect). Thus, depending on the RTA in question, economic integration and peace solidification can both occupy center stage on the agenda of the prospective RTA partners during the trade negotiations, affecting their duration. It is well known that the duration of negotiations across RTAs differs substantially, but this phenomenon has not received much attention in the literature. In this paper, we explore for the first time the legacy of past conflict on RTA negotiations. Using a unique dataset on the history of formation of a large number of RTAs (Tabakis and Zanardi, 2018) as well as data on conflict from the Correlates of War project and by employing survival analysis techniques, we found that country pairs with history of conflict conclude their trade negotiations relatively faster—1.5 to 2.2 times faster in comparison with country pairs with no history of conflict. The result has implications for firms' investment decision and the role of politics in RTAs negotiation.

Finally in chapter three, we estimate the role of developing countries exposure to more advanced countries, proxied by regional trade agreement with high income country, in improving the use of improved manufactured inputs for agricultural production such as fertilizer and agricultural machinery. Using pooled OLS with country and year fixed effects and alternative instrumental variable, we found that having RTAs with high income countries is associated with higher consumption of fertilizers relative to those who don't have—about 10 percent higher. Similar result is observed for the use agricultural machinery per 100 square kilometer; relative to those countries who do not have RTA with high income countries, those countries who have such RTA uses higher number, which is more than twice, of agricultural machineries.

Keywords: Agricultural input, building block, Conflict, Duration

Dedicate to My twin kids Abraham Belayneh, Rahiel Belayneh and my wife Yezina Yitayih

ACKNOWLEDGEMENTS

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CHAPTER 1. FREE-TRADE AREAS AND CONTINGENT PROTECTION BETWEEN COMPETING EXPORTERS

1.1 Introduction

There is ongoing theoretical debate among economists about the impact of RTAs on the realization of multilateral trade liberalization. The first group of economists argues that Regional trade agreements can be a building block for the realization of multilateral trade liberalization. While others argue RTAs as a tumbling block for multilateral cooperation.

For example Summers (1991) emphasize the positive role of preferential trade agreements on the facilitation of multilateral trade negotiations. Similarly, by addressing the static and dynamic consequence issues identified by Bhagwati (1993) and Ornels (2004) by using an oligopolistic-political-economy model argued the role FTAs in reducing obstacles to multilateral trade liberalization, thus helping as a building block for global free trade.

On the other hand, there is a theoretical justification where Regional trade agreements (RTAs) can be "Stumbling block" for multilateral negotiations due to possibility that such agreements can generate static welfare gains. Under such circumstance RTAs will reduce the incentives to extend trade liberalization. In his 'dynamic path model' Krugman (1993) cited in Aghion et.al (2006), showed how regionalism affects multilateralism.

The other theoretical paper by Krishna (1998) showed that PTAs creates disincentive for multilateral trade liberalization. Using a model of imperfect compe-

tition in different segmented markets, Krishna posited two conclusions: preferential trade arrangements that results trade diversion are more likely to be supported politically and hence, such PTAs will reduce incentive for multilateral liberalization. Aghion et. al (2006) developed a dynamic bargaining model and showed possibilities of stambling block and building blocks effects of FTAs on Multilateral cooperation.

Bagwell and Saiger (1996) modeled the implication of customs-union formation on multilateral tariff cooperation and showed early formation of customs-union can lead to a temporary easing of multilateral trade tentions at the early stages of its formation. But once the process of customs union is completed, the market power consequence becomes real and there will be an incentive to deviate to higher tariff. The intuition is formation of customs union creates trade diversion effect and market power effect. Thus their model shows the relative importance of market power effect to trade diversion effect that ultimately resulted a prediction where the positive impact of custom union formation is just temporary which will have a negative consequence on multilateral tariff cooperation once the process of custom union formation has completed.

On a similar work Bagwell and Staiger (1997), has modeled the consequence of the formation of regional trade agreements on the ability to maintain effective multilateral cooperation. Their model predicted that from the conception to the process of formation of the regional agreements, the impact on the ability of multilateral cooperation is negative. However, their model suggests that the negative impact on multilateral tariff cooperation is temporary. Once the regional trade agreement process is completed, the greater multilateral cooperation will be restored.

Existed theoretical literatures such as Tabakis (2015) by developing import competing model, showed parallel formation of FTAs leads to gradual and permanent ease of multilateral trade tension. This paper investigates the impact of FTAs on multilateral cooperation by looking in to the competing exporters model which

is an extension of the import copmeting model by looking the export side and is differentiated from the competing exporters model of Bagwell et al.(1999) by considering export volatility in the model.

1.2 The Model

We assume four-country four good world where each importing country has three countries competing to export for a specific good. Suppose the four countries are, X, Y,W and Z, and the associated goods that are produced and exchanged in the international market are x, y, w and z. At any period , country i's endowment of good i and j is 1-e and $1 + \frac{e}{3}$ respectively; where j and i $\in (x, y, w, z), i \neq j$ and The variable e, that we use to capture trade flow volatility is a random number which is drawn independently from a uniform distribution on [0,1]. Country i is the only importer of good i for $i \neq j$ and i and j ϵ\{x,y,w,z\}. on the consumption side, we assume all countries face symmetric demand functions where the demand for product i in country j is given by $C(P_i^j) = \alpha - \beta P_i^j$ where the constant β is positive and $\alpha > 4$; P_i^j is price of good i in country j. our model follows from Tabakis(2015) that ephasizes imports three goods but exports one good (an import competing model).

In this Paper we tried to see the export competing model which is a compliment for what Tabakis(2015) investigate where the later focus on the import competing model. as in Tabakis(2015) , in this model we assume two trading blocs; country X and Y form FTA in one side and W and Z form an FTA in another FTA blocs. Country i imports good i from country j, hence country i's import of good i from j is equal to country j' s export of good i. Thus, country i's import demand for good i from country j is given by $(1 + \frac{e}{3}) - C(P_i^j)$ which is exactly country j's export of good i. And we keep assuming countries encounter common exogenous shock every period that is a function of e as in Tabakis, (2015). Following Tabakis(2015) and Bagwell and Staiger(1997a), we assume three phases;

Phase I with no any kind of FTA between countries, but with future possibility of FTA among prospective country pairs, Phase II where trade negotiation held between X and Y in one bloc , W and Z in another bloc, finally phase III , two symmetric FTA in the world. Moreover, each country follows the MFN principles for non-discriminatory tariff. In addition, we assume also if FTA negotiation is not yet started, there is a probability that the FTA between X and Y in one side W and Z in another side will start in next period with probability $\rho \in [0, 1]$. Finally, we assume that the trade talk started at time t between country pairs will be concluded and be in effect in t+1 with probability $\lambda \in [0, 1]$.

1.3 Phase III

Phase III is where two countries , X and Y, form FTA in one bloc and W and Z in another bloc; and it is in effect; Thus, our analysis begins with such symetric world.

1.3.1 Phase III-Static Game

Prices

$$P_X^X = P_X^Y; P_X^X = P_X^W + \tau^X \tag{1.1}$$

$$P_W^W = P_W^X + \tau^W \tag{1.2}$$

P_X^X refers the price of product X in country X and τ^X and τ^W country import tariff of country X and country W respectively. The market clearing price for good i requires the world demand to be equal to the world supply.

$$1-e+3(1+\frac{e}{3})=C_X^X+C_X^Y+C_X^W+C_X^Z=4\alpha-\beta P_X^X-\beta P_X^Y-\beta P_X^W-\beta P_X^Z$$

$$=4\alpha-4\beta P_X^X+\beta\left(\tau^X+\tau^X\right)\Rightarrow 4=4\alpha-4\beta P_X^X+\beta\left(\tau^X+\tau^X\right)$$

$$\Rightarrow P_X^X=\frac{4\alpha-4+2\beta\tau^X}{4\beta}=\frac{\alpha-1}{\beta}+\frac{\tau^X}{2}=P_X^Y \quad \text{.....(3)}$$

Therefore:

$P_X^W=\frac{\alpha-1}{\beta}-\frac{\tau^X}{2}$

In our case country X imports good x from three countries, Y, W and Z. But the tariff with country Y is zero (FTA). We assume that the tariff that is chosen by each country is non-negative and non-prohibitive for any bilateral tradeT Thus, the price set for a give product has the following arbitrage condition .

$P_X^X=P_X^Y=P_X^W+\tau^X=P_X^Z+\tau^X$ .....(4)

Country X's Import function is thus expressed as; $M_W^X=(1+\frac{e}{3})-(\alpha-\beta\left(P_X^W\right))$

$=\frac{e}{3}-\frac{\beta\tau^X}{2}$.....(5) similar for X's import from Z

Equation (5) clearly shows that countries' import is negatively related by the tariff imposed by imported country. Therefore, country X's welfare is defined as the sum of surplus received from the consumption of four goods, surplus received from the production of the four goods and the tariff revenue from import of X from country W and Z

$$W_3^X=\int_{P_X^X}^{\alpha/\beta}C\left(P\right)dP+\int_{P_Y^X}^{\alpha/\beta}C\left(P\right)dP+\int_{P_W^X}^{\alpha/\beta}C\left(P\right)dP+\int_{P_Z^X}^{\alpha/\beta}C\left(P\right)dP$$

$$+\int_0^{P_X^X}(1-e)\,dP+\int_0^{P_Y^X}\left(1+\frac{e}{3}\right)dP+\int_0^{P_W^X}\left(1+\frac{e}{3}\right)dP+\int_0^{P_Z^X}\left(1+\frac{e}{3}\right)dP$$

$$+\tau^X M_W^X+\tau^X M_Z^X \quad \text{.....(6)}$$

Using equation (6), we can derive the optimal tariff for country X,

$\frac{\partial W_3^X}{\partial \tau^X} = \frac{e}{6} - \frac{7}{4}\beta\tau^X$.....(7)

This imply that W_3^X is strictly concave in τ^X and the best response tariff for X eqaul:

$\tau_X^N = \frac{2e}{21\beta}$.....(8)

Since country X and country Y faces similar situation they have symmetric Nash tariff. That is the best response tariff for country Y equal:

$\tau_Y^N = \frac{2e}{21\beta}$

Note that the global efficient tariff is , $\frac{\partial W_3(e,\vec{\tau})}{\partial \tau} = -2\beta\tau$ implying that the Nash tariff choosen by each country is not efficient. Hence countries can make better off if they cooperativly choose their tariff. To give intuitive explanation, a tariff by importing country on exporting country worsens exporting countries' terms of trade and hence welfare. Though the importing country is better off in terms of generating tariff revenue, its welfare will be negatively affected by tariffs on its export. The implication is that our static game is feature of the prisoners dilemma. Hence, countries can do better if they cooperate

1.3.2 Phase III- Dynamic Game

Now we consider the dynamics of the game by taking into account the infinitely repeated game case where countries interact in the future course of action. We assume at the start of the period, countries are informed about the possibility of FTA formation between two countries in one bloc and other two in another bloc and its implication on trade volume. Then they simultaneously choose their current –period tariff which comes with its own payoffs. When countries choose

their current period tariff, the chosen tariff must be self-enforcing. More precisely, for a given value of e, a one-time deviation from the cooperative tariff must not exceed the discounted future benefit of cooperation. To develop it mathematically for the trade gains from one time devation that comes due to trade volume;

$$\frac{d\Omega(e,\tau_x^N,\tau_x^c,\tau_{-x}^c)}{de} = \frac{\partial W_3^x(e,\tau_x^N,\tau_x^c,\tau_{-x}^c)}{\partial e} - \frac{\partial W_3^x(e,\tau_x^c,\tau_x^c,\tau_{-x}^c)}{\partial e} = \frac{1}{6}[\tau_x^N - \tau_x^c] \text{.....(9)}$$

$$\frac{d\Omega(e,\tau_x^N,\tau_x^C,\tau_{-x}^c)}{d\tau_x^c} = \frac{\partial W_3^x(e,\tau_x^N,\tau_x^c,\tau_{-x}^c)}{\partial \tau_{-x}^c} - \frac{\partial W_3^x(e,\tau_x^c,\tau_x^c,\tau_x^c)}{\partial \tau_x^c} = -[\frac{1}{6}\tau_x^N - \frac{7\beta}{4}\tau_x^c] \text{.....(10)}$$

Using the Envelope theorem, $\frac{d\Omega(e,\tau_x^N,\tau_x^c,\tau_{-x}^c)}{de} > 0$ and $\frac{d\Omega(e,\tau_x^N,\tau_x^c,\tau_{-x}^c)}{d\tau_x^c} < 0$ this is true if and only if $\tau_x^C < \frac{2e}{21\beta} = \tau_x^N$. In other words if the cooperative tariff is set to the Nash tariff, there is no incentive to cheat. In general the static gain from defection is given by :

$\Omega(\tau_x^N, \tau_x^c, \tau_{-x}^c) = W_3^X(\tau_x^N, \tau_{-x}^c) - W_3^X(\tau_x^c, \tau_{-x}^c)$

$$\Omega(\tau_x^N, \tau_x^c, \tau_{-x}^c) = \frac{7b}{8}[(\tau_x^c)^2 - (\tau_x^N)^2] + \frac{e}{6}[\tau_x^N - \tau_x^c] \text{.....(11)}$$

Equation(11) has important implication about the chanel through which the deviation from the cooperative tariff has ; change through the consumer and producer surplus and gain from tariff revenue. The first term from the RHS of equation (11) shows the loss of consumer and producer surplus from consumption and production distorion effect of tariff increase respectively.

However, any temptation to cheat has a risk of trade war which eventually lead for infinite reversion to the non-cooperative equilibrium , the Nash tariff, Grim trigger strategy for the infinitely repeated prisoners dilemma.

Thus when countries attempt to deviate from the cooperative tariff, they compare the static gain from defection with the future discounted value of cooperation. suppose all countries value the future equally and let each country's discount fac-

tor between periods be $\delta \in [0,1)$ and E be the expectation operator, expectations over the distribution of e. Then the present discounted value of the expected future gains from multilateral cooperation today is given as:

$\frac{\delta}{1-\delta}[EW^x(e,\tau_x^C,\tau_{-x}^C) - EW^x(e,\tau_x^N,\tau_{-x}^N)]$.....(12)

$\omega = \frac{\delta}{1-\delta}\frac{1}{1323}\left[2\left(\sqrt{126\beta\omega}\right)^3 - 6\left(126\beta\omega\right) + 6\sqrt{126\beta\omega}\right]$ .....(13)

Following the approach of Tabakis (2015) and Bagwell and Staiger(1990), we initially fix ω at an arbitrary non- negative value and solve the smallest possible non negative cooperative tariff as well as the threshold volume of trade.

Thus, fixing $\bar{\omega} > 0$ and solving for $\bar{e}$

$\omega \equiv W^X(\bar{e_1}, \tau_X^N(\bar{e}), 0) - W^X(\bar{e}, 0, 0) = \frac{e^2}{126\beta}$

Solving for $\bar{e_1} = \sqrt{126\beta\omega}$.....(14)

The value on equation (14)is the threshold volume of trade through which free cooperative tariff is maintained. Thus, the most cooperative tariff for country X can be found by solving the following equation :

$\omega = W^X\left(e, \tau_X^N, \tau_{-x}^c\right) - W^X\left(e, \tau_x^c, \tau_{-x}^c\right)$

$\omega = \frac{441\beta^2(\tau_x^c)^2 - 84e\beta\tau_X^C + 4e^2}{504\beta}$

Solving for τ_X^C, $\tau_x^c = \frac{2\left[e-\sqrt{126\beta\omega}\right]}{21\beta} = \frac{2[e-\bar{e}]}{21\beta}$.....(15)

Proof of the above results

For any positive welfare gain from deviation $\omega > 0$ if $e = 0$ and $\tau_x^c = 0$ $\Omega(0, \tau_x^N(0), 0) = W(0, \tau_x^N(0), 0) - W(0,0,0) = 0 < \omega$ solving for $\bar{e}$

$$\Omega(\bar{e}, \tau_x^N(0), 0) = W(\bar{e}, \tau_x^N(\bar{e}), 0) - W(\bar{e}, 0, 0)$$

$$W_3(\bar{e}, 0, 0) = 4\int_{\frac{\alpha-1}{\beta}}^{\alpha/\beta} C(P)\, dP + \int_0^{\frac{\alpha-1}{\beta}} (1-e)\, dP + 3\int_0^{\frac{\alpha-1}{\beta}} \left(1+\frac{e}{3}\right) dP$$
$$= \frac{2(2\alpha-1)}{\beta}$$

$W_3(\bar{e}, \tau_x^N(\bar{e}), 0) = \int_{\frac{21(\alpha-1)+e}{21\beta}}^{\frac{\alpha}{\beta}} + 3\int_{\frac{\alpha-1}{\beta}}^{\alpha/\beta} C(P)\, dP + \int_0^{\frac{21(\alpha-1)+e}{21\beta}} (1-e)\, dP + 3\int_0^{\frac{\alpha-1}{\beta}} \left(1+\frac{e}{3}\right) dP +$
$2(\frac{2e}{21\beta})[\frac{e}{3} - \frac{e}{21}]$

$= \frac{252(2\alpha-1)+e^2}{126\beta}$

Hence, $\Omega(\bar{e_1}, \tau_x^N(0), 0) = W(\bar{e_1}, \tau_x^N(\bar{e_1}), 0) - W(\bar{e_1}, 0, 0) = \frac{252(2\alpha-1)+e^2}{126\beta} - \frac{2(2\alpha-1)}{\beta} = \frac{e}{126\beta}$

Therefore, $\omega = \frac{e^2}{126\beta}$

solving $\bar{e} \implies \bar{e} = \sqrt{126\beta\omega_1}$

Putting together the Phase III most cooperative tariffs :

$$\hat{\tau_x^c}(e) = \begin{cases} 0 & \text{if } e \in [0, \bar{e}]; \\ \frac{2(e-\bar{e})}{21\beta} & \text{if } e \in (\bar{e}, 1]. \end{cases} \quad \text{.....(16)}$$

Equation (16) illustrates the cooperative tariff chosen by the four countries.

The phase III no defect condition requires :

$\Omega_3(e, \tau_X^c(e), \tau_Y^c(e, \tau_w^c(e), \tau_Z^c(e) \leq \omega_3(e, \tau_X^c(e), \tau_Y^c(e, \tau_w^c(e), \tau_Z^c(e)), \forall e$.....(17)

The next step is to demonstrate the conditions prescribed under (13) and (17) is not violated. After the expected values we define new function that shows the joint conditions of equation .To do this we solve (13)

Using ω in the above equation:

$$\omega = \frac{\delta}{1-\delta}\frac{1}{1323}\left[2\left(\sqrt{126\beta\omega}\right)^3 - 6\left(126\beta\omega\right) + 6\sqrt{126\beta\omega}\right]$$

Define a function :

$$F\left(y\right) = 2y^{\frac{3}{2}} - 6y + 6y^{\frac{1}{2}}$$

$$F'\left(y\right) = 3\left(y\right)^{\frac{1}{2}} - 6 + 3\left(y\right)^{-\frac{1}{2}} = 3\left(y^{\frac{1}{2}} + y^{-\frac{1}{2}} - 2\right) = 3\frac{\left(\sqrt{y}-1\right)^2}{\sqrt{y}} > 0 \text{ iff } y \neq 1$$

$$F''\left(y\right) = 3\frac{1}{2}\left(y\right)^{-\frac{1}{2}} - 3\frac{1}{2}\left(y\right)^{-\frac{3}{2}} = \frac{3}{2}\left(y^{-\frac{1}{2}} - y^{-\frac{3}{2}}\right) = \frac{3}{2}\left(\frac{1}{\sqrt{y}} - \frac{1}{y^{\frac{3}{2}}}\right) = \frac{3\left(x-1\right)}{2y^{\frac{3}{2}}} < 0 \text{ iff } y < 1$$

$$\widetilde{\omega}\left(\omega\right) = \frac{\delta}{1-\delta}\frac{2\left(\sqrt{126\beta\omega}\right)^3 - 6(126)\beta\omega + 6\sqrt{126\beta\omega}}{1323\beta} = \frac{\delta}{1-\delta}\frac{F\left(126\beta\omega\right)}{1323\beta}$$

$\widetilde{\omega}\left(0\right) = \frac{\delta}{1-\delta}\frac{F(0)}{1323\beta} = 0$

$\widetilde{\omega}'\left(\omega\right) = \frac{\delta}{1-\delta}\frac{126}{1323}F'\left(126\beta\omega\right) > 0 \text{ iff } 126\beta\omega \neq 1 \Rightarrow \omega \neq \frac{1}{126\beta}$

$\widetilde{\omega}'\left(0\right) = \frac{\delta}{1-\delta}\frac{126}{1323}F'\left(0\right) = \frac{\delta}{1-\delta}\frac{126}{1323}3\frac{(0-1)^2}{0} = +\infty$

$\widetilde{\omega}'\left(\frac{1}{126\beta}\right) = \frac{\delta}{1-\delta}\frac{126}{1323}F'\left(1\right) = \frac{\delta}{1-\delta}\frac{126}{1323}3\frac{(1-1)^2}{1} = 0$

$\widetilde{\omega}_1''\left(\omega_1\right) = \frac{\delta}{1-\delta}\frac{15876\beta}{1323}F''\left(126\beta\omega\right) < 0 \text{ iff } 126\beta\omega < 1 \Rightarrow \omega_1 < \frac{1}{126\beta}$.....(18)

$\{0 < \omega^{III} < \frac{1}{126\beta}\}$

Then ,

$\Longrightarrow \frac{\delta}{1-\delta}\frac{F(1)}{1323\beta} < \frac{1}{126\beta}$

$\Longrightarrow \delta < \frac{1323}{1575} = 0.84$.....(18')

Lemma 1: The proofs are explianed above:

$$\hat{\tau_x^c}(e) = \begin{cases} 0 & \text{if } e \in [0, \bar{e_3}]; \\ \frac{2(e-\bar{e})}{21\beta} & \text{if } e \in (\bar{e}_3, 1]. \end{cases} \quad \text{.....(16')}$$

Where: $\bar{e}_3 = \sqrt{126\beta\omega}$

With $\omega^{III} \in (0, \frac{1}{126\beta})$ the unique interior fixed point:

$$\widetilde{\omega}^{III}(\bar{\omega}) = \begin{cases} \frac{\delta}{1-\delta}\frac{F(126\beta\bar{\omega})}{1323\beta} & \text{if } \bar{\omega} \in [0, \frac{1}{126\beta}]; \\ \frac{\delta}{1-\delta}\frac{2}{1323\beta} & \text{if } \bar{\omega} > \frac{1}{126\beta}. \end{cases} \quad \text{.....(19)}$$

The implication of lemma 1 is that free trade can be sustained between countries if the inter-bloc trade volume is low. For low inter-bloc volume of trade, the incentive for static gain from defect is small. But as along as the trade volume between blocs increases and sufficiently greater than the reshold volume of trade, $\bar{e}_3$, there will be greater incentive to deviate from the cooperation and hence, free trade could not be an option. As an alternative protection measures, countries may apply special protections such as safeguarding or countervailing measures so that the incentive to deviate from the cooperative tariff would be limmited.

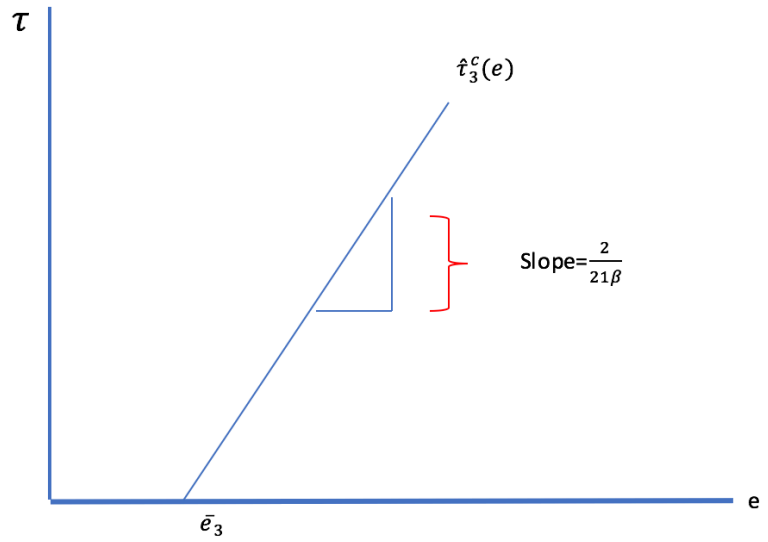


Figure 1, Tariff function in Phase III

1.4 Phase II

Phase II is the transition period where where there is two parallel trade talks between pair of countries and trade takes place between countries normally without any discrimination.

1.4.1 Phase II-Static Game

In phase II , we can characterize the Nash equilibrium by taking country X , due to the fact that all countries face the symmetric situation. Hence, the market clearing price for good X is detrmined where world supply equals world demand for good x.

$$P_x^x = \frac{\alpha-1}{\beta} + \frac{3\tau^x}{4} \text{.....(20)}$$
$$P_x^{-x} = \frac{\alpha-1}{\beta} - \frac{\tau^x}{4} \text{.....(21)}$$

Imports: Country X's import from j's country, where $j \in (Y, W, Z)$ is equal to country j's total export of good X. Thus import is given by:

$$M_j^x = (1 + \tfrac{e}{3}) - (\alpha - \beta P_x^j) = \tfrac{e}{3} - \tfrac{\beta\tau^x}{4} \text{.....(23)}$$

Now define the welfare of X which is sum of consumer surpluss, Producer surpluss and tariff revenue.

$$W_2^X = \int_{P_X^X}^{\alpha/\beta} C(P)\,dP + \int_{P_Y^X}^{\alpha/\beta} C(P)\,dP + \int_{P_W^X}^{\alpha/\beta} C(P)\,dP + \int_{P_Z^X}^{\alpha/\beta} C(P)\,dP$$
$$+ \int_0^{P_X^X} (1-e)\,dP + \int_0^{P_Y^X} \left(1+\frac{e}{3}\right) dP + \int_0^{P_W^X} \left(1+\frac{e}{3}\right) dP + \int_0^{P_Z^X} \left(1+\frac{e}{3}\right) dP$$
$$\tau^X M_Y^X + \tau^X M_W^X + \tau^X M_Z^X \text{.....(24)}$$

Using equation (24), we can derive the optimal tariff for country X,

$\frac{\partial W_2^X}{\partial \tau^X} = \frac{e}{4} - \frac{15}{16}\beta\tau^X$.....(25)

This imply that W_2^X is strictly concave in τ^X and the best response tariff for X eqaul:

$\tau_X^N = \frac{4e}{15\beta}$.....(26)

Note that the Nash tariff in phase III is $\frac{2e}{21\beta}$ which is less than phase II Nash tariff of $\frac{4e}{15\beta}$ implying that once, FTA is formed between countries, each country further reduces the external tariff a against the non-members. This is off course in support of prior literatures about the existence of tariff complementarity effect. The implication of the tariff complimentary effect is; as tariff on good imported from FTA partner set to zero, the consumer (consumption of the imported good with zero tariff increase). Again, higher consumption leads to higher import demand from both FTA and non-FTA partner and thus higher tariff revenue from import of the good from the non-FTA trade partner.

1.4.2 Phase II-Dynamic Game

Now we turn to characterize to the phase II dynamic game; doing so , we first look at the most cooperative tariff function that can be supported in the transition phase . We start by examining the static incentive to gain from defecting from cooperative tariff.

The static gain from defection is given by :

$\Omega_2(\tau_x^N, \tau_x^C, \tau_{-x}^C) = W_2^x(\tau_x^N, \tau_{-x}^C) - W_2^x(\tau_x^C, \tau_{-x}^C)$.....(27)

$= \frac{15\beta}{32}[(\tau_x^C)^2 - (\tau_x^N)^2] + \frac{e}{4}[\tau_x^N - \tau_x^C]$

Thus;

$\frac{d\Omega_2(e,\tau_x^N,\tau_x^C,\tau_{-x}^c)}{de} = \frac{\partial W_2^x(e,\tau_x^N,\tau_x^C,\tau_{-x}^c)}{\partial e} - \frac{\partial W_2^x(e,\tau_x^c,\tau_x^C,\tau_{-x}^c)}{\partial e} = \frac{1}{4}[\tau_x^N - \tau_x^c]$.....(28)

$\frac{d\Omega_2(e,\tau_x^N,\tau_x^c,\tau_{-x}^c)}{d\tau_x^c} = \frac{\partial W_2^x(e,\tau_x^N,\tau_x^C,\tau_{-x}^C)}{\partial \tau_{-x}^c} - \frac{\partial W_2^x(e,\tau_x^c,\tau_x^C,\tau_x^C)}{\partial \tau_x^C} = -[\frac{1}{4}\tau_x^N - \frac{7\beta}{4}\tau_x^c]$.....(29)

Using the Envelope theorem, $\frac{d\Omega(e,\tau_x^N,\tau_x^C,\tau_{-x}^C)}{de} > 0$ and $\frac{d\Omega(e,\tau_x^N,\tau_x^C,\tau_{-x}^C)}{d\tau_x^C} < 0$ this is true if and only if $\tau_x^C < \frac{4e}{15\beta} = \tau_x^N$. In other words if the cooperative tariff is set to the Nash tariff, there is no incentive to cheat.

The discounted expected future welfare loss for a country that violates the multilateral cooperation today is given by;

$\omega^{II} = \frac{(1-\lambda)\delta}{1-(1-\lambda)\delta}[EW_2(e,\tau_x^c,\tau_{-x}^c) - EW_2(e,\tau_x^N,\tau_{-x}^N)] + \frac{\lambda}{1-(1-\lambda)\delta}\omega^{III}$.....(30)

Finally, $\omega^{II} = \frac{(1-\lambda)\delta}{1-(1-\lambda)\delta}\left[\frac{2}{75\beta}\left(var\left(e\right) + \left(E\left(e\right)\right)^2\right) - \frac{3\beta}{8}\left(var\left(\tau^c\right) + \left(E\left(\tau^c\right)\right)^2\right)\right] + \frac{\lambda\omega^{III}}{1-(1-\lambda)}$.....(31)

We initially fix ω^{II} at an arbitrary non- negative value and solve the smallest possible non negative cooperative tariff as well as the threshold volume of trade.

Thus, fixing $\bar{\omega} > 0$ and solving for $\bar{e}$

$\omega^{II} = W^X(\bar{e}, \tau_X^N(\bar{e}), 0) - W^X(\bar{e}, 0, 0) = \frac{e^2}{30\beta}$

Solving for $\bar{e}_2 = \sqrt{30\beta\omega^{II}}$.....(32)

Thus, the most cooperative function is given by:

$$\hat{\tau_x^c}(e) = \begin{cases} 0 & \text{if } e \in [0, \bar{e}_2]; \\ \frac{4(e-\bar{e}_2)}{15\beta} & \text{if } e \in (\bar{e}_2, 1]. \end{cases} \quad \text{.....(33)}$$

$$\widetilde{\omega}^{II}(\omega^{II}) = \frac{(1-\lambda)\delta}{1-(1-\lambda)\delta}\left[\frac{\left[2\left(\sqrt{30\beta\,\omega}\right)^3 - 180\beta\omega + 6\sqrt{30\beta\omega}\right]}{225\beta}\right] + \frac{\lambda}{1-(1-\lambda)\delta}\omega^{III} \text{.....34}$$

Define a function :

$$F(y) = 2y^{\frac{3}{2}} - 6y + 6y^{\frac{1}{2}}$$

$$\widetilde{\omega}^{II}(\omega^{II}) = \frac{(1-\lambda)\delta}{1-(1-\lambda)\delta}\frac{F\left(30\beta\omega^{II}\right)}{225\beta} + \frac{\lambda}{1-(1-\lambda)\delta}\omega^{III}$$

$$\widetilde{\omega}'^{II}(\omega^{II}) = \frac{(1-\lambda)\delta}{1-(1-\lambda)\delta}\frac{30F\left(30\beta\omega^{II}\right)}{225\beta} > 0 \text{ iff } 30\beta\omega^{II} \neq 1 \implies \omega^{II} \neq \frac{1}{30}$$

$$\widetilde{\omega}'^{II}(0) = \infty$$

$$\widetilde{\omega}'^{II}(\tfrac{1}{30\beta}) = \frac{(1-\lambda)\delta}{1-(1-\lambda)\delta}\frac{30F(1)}{225\beta} = 0$$

$$\widetilde{\omega}''^{II}(\omega) = \frac{(1-\lambda)\delta}{1-(1-\lambda)\delta}\frac{900F\left(30\beta\omega^{II}\right)}{225\beta} < 0 \text{ iff } 30\beta < 1 \implies \omega^{II} < \frac{1}{30\beta}$$

Therefore, the neccessary and sufficient condition for a unique fixed point $\omega^{II} \in (0, \frac{1}{30\beta})$ is $\widetilde{\omega}^{II}(\frac{1}{30\beta}) < \frac{1}{30\beta}$

Lemma 2 The proofs are discussed above:

The most cooperative tariff in Phase II is

$$\hat{\tau^c}(e) = \begin{cases} 0 & \text{if } e \in [0, \bar{e}_2]; \\ \frac{4(e-\bar{e}_2)}{15\beta} & \text{if } e \in (\bar{e}_2, 1]. \end{cases} \quad \text{.....(35)}$$

$$\bar{e}_2 = \sqrt{30\beta\omega^{II}}$$

With $\omega^{II} \in (0, \frac{1}{30\beta})$ being the unique fixed point:

$$\widetilde{\omega}^{II}(\bar{\omega}) = \begin{cases} \frac{(1-\lambda)\delta}{1-(1-\lambda)\delta}\frac{F(30\beta\bar{\omega})}{225\beta} + \frac{\lambda}{1-(1-\lambda)\delta}\omega^{III} & \text{if } \bar{\omega}^{II} \in [0, \frac{1}{30\beta}]; \\ \frac{(1-\lambda)\delta}{1-(1-\lambda)\delta}\frac{2}{225\beta} + \frac{\lambda}{1-(1-\lambda)\delta}\omega^{III} & \text{if } \bar{\omega}^{II} > \frac{1}{30\beta}. \end{cases} \quad \text{.....(36)}$$

Having all these most cooperative tariffs, we compare ω^{II} and ω^{III}

Lemma 3: $\omega^{II} < \omega^{III}$ The proof for this is in the appendex:

The implication of Lemma 3 has the following corollary :

Corollary 1: $\bar{e}^{II} < \bar{e}^{III}$ and corollary 1 implies the following proposition:

Proposition 1: $\hat{\tau_2^c}(e) = \hat{\tau_3^c}(e) = 0$ for $e \in [0, \bar{e_2}]$; and $\hat{\tau_2^c}(e) > \hat{\tau_3^c}(e)$ for $e \in [\bar{e_2}, 1]$

An important observation of phase II is that, the volume of inter-bloc trade in phase is lower than that of phase III implying that protection measures are more frequent and higher as compared to phase III. As it is noted in Tabakis(2015), Lemma 3 entails that the cooperative effect of multilateral trade liberalism dominates the punishment effect of defection.

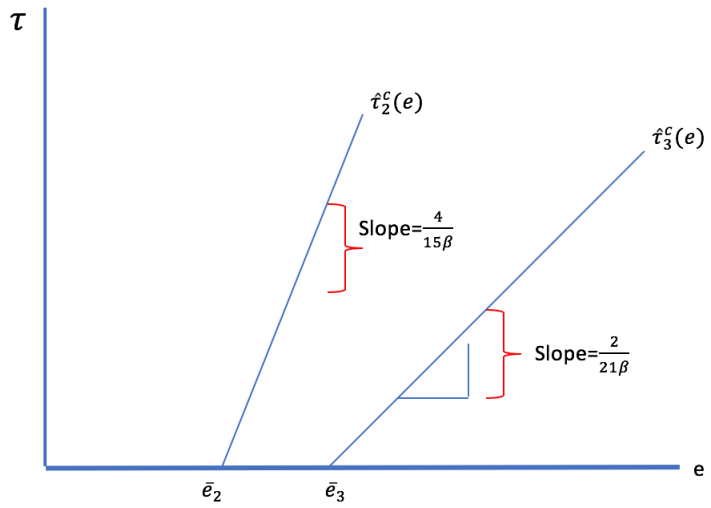


Figure 2, Tariff Function in phase II relative to phase III

1.5 Phase I

Phase I is a period where countries trade normally but expecting trade negotiation will start soon between countries . Here the phase I static game outcome is similar with that of phase-II. Where the static Nash- equilibrium is :$\tau_j^N = \frac{4e}{15\beta}$ where j=X,Y,W and Z

1.5.1 Phase I-Dyamic Game

Now we turn to analyze the most cooperative tariff that can be supported during the pre-negotiation period. We start by analyzing the static incentive to cheat from the most cooperative tariff. Welfare gain from cheating the most cooperative tariff(one time cheat in phase I)

$\Omega(\tau_x^N, \tau_x^C, \tau_{-x}^C) = W^x(\tau_x^N, \tau_{-x}^C) - W^x(\tau_x^C, \tau_{-x}^C)$.....(37)

$= \frac{15\beta}{32}[(\tau_x^C)^2 - (\tau_x^N)^2] + \frac{e}{4}[\tau_x^N - \tau_x^C]$

$\frac{d\Omega(e,\tau_x^N,\tau_x^C,\tau_{-x}^C)}{de} = \frac{\partial W^x(e,\tau_x^N,\tau_x^C,\tau_{-x}^C)}{\partial e} - \frac{\partial W^x(e,\tau_x^c,\tau_x^C,\tau_{-x}^C)}{\partial e} = \frac{1}{4}[\tau_x^N - \tau_{-x}^C]$.....(38)

$\frac{\partial\Omega(e,\tau_x^N,\tau_x^C,\tau_{-x}^C)}{\partial\tau_x^C} = \frac{\partial W^x(e,\tau_x^N,\tau_x^C,\tau_{-x}^C)}{\partial\tau_{-x}^C} - \frac{\partial W^x(e,\tau_x^c,\tau_x^C,\tau_x^C)}{\partial\tau_x^C} = -[\frac{1}{4}\tau_x^N - \frac{7\beta}{4}\tau_x^C]$.....(39)

Using the Envelope theorem, $\frac{d\Omega(e,\tau_x^N,\tau_x^C,\tau_{-x}^C)}{de} > 0$ and $\frac{\partial\Omega(e,\tau_x^N,\tau_x^C,\tau_{-x}^C)}{\partial\tau_x^C} < 0$ this is true if and only if $\tau_x^C < \frac{4e}{15\beta} = \tau_x^N$. In other words if the cooperative tariff is set to the Nash tariff, there is no incentive to cheat.

The discounted expected future welfare loss for a country that violates the multilateral cooperation today is given by;

$\omega^I = \frac{(1-\rho)\delta}{1-(1-\rho)\delta}\left[EW\left(e,\ \tau_x^c,\ \tau_{-x}^c\right) - EW\left(e,\ \tau_x^N,\ \tau_{-x}^N\right)\right] + \frac{\rho}{1-(1-\rho)\delta}\frac{\omega^{II} - \lambda\omega_1{}^{III}}{1-\lambda}$

Finally, $\omega^I = \frac{(1-\lambda)\delta}{1-(1-\lambda)\delta}\left[\frac{2}{75\beta}\left(var\left(e\right)+\left(E\left(e\right)\right)^2\right)-\frac{3\beta}{8}\left(var\left(\tau^c\right)+\left(E\left(\tau^c\right)\right)^2\right)\right]+\frac{\rho}{1-(1-\rho)\delta}\frac{\omega^{II}-\lambda\omega^{III}}{1-\lambda}$

$$\widetilde{\omega}^I(\omega^I) = \frac{(1-\rho)\delta}{1-(1-\rho)\delta}E\left[\frac{-225\beta^2(\tau_x^c)^2+16e^2}{600\beta}\right]+\frac{\rho}{1-(1-\rho)\delta}\frac{\omega^{II}-\lambda\omega^{III}}{1-\lambda}.$$

Using the distribution of e, we can calculate $E(\tau_x^c)^2$ and $E(\tau_w^c)^2$

Hence,

$$\widetilde{\omega_1}^I(\omega^I) = \frac{(1-\rho)\delta}{1-(1-\rho)\delta}[\frac{2(\sqrt{30\beta\omega^I})^3-180\beta\omega^I+6\sqrt{30\beta\omega^I}}{225\beta}]+\frac{\rho}{1-(1-\rho)\delta}\frac{\omega^{II}-\lambda\omega^{III}}{1-\lambda}$$

Lemma 4: The most Cooperative tariff function in Phase I:

$$\hat{\tau^c}(e) = \begin{cases} 0 & \text{if } e \in [0, \bar{e_1}]; \\ \frac{4(e-\bar{e})}{15\beta} & \text{if } e \in (\bar{e}, 1]. \end{cases}$$

$\bar{e}_1 = \sqrt{30\beta\omega^I}$

With $\omega^I \in (0, \frac{1}{30\beta})$ being the unique fixed point:

$$\widetilde{\omega}^I(\bar{\omega}) = \begin{cases} \frac{(1-\rho)\delta}{1-(1-\rho)\delta}\frac{F\left(30\beta\bar{\omega}^I\right)}{225\beta}+\frac{\rho}{1-(1-\rho)\delta}\frac{\omega^{II}-\delta\omega^{III}}{1-\lambda} & \text{if } \bar{\omega}^I \in [0, \frac{1}{30\beta}]; \\ \frac{(1-\rho)\delta}{1-(1-\rho)\delta}\frac{2}{225\beta}+\frac{\rho}{1-(1-\rho)\delta}\frac{\omega^{II}-\delta\omega^{III}}{1-\lambda} & \text{if } \bar{\omega}^I > \frac{1}{30\beta}. \end{cases}$$

Now let's compare ω^I and ω^{II}

Lemma 5: $\omega^I < \omega^{II}$ From Lemma 4 and Lemma 6 $\Longrightarrow$ $\omega^I < \omega^{III}$

Corollary 3: $\bar{e}^I < \bar{e}^{II} < \bar{e}^{III}$ based on this we can put the following proposition:

Proposition 2: $\hat{\tau_1^c}(e) = \hat{\tau_2^c}(e) = \hat{\tau_3^c}(e) = 0$ if $e \in [0, \bar{e_1}]$ and $\hat{\tau_1^c}(e) > \hat{\tau_2^c}(e) > \hat{\tau_3^c}(e)$ if $e \in (\bar{e_1}, 1]$

Implications: Comparing phase II and I, even in the absence of FTA , the

prospects of having FTA between countries in the future, as soon as parallel trade talk is opened between them, the ability of countries to multilaterally cooperate starts to realized and hence, any trade tension among them starts to decline.

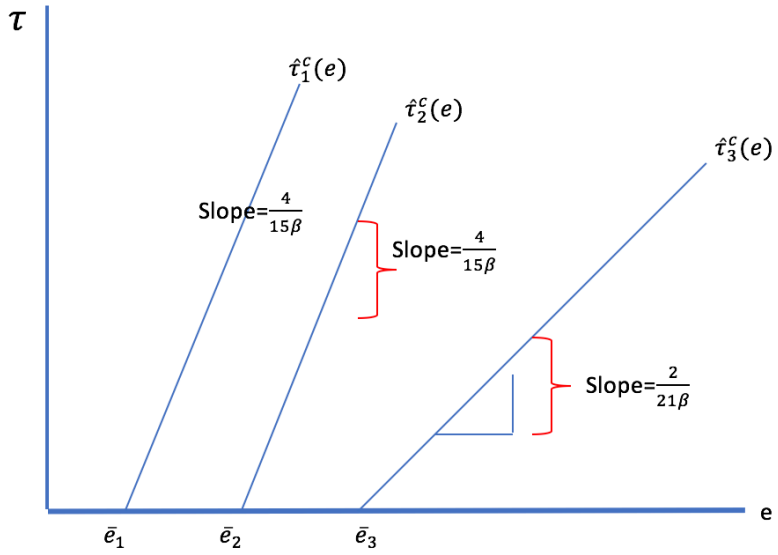


Figure 3, Tariff function in Phase I relative to Phase II and III

1.6 Conclusion

This paper investigates the impact of free-trade areas (FTAs) on the use of contingent protection between competing exporters. We consider four country four goods model and develop a dynamic model similar to the competing-importers one of Tabakis (2015), where cooperation to multilateral trade agreement is self-enforcing and the economic environment is characterized by trade-flow volatility. We classify the period s in to three distinct but interrelated phases, phase I which is pre negotiation period, phase II negotiation period and phase III , the period where the world has two symmetric FTAs among the four countries who are competing for export. Our analysis demonstrates that the findings of Tabakis (2015) extend to our competing-exporters case. In particular, the parallel formation of different FTAs results in a gradual but permanent easing of multilateral trade tensions, especially as far as contingent protection is concerned. Thus, our

results supports the building-block effect of FTAs on multilateral trade cooperation.

Though our model shows an extension of the previous literatures based on restrictive assumptions, we believe the result will give a bench mark theoretical justifications for the ongoing debates about the ability of formation of FTAs to enhance multilateral cooperation. The future area of research might be relaxing the assumptions such as considering asymmetric formation of FTAs to obtain more robust result on the question at hand.

1.6.1 Reference

1. Aghion, philippe, Pol Antras, and Elhanan Helpman. 2007, “Negotiating Free trade.” Journal of International Economics 73: 1-30

2. Bagwell, Kyle, and Robert Staiger. 1997a, “Multilateral Tariff Cooperation During the formation of Free Trade Areas.” International Economic Review 38: 291-319

3. Bagwell, K., Staiger, R. W., & Richardson, M. (1999). Regionalism and multilateral tariff co-operation. In International trade policy and the Pacific Rim (pp. 157-190). Palgrave Macmillan, London.

4. Baldwin, R.E., 1996, “A domino Theory of Regionalism.” Cambridge University Press, Cambridge , UK.

5. Krishna, Pravin. 1998. “Regionalism and Multilateralism: A Political Economy Approach.” Quarterly Journal of Economics 113: 227-251

6. Ornelas, Emanuel. 2005. “Endogenous Free Trade Agreements and the Multilateral Trading System.” Journal of International Economics 74: 202-224

7. Summers, P.A, 1991, “Regionalism and the World Trading System. Policy Implications of Trade and Currency Zones.” Federal Reserve Bank, Kansas City

8. Tabakis, C., 2015. Free-trade areas and special protection. The Journal of International Trade & Economic Development, 24(8), pp.1054-1076.

1.7 Appendix A

Proof of Lemma 3

Following Similar procedure as in Tabakis(2015), we have the following :

Given the condition for existence of unique solution in $\omega^{II} \in (0, \frac{1}{30\beta})$ We define a continuous function $\phi(\bar{\omega}^{II}) = \tilde{\omega}^{II}(\bar{\omega}^{II}) - \bar{\omega}^{II}$

$\phi(0) = \frac{\lambda}{1-(1-\lambda)\delta}\omega_i^{III} > 0$ Thus if $\phi(\omega^{III}) - \omega^{III} < 0$ then we must have $\phi(\bar{\omega}^{II}) = 0$ in the interval $(0, \omega^{III}) \implies \omega^{II} < \omega^{III}$

Hence,The following should be satisfied

$$\tilde{\omega}^{II}(\omega^{III}) < \omega^{III} \iff \frac{(1-\lambda)\delta}{1-(1-\lambda)\delta}\frac{F\left(30\beta\omega^{III}\right)}{225\beta} + \frac{\lambda}{1-(1-\lambda)\delta}\omega^{III} < \omega^{III}$$

Rearranging :

$$\iff \frac{(1-\lambda)\delta}{1-(1-\lambda)\delta}\frac{F\left(30\beta\omega_i^{III}\right)}{225\beta} < \frac{(1-\lambda)(1-\delta)}{1-(1-\lambda)\delta}\omega_i^{III}$$

$$\iff \delta\frac{F\left(30\beta\omega_i^{III}\right)}{225\beta} < (1-\delta)\,\omega_i^{III}$$

$\iff F\left(30\beta\omega^{III}\right) < (1-\delta)\,\omega^{III}\frac{225\beta}{\delta} \implies F\left(30\beta\omega^{III}\right) < \frac{225\beta\omega^{III}}{\frac{\delta}{1-\delta}}$ Recall from the proof of Lemma 1 F(y) is strictly increasing for all y except $y \neq 1$:

Hence,

$$\implies F\left(30\beta\omega^{III}\right) < \frac{225\beta\omega^{III}}{\frac{\delta}{1-\delta}}$$

Thus: Since $\omega^{III} < \frac{1}{126\beta} < \frac{1}{30\beta}$, F is strictly increasing

$\Longrightarrow\ F\left(126\beta\omega^{III}\right) > F\left(30\beta\omega^{III}\right) < \frac{225\beta\omega^{III}}{\frac{\delta}{1-\delta}}$

$\Longrightarrow\ F\left(126\beta\omega^{III}\right) > \frac{225\beta\omega^{III}}{\frac{\delta}{1-\delta}}$

From Lemma 1 we have $F\left(126\beta\omega^{III}\right) = \frac{1323\beta\omega^{III}}{\frac{\delta}{1-\delta}}$

Therefore, $\frac{1323\beta\omega^{III}}{\frac{\delta}{1-\delta}} > \frac{225\beta\omega^{III}}{\frac{\delta}{1-\delta}}$

Proof of Lemma 5:

Using the same techniques as in the proof of Lemma 4, we define a function $\pi\left(\bar{\omega}^I\right) \equiv \tilde{\omega}^I(\bar{\omega}^I) - \bar{\omega}^I$ and recalling $\omega^I \in (0, \frac{1}{30\beta})$ if we evaluate $\phi(0) = \tilde{\omega}(0) - 0 = \frac{\rho\left(\omega^{II} - \omega^{III}\right)}{[1-(1-\rho)\delta][1-\lambda]} > 0$

And $\frac{\rho\left(\omega^{II} - \omega^{III}\right)}{[1-(1-\rho)\delta][1-\lambda]} = \frac{\rho}{[1-(1-\rho)\delta][1-\lambda]}\left[\frac{(1-\lambda)\delta}{1-(1-\lambda)}\frac{F\left(30\beta\omega^{II}\right)}{225\beta} + \frac{\lambda(\delta-\lambda\delta)}{1-(1-\lambda)\delta}\omega^{III}\right]$

Therefore if $\pi(\omega^{II}) < \tilde{\omega}^I(\omega^{II}) - \omega^{II} < 0\ \Longrightarrow\ \pi(\bar{\omega}^I) = 0$ at some point $(0, \omega^I)$

Next we will check if $\pi(\omega^{II}) < \tilde{\omega}^I(\omega^{II}) - \omega^{II} < 0$

$\pi(\omega^{II}) < \tilde{\omega}^I(\omega^{II}) - \omega^{II} < 0\ \Longrightarrow\ \tilde{\omega}^I(\omega^{II}) < \omega^{II}$

$\Longrightarrow\ \frac{(1-\rho)\delta}{1-(1-\rho)\delta}\frac{F\left(30\beta\omega^{II}\right)}{225\beta} + \frac{\rho}{1-(1-\rho)\delta}\frac{\omega^{II}-\lambda\omega^{III}}{1-\lambda} < \omega^{II}$

$\Longleftrightarrow\ \frac{\rho}{[1-(1-\rho)\delta][1-\lambda]}\left[\frac{(1-\lambda)\delta}{1-(1-\lambda)}\frac{F\left(30\beta\omega^{II}\right)}{225\beta} + \frac{\lambda(\delta-\lambda\delta)}{1-(1-\lambda)\delta}\omega^{III}\right]\left[\frac{(1-\rho)\delta}{1-(1-\rho)\delta}\frac{F\left(30\beta\,\omega^{II}\right)}{225\beta}\right] + \frac{(1-\rho)\delta}{1-(1-\rho)\delta}\frac{F\left(30\beta\omega^{II}\right)}{225\beta}$

$< \frac{(1-\lambda)\delta}{1-(1-\lambda)\delta}\frac{F\left(30\beta\omega^{II}\right)}{225\beta} + \frac{\lambda}{1-(1-\lambda)\delta}\omega^{III}\ \Longleftrightarrow$

$\frac{\lambda\delta}{[1-(1-\rho)\delta][1-(1-\lambda)\delta]}\left[\frac{F\left(30\beta\omega^{II}\right)}{225\beta} - \frac{F\left(126\beta\omega^{III}\right)}{1323\beta}\right] < 0$

Note: The term in the bracket is negative becuase from lemma 3, $\omega^{II} < \omega^{III}\ \Longrightarrow\ F(30\beta\omega^{II}) < F(30\beta\omega^{III})$ Since, $\frac{\lambda\delta}{[1-(1-\rho)\delta][1-(1-\lambda)\delta]} > 0$; we need to show $\left[\frac{F\left(30\beta\omega^{II}\right)}{225\beta} - \frac{F\left(126\beta\omega^{III}\right)}{1323\beta}\right]$ is negative .Devide all terms by $\frac{\delta}{1-\delta}$

$$\frac{F\left(30\beta\omega^{II}\right)}{\frac{225\beta}{\frac{\delta}{1-\delta}}} - \frac{F\left(126\beta\,\omega^{III}\right)}{\frac{1323\beta}{\frac{\delta}{1-\delta}}}$$

From Lemma 1 $F\left(126\beta\,\omega^{III}\right) = \frac{1323\beta}{\frac{\delta}{1-\delta}} \implies \frac{F\left(126\beta\,\omega^{III}\right)}{\frac{1323\beta}{\frac{\delta}{1-\delta}}} = 1$

From Lemma 4: $F\left(30\beta\,\omega^{III}\right) < \frac{225\beta}{\frac{\delta}{1-\delta}}$ and $\omega^{II} < \omega^{III} \implies F\left(30\beta\omega^{II}\right) < F\left(30\beta\,\omega^{III}\right) < \frac{225\beta}{\frac{\delta}{1-\delta}}$ Becuase F is increasing. This implies that $\frac{F\left(30\beta\,\omega^{III}\right)}{\frac{225\beta}{\frac{\delta}{1-\delta}}} < 1$ and hence , $\left[\frac{F\left(30\beta\omega^{II}\right)}{225\beta} - \frac{F\left(126\beta\omega^{III}\right)}{1323\beta}\right]$ is negativ

References

CHAPTER 2. THE LEGACY OF CONFLICT ON TRADE NEGOTIATIONS

2.1 Introduction

Despite existence of a heated debate among trade economists and policymakers about the role of RTAs on the realization of multilateral trading system, there is unprecedented increase in the number and coverage of regionalism. Most of the worlds country has moved towards freer trade onwards 1990s.The establishment of the General agreement on tariff (GATT) paved the way for such expansion (Milner, 1999). Besides the standard economic gains from regional integration, RTAs can produce significant political gains for their member countries, such as reduction in interstate conflict between RTA members (peace-creation effect).The one that is mentioned in most literature for the support of such argument is European Coal and still Community(ECSC) which was established in 1951 following Robert Schuman's proposal. Many historians and political scientists argue that the driving force of the ECSC was mainly to solidify peace so as to avoid other destructive conflicts that has been seen in the major world wars.

The peace creation effect of RTA is discussed in many literatures in relation to the liberal Peace argument; which states that bilateral trade reduces the probability of interstate conflict. The argument follows from that, RTAs create trade and large volume of bilateral trade increases the opportunity cost of interstate conflict. Martin et al. (2012), has analyzed such two-stage links, i.e. in the first stage RTAs create trade and the second stage trade reduces the probability

of interstate conflict and find that RTAs are more likely to be signed between countries who have higher frequency of past conflict. Martin et al. (2008) also showed both theretically and empirically abouth dampening impact of bilateral trade openess on probability of conflict but contrsting result for multilateral trade openess. Costas et al.(2016) investigate both theoretically and empirically the implication of Preferential trade agreement for interstate conflict and found that preferential trade agreements produce both peace creation and peace diversion effects, where the peace creation effect is found between member countries.

Therefore, depending on the RTA in question, economic integration and peace solidification can both occupy center stage on the agenda of the prospective RTA partners during the trade negotiations, affecting their duration.It is well known that the duration of negotiations across RTAs differs substantially, but this phenomenon has not received much attention in the literature.

In this paper, we explore for the first time the legacy of past conflict on RTA negotiations. Two offsetting forces are at work here. On the one hand, past conflict might reduce trust between prospective RTA partners, prolonging the trade negotiations. On the other hand, past conflict might induce the negotiating countries to conclude the negotiations faster in order to reap the peace-creation benefits of an RTA. It is well documented in the literature that history of conflict lowers bilateral trust. For example, Guiso et al. (2009) reported an evidence that Countries with a long history of wars tend to trust each other less. There is also a theoretical link between historical cooperation and conflict with current cooperation (Ansell and Gash, 2007)

We test the offsetting predictions using a unique dataset on the history of formation of a large number of RTAs (Tabakis and Zanardi, 2018) from 1972 onwards as well as data on conflict from the Correlates of War project(COW). By employing survival analysis techniques for duration of trade negoattion from the start to the end and our results provide robust evidence in support of accelerating effect of conflict on negotiation: country pairs with past history of conflict

conclude their trade negotiations relatively faster—1.5 to 2 times faster in comparison with country pairs with no history of conflict. Apart from the conflict variable our finding suggest that trade conducted bilaterally takes significantly shorter time while it takes much longer time if EU takes part in the process. This has implications on the number of participant and additional provisions that EU might require.

The implication of duration of trade negotiation can be seen from two different major perspectives; economic and political. The economic implication is related with its impact on firms' investment decision. The anticipation of trade liberalization by firms affect firm-level adjustment that address to innovate and enter into the export market (Constantini and Melitz, 2008 ; Burstein and Melitz, 2011). In their dynamic model of firm level adjustments for economic openess, Constantini and Melitz (2008) showed anticipation effect of trade liberalization that induces firms to innovate ahead of export market entry. Thus, knowing factors affecting the process of trade negotiation can help firms by reducing their uncertainty while taking investment decisions in preparing the anticipated trade liberalization era.

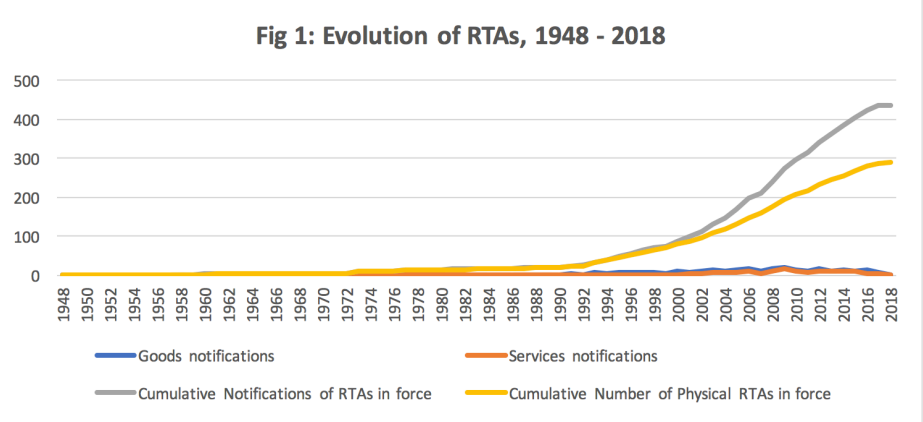
In this paper, we make two major contributions to the literature. First, we estimate the magnitude of the effect of past conflict on the duration of trade negotiations, which has important ramifications for firms' investment decisions. Second, we highlight the prominence of non-economic reasons in negotiating and establishing RTAs.

2.2 Theory and Foundation of Trade Agreements: An overview

In this part, we provide a brief explanation of the genesis of regional trade agreements from historical view and some theoretical justifications about the purpose of forming RTAs. The general agreement on trade and tariff (GATT), was estab-

lished back in 1947 with an initial number of 23 member countries. Now a day the former GATT got the new name called World trade organization(WTO) with greater scopes at Uruguay round in 1995, which took about 8 years of negotiation from 1986 to 1994 currently having 164 members, which represent about 98 per cent of the world trade. The formation of regional integration has long history, dated back to 1860 (Ashely,1904 cited in (Grossman & Helpman, 2018)), the first bilateral agreement between France and Britain called Cobden-chevalier Treaty. The Cobden-chevalier Treaty paved a way for waves of bilateral negotiation among the major powers of Europe, what (Baldwin, 1993) called – 'domino effects of Regionalism'. Most of the world's country has moved towards freer trade onwards 1980s. The conclusion of multilateral trade negotiations such as the General Agreement on Tariffs and Trade (GATT) pave a way for RTAs to flourish (Milner, 1999).

Currently all WTO members have an RTA in force. According to WTO report between 1948-1994, about 124 RTAs were notified to GATT/WTO, this number has increased dramatically after the creation of the WTO in 1995, more than 400 RTAs were notified out of it about 288 RTAs are in force. Fig. 1. Summarize the evolution of RTAs since 1948. The figure clearly shows an increase gap between number of RTAs notified and RTAs in in force in recent years.



Source: WTO, Regional Trade Agreements Information System (RTA-IS), 2018.

2.2.1 Why Countries sign RTAs?

When countries are signing binding agreements, they are limiting their sovereign rights. Thus, the question is thus; what are the motivating factors for a given country to participate such agreements? Countries have been implementing regional trade agreements for both political and economic motives. Bagwell and Staiger, (2002) discussed the motives for forming RTAs by developing three major theoretical approaches; the traditional economic approach, the political economic approach and the commitment approach. The first approach explains the role of the government in targeting to maximize social welfare by manipulating the terms of trade using tariff as an instrument. Bagwell and Staiger cited Harry Johnson (1953) who analyzed the strategic interdependence among countries', national welfare maximizing government uses tariff as an instrument to manipulate to control terms of trade driven inefficiencies and pointed out that tariffs is being the outcome of a static game played by a pair countries who have welfare-maximizing governments. Thus, according to this approach Bagwell and Staiger (2002) conclude that the pursuit of terms of trade gain alone will lead the government to be more inefficient by dragging back from the efficient outcome of reciprocal free trade to the inefficient Nash equilibrium outcome. Hence, free trade is the remedy that guides the government from inefficient outcome to Pareto efficient outcomes.

In the second approach; they emphasize how the government tariff selection is transmitted to distributional and economic efficiency consequences. Tariff setting decision for politically motivated Policy makers usually goes beyond terms of trade manipulation. The motivating force such government is to re-distribute income to so that voters can alter their decision in favor of the electorate or to groups that campaign support. Such inward-looking behavior of the government to in altering their trade policy through tariff might be followed by inefficiencies that trade agreement can be taken as a remedy. Grossman and Helpman (1995)

examined if trade agreement can be emerged as an equilibrium outcome between two politically motivated governments and they claim that liberalization arises when FTA results substantial welfare gain for average voters and when there is a net gain for potential exporters.

Bagwell and Staiger (2002) discusses if there exists a separate political motive for trade agreements. Their analysis follows two approaches: government preference (combination of welfare maximization as well as distributional concerns) and the possibility of efficiency once the motive of influencing terms of trade through tariff is ignored. They made three major observations from their analysis of political economy approach. Firstly, when government set their trade policies unilaterally, the Nash equilibrium (non-cooperative Nash equilibrium) fails to satisfy the condition for efficiency. Second, trade agreements among politically motivated governments must entail reciprocal trade liberalization. The implication for this observation is that trade policy in a unilateral fashion leads to higher tariff rate which is in efficient. Hence, trade agreement in bilateral fashion will help both governments to gain from trade. Under this observation, there are two externalities that we can consider: "terms-of-trade externality" and "Political externality". In the previous approach, trade agreement as an outcome of terms-of-trade externality was discussed. The question under this approach is hence, if inefficiencies that arise due to political externality is remedied by trade agreements. Maggi and Rodríguez (2007) and Grossman (2016) also presented theoretically the importance of politics for trade agreement.

In the second approach; they emphasize how the government tariff selection is transmitted to distributional and economic efficiency consequences. Politically motivated Policy makers might be tempted to choose protectionist policies not (or not only) to manipulate the terms of trade, but rather (or also) to re-distribute income to swing voters in the electorate or to groups that campaign support. The inward-looking behavior of the government to manipulate terms of trade may create an inefficiency that trade agreement can be taken as a remedy.

Grossman and Helpman (1995) examined if trade agreement can be emerged as an equilibrium outcome between two politically motivated governments using a political-economy framework that emphasizes the interaction between industry special- interest groups and an incumbent government. As a necessary condition for FTA to be an equilibrium outcome, they describe both cases when the agreement must cover all bilateral trade and when a few politically sensitive sectors can be excluded from the agreement. According to them, a government might endorse an agreement in two types of situations if an FTA must completely liberalize trade among the partner countries, the first arises when the FTA would generate substantial welfare gains for the average voter and adversely affected interest groups fail to coordinate their efforts to defeat the accord. The second arises when the agreement would create profit gains for actual or potential exporters more than the losses that would be suffered by import-competing industries, plus the political cost of any welfare harm that might be inflicted on the average voters.

Bagwell and Staiger (2002) discusses if there exists a separate political motive for trade agreements. Their analysis follows two approaches: government preference (combination of welfare maximization as well as distributional concerns) and the possibility of efficiency if governments tariff selection ignores their ability to affect the terms of trade. They made three major observations from their analysis of political economy approach. Firstly, when government set their trade policies unilaterally, the Nash equilibrium (non-cooperative Nash equilibrium) fails to satisfy the condition for efficiency. Second, trade agreements among politically motivated governments must entail reciprocal trade liberalization. The implication for this observation is that trade policy in a unilateral fashion leads to higher tariff rate which is in efficient. Hence, trade agreement in bilateral fashion will help both governments to gain from trade. Under this observation, there are two externalities that we can consider: "terms-of-trade externality" and "Political externality". In the previous approach, we have seen

that terms-of-trade externality as a main reason for trade agreements. The question under this approach is hence, if inefficiencies that arise due to political externality is remedied by trade agreements. The conclusion here is, where the government maximizes national welfare, it will consider the politically optimal tariff that corresponds to the reciprocal free trade. The third observation is that, politically optimal tariffs are efficient. The implication of this observation is that if a term of trade motivation is removed and if each government sets tariffs optimally, any slight reduction in tariff in any one country will reduce the local preferred price at home and abroad. This results a reduction in world price. However, the reduction in world price cannot generate any efficiency, it is just pure international transfer in tariff revenue. This follows that if terms-of-trade motivation is ignored from trade policy choice, there is no further scope for Pareto improvements. Hence, according to them politically motivated governments engage in trade agreements only to correct for terms of trade externalities. Thus, ”politics” does not affect the motivation to engage in trade agreement.

According to the commitment theory, trade agreement can be used as a remedy for difficulties in making credible policy and dynamic time inconsistency. Staiger and Tabellini (1987) found an evidence that rules prescribed under GATT helped the US government to make domestic trade policy commitments that it could not have made in the absence of these rules. Matsuyama (1990) also showed the possibility of this using different game structure.

Unlike the traditional approach, under the commitment approach the game is between the government and its private sector. That is government makes policy and agents make their decision based on the policy. The more the government is flexible the more the problem of credibility and hence inefficiency. Thus, more government’s decision is flexible, the more cost trade policy will have. Trade agreement can be a remedy to make a government to be committed on preferred tariff policy (Grossman ,2016).

Though the motivation of forming RTAs are justified from traditional eco-

nomic approach and domestic politics point of view, there is a growing evidence that the purpose of signing regional trade agreements (RTAs) are beyond the trade creation effects. The peace creation effects of RTAs have becoming a center of attention in recent empirical works. According to the Liberal Peace argument, trade flows between country pairs reduces the probability of future conflict by increasing the opportunity cost of conflict. Thus, RTAs can be signed between members who are inspired by its peace creation effects. Regarding the relationship between conflict and formation of RTAs, Martin, Mayer, & Thoenig, 2016 ; Vicard, 2012) showed the complementarity between economic and political determinates of the formation of RTAs: and showed that , countries with higher frequency of past war are more likely to sign RTAs. Thus, economic factors and political factors are two sides of a coin in negotiating RTAs. Many more scholars argue that the driving force of concluding RTAs is mostly due to its peace creation effect though it has a contagious effect latter once the first agreement is concluded (Baldwin, 1993). Many believe that the European coal and Steel community(ECSC) in 1951 was established mainly to avoid conflict and create peace than commercial purpose. Hadjiyiannis, Iris, & Tabakis, (2012) develop a theoretical framework explaining the peace creation effect of RTAs. There is an empirical evidence that signing of RTAs will reduce the possibility of future conflict among signing countries

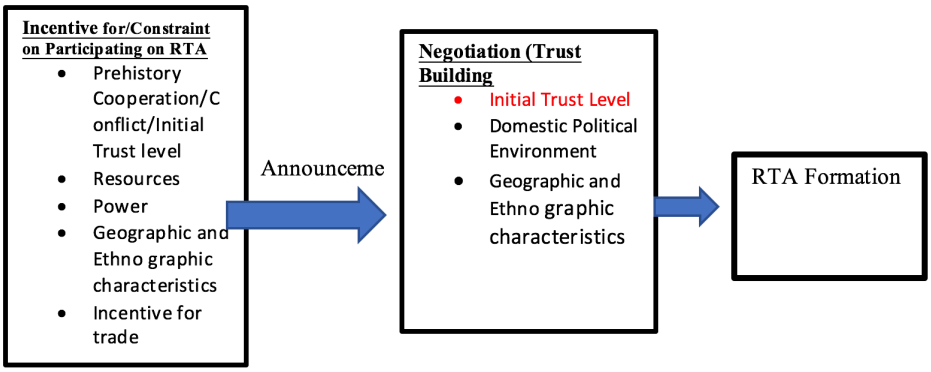
Generally, countries signed RTAs due to economic, domestic politics and international politics point view. Hence, the complexity of negotiating RTAs depends on which driving force dominates among others. This paper uncovers such fact that given other factors, an RTA between country pairs involved history of conflict takes relatively shorter period of negotiation as compared to country pairs who don't have such conflicts at least in the past 200 years.

2.3 Related Literatures

2.3.1 Theoretical Consideration

When we analyze the impact of historical conflict on current cooperation, two testable predictions are at work; the pursuit of peace creation and the dampening effect of conflict on trust and hence, cooperation. in their dynamic theory of civil conflict on trust and trade between the conflicting ethnic group, Rohner, Thoenig, & Zilibotti (2013) explained the dampening effect of current conflict on future trust and creates a disincentive for cooperation. Similarly, Acemoglu & Walitz (2012) showed theoretically the possibility of conflict on breaking trust and hence trade and cooperation. Thus, we develop our model based on Ansell & Gash's model of participatory government Ansell & Gash's (2007). In their model, they explained how incentive and constraints to participate in each decision-making process is linked with cooperation and an intended outcome. We borrowed their idea to frame the models for the process of concluding regional trade agreements.

Figure 1: Model of Regional Trade agreement



Ansell & Gash (2007) discussed the role of initial conditions for participation as a main deriving force either to facilitate or discourage cooperation among stakeholders. Likewise, this model can be applicable for country pairs initial

condition to participate in trade negotiation. The economic reasons, domestic political conditions and country pairs historical cooperation or conflict are some of the main ingredients that has an implication in trade negotiation process. Historical bilateral conflict, which is the focus of this paper, hinders cooperation among participants (Andranovich ,1995). However, there is a way to argue that presence of historical conflict can ease the complexity of the negotiation between participating countries who are inspired by solidifying peace.

2.3.2 Empirical Evidence

In this section, we provide some related literatures under the umbrella of two basic topics: why duration matters and prior evidences on duration variability. Regarding the standard economic gains of RATs, much has been said in the literature about the trade creation effects of RTAs. Which has direct implications for firm level adjustments for the new market. In his dynamic industry model with heterogamous firms Melitz (2003) analyzed the intra-industry effects of international trade and showed, productivity difference among firms resulted entry and exit to the export market. But this might have different magnitudes if agents are forward looking. Anticipation of future market have an impact on current resources allocation behaviors of firms. For example, Freund and McLaren (1999) showed how anticipated trade agreement affects current trade adjustments. Using the case of counties joining the EU and show their trade responds to trade talks 4 years before the conclusion. Similarly Magee (2008) showed that trade increases by about 26 per- cent before FTA is realized between negotiating countries. More studies have shown the existence of such anticipatory trade effects. That is when bilateral trade negotiations start between country pairs, there trade increases before the RTA come into force (Croce et al. ,2004; Molders and Volz, 2011; Bergin and Lin, 2012; Coulibaly ,2007, C. Lakatos and L. Nilsson ,2016). The implication is when agents speculate future trade agreement they will alter their current behavior to maximize current and future returns. Hence, if trade

agreement is launched between countries, how long it will take matters a lot for forward looking welfare maximizing agents. Though duration of trade negotiation differs substantially, the phenomenon has not received much attention in the literature. Few empirical evidence has presented some evidences about the determinants of such variation. Moser & Rose (2012) emphasize the economic reasons; using semi-parametric Cox proportional hazards model for 88 RTAs, they found that trade negotiation between different regions and involving many participants in the negotiation table takes relatively longer durations while negotiations between open and richer countries takes shorter time periods. On the other similar work Mölders (2016), stresses the political factors such as democratic regime; and using duration analysis for event data, they pointed out that while political constraints are associated with longer negotiation periods, country pairs with high level of democratization takes relatively shorter periods. Though Moser & Rose (2012) and Mölders (2016) give an insight about the determinant factors for duration of trade negotiation, this paper contributes for the literature about the impact of historical bilateral conflict on duration which is of course matters a lot in negotiating trade.

2.4 Data and Identification strategies

2.4.1 Data

The main source data used in this paper for military conflicts is the Correlates of War (COW) project which provide a wide range of dataset related to armed conflict. Our key explanatory variable, conflict, used in this paper is occurrence of Militarized Interstate Disputes (MID), which shows all bilateral interstate conflicts from 1816 to 2010. The MID database also provides more detail information about the intensity of the bilateral conflict and quantifies their intensity on a 1 to 5 hostility level (where 1= no militarized action and 5= War). In this paper, the key explanatory variable is thus a dummy variable Conflictijt =1 if country i

and j ever had a conflict at time t or 0 otherwise. we use a broader definition of conflict from COW which is hostility level 3, 4 and 5. In our robustness analysis, we use a more stricter definition of war by taking only MIDs with hostility level 4 and 5. Using the advantages of a more detailed information from MID database such as dates of the start and end of the dispute, we were able to exploit a broader information of bilateral conflict to analyze the impact. Hence, in our analysis we controlled for number of peaceful years between the last conflict and start of trade negotiation, the duration of war (the sum of all possible wars before trade negotiation started), frequency of conflict (how many times the country pairs involved in interstate conflict).

In this paper we employ the unique data set for duration of trade negotiations by C. Tabakis and Maurizio (2018) . using the details of the unique dataset and WTO database, we made more robustness analysis by classifying whether the country i is WTO member or not, the negotiation is bilateral or plurilateral, if EU is involved or not.

Other control variables

We believe that more open countries are more likely to make the negotiation process easier. Accordingly, we control for level of trade openness (Country pairs export/their GDP). we control also level of economic development (Average GDP per capita difference between Country Pairs) which shows the bargaining power difference. We gather these data on national characteristics from the World Bank's World Development Indicators. It is true that the decision to participate and cooperate for a common goal might be influenced by set of gravity variables like bilateral distance, common language, contiguity and colonial linkages. we control such variables and al those come from the Centre d'Etudes Prospectives et d'lnformations Internationales (CEPII) distance database.

2.4.2 Stylized Facts

We have 114 RTAs in our sample of which 98 of them are already concluded and the rest 16 RTAs are under negotiation. The following figure shows the variability of the duration for those whose negotiation is finalized.

2.4.3 The Model

In this paper, we motivate our estimation strategy by using the survival analysis for duration data. Hence, we define the survival function s(t) conditional on set of covariates. The survival function defined in this context is the probability of the trade negotiation started at T=0 to survive/ still under negotiation beyond a given time T=t.

we used the standard Weibull model for survival analysis which adds shape parameters to fit different kinds of the data. The advantage of the Weibull model over semi-parametric Cox proportional hazards (PH) model is the later does not specify any distribution for the conditional hazard rate. Unlike the semi-parametric Cox proportional hazards (PH) which assumes the hazard ratio between group is time invariant, the Weibull model assumes a monotonically increasing or decreasing hazard ratios between groups. In this paper, we have done different sensitivity analysis for such various survival analysis. In the context of the trade negotiation, the hazard function H(t) refers to the probability that either the trade negotiation is concluded or not at time t.

The Weibull model assumes a baseline hazard of the form:

$$h_0(t) = pt^{p-1}exp(\beta_0)$$

where p is shape parameter and $exp(\beta_0)$ is scale parameter. Thus, conditional on control variables X, the hazard function takes the form :

$$H(t) = t^{p-1} exp(X'_{ij}\beta + \gamma(Conflict_{ij} + \beta_0))$$

Where H(t) is the hazard function, t is failure time (which refers either or not the trade negotiation is ended), P is the Weibull shape parameter, X is vector of control variables, $Conflict_{ij}$ is a dummy variable 1 if there is historical conflict between country i and country j.

Table 2.1: Summary Statistics

	(1)	
	Mean	sd
Conflict	.0733318	.2606879
Duration of Negotiation in Years	8.4625	3.657506
1=Language is spoken by at least 9% of the population	.1108086	.3139041
1=Contiguity	.0321478	.1763977
1=Pair ever in colonial relationship	.0371872	.1892258
1=Common colonizer post 1945	.0469764	.2115944
1=Pair in colonial relationship post 1945	.0263554	.1601946
Log of bilateral distance	8.479701	.7132394
Bilateral	.0151761	.1222565
EU	.8076923	.3941249
WTO member	.9270158	.2601182
lgGdp_diffb	9.641918	1.279681
Log Openess	4.494921	.3931823
Frequency	.261469	1.642985
Peacefull year	.0149966	.7618271
War duration	.1989818	1.224902

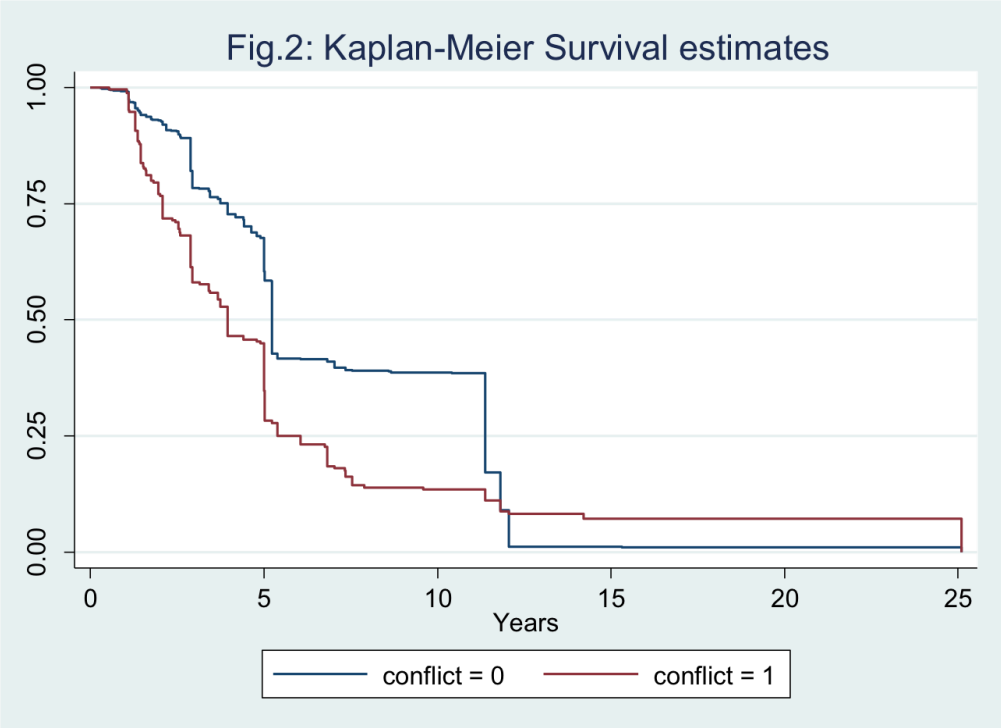
2.5 Empirical Results

 In this section we discuss the main results of the paper

2.5.1 Descriptive Statistics

Table 1 shows the summary statistics of the main variables used in this paper. Based on group of 114 RTAs under consideration, the average length of time to conclude the RTA negotiation is about 8.5 years. Figure 2 below depicts the survival graph for RTA negotiation from the Start to the end for two group of country pairs; the survival function is plotted according to the country pairs who have bilateral conflict history and country pairs who don't have conflict history. It describes the probability that RTA negotiation process to be longer than a given time, years in our case. As it is shown, the probability that RTA negotiation to be longer than a given year is lower for country pairs who have historical conflict than country pairs who don't have any conflict prior to the start of the negotiation. Consider for example probability for not observing concluding negotiation

prior to year 10; the probability for trade negotiations involving history of conflict for country pairs is below 25 percent whereas for country pairs who doesnot have conflict history, it is above 25 percent. This support the prediction that a trade negotiation that involve conflicting country pair take shorter time than those negotiations who do not have conflict history. The implication is straight forward; the peace creation motive of RTA formation is strong. The other observation from figure 2 is that, the two curves in the survival graph tend to intersect in some points. This is an evidence that proportional hazard assumption is not supported. Thus we use the Weibull model as a good candidate for the parametric approach. In our paper we presented the competing survival models such

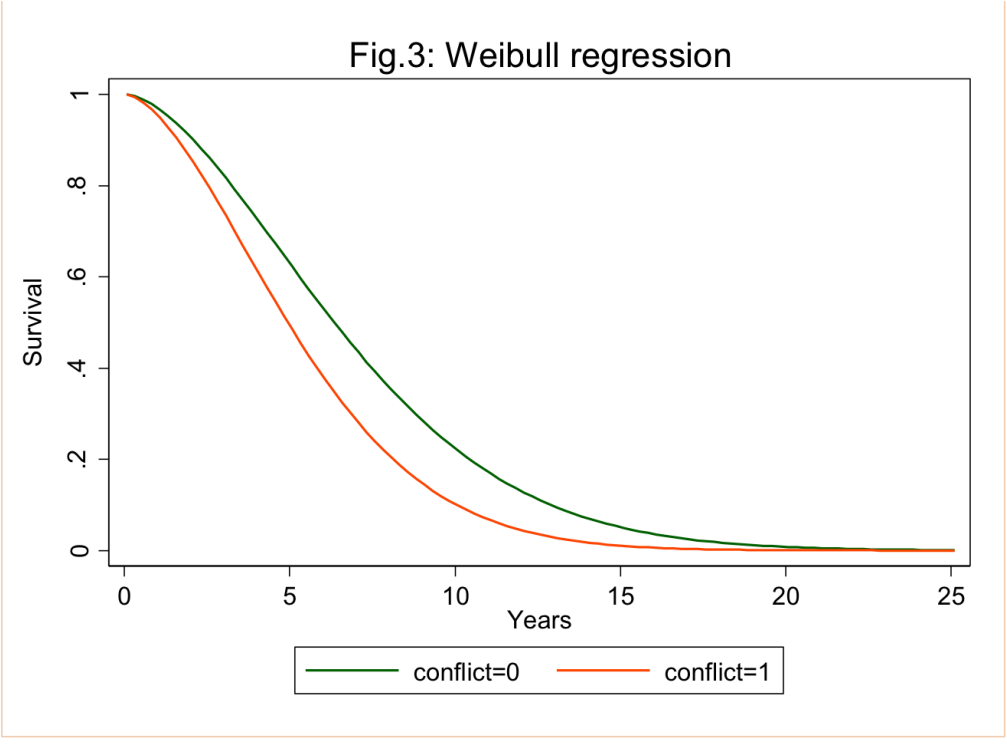


as Cox-proportional hazard , Weibull and accelerated failure time. The beauty of Cox-proportional hazard model is, it allows us to estimate the effect of the covariates even without specifying the baseline hazard. That is why it is called semi-parametric model. But the model puts strong assumption that hazards are proportional between groups and do not depend on time. But this might not be the case; there may be interaction between time and the covariates which results the hazard not to be proportional. Fig2. shows this where through the passage

of time the hazard tend to converge. Hence,we presented the weibull estimates to check the robustness of our result.

One of the requirement for Weibull distribution, the hazard should be constant (exponential distribution can be used in this case), monotonically increasing or monotonically decreasing. Figure 3 below visualize what the hazard looks like for the two groups of country pairs (conflict vs non conflict) on average. As it is shown by the figure the hazard is monotonically decreasing for both groups on average. Where the probability of surviving longer than a given year is lower for country pairs with pre negotiation conflict than those who do not have pre negotiation history of conflict.

The other competing model is which is not depend on the proportional hazard assumption is the accelerated failure time (AFT) model. This model focuses on the survival function and therefore the estimates of the coefficient can be directly interpreted as elasticities on the survival function.



2.5.2 Main Results

Table 2 show how bilateral conflict affect the length of trade negotiation. The result in table 2 is based on conflict level which is defined as in correlates of war dataset from hostility level 3 to 5 for all the years (old and new conflicts). On average country pairs who have bilateral conflict takes shorter duration (years) to negotiate FTA than their counter parts.

Table 2.2: Duration between: Start-end of negotiation: (Conflict ; Hostility 3, 4 and 5)

	Cox Proportional Hazard Model				Weibull Model			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Conflict	0.70***	0.44***	0.40***	0.52***	0.78***	0.53***	0.45***	0.60***
	(0.07)	(0.08)	(0.09)	(0.10)	(0.09)	(0.11)	(0.14)	(0.14)
Common ethnographic language		0.03	0.04	0.03		0.04	0.04	0.02
		(0.07)	(0.07)	(0.08)		(0.09)	(0.09)	(0.10)
Contiguity		-0.10	-0.04	-0.10		-0.18	-0.08	-0.24
		(0.12)	(0.13)	(0.13)		(0.19)	(0.19)	(0.20)
Colonial relationship		0.11	0.10	0.21		0.23	0.22	0.38*
		(0.17)	(0.16)	(0.17)		(0.21)	(0.20)	(0.21)
Common colonizer post 1945		-0.15*	-0.13	-0.27***		-0.11	-0.09	-0.26**
		(0.09)	(0.09)	(0.08)		(0.13)	(0.13)	(0.12)
Colonial relationship post 1945		-0.53**	-0.50**	-0.48**		-0.69**	-0.63**	-0.59**
		(0.23)	(0.21)	(0.22)		(0.28)	(0.25)	(0.26)
Log of bilateral distance		-0.04	-0.04	0.01		-0.08*	-0.10**	-0.02
		(0.03)	(0.03)	(0.03)		(0.05)	(0.05)	(0.05)
Bilateral		0.28	0.31	0.34		0.43*	0.48*	0.52
		(0.21)	(0.20)	(0.24)		(0.26)	(0.26)	(0.33)
EU		-0.80***	-0.80***	-0.73***		-0.50***	-0.49***	-0.34***
		(0.08)	(0.08)	(0.09)		(0.10)	(0.10)	(0.12)
WTO		0.23***	0.23***	0.39***		0.10	0.12	0.35***
		(0.09)	(0.09)	(0.09)		(0.11)	(0.11)	(0.11)
War Frequency			-0.02	-0.02			-0.03	-0.03
			(0.02)	(0.02)			(0.02)	(0.02)
(1/peacefull year)			0.00	-0.08			0.01*	-0.51
			(0.00)	(1.35)			(0.00)	(1.55)
Total duration of War			0.03**	0.03**			0.06***	0.06***
			(0.01)	(0.01)			(0.02)	(0.01)
Log(GDP per capita difference)				-0.09***				-0.17***
				(0.02)				(0.02)
Log (Trade openess)				0.32***				0.42***
				(0.05)				(0.07)
_cons					-4.71***	-3.71***	-3.64***	-5.06***
					(0.07)	(0.41)	(0.41)	(0.54)
ln_p					0.75***	0.77***	0.77***	0.80***
					(0.01)	(0.01)	(0.01)	(0.01)
N	17189	17189	17189	16967	17189	17189	17189	16967

Note: Standard errors in parentheses (clustered in country pairs) $*p < 0.10, **p < 0.05, ***p < 0.01$: where Conflict denote Dummy variable=1 if two countries have had conflict history) , Contiguity refers dummy variable=1 if two countries share common border; Commmon ethnographic language =1 if two countries share common ethnic language (at least 9% of the population; Colonial relationship =1 if two countries ever had colonial link; Common colonizer post 1945=1 if two countries have had common colonizer after 1945; Colonial relationship post 1945=1 if two countries have had colonial relationship after 1945: Log of bilateral distance refers Log of Weighted bilateral distance between country pairs; EU=1 if EU is involved; WTO =1 if one of the country pair is WTO member; War frequency refers the number of bilateral conflict between country pairs; 1/Peaceful year(The reciprocal of peaceful years between the end of last war and the start of trade negotiation); total duration of war (Duration of war in years); log (Gdp per capita difference) refers GDP per capita difference b/n country pairs (log form) ; Log (Trade Openess)refers Log of trade openness (the ratio of country pairs average trade to GDP).

The results in table 2 are based on two competing survival analysis techniques, column 1 to 5 is based on the Semi-Parametric cox PH results and column 6 to 10 based on the Weibull method. Our result is consistent with this

different method and with and without control of additional covariates. Our key variable is the dummy variable which is equal to 1 if there is historical bilateral conflict. But this might give us little information about the conflict. Thus, we control for number of peaceful years between the end of the last conflict day and the beginning of the trade talk, total duration of war, and number of times the country pairs involved in conflict historically in column 3,4, 7 and 8.

In all the cases our result shows the negotiation between country pairs who had historical conflict ends relatively faster. Depending on what control variables we use and estimation method the conflict variable in table 2 shows that negotation ends from 1.5 to 2 times faster for country pairs who have history of conflict.

In addition to our conflict variable, the other conflict variable which is duration of war also gives similar stories.Duration of war in this context is the sum total of years country pairs involved in conflict regardless of the nature and type of conflict. The more number of years is associated with faster negotiation. Similar with Molders(2016) and Moser and Rose (2012) , Our result also shows if trade negotiation is conducted bilaterally(between two countries only) it takes relatively shorter time to conclude. And if country pairs are member of WTO, the negotiation the negotation process is much faster. On the other hand, If European Union members take part in the negotiation, it takes much longer time to conclude.

In table 3 we restrict the broder defination of conflict to a more Stricter definition of conflict based on the Correlates of War project data. Hence, we consider hostility level of 4 and 5 only as a conflict variable. Our result is robust to such restrictions too.

Table 2.3: Duration between: Start-end of negotiation: (Conflict ; Hostility 4 and 5)

	Cox Proportional Hazard Model				Weibull Model			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Conflict	0.67***	0.40***	0.33***	0.42***	0.75***	0.47***	0.36**	0.51***
	(0.07)	(0.08)	(0.10)	(0.10)	(0.10)	(0.11)	(0.14)	(0.14)
Common ethnographic language .		0.02	0.03	0.03		0.03	0.04	0.02
		(0.07)	(0.07)	(0.07)		(0.09)	(0.09)	(0.10)
Contiguity		-0.06	-0.00	-0.06		-0.12	-0.03	-0.19
		(0.12)	(0.12)	(0.12)		(0.19)	(0.19)	(0.19)
Colonial relationship		0.13	0.12	0.23		0.25	0.24	0.39*
		(0.17)	(0.16)	(0.17)		(0.21)	(0.20)	(0.21)
Common colonizer post 1945		-0.13	-0.12	-0.26***		-0.08	-0.06	-0.24**
		(0.09)	(0.09)	(0.08)		(0.13)	(0.12)	(0.12)
Colonial relationship post 1945		-0.55**	-0.52**	-0.50**		-0.70**	-0.65***	-0.61**
		(0.24)	(0.21)	(0.22)		(0.28)	(0.25)	(0.26)
Log of bilateral distance		-0.05*	-0.05*	-0.00		-0.10**	-0.11**	-0.03
		(0.03)	(0.03)	(0.03)		(0.05)	(0.05)	(0.05)
Bilateral		0.28	0.31	0.35		0.44*	0.49*	0.52
		(0.21)	(0.20)	(0.24)		(0.26)	(0.26)	(0.32)
EU		-0.81***	-0.81***	-0.73***		-0.51***	-0.50***	-0.34***
		(0.08)	(0.08)	(0.09)		(0.10)	(0.10)	(0.12)
WTO		0.24***	0.24***	0.40***		0.12	0.13	0.36***
		(0.09)	(0.09)	(0.09)		(0.11)	(0.11)	(0.11)
War Frequency			-0.02	-0.02			-0.03	-0.03
			(0.02)	(0.02)			(0.02)	(0.02)
(1/peaceful year)			0.00	0.08			0.01	-0.36
			(0.00)	(1.21)			(0.00)	(1.42)
Total duration of War			0.04***	0.04***			0.06***	0.06***
			(0.01)	(0.01)			(0.02)	(0.02)
Log(GDP per capita difference)				-0.09***				-0.17***
				(0.02)				(0.02)
Log (Trade openess)				0.30***				0.40***
				(0.05)				(0.07)
_cons					-4.68***	-3.59***	-3.53***	-4.83***
					(0.07)	(0.41)	(0.41)	(0.53)
ln_p					0.75***	0.77***	0.77***	0.80***
					(0.01)	(0.01)	(0.01)	(0.01)
N	17189	17189	17189	16967	17189	17189	17189	16967

Note: Standard errors in parentheses (clustered in country pairs) $*p < 0.10, **p < 0.05, ***p < 0.01$: where Conflict denote Dummy variable=1 if two countries have had conflict history) , Contiguity refers dummy variable=1 if two countries share common border; Commmon ethnographic language =1 if two countries share common ethnic language (at least 9% of the population; Colonial relationship =1 if two countries ever had colonial link; Common colonizer post 1945=1 if two countries have had common colonizer after 1945; Colonial relationship post 1945=1 if two countries have had colonial relationship after 1945: Log of bilateral distance refers Log of Weighted bilateral distance between country pairs; EU=1 if EU is involved; WTO =1 if one of the country pair is WTO member; War frequency refers the number of bilateral conflict between country pairs; 1/Peaceful year(The reciprocal of peaceful years between the end of last war and the start of trade negotiation); total duration of war (Duration of war in years); log (Gdp per capita difference) refers GDP per capita difference b/n country pairs (log form) ; Log (Trade Openess)refers Log of trade openness (the ratio of country pairs average trade to GDP).

Our original conflict data includes more old conflict which is more than 100 years. Though we controlled for number of peaceful years in table 2 and 3, one might argue that more recent conflicts might have different results. Hence, in table 4 we take only the more recent conflicts as conflict and the rest as non-conflict. We took post 1950 as new conflict (just 5 years after the end of WW II) . We found qualitatively similar results in most of the cases ; implying the robustness of our benchmark estimates. In the Weibull result after we control for other definition of conflicts, the coefficient in our conflict variable turns out to be insignificant. But still War duration variable shows significant impact in failure time.

Table 2.4: Duration between: Start-end of negotiation: (For recent conflict; After 1950)

	Cox Proportional Hazard Model				Weibull Model			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Conflict	0.72***	0.26**	0.18*	0.23*	0.71***	0.29*	0.20	0.28*
	(0.11)	(0.11)	(0.11)	(0.12)	(0.14)	(0.15)	(0.15)	(0.17)
Common ethnographic language.		0.03	0.04	0.05		0.05	0.06	0.05
		(0.07)	(0.07)	(0.07)		(0.09)	(0.09)	(0.10)
Contiguity		0.02	0.04	-0.01		-0.01	0.02	-0.11
		(0.12)	(0.12)	(0.12)		(0.18)	(0.18)	(0.19)
Colonial relationship		0.15	0.12	0.23		0.27	0.25	0.40*
		(0.17)	(0.16)	(0.17)		(0.21)	(0.20)	(0.21)
Common colonizer post 1945		-0.17**	-0.15*	-0.29***		-0.13	-0.10	-0.29**
		(0.09)	(0.08)	(0.08)		(0.12)	(0.12)	(0.12)
Colonial relationship post 1945		-0.59**	-0.55***	-0.55**		-0.74***	-0.69***	-0.67**
		(0.23)	(0.21)	(0.22)		(0.28)	(0.25)	(0.26)
Log of bilateral distance		-0.06**	-0.06**	-0.02		-0.11**	-0.12***	-0.05
		(0.03)	(0.03)	(0.03)		(0.05)	(0.05)	(0.05)
Bilateral		0.34*	0.35*	0.40*		0.51**	0.53**	0.58*
		(0.20)	(0.20)	(0.24)		(0.26)	(0.26)	(0.32)
EU		-0.81***	-0.79***	-0.71***		-0.51***	-0.49***	-0.32***
		(0.08)	(0.08)	(0.09)		(0.10)	(0.10)	(0.12)
WTO		0.24***	0.24***	0.39***		0.13	0.14	0.36***
		(0.09)	(0.09)	(0.09)		(0.11)	(0.11)	(0.11)
War Frequency			-0.01	-0.01			-0.02	-0.02
			(0.01)	(0.02)			(0.02)	(0.02)
(1/peaceful year)			0.00	0.06			0.00	-0.43
			(0.00)	(1.25)			(0.01)	(1.43)
Total duration in war			0.06***	0.06***			0.08***	0.09***
			(0.01)	(0.01)			(0.01)	(0.02)
Log(GDP per capita difference)				-0.09***				-0.17***
				(0.02)				(0.03)
Log (Trade openess)				0.28***				0.37***
				(0.05)				(0.07)
_cons					-4.61***	-3.41***	-3.43***	-4.57***
					(0.07)	(0.41)	(0.40)	(0.53)
ln_p					0.74***	0.76***	0.77***	0.80***
					(0.01)	(0.01)	(0.01)	(0.01)
N	17189	17189	17189	16967	17189	17189	17189	16967

Note: Standard errors in parentheses (clustered in country pairs) $*p < 0.10, **p < 0.05, ***p < 0.01$: where Conflict denote Dummy variable=1 if two countries have had conflict history) , Contiguity refers dummy variable=1 if two countries share common border; Commmon ethnographic language =1 if two countries share common ethnic language (at least 9% of the population; Colonial relationship =1 if two countries ever had colonial link; Common colonizer post 1945=1 if two countries have had common colonizer after 1945; Colonial relationship post 1945=1 if two countries have had colonial relationship after 1945: Log of bilateral distance refers Log of Weighted bilateral distance between country pairs; EU=1 if EU is involved; WTO =1 if one of the country pair is WTO member; War frequency refers the number of bilateral conflict between country pairs; 1/Peaceful year(The reciprocal of peaceful years between the end of last war and the start of trade negotiation); total duration of war (Duration of war in years); log (Gdp per capita difference) refers GDP per capita difference b/n country pairs (log form) ; Log (Trade Openess)refers Log of trade openness (the ratio of country pairs average trade to GDP).

As a robustness check, We present results based on accelerated failure time (AFT) in table 5. The coefficients in this tables are directly interpreted as elasticities on survival function. The advantage of this model is, we no longer bound by proportional hazard assumption, instead the change in covariates may have increas- ing or decreasing impact on failure along duration.

As it is shown in table 5, our result is consistent with our baseline result in table 2. Our sensitivity analysis and robustness checks confirms that the result presented in our baseline regression is viable. Note that our outcome variable is the time period from the start of the trade negotiation to the end. It is known that trade negotiations are not made overnight. To start trade negotiation there is

always preliminary tasks to be done. Thus, one might argue that the pre negotiation periods are more important to determine how long it will take to conclude the trade talk. That is, countries will make feasibility studies and other related tasks before they officially start negotiation. To account for such factors, we control the time period between the date of initiation to the start of the negotiation in our robustness check of table 8. In addition to duration from initiation to negotiation, we control for the number of participants in the negotiation table. Thus, our result is robust to such additional controls. The coefficient for duration from initiation to start of negotiation('preparation time') has significant impact; the more the preparation time the more the length of negotiation. Similarly, the more the number of participants in the negotiation table, the more the time to end the negotiation process.

We also presented a sub sample analysis in table 6 and table 7. Table 6 presents result for those trade agreements where European Union(EU) is involved. The result in tabele 6, for our key variable has very strong impact which confirms the claims made by political scientists and economists about the establishment of EU. But when we exclude those trade agreements where there is no EU, the conflict variable turns out to be insignificant yet the war duration still matters.

Table 2.5: Duration between: Start-end of negotiation

	Accelerated Failure Time, AFT			
	(1)	(2)	(3)	(4)
Conflict	-0.37***	-0.24***	-0.21***	-0.27***
	(0.04)	(0.05)	(0.06)	(0.06)
Common ethnographic language		-0.02	-0.02	-0.01
		(0.04)	(0.04)	(0.04)
Contiguity		0.08	0.04	0.11
		(0.09)	(0.09)	(0.09)
Colonial relationship		-0.11	-0.10	-0.17*
		(0.10)	(0.09)	(0.09)
Common colonizer post 1945		0.05	0.04	0.12**
		(0.06)	(0.06)	(0.06)
Colonial relationship post 1945		0.32**	0.29**	0.26**
		(0.13)	(0.11)	(0.12)
Log of bilateral distance		0.04*	0.05**	0.01
		(0.02)	(0.02)	(0.02)
Bilateral		-0.20*	-0.22*	-0.23
		(0.12)	(0.12)	(0.15)
EU		0.23***	0.23***	0.15***
		(0.05)	(0.05)	(0.05)
WTO		-0.05	-0.06	-0.15***
		(0.05)	(0.05)	(0.05)
War Frequency			0.02	0.01
			(0.01)	(0.01)
(1/peaceful year)			-0.00*	0.23
			(0.00)	(0.69)
Total duration of War			-0.03***	-0.03***
			(0.01)	(0.01)
Log(GDP per capita difference)				0.07***
				(0.01)
Log (Trade openess)				-0.19***
				(0.03)
_cons	2.22***	1.72***	1.68***	2.27***
	(0.01)	(0.20)	(0.19)	(0.24)
ln_p	0.75***	0.77***	0.77***	0.80***
	(0.01)	(0.01)	(0.01)	(0.01)
N	17189	17189	17189	16967

Note: Standard errors in parentheses (clustered in country pairs) $*p < 0.10, **p < 0.05, ***p < 0.01$: where Conflict denote Dummy variable=1 if two countries have had conflict history) , Contiguity refers dummy variable=1 if two countries share common border; Commmon ethnographic language =1 if two countries share common ethnic language (at least 9% of the population; Colonial relationship =1 if two countries ever had colonial link; Common colonizer post 1945=1 if two countries have had common colonizer after 1945; Colonial relationship post 1945=1 if two countries have had colonial relationship after 1945: Log of bilateral distance refers Log of Weighted bilateral distance between country pairs; EU=1 if EU is involved; WTO =1 if one of the country pair is WTO member; War frequency refers the number of bilateral conflict between country pairs; 1/Peaceful year(The reciprocal of peaceful years between the end of last war and the start of trade negotiation); total duration of war (Duration of war in years); log (Gdp per capita difference) refers GDP per capita difference b/n country pairs (log form) ; Log (Trade Openess)refers Log of trade openness (the ratio of country pairs average trade to GDP).

Table 2.6: Duration between: Start-end of negotiation: (Only if EU is involved)

	Cox Proportional Hazard Model				Weibull Model			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Conflict	0.64***	0.60***	0.86***	0.87***	0.93***	0.79***	1.26***	1.25***
	(0.08)	(0.08)	(0.13)	(0.14)	(0.12)	(0.12)	(0.19)	(0.20)
common ethnographic language		0.02	0.02	0.00		0.03	0.02	-0.01
		(0.07)	(0.07)	(0.07)		(0.09)	(0.09)	(0.09)
Contiguity		0.31**	0.18	-0.03		0.42**	0.28	-0.08
		(0.14)	(0.16)	(0.16)		(0.18)	(0.19)	(0.21)
Colonial relationship		0.18	0.20	0.37**		0.29	0.29	0.58***
		(0.15)	(0.15)	(0.15)		(0.20)	(0.20)	(0.21)
Common colonizer post 1945		-0.11	-0.11	-0.28***		-0.06	-0.06	-0.31**
		(0.08)	(0.08)	(0.08)		(0.12)	(0.12)	(0.12)
Colonial relationship post 1945		-0.41**	-0.42**	-0.43**		-0.57**	-0.57**	-0.58**
		(0.18)	(0.18)	(0.17)		(0.24)	(0.24)	(0.24)
Log of bilateral distance		0.02	0.02	0.05		-0.14**	-0.14***	-0.07
		(0.03)	(0.03)	(0.03)		(0.05)	(0.05)	(0.05)
WTO		0.32***	0.33***	0.39***		0.21**	0.23**	0.35***
		(0.08)	(0.08)	(0.08)		(0.11)	(0.11)	(0.11)
War frequency			0.06*	0.08**			0.04	0.07*
			(0.04)	(0.04)			(0.04)	(0.04)
(1/peacefull year)			-12.53**	-11.71**			-21.84**	-19.58**
			(5.88)	(5.60)			(9.09)	(7.95)
Total duration of in war			-0.05**	-0.05**			-0.04	-0.04
			(0.02)	(0.02)			(0.03)	(0.03)
Log (GDP per capita difference)				-0.15***				-0.27***
				(0.02)				(0.02)
Log (Trade openess)				0.29***				0.45***
				(0.05)				(0.07)
_cons					-5.35***	-4.42***	-4.42***	-4.69***
					(0.09)	(0.45)	(0.44)	(0.56)
ln_p					0.86***	0.87***	0.87***	0.91***
					(0.01)	(0.01)	(0.01)	(0.01)
N	15166	15166	15166	15022	15166	15166	15166	15022

Note: Standard errors in parentheses (clustered in country pairs) $*p < 0.10, **p < 0.05, ***p < 0.01$: where Conflict denote Dummy variable=1 if two countries have had conflict history) , Contiguity refers dummy variable=1 if two countries share common border; Commmon ethnographic language =1 if two countries share common ethnic language (at least 9% of the population; Colonial relationship =1 if two countries ever had colonial link; Common colonizer post 1945=1 if two countries have had common colonizer after 1945; Colonial relationship post 1945=1 if two countries have had colonial relationship after 1945: Log of bilateral distance refers Log of Weighted bilateral distance between country pairs; EU=1 if EU is involved; WTO =1 if one of the country pair is WTO member; War frequency refers the number of bilateral conflict between country pairs; 1/Peaceful year(The reciprocal of peaceful years between the end of last war and the start of trade negotiation); total duration of war (Duration of war in years); log (Gdp per capita difference) refers GDP per capita difference b/n country pairs (log form) ; Log (Trade Openess)refers Log of trade openness (the ratio of country pairs average trade to GDP).

Table 2.7: Duration between: Start-end of negotiation: (Only if EU is involved)

	Cox Proportional Hazard Model				Weibull Model			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Conflict	0.15	0.18	0.03	0.16	0.14	0.24	0.05	0.21
	(0.10)	(0.11)	(0.13)	(0.15)	(0.14)	(0.16)	(0.18)	(0.20)
Common ethnographic language		-0.05	-0.03	-0.01		-0.01	0.01	0.02
		(0.10)	(0.10)	(0.11)		(0.14)	(0.14)	(0.15)
Contiguity		-0.11	-0.09	-0.03		-0.12	-0.08	-0.06
		(0.14)	(0.15)	(0.15)		(0.21)	(0.21)	(0.21)
Colonial relatioship		-0.68**	-0.63**	-0.46		-0.70**	-0.64**	-0.47
		(0.32)	(0.29)	(0.37)		(0.32)	(0.29)	(0.34)
Common colonizer post 1945		-0.13	-0.13	-0.16		-0.04	-0.01	-0.07
		(0.13)	(0.13)	(0.13)		(0.18)	(0.18)	(0.18)
Colonial relationship post 1945		-1.18	-1.23	-1.39		-1.39	-1.39	-1.51
		(1.09)	(1.09)	(1.13)		(1.22)	(1.21)	(1.26)
Log of bilateral distance		-0.06	-0.08	-0.04		-0.01	-0.04	0.02
		(0.07)	(0.07)	(0.09)		(0.09)	(0.09)	(0.11)
Bilateral		0.46***	0.48***	0.46***		0.47**	0.49**	0.45**
		(0.16)	(0.17)	(0.17)		(0.21)	(0.22)	(0.23)
WTO		-0.01	0.03	0.15		-0.05	0.00	0.18
		(0.17)	(0.17)	(0.20)		(0.20)	(0.20)	(0.23)
War frequency			-0.00	0.01			-0.01	-0.00
			(0.01)	(0.01)			(0.01)	(0.02)
(1/peacefull year)			0.01	-0.21			0.00	-0.27
			(0.00)	(1.25)			(0.01)	(1.31)
total duration of in war			0.04***	0.04**			0.06***	0.05***
			(0.01)	(0.01)			(0.01)	(0.02)
Log (GDP per capita difference)				0.00				-0.03
				(0.04)				(0.05)
Log(Trade openess)				0.27**				0.31*
				(0.12)				(0.17)
_cons					-2.93***	-2.89***	-2.76***	-4.67***
					(0.10)	(0.78)	(0.79)	(1.21)
ln_p					0.45***	0.46***	0.48***	0.50***
					(0.03)	(0.03)	(0.04)	(0.04)
N	2023	2023	2023	1945	2023	2023	2023	1945

Note: Standard errors in parentheses (clustered in country pairs) $*p < 0.10, **p < 0.05, ***p < 0.01$: where Conflict denote Dummy variable=1 if two countries have had conflict history) , Contiguity refers dummy variable=1 if two countries share common border; Commmon ethnographic language =1 if two countries share common ethnic language (at least 9% of the population; Colonial relationship =1 if two countries ever had colonial link; Common colonizer post 1945=1 if two countries have had common colonizer after 1945; Colonial relationship post 1945=1 if two countries have had colonial relationship after 1945: Log of bilateral distance refers Log of Weighted bilateral distance between country pairs; EU=1 if EU is involved; WTO =1 if one of the country pair is WTO member; War frequency refers the number of bilateral conflict between country pairs; 1/Peaceful year(The reciprocal of peaceful years between the end of last war and the start of trade negotiation); total duration of war (Duration of war in years); log (Gdp per capita difference) refers GDP per capita difference b/n country pairs (log form) ; Log (Trade Openess)refers Log of trade openness (the ratio of country pairs average trade to GDP).

Table 2.8: Robustness Checks

	Cox Proportional Hazard Model			Weibul model		
	Conflict (Main)	Conflict(Strict)	Conflict (Recent)	Conflict(Main)	Conflict(Strict)	Conflict(Recent)
	(1)	(2)	(3)	(4)	(5)	(6)
Conflict	0.52***	0.42***	0.19	0.67***	0.56***	0.20
	(0.10)	(0.11)	(0.11)	(0.12)	(0.13)	(0.14)
Common ethnographic language	0.07	0.07	0.08	0.05	0.05	0.06
	(0.08)	(0.08)	(0.08)	(0.11)	(0.11)	(0.11)
Contiguity	0.07	0.11	0.13	0.02	0.08	0.11
	(0.13)	(0.13)	(0.13)	(0.16)	(0.16)	(0.16)
Colonial relationship	0.04	0.06	0.07	0.10	0.12	0.14
	(0.20)	(0.20)	(0.19)	(0.25)	(0.25)	(0.23)
Common colonizer post 1945	-0.24***	-0.22**	-0.24***	-0.25**	-0.22*	-0.25**
	(0.09)	(0.09)	(0.09)	(0.12)	(0.12)	(0.12)
Colonial relationship post 1945	-0.36	-0.39	-0.43*	-0.35	-0.38	-0.45
	(0.24)	(0.24)	(0.24)	(0.29)	(0.29)	(0.27)
Log of bilateral distance	0.05	0.04	0.03	-0.04	-0.05	-0.07
	(0.04)	(0.03)	(0.03)	(0.05)	(0.05)	(0.05)
EU	0.01	0.01	0.10	0.41*	0.42*	0.54**
	(0.17)	(0.17)	(0.17)	(0.23)	(0.23)	(0.23)
WTO	0.34***	0.35***	0.35***	0.26**	0.26**	0.26**
	(0.09)	(0.09)	(0.09)	(0.10)	(0.10)	(0.10)
War Frequency	-0.02	-0.02	-0.02	-0.04**	-0.03**	-0.02
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
(1/peacefull year)	0.10	0.25	0.36	-0.17	0.02	0.21
	(0.96)	(0.79)	(0.77)	(1.20)	(0.97)	(0.89)
Total duration in war	0.03**	0.04***	0.07***	0.05***	0.06***	0.09***
	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)
Log(GDP per capita difference)	-0.09***	-0.09***	-0.09***	-0.16***	-0.17***	-0.16***
	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)
Log (Trade openess)	0.27***	0.25***	0.22***	0.32***	0.30***	0.26***
	(0.06)	(0.06)	(0.06)	(0.08)	(0.08)	(0.08)
Duration from initation to start	-0.14***	-0.14***	-0.13***	-0.27***	-0.27***	-0.26***
	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)
log number of participant	-0.52***	-0.53***	-0.57***	-0.60***	-0.61***	-0.67***
	(0.09)	(0.09)	(0.09)	(0.13)	(0.13)	(0.13)
_cons				-2.75***	-2.50***	-2.09***
				(0.48)	(0.47)	(0.46)
/						
ln_p				0.87***	0.87***	0.86***
				(0.02)	(0.02)	(0.02)
N	16790	16790	16790	16790	16790	16790

Notes: Standard errors in parentheses (clustered in country pairs) $*p < 0.10, **p < 0.05, ***p < 0.01$: where Conflict denote Dummy variable=1 if two countries have had conflict history) , Contiguity refers dummy variable=1 if two countries share common border; comlang_ethno =1 if two countries share common ethnic language (at least 9% of the population; colony =1 if two countries ever had colonial link; Common colon=1 if two countries have had common colonizer after 1945; col45=1 if two countries have had colonial relationship after 1945: Ldist refers Log of Weighted bilateral distance between country pairs; EU=1 if EU is involved; WTO =1 if one of the country pair is WTO member; Frequency refers the number of bilateral conflict between country pairs; 1/Peaceful year(The reciprocal of peaceful years between the end of last war and the start of trade negotiation); War duration (Duration of war in years); lgGdp_diffb refers GDP per capita difference b/n country pairs (log form) ; Log_Openess refers Log of trade openness (the ratio of country pairs average trade to GDP), Duration from initiation to start of negotation is the period between initial anouncement to the start of negotation and number of participant refers the total number of participant countries in the negotiation table .

2.6 Conclusion

Economic integration and peace creation is the center of agenda during trade negotiation. The motive of forming regional trade agreements (RTAs) has a direct implication on the complexity of the negotiation process and hence duration. Durations from the start of the negotiations through the end differs considerably. Our main result shows that trade negotiations concluded faster for those country pairs who ever had conflict than who never had. After controlling set of explanatory variables, we found that duration of trade negotiation for country pairs involved in historical conflict takes from 1.6 to 2 times faster than those countries who never had conflict history. That is from the average duration of about 8 years, duration of trade negation for conflicting country pairs takes from 3 to 4 years faster than country pairs who never had conflict history. Our result

is more robust to number of sensitivity checks particularly using broad and strict definition of conflict variable from the correlates of war. Apart from the conflict variable; trade openness, involvement of WTO member in the trade negotiation concluded faster. On the contrary Involvement of EU members in the negotiation, bilateral distance, log GDP per capita difference between members results the negotiation process to take long. In this paper, we made two major contributions; First, we estimate the magnitude of the effect of conflict on duration of trade negotiation that will be more helpful for firms' investment decision. Second, uncover the role of politics in the process of trade negotiation. Though this paper gives a benchmark study about the impact of past history of conflict on today's negotiation; there is potential future research work to see about history of conflict and cooperation and spillover effects of parallel trade deals on other negotiation process ; from initiation to enforcement process.

References

1. Boehmke, F.J., Morey, D.S. and Shannon, M., 2006. Selection Bias and Continuous□Time Duration Models: Consequences and a Proposed Solution. American Journal of Political Science, 50(1), pp.192-207.

2. Burstein, A. and Melitz, M.J., 2011. Trade liberalization and firm dynamics (No. w16960). National Bureau of Economic Research.

3. Costantini, J. and Melitz, M., 2008. The dynamics of firm-level adjustment to trade liberalization. The organization of firms in a global economy, 4, pp.107-141.

4. Gash, C.A.A., 2007. Collaborative governance in theory and practice. Journal of Public Administration Research and Theory, 18.

5. Guiso, L., Sapienza, P. and Zingales, L., 2009. Cultural biases in economic exchange?. The Quarterly Journal of Economics, 124(3), pp.1095-1131.

6. Heckman, J.J., 1976. The common structure of statistical models of truncation, sample selection and limited dependent variables and a simple estimator for such models. In Annals of Economic and Social Measurement, Volume 5, number 4 (pp. 475-492). NBER.

7. Heckman, James J. 1979. Sample Selection Bias as a Specification Error. Econometrica 47(1):153–61

8. Martin, P., Mayer, T. and Thoenig, M., 2012. The geography of conflicts and regional trade agreements. American Economic Journal: Macroeconomics, 4(4), pp.1-35.

9. Martin, P., Mayer, T. and Thoenig, M., 2008. Make trade not war?. The Review of Economic Studies, 75(3), pp.865-900.

10. Milner, H.V., 1999. The political economy of international trade. Annual Review of Political Science, 2(1), pp.91-114.

11. Mölders, F., 2016. On the path to trade liberalisation: Political regimes in trade negotiations. The World Economy, 39(7), pp.890-924.

12. Moser, C. and Rose, A.K., 2012. Why do trade negotiations take so long?. Journal of Economic Integration, pp.280-290.

13. Prieger, J.E., 2002. A flexible parametric selection model for non□normal data with application to health care usage. Journal of applied econometrics, 17(4), pp.367-392.

14. Vicard, V., 2012. Trade, conflict, and political integration: Explaining the heterogeneity of regional trade agreements. European Economic Review, 56(1), pp.54-71.

15. Palmer, Glenn, Vito D'Orazio, Michael Kenwick, and Matthew Lane. 2015. "The Mid4 Dataset, 2002–2010: Procedures, Coding Rules and Description." Conflict Management and Peace Science 32: 222-42.

16. Ghosn, Faten, Glenn Palmer, and Stuart Bremer. 2004. "The MID3 Data Set, 1993–2001: Procedures, Coding Rules, and Description." Conflict Management and Peace Science 21:133-154.

17. Jones, Daniel M., Stuart A. Bremer and J. David Singer. 1996 ."Militarized Interstate Disputes, 1816-1992: Rationale, Coding Rules, and Empirical Patterns." Conflict Management and Peace Science 15:163-213.

@bookbagwell2004economics, title=The economics of the world trading system, author=Bagwell, Kyle and Staiger, Robert W, year=2004, publisher=MIT Press

CHAPTER 3. NORTH–SOUTH TRADE AGREEMENTS AND AGRICULTURAL INPUT USE

3.1 Introduction

The promotion of trade liberalization as a key component of development strategies has been taken place in many countries. Countries are taking liberalization measures since liberalization will create greater efficiency in resource allocation, specialization in production, knowledge and technological spillovers, and competition, and hence promote economic growth and development.

Growth in agricultural productivity has been a central issue for insuring an increasing food demand from growing population. There is a growing evidence; both theoretical and empirical, about the role of agricultural productivity on economic growth (Gollin, D.2010). Among the four channels where agriculture contributes to growth summarized by Kuznets (1968), the backward and forward linkage to the manufacturing industry is the main one. In the forward linkage agriculture provides raw materials to the manufactured sector and hence gets manufactured inputs back from the industrial sector. For example, MaArthur & McCord, (2017) investigated how the use of manufactured input for agriculture improves the agricultural productivity growth and hence facilitate the process of structural change. In their work, they showed that the use of fertilizer boosts agricultural yields and economic growth.

Though, the use of manufactured inputs to agriculture such as fertilizer and agricultural machinery are acknowledged in the literature, consumption of such inputs for agricultural production varies significantly across countries, which im-

plies poor link between the manufacturing and agricultural sector. In most developing countries, where the manufacturing sector is not yet developed, this linkage is yet so weak and in-turn the agricultural sector is not yet developed. Thus, one can argue that any economic integration such as Regional Trade Agreements (RTAs now onwards) between manufacturing country and agricultural country can bring productivity growth in both countries by improving input mixes at their optimal level.

The existence of huge variation in agricultural input use across counties and its link to countries participation to regional trade agreement follows from two main motivations. First, if RTAs are among similar countries such as south-south RTAs, technological spillover is so low and hence, RTAs among agricultural countries might have little impact on the pattern of agricultural input use. Second, if RTAs is among differentiated countries, it will enhance complementary effect. That is an RTA between technologically advanced economy and traditional agrarian economy might enhance improved agricultural input use.

We test the above prediction by using data on agricultural input use for 66 developing countries from the period 1980 to 2015. We employ two different econometric strategy to examine the causal relationship between manufactured aids of agricultural production and regional trade agreement. In our first approach, we estimate the fertilizer and agricultural machinery use by pooling all other cross sectional units and run OLS estimation. We control for set of variables such as population, agricultural land, GDP per capita, agricultural value added and country and year fixed effects. In our second approach, we employ instrumental variable(IV) approach for RTA membership to examine the causal link between agricultural input use and RTA membership. Hence, we found that, countries participation to RTAs increases the use of agricultural input. Moreover, the effect of RTAs participation is much larger for those countries who have RTAs with developed countries. Our result confirms the prediction of backward linkage where the manufactured sector produces manufactured aids for agricultural

production and feeds the agricultural sector; the linkage is between countries in this case, where countries' integration facilitates factor movement and hence productivity gain. Our result suggests that relative to those countries who do not have RTAs with high income countries, those countries who have such RTAs uses about 5.7 kg/ha more of fertilizer which has huge implication to agricultural yield gain as predicted by MaArthur & McCord, (2017). MaArthur & McCord, (2017) estimated that a 0.8 kg/ha increase in the use of fertilizer results an increase in yield by 7kg/ha. Similarly, developing countries participation of RTAs with the developed country is associated with use of about 14 more machinery per 100 square kilometers of arable land.

Previous studies on the area also showed qualitatively similar results. For example, a study by Ahmed, (1995) showed that liberalization of the agricultural input market has resulted a remarkable increase in adoption of new technologies such as fertilizer, power-driven equipment, high yield variety seeds, and pesticides in Bangladesh. The North American Free Trade Agreement (NAFTA) has increased fertilizer use in Mexico and pesticide use in the United states (P. Williams, & C. Shumway, 2000).

3.2 Theoretical Motivation

For a simple agricultural production function y=f(Land, Labor, K) where K is all manufactured aids of agricultural production (fertilizer, agri-machinery and tractors), employment of any one of this inputs below the optimal amount forces the other input to be used above the optimal level where marginal productivity is less. In most developing countries where labor and land is in a relative abundance, capital input is scarce. Hence, any mechanism that brings capital use convenient might affect factor input mixes in a more productive way and hence output growth.

Assume country i is small country (no influence on international price for agri-

cultural input). A small country has relatively inelastic supply curve for agricultural inputs due to capacity constraint. Figure 1, shows the theoretical link between trade liberalization and demand for fertilizer in panel A and fertilizer use and yield in panel B. This paper is thus a modest attempt to empirical show the theoretical link in panel A.

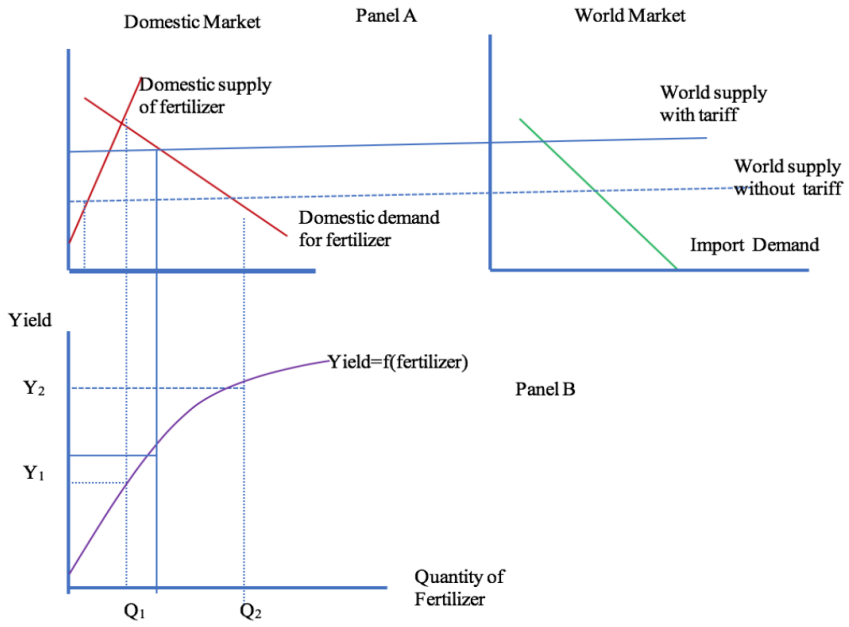


Figure 1, Market, production technology and yield

Let the representative producer production function be:

$$maxY = AL^{\alpha}K^{\beta}N^{\theta} \tag{3.1}$$

subject to $wL + rK + RN \leq C$

where Y is agricultural yield , L is labor, K is capital and N is land. w,r and R are respectively, price of labor, price of capital and price of land.

FOC:

$$\alpha AL^{\alpha-1}K^{\beta}N^{\theta}=0 \tag{3.2}$$
$$\beta AL^{\alpha}K^{\beta-1}N^{\theta}=0$$
$$\theta AL^{\alpha}K^{\beta}N^{\theta-1}=0$$

Solving the three equations simultaneously:

$$L^{*}=\frac{\alpha C}{w\left[\alpha+\beta+\theta\right]} \tag{3.3}$$
$$K^{*}=\frac{\beta C}{r\left[\alpha+\beta+\theta\right]}$$
$$N*=\frac{\theta C}{R\left[\alpha+\beta+\theta\right]}$$

For a constant return to scale(CRS), $L^{*}=\frac{\alpha C}{w}$, $K^{*}=\frac{\beta C}{r}$, , $N^{*}=\frac{\theta C}{R}$,

Thus, $Y^{*}=AL^{*\alpha}K^{*\beta}N^{*\theta}=A\left(\frac{\alpha}{w}\right)^{\alpha}\left(\frac{\beta}{r}\right)^{\beta}\left(\frac{\theta}{R}\right)^{\theta}C$

Assume K is the only tradable input across countries: Hence, for the country who imports the capital input, the price of capital r=r*+t. where t is per unit tariff for capital inputs.

$$\frac{dK^{*}}{dt}=\frac{dK^{*}}{dr}\frac{dr}{dt}=-\frac{\beta C}{r^{2}}<0 \tag{3.4}$$
$$\frac{dY}{dt}=\frac{dY}{dr}\frac{dr}{dt}<0$$

This model predicts that any trade policy that reduces tariff such as free trade agreement increases the use of capital inputs in the agricultural sector and here by agricultural production.

3.3 Overview of Countries Participation to RTAs And Agricultural Input Use

Despite low participation of developing countries to RTAs, every country is a member of at least one RTA. Most of the RTAs that developing countries participate are mainly South-South RTA where it is characterized by poor implementation and weaker link to the process of industrialization and yet there is an increasing trends of South-South RTA as compared to North-South RTAs (Dicaprio, Santos-Paulino, & Sokolova, 2017). This model predicts that any trade policy that reduces tariff such as free trade agreement increases the use of capital inputs in the agricultural sector and here by agricultural production.

3.4 Overview of Countries Participation to RTAs And Agricultural Input Use

Despite low participation of developing countries to RTAs, every country is a member of at least one RTA. Most of the RTAs that developing countries participate are mainly South-South RTA where it is characterized by poor implementation and weaker link to the process of industrialization and yet there is an increasing trends of South-South RTA as compared to North-South RTAs (Dicaprio, Santos-Paulino, & Sokolova, 2017). As it is clearly shown in figure 2, RTA participation is much higher in the South-East Asia, Europe, North America and some part of Latin America. Surprisingly, such variation is also reflected in countries level of growth and moreover agricultural input use. Figure 3 shows the variations in fertilizer use across regions. The time series data of the trend in fertilizer use generally shows an increasing trend which off course coincides with the proliferation of RTAs in the early 1980s and high jump is observed after 1990s. For example, Global System of Trade Preferences (GSTP) was a pref-

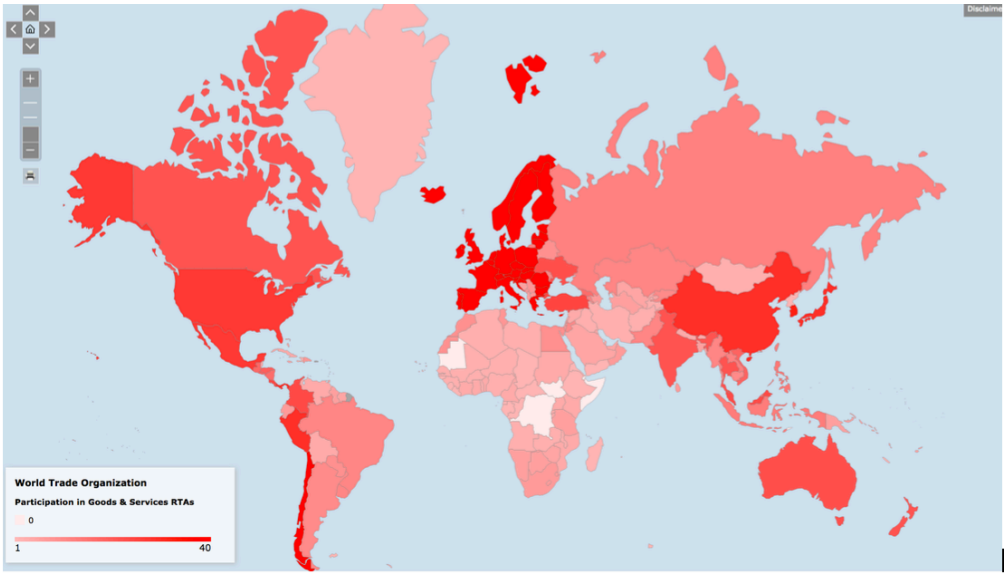


Figure 2: Map of countries' participation on RTAs

Source: WTO, 2018.

erential trade agreement among developing countries and some middle income developing countries that come into effect in the late 1980s.

3.4.1 Agricultural input and Yield

The use of improved seeds, fertilizers and other agronomy technologies has been mentioned in the literature as the driving force for the 1960s Green revolution in Asia (Hazell, 2009). A field experiments by Yousaf et al., (2017), in china showed the effect of fertilizer on agricultural yield; application of fertilizers enhanced crop yields by 19-41% for rice and from 61-76 % for rapeseeds. Similarly, a field experiment in Kenya by Duflo, et al. (2008) presented that the use of most profitable quantity of fertilizer results a 36 percent increase in the mean rate of return over a season, implying that there is 69.5 percent increase in rate of return on an annualized basis. Similarly by exploiting the global distribution of fertilizer production and associated differences in transportation distance across countries as a source of exogenous variation, McArthur & McCord, (2017) found that the use of improved inputs such as fertilizer results a huge productivity gain in the agricultural output. Figure 4 and 5 shows a simple correlation between

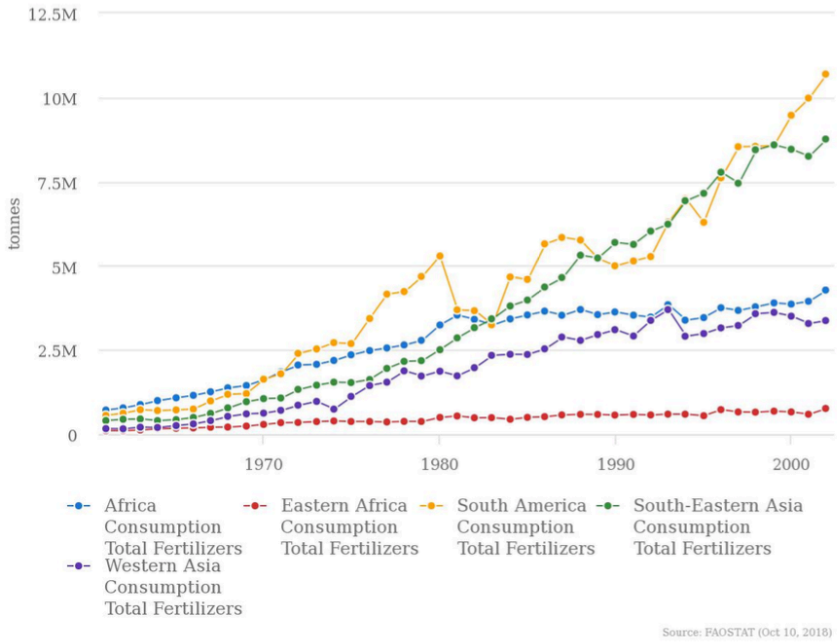


Fig 3 . Fertilizer consumption by region

Source: FAOSTAT, 2018

fertilizer use per hectare and yield as well as the use of agricultural machinery and yield respectively for our sample.

3.5 Data and Identification strategies

3.5.1 Data

Data for this study is mainly from FAOSTAT where the estimation strategy is drawn based on a cross country data over repeated time. But the data setting deviates from the standard panel data structures because in this dataset there is repeated time for the same cross sectional units. In other words, a given cross sectional unit can be matched with more than one cross sectional unit at a time which resulted repeated time for same unit. Hence, we take in to account this in our estimation strategy. In our analysis, we consider the time span from 1980 to 2015. But the time series data for our key outcome variable is not uniformly available for those years. For example, fertilizer use per hectare is available

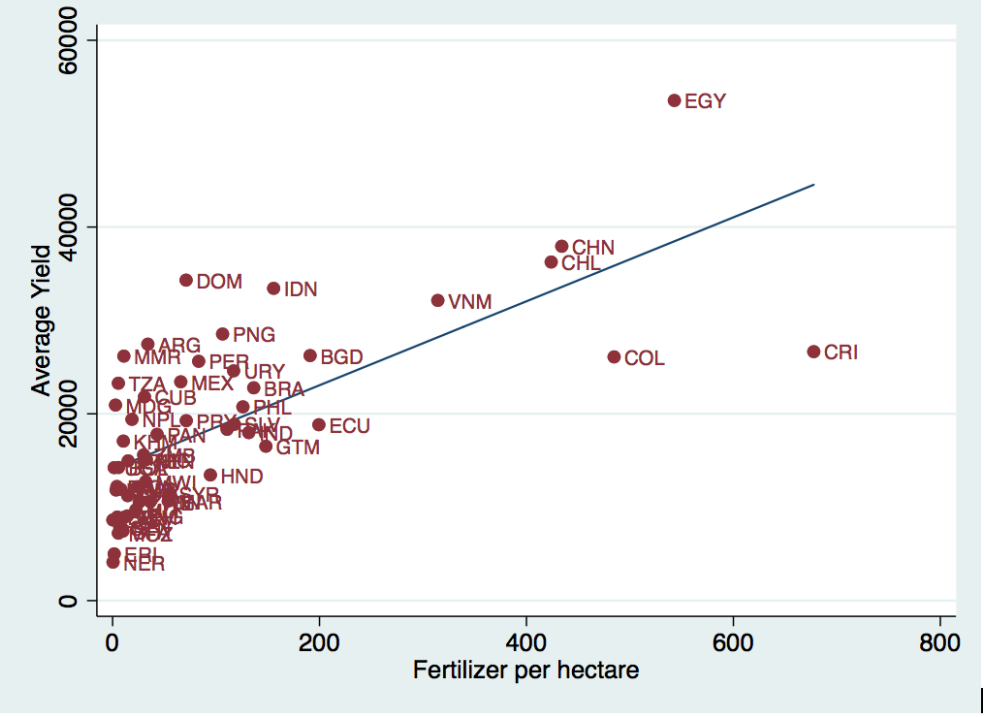


Figure 4: Correlation Between Average fertilizer use per hectare and average yield

Source: authors' calculation based on data from FAOSTAT, 2018

in two different measurements according to the FAOSTAT data. From 1961 to 2001, they use different measurement and from 2002 to 2015 they use different measurement and yet the harmonization is not done. Hence, to avoid any bias associated with such different measurement, we relay estimation of fertilizer use after 2002. For agricultural machinery use data is available before 2009. Therefore, in this paper we estimate the fertilizer use and agricultural machinery use in a separate analysis. Fertilizer consumption is defined as it defined in WDI(2018) which "measures the quantity of plant nutrients used per unit of arable land. Fertilizer products cover nitrogenous, potash, and phosphate fertilizers (including ground rock phosphate)". Traditional nutrients–animal and plant manures–are not included according to FAO. Thus, Fertilizer consumption (kilograms per hectare of arable land) is used in the analysis. Regarding agricultural machinery WB- WDI (2018) defined and recorded as the number of agricultural machinery and tractors per 100 sq. km of agricultural land which

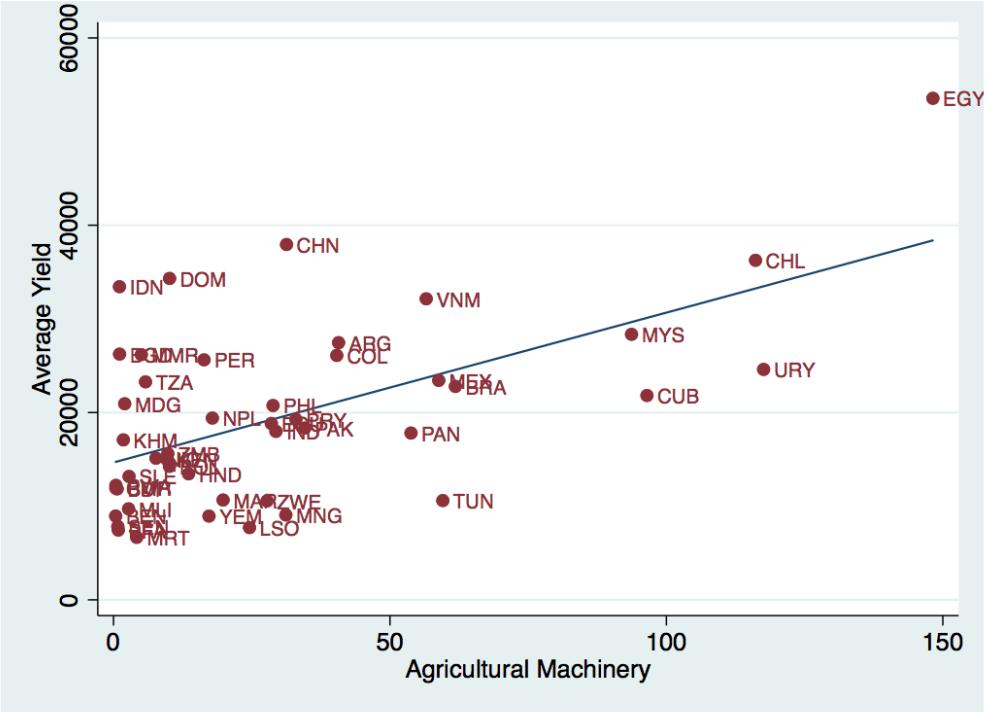


Figure 5: Correlation Between Average Machinery use per 100 sq.km. and average yield

Source: authors' calculation based on data from FAOSTAT, 2018

can be arable.

The key independent variable is whether a given country is participated in any RTAs at time t. Thus, we use a country pair data over long period of time. Data for such gravity variables comes from the WTO and the Centre d'Etudes Prospectives et d'lnformations Internationales (CEPII) database. For capturing the effect of North-south RTA, we create an interaction term explaining whether RTAs is between developing country and high income country (High Income RTA: we use the world development indicator's classification of income group of countries , and with EU only (RTA_EU). Other controls include, Agricultural land (share of land that is arable), log of GDP per capita pp adjusted 2011 constant price, Population and log of agricultural value added. All this data comes from the World Bank's World Development Indicator(WDI, 2018).

3.5.2 Strategy

Our interest is assessing whether country i's agricultural input use is affected by any trade policy measures (specifically RTA membership status).□

$$Input_{it} = \alpha_i + \beta RTA_{ijt} + \theta RTA_{ijt} \cdot North_j + X'\gamma + \eta_t + \epsilon_{it} \qquad (3.5)$$

Where $Input_{it}$ is use of country i's manufactured aids of agricultural production at time t. $RTA_{ijt}$is a dummy variable equal to 1 if country i and j have RTA at time t. The interaction variable is a dummy variable whether the RTA is among developed country or not; X is set of control variable such as agricultural land, log of GDP per capita, population, and log of agricultural value added. α_i and η_t are country specific fixed and year fixed effects respectively. Finally, ϵ_{it} is common idiosyncratic error term.

3.5.3 Instrumenting for membership to RTAs

One might have difficulty to accept the estimates of RTA membership and agricultural input use as causal link. Omitted variable bias might be a problem here that makes our key explanatory variable to be endogenous. We use an instrumental variable approach to identify the causal link. Many historians and political scientists believe that the driving force of the establishment of European Coal and still Community(ECSC) in 1951 was mainly to solidify peace so as to avoid other destructive conflicts that has been seen in the major world wars. Martin et al. (2012) showed that there is high probability for country pairs to have RTA if they have had higher frequency of historical war. Hence, we use history of bilateral conflict as an instrument for formation of RTAs between country pairs. We believe that past history of conflict between county pairs has no direct impact on current utilization of agriculture input. Since the purpose of our paper is to disentangle the impact of RTA with high income countries from the general RTA, we use additional instrument to identify the second endogenous variable.

The second instrument is motivated by the domino theory of regionalism– formation of regional integration between countries harms the non-members trade and hence triggers them to be pro-membership activity (Baldwin, 1993). Costas et al. (2016) used this domino theory of regionalism as an instrument for formation of RTA. In their paper they used the number of Free Trade Areas(FTAs) and number of Custom union(CU) agreements signed between country pairs and the rest of the world as an instrument. In our paper we deviate slightly from Costas et al. (2016) approach by excluding the number of RTAs signed by the country that we are studding for. This approach will help us to reduce the risk of non fulfilment of the exclusion restriction. In other words the number of RTAs signed by country i directly affects country i's agriculture input use. Hence we exclude this part and consider only the number of country j's signed RTAs as an instrument for formation of RTAs between country i and j.

$$RTA_{ijt} = \delta_i + \phi_1 Conflict_{ij} + \phi_2 Num\_RTA_j + X'\varphi + \tau_t + \xi_{it} \qquad (3.6)$$

Where set of controls, country specific and year specific countries are defined above, $Conflict_{ij}$ is a dummy variable 1 if country pairs have had conflict, Num_RTA_j is number of RTAs signed by country j with the rest of the world.

3.6 Empirical Result

3.6.1 Descriptive statistics

We start to analyze our estimation result by presenting the general picture of the data used in our paper. Table 1 presents the descriptive statistics result of the main variables used. For the sample of 66 developing countries used in the paper, their average fertilizer consumption is about 119.5 kg/ hectare where as the number of agricultural machinery used is about 34 per 100 square kilometers of arable land. The use of fertilizer across countries varies significantly. For

example in our sample for the period between 2002 and 2015 fertilizer use varies from a minimum of less than 1 kilogram per hectare in most sub Saharan country to more than 1000 kilograms per hectare in south eastern Asian countries .This variation is of course reflected in terms of economic integration through regional trade agreements. Sub Saharan African countries are the less integrated with high income countries; from the total of RTAs they have only 6.08 percent are with high income countries. Whereas East Asia & Pacific countries are relatively integrated through trade agreements; from the total RTAs they have about 36 percent is with high income countries.

Table 2 presents the pooled OLS result after controlling country and year fixed

Table 1 : Descriptive Statistics

	Mean	**Standard Deviation**	Observation
Fertilizer per hectare	119.52	239.30	169,192
Agricultural machinery	34.16	54.92	208,193
RTA	0.06	0.24	801,179
Agricultural land (% of land area)	41.94	20.46	795,548
GDP per capita, PPP (constant 2011 international $)	4864.40	4562.49	363,858
Population (in million)	51.92	173.38	800,991
Agriculture value added per worker	2439.71	325.67	447,572

effects. The dependent variable in all of the columns is the log of fertilizer use per hectare for the period 2002 to 2015. Our key variable is the dummy variable RTA equal 1 if country has RTAs in force. For the purpose of examining north-south RTAs effect , we create interaction between RTA and whether the partner country is high income country or not. The coefficient on RTA is about 0.10 and strongly significant. After controlling other factors including country and year specific factors, countries who have RTA, there fertilizer consumption per hectare is 10 percent higher than those who don't have. In column 1 and 2 we added the interaction between RTA and whether the partner country is European union(EU)

member or not; the result confirmed that, having RTA with EU member country

Table 2: Estimated Results for Fertilizer use(2002-2015)

	(1)	(2)	(3)	(4)	(5)	(6)
Pooled OLS with year and country fixed effect Dependent Variable: Log of fertilizer consumption per hectare						
RTA	0.10***	0.10***	0.10***	0.11***	0.10***	0.10***
	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)
EU_RTA	0.05***	0.08***				
	(0.01)	(0.00)				
High Income_RTA			0.03***	0.04***		
			(0.01)	(0.01)		
High income + upper middle Income_RTA					0.02***	0.03***
					(0.01)	(0.01)
Agricultural Land		-0.02***		-0.02***		-0.02***
		(0.00)		(0.00)		(0.00)
Log GDP per capita		0.21***		0.21***		0.21***
		(0.01)		(0.01)		(0.01)
Log population		2.18***		2.18***		2.18***
		(0.07)		(0.07)		(0.07)
Log (agricultural value add)		0.22***		0.22***		0.22***
		(0.02)		(0.02)		(0.02)
Country FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
N	169015	159092	169015	159092	169015	159092
Number of countries	59	59	59	59	59	59

*Note: Standard errors in parentheses (clustered in country pairs) *p < 0.10, **p < 0.05, ***p < 0.01: where RTA denote Dummy variable=1 if the country have any RTA with any trading partner) , EU_RTA &* High Income_RTA *Income refers dummy variable=1 if country i's(the unit of interest country) RTA is with EU and high income country respectively; Agricultural land refers to percentage of arable land from total area;* Log GDP per capita is log of *GDP per capita, PPP (constant 2011 international $);* Log (population) is the log of total population: Log agricultural Value Add *is Agriculture value added per worker (constant 2010 US$):* High income + high middle Income_RTA is RTA with high income and upper middle income countries .

is associated with consumption of more fertilizers compared with others who do not have RTA with EU. To address the North—South RTA, in column 3 and 4 we use the interaction between RTA and all high income trading partner as a key variable for our research question. The coefficient on High Income_RTA, which represents the North—South RTA, is 0.04 and statistically significant. Finally, we report the result which includes the upper middle income and high income countries in column 5 and 6. Though, the magnitude marginally declines as it is expected, the result is qualitatively similar.

3.6.2 Instrumenting RTA and its Interactions

In order to confirm the estimate that we present in table 2 is causal estimate, we employ instrumental variable approach. Table 3, presents the results from the two stage least square estimates(2SLS). Column 1 , 2 and 3 repeats the result of column 2,4 and 6 of table 2 but using instrumental variable(IV) for RTA and the interaction terms of RTA. From column 1 through three, we use conflict history as an IV for RTA and the number of RTAs signed by partner country with the rest of the world as an IV for each respected interactions of RTA. The coefficient for RTA in column 1 and 2 is consistent with what we found in the respective column of table 2. And fertilizer consumption per hectare for countries' having RTA with either EU countries or high-income countries is 8 percent and 11 percent higher than those who do not have respectively. Column 3 presents the result for RTAs with high and upper middle income countries—the RTA become insignificant, whereas the coefficient for RTA with high and upper middle income is 0.16 and statistically significant. Thus our instrumental variable approach revealed that most of the effect of RTA comes from an RTA with high and upper middle income; implying RTAs with low and lower middle income countries have negligible impact on fertilizer use. Apart from the RTA variables, GDP per capita, population and agricultural value add which represents the relative importance of agricultural sector in the economy, are associated with higher consumption of fertilizer. Whereas agricultural land has negative and significant coefficient. The implication of the negative sign in the agricultural land size can possibly be, countries who have large agricultural land, practices extensive farming than intensive and technology based farming system. To maintain the fertility of the land, farmers usually use the practice of shifting cultivation and fallowing system. But this practice is common where farmers have better access for agricultural land. For example a study on Peruvian amazon, Coomes et al. (2000) shows that relative to those households who have less acess to land,

households with better access to land uses fallowing system for longer time. Table 4, Presents the estimated results for agricultural machinery use. Covering from 1980 to 2009, the impact of having an RTA with any country is positive and statistically significant. For example, the estimated coefficient for having RTAs with high income countries in column 4 is 0.94 and it is statistically significant; relative to those countries who do not have RTAs with high income countries, agricultural machinery use is more than 100 percent higher for those who have RTAs with high income countries. Similar to fertilizer use, we instrument RTAs with conflict and number of RTAs signed by the partner country with the rest of the world and reported in table 5. The result confirmed similar and more strong evidences for the causal link between countries RAT with high income country and agricultural machinery use.

On table 6, we report the robustness check for our benchmark regression for both dependent variables. We believe that legacy history of colonial relationship still observed in terms of economic integration and development cooperation. Hence, we use colonial link as an additional exogenous variation for overidentification test and checking the robustness of our baseline result. The result from column 1, shows that our result is consistent with our main result of table 2 and 3. Similar result is observed in column 3 for agricultural machinery use. Finally, the p-value for our over-identification test confirmed that, our instruments are indeed exogenous.

Table 3: 2SLS Results for Fertilizer use(2002-2015)

	(1)	(2)	(3)
	Dependent Variable: Log of fertilizer consumption per hectare		
	The Second Stage		
RTA	0.13***	0.11***	0.08
	(0.03)	(0.04)	(0.06)
EU_RTA	0.08***		
	(0.03)		
High Income_RTA		0.11**	
		(0.05)	
High income + Upper middle Income_RTA			0.16**
			(0.10)
Agricultural Land	-0.02***	-0.02***	-0.02***
	(0.00)	(0.00)	(0.00)
Log GDP per capita	0.21***	0.21***	0.21***
	(0.01)	(0.01)	(0.01)
Log population	2.18***	2.19***	2.19***
	(0.07)	(0.07)	(0.07)
Log agricultural Value Add	0.22***	0.22***	0.22***
	(0.02)	(0.02)	(0.02)
Country FE	YES	YES	YES
Year FE	YES	YES	YES
	First stage for RTA		
Conflict	0.38***	0.38***	0.38***
	(0.04)	(0.04)	(0.04)
Number of RTAs country j have	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)
F statistic	132.35	132.35	132.35
	First stage		
	EU_RTA	High Income_RTA	High income + upper middle Income_RTA
Conflict	0.01	0.01	0.01
	(0,01)	(0.01)	(0.01)
Number of RTAs country j have	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)
F statistic	68.31	68.31	68.31
N	159092	159092	159092

*Note: Standard errors in parentheses (clustered in country pairs) *p < 0.10, **p < 0.05, ***p < 0.01: where RTA denote Dummy variable=1 if the country have any RTA with any trading partner) , EU_RTA &* High Income_RTA *Income refers dummy variable=1 if country i's(the unit of interest country) RTA is with EU and high income country respectively; Agricultural land refers to percentage of arable land from total area;* Log GDP per capita is log of *GDP per capita, PPP (constant 2011 international $);* Log (population) is the log of total population: Log agricultural Value Add *is Agriculture value added per worker (constant 2010 US$):* High income + high middle Income_**RTA** is RTA with high income and upper middle income countries . *the number of RTAs country j is the number of RTAs the partner country has with the rest of the world.*

Table 4: Estimated Results for Agricultural Machinery Use (1980-2009)

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent Variable: log of agricultural machinery use					
RTA	0.20***	0.19***	0.03***	0.03***	0.05**	0.05***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
EU_RTA	0.84***	0.78***				
	(0.02)	(0.02)				
High Income_RTA			1.00***	0.94***		
			(0.01)	(0.01)		
High income + high middle Income_RTA					0.83***	0.76***
					(0.02)	(0.02)
Agricultural Land		-0.02***		-0.02***		-0.02***
		(0.00)		(0.00)		(0.00)
Log GDP per capita		0.27***		0.27***		0.27***
		(0.00)		(0.00)		(0.00)
Log population		0.85***		0.85***		0.85***
		(0.02)		(0.01)		(0.02)
Log agricultural Value Add		0.37***		0.37***		0.37***
		(0.00)		(0.00)		(0.00)
Country FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
N	208399	208399	208399	208399	208399	208399
Number of countries	47	47	47	47	47	47

*Note: Standard errors in parentheses (clustered in country pairs) *p < 0.10, **p < 0.05, ***p < 0.01: where RTA denote Dummy variable=1 if the country have any RTA with any trading partner) , EU_RTA &* High Income_RTA *Income refers dummy variable=1 if country i's(the unit of interest country) RTA is with EU and high income country respectively; Agricultural land refers to percentage of arable land from total area;* Log (GDP per capita) is log of *GDP per capita, PPP (constant 2011 international $);* Log (population) is the log of total population: Log agricultural Value Add *is Agriculture value added per worker (constant 2010 US$):* High income + upper middle Income_RTA is RTA with high income and upper middle income countries. *the number of RTAs country j is the number of RTAs the partner country has with the rest of the world.*

Table 5: 2SLS Results for Agricultural machinery use

	(1)	(2)	(3)
	Dependent Variable: Log of agricultural machinery		
	The Second Stage		
RTA	0.45***	0.32*	0.06
	(0.05)	(0.08)	(0.18)
EU_RTA	0.62***		
	(0.22)		
High Income_RTA		0.90***	
		(0.31)	
High income + Upper middle Income_RTA			1.38***
			(0.49)
Agricultural Land	-0.02***	-0.02***	-0.02***
	(0.00)	(0.00)	(0.00)
Log GDP per capita	0.28***	0.28***	0.27***
	(0.00)	(0.00)	(0.00)
Log population	0.82***	0.83***	0.85***
	(0.02)	(0.02)	(0.02)
Log agricultural Value Add	0.37***	0.37***	0.35***
	(0.01)	(0.01)	(0.01)
Country FE	YES	YES	YES
Year FE	YES	YES	YES
	First stage for RTA		
Conflict	0.10***	0.10***	0.10***
	(0.00)	(0.00)	(0.00)
Number of RTAs country j have	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)
F statistic	412.89	412.89	412.89
	First stage		
	EU_RTA	High Income_RTA	High income + upper middle Income_RTA
Conflict	0.02***	0.02***	0.02***
	(0.00)	(0.00)	(0.00)
Number of RTAs country j have	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)
P-value	[0.000]	[0.000]	[0.000]
N	208399	208399	208399

*Note: Robust standard errors in parentheses *p < 0.10, **p < 0.05, ***p < 0.01: where RTA denote Dummy variable=1 if the country have any RTA with any trading partner) , EU_RTA &* High Income_RTA *Income refers dummy variable=1 if country i's(the unit of interest country) RTA is with EU and high income country respectively; Agricultural land refers to percentage of arable land from total area;* Log GDP per capita is log of *GDP per capita, PPP (constant 2011 international $);* Log (population) is the log of total population: Log agricultural Value Add *is Agriculture value added per worker (constant 2010 US$):* High income + high middle Income_RTA is RTA with high income and upper middle income countries . *the number of RTAs country j is the number of RTAs the partner country has with the rest of the world.*

Table 6: Robustness Check (using alternative Instruments)

	(1)	(2)
	Log of fertilizer consumption per hectare	Log of agricultural machinery
	Panel A: The Second Stage	
RTA	0.11***	0.33*
	(0.04)	(0.17)
High Income_RTA	0.12**	0.87***
	(0.05)	(0.32)
Agricultural Land	-0.02***	-0.02***
	(0.00)	(0.00)
Log GDP per capita	0.21***	0.28***
	(0.01)	(0.01)
Log population	2.19***	0.83***
	(0.07)	(0.04)
Log agricultural Value Add	0.22***	0.37***
	(0.02)	(0.01)
Panel B: First stage for RTA		
Conflict	0.10***	0.10***
	(0.00)	(0.00)
Number of RTAs country j have	0.001***	0.0001***
	(0.000)	(0.000)
Colonial relationship	0.1**	0.01
	(0.05)	(0.01)
Number of RTAs country j have	0.001***	0.001***
	(0.000)	(0.000)
F statistic	89.7	25.18
	Panel C: First stage the interaction	
Conflict	0.06***	0.02***
	(0,02)	(0.00)
Number of RTAs country j have	0.0001***	0.0001***
Colonial relationship	0.09***	0.01
	(0.03)	(0.01)
F statistic	41.49	16.51
	Panel D: Results from over Identification Test	
Hansen J statistic	0.027	0.001
p-value (from chi- squared t[st)	[0.9742]	[0.9742]
N	159092	208399

Note: Standard errors in parentheses (clustered in country pairs) ***p < 0.10, **p < 0.05, ***p < 0.01*: where **RTA** *denote Dummy variable=1 if the country have any RTA with any trading partner)* , **EU_RTA** & **High Income_RTA** *Income refers dummy variable=1 if country i's(the unit of interest country) RTA is with EU and high income country respectively;* ***Agricultural land*** *refers to percentage of arable land from total area;* **Log GDP per capita** is log of *GDP per capita, PPP (constant 2011 international $);* **Log (population)** is the log of total population: **Log agricultural Value Add** *is Agriculture value added per worker (constant 2010 US$):* **High income + Upper middle Income_RTA** is RTA with high income and upper middle income countries ,**Log Agricultural trade as ratio of GDP** *is the sum of agricultural export and import as a ratio of GDP in log form. the number of RTAs country j is the number of RTAs the partner country has with the rest of the world.*

In Table 7, we examine the channel through which the response in agriculture input is observed following countries RTA membership with high income countries. Because of data availability I did three exercises for fertilizer from column 1 to 3 and only one exercise for agricultural machinery. When countries sign an RTA with developed country, there might be an increase in both demand for agricultural output by country's RTA partner and hence an increase in demand for agricultural input. In other words, the increase in agricultural input use following formation of RTA might be either through an increase demand for agricultural output by RTA partner or through increase in access for factor markets. To identify that, in column 1 we control for an interaction term between RTA and import demand for agricultural output by the country's RTA partner. The coefficient for import demand for agricultural output by RTA partner in column 1 is zero and our coefficient of interest is consistent with the benchmark result. Column 2 and 3, is an RTA with net exporter of fertilizer. In all of the exercises the result holds. Finally in column 4, we did for agricultural machinery use by controlling RTA partner's demand for agricultural output. The result confirmed that an RTA with high income country still holds. Moreover, agricultural output demand by RTA partner has positive and significant impact on agricultural machinery use.

In our main result of table 3 and 5 we have shown that when we control for RTA with upper middle income and high income country , the coefficient for RTA alone becomes insignificant. Implying RTA between both low income countries have no impact on our outcome variable.

In table 8, we did a falsification test. Our falsification test follows from the argument that; if the claim that developing countries have RTAs with high income countries, there will be a technology transfer from advanced countries to developing countries explained by the use of improved inputs for agriculture. If the above claim is true, the impact of having RTA with developing will not

Table 7: Identifying the channel

	(2)	(2)	(3)	(4)
	Log fertilizer	Log fertilizer	Log fertilizer	Log of agricultural machinery
RTA	0.05	0.12***	0.12***	-0.16
	(0.04)	(0.00)	(0.01)	(0.10)
High Income_RTA	0.04***			1.42***
	(0.01)			(0.03)
RTA with net exporter of fertilizer		0.02**		
		(0.01)		
RTA with high income net exporter of fertilizer			0.04***	
			(0.01)	
Agricultural Land	-0.02***	-0.02***	-0.02***	-0.02***
	(0.00)	(0.00)	(0.00)	(0.00)
Log GDP per capita	0.21***	0.21***	0.21***	0.20***
	(0.02)	(0.01)	(0.02)	(0.01)
Log population	2.18***	2.18***	2.18***	0.74***
	(0.09)	(0.07)	(0.09)	(0.06)
Log agricultural Value Add	0.22***	0.22***	0.22***	0.30***
	(0.02)	(0.02)	(0.02)	(0.02)
			(0.00)	
Log(import of agricultural output by RTA partner)	0.00			0.02**
	(0.00)			(0.01)
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
N	95188	159092	95188	90009

Note: Standard errors in parentheses (clustered in country pairs) ***p < 0.10, **p < 0.05, ***p < 0.01*: where **RTA** *denote Dummy variable=1 if the country have any RTA with any trading partner)* , ***Agricultural land*** *refers to percentage of arable land from total area;* **Log GDP per capita** is log of *GDP per capita, PPP (constant 2011 international $);* **Log (population)** is the log of total population: **Log agricultural Value Add** *is Agriculture value added per worker (constant 2010 US$):* **High Income_RTA** *Income refers dummy variable=1 if country i's(the unit of interest country) RTA is with high income country.* ***RTA with high income net exporter of fertilizer****(dummy =1 if RTA is with high income and net exporter of fertilizer),* ***RTA with net exporter of fertilizer****(RTA with net exporter of fertilizer) and finally we have log of import of agricultural output by RTA partner.*

have any impact on fertilizer and agricultural machinery use by developed countries. Thus, For fertilizer use and agricultural input use, we estimate high income countries agricultural input use on having an RTA with low income countries. The result for both inputs coefficients are statistically zero. The implication of such result is thus, developing countries exposure to the international market through RTA with high income countries have significant spillover effect on use of manufactured aids of production for agricultural sector..

Table 8: Falsification Test

	(2)	(4)
	log fertilizer	log machinery
RTA	0.01	0.00
	(0.00)	(0.00)
Low Income_RTA	-0.01	-0.00
	(0.01)	(0.00)
Agricultural Land	-0.02***	0.001***
	(0.00)	(0.00)
Log GDP per capita	1.55***	-0.39***
	(0.03)	(0.01)
Log population	3.61***	1.33***
	(0.02)	(0.02)
Log agricultural Value Add	0.61***	0.11***
	(0.01)	(0.00)
Country FE	YES	YES
Year FE	YES	YES
N	99593	70112

Note: Standard errors in parentheses (clustered in country pairs) ***p < 0.10, **p < 0.05, ***p < 0.01*: *where* ***RTA*** *denote Dummy variable=1 if the country have any RTA with any trading partner)* **, *Agricultural land*** *refers to percentage of arable land from total area;* **Log GDP per capita** is log of *GDP per capita, PPP (constant 2011 international $);* **Log (population)** is the log of total population: **Log agricultural Value Add** *is Agriculture value added per worker (constant 2010 US$):* **High Income_RTA** *Income refers dummy variable=1 if country i's(the unit of interest country) RTA is with high income country.*, **Low Income_RTA** refers dummy variable=1 if country i has RTA with low income country.

3.7 Conclusion

In our analysis, we documented that countries having RTA uses more fertilizer and agricultural machinery per units of arable land. Moreover, our paper showed a strong links between regional trade agreement with high income countries– and fertilizer use as well as agricultural machinery use after controlling country and year specific factors. We employ both pooled OLS with country and year fixed effects as well us instrumental variable approach to present the causal link between the variable of interest. We use theory driven instruments such as conflict and domino (number of RTAs partner country have with the rest of the world) to identify our factor demand equation so that to produce causal link. From table 2, through table 6, our result confirms that countries who have RTAs use more agricultural inputs which has a great implication on yield and structural change as it is posited by McArthur & McCord, (2017). This result gives a hint that the role of economic integration with heterogenous countries in terms of economic activity has a complimentary effect for the domestic economy for the process of structural transformation. Hence, in signing an RTAs, identifying domestic production gaps and finding a trading partner who can fill that gap either in in transfer of production technology and filling the short run consumption demand should due attention.

We believe this paper is a starting point to explore the link between agricultural input and trade integration. In the future more robust result can be found if we add gricultural output and overall structural transformation for the economy in relation to trade integration by considering a detailed evidences on factors affecting agricultural activity.

References

Ahmed, R. (1995). *Liberalization of agricultural input markets in Bangladesh: process, impact, and lessons*. Agricultural Economics, 12(2), 115–128.

Baldwin, R. (1993). *A Domino Theory of Regionalism*. National Bureau of Economic Research Working Paper Series (Cambridge).

Bell, C. (1972). *The acquisition of agricultural technology: its determinants and effects*. The Journal of Development Studies, 9(1), 123-159.

Coomes, O. T., Grimard, F., & Burt, G. J. (2000). *Tropical forests and shifting cultivation: Secondary forest fallow dynamics among traditional farmers of the Peruvian Amazon*. Ecological Economics, 32(1), 109–124.

Dicaprio, A., Santos-Paulino, A. U., & Sokolova, M. V. (2017). *Regional trade agreements, integration and development*, (1), 1–24.

Duflo, E., Kremer, M., & Robinson, J. (2008). *How High are Rates of Return to Fertilizer?* American Economic Review, 98(2), 482–88.

Gollin, D. (2010).*Agricultural productivity and economic growth*. Handbook of agricultural economics, 4, 3825-3866.

Hazell, P. B. R. (2009). *The Asian Green Revolution* . IFPRI Discussion Paper 00911, (November), 1–31.

Kuznets, S. S., & Kuznets, S. S. (1968). *Toward a theory of economic growth, with reflections on the economic growth of modern nations*

McArthur, J. W., & McCord, G. C. (2017).*Fertilizing growth: Agricultural inputs and their effects in economic development* . Journal of development economics, 127, 133-152.

Williams, S. P., & Shumway, C. R. (2000). *Trade Liberalization and Agricultural Chemical Use : United States and Mexico*. American Journal of Agricultural Economics, Vol. 82, No. 1 (Feb., 2000), Pp. 183- 199, 82(1), 183–199.

Yousaf, M., Li, J., Lu, J., Ren, T., Cong, R., Fahad, S., & Li, X. (2017). *Effects of fertilization on crop production and nutrient-supplying capacity under rice-oilseed rape rotation system*. Scientific Reports, 7(1), 1–9.

3.8 Appendix

List of countries in the Sample

Iso	Country	Iso	Country	Iso	Country	Iso	Country
ARG	Argentina	EGY	Egypt, Arab Rep.	MLI	Mali	PRY	Paraguay
BDI	Burundi	ERI	Eritrea	MMR	Myanmar	RWA	Rwanda
BEN	Benin	ETH	Ethiopia	MNG	Mongolia	SDN	Sudan
BFA	Burkina Faso	GHA	Ghana	MOZ	Mozambique	SEN	Senegal
BGD	Bangladesh	GTM	Guatemala	MRT	Mauritania	SLE	Sierra Leone
BOL	Bolivia	HND	Honduras	MWI	Malawi	SLV	El Salvador
BRA	Brazil	HTI	Haiti	MYS	Malaysia	SYR	Syrian Arab Republic
CAF	Central African Republic	IDN	Indonesia	NAM	Namibia	TUN	Tunisia
CHL	Chile	IND	India	NER	Niger	TZA	Tanzania
CHN	China	KEN	Kenya	NIC	Nicaragua	UGA	Uganda
CIV	Côte d'Ivoire	KHM	Cambodia	NPL	Nepal	URY	Uruguay
CMR	Cameroon	LAO	Lao PDR	PAK	Pakistan	VNM	Vietnam
COL	Colombia	LBR	Liberia	PAN	Panama	YEM	Yemen, Rep.
CRI	Costa Rica	LSO	Lesotho	PER	Peru	ZMB	Zambia
CUB	Cuba	MAR	Morocco	PHL	Philippines	ZWE	Zimbabwe
DOM	Dominican Republic	MDG	Madagascar	PNG	Papua New Guinea		
ECU	Ecuador	MEX	Mexico				