Trade, Openness and Domestic Conflict: An Empirical Investigation for Latin America

Prasad S. Bhattacharya and Dimitrios D. Thomakos
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Abstract

This paper explores whether there is an empirical relationship between trade, openness and domestic conflict for Latin America based on the analytical framework of Garfinkel, Skaperdas and Syropoulos (2004). Using ordinal regressions and Markov switching models for seventeen countries, we identify the factors responsible for the initiation and sustenance of domestic conflict. Our overall results suggest that: (i) increased trade openness reduces domestic conflict intensities but (ii) over dependence on agricultural exports, along with poor socio-political performance, lead to sustenance of low intensity conflicts. We also analyze conflict duration using proportional hazard models and find that over-reliance on agricultural exports plays the main role in conflict sustenance after controlling for socio-political factors.

JEL Classifications: C35, O54, Q34.

Keywords: Trade Openness, Domestic Conflict, Ordinal Regression, Markov Switching, Proportional Hazard Model, Latin America.

* Our sincere thanks to Costas Syropoulos, Peter Thompson, Cem Karayalcin, Nejat Anbarci, Hristos Doucouliagos, Mehmet Ulubasoglu and the seminar participants at the 24th International Symposium on Forecasting in Australia, for very useful comments and suggestions. All remaining errors are our responsibility.

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Introduction

Analyzing conflicts over resources and output is an important topic of economic and sociopolitical research. The World Bank project on the Economics of Civil War, Crime and Violence is one of the many examples of ongoing research efforts\(^1\) that analyze occurrences and duration of conflicts, in an attempt to devise credible mitigation mechanisms. One of the important results of these studies is the fact that increased trade openness may have some mitigating effects on conflict (see Hegre (2002) for example). However, some studies, like Collier and Hoeffler (2004), also point that over-reliance on primary commodity exports, which may be fallout of increased trade openness, leads to more conflicts. This effect is especially pronounced for Africa. This argument indicates the problem of the, so-called, “natural resource curse”. It is also established that underlying socio-political and institutional structures play significant roles for starting and sustaining conflicts (see Collier and Hoeffler (1998), Sambanis (2004) for example). Although significant progress has been made in terms of conceptualizing and analyzing conflicts, there is still work that needs to be done on formalization and figuring out the channels of the domestic conflict problem, with possible interaction from trade and openness factors. To be precise, the relevant research question is: holding the underlying socio-political and institutional structures constant, does trade openness and increased interaction with the world market necessarily lead to conflict mitigation? We empirically analyze this line of research in this paper taking the case of domestic conflict in Latin America between 1973 and 1995. Our analysis and results are related with the recent

\(^1\) Sambanis (2004) has a comprehensive discussion regarding case study based conflict and civil war analysis across the world.
study done by Garfinkel, Skaperdas and Syropoulos (2004) who address the above question analytically.\(^2\)

Garfinkel et al. (2004) have developed a theory about how trade liberalization can, under certain circumstances, be welfare reducing if it stimulates domestic conflict. At the heart of Garfinkel et al.’s (2004) theory is a simple story: a country has a resource contested by two or more groups and the price of this resource affects both the incentive and opportunity to engage in conflict over its control. Consequently, if opening to trade lowers the price of the contested resource relative to the no-trade situation, domestic conflict declines. In contrast, if openness raises its price above the level of the price in a no-trade scenario, conflict increases.\(^3\) Garfinkel et al. (2004) point out that in the latter case, internal conflict may increase such that it offsets the usual static gains from trade.

Interesting though their theory is, it is motivated and supported by anecdotal evidence. This paper, using the analytical approach of Garfinkel et al. (2004), undertakes a careful empirical analysis for a panel of Latin American countries. We address two important, but fundamentally distinct questions. First, how do changes in trade openness affect the likelihood to initiate the conflict? Second, once initiated, how do variations in openness affect the duration of conflict? Although Garfinkel et al.’s (2004) analysis is static and does not address the second question directly, it is a natural corollary of their argument. If trade openness serves to increase the incentives and opportunity to engage in conflict, it is likely also to affect the participant’s incentives and ability to sustain

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\(^2\) The premise of Garfinkel, Skaperdas and Syropoulos (2004) is asymmetric resource distribution, the reason for which can be the underlying socio-political and institutional structures. For a perspective of resource distribution in Latin America, see the latest World Bank report on Inequality in Latin America, which provides insight to possible reasons of persisting inequalities in Latin America.

\(^3\) We provide the underlying intuition of this result in the next section when we discuss the Garfinkel et al. (2004) framework in greater detail.
conflict. We take this point to investigate the conflict duration issue simultaneously with the onset issue, which is a major but plausible departure from the existing literature. Latin America has a history of domestic conflict which went down significantly when most of the countries in the region embraced open market strategies in the eighties. Therefore, the analytical link pointed out in the Garfinkel et al. (2004) paper may throw some light into this aspect. We empirically analyze this potential link in Latin America using yearly information from 1973 to 1995. Unlike the usual practice of looking at conflict scenario for five-year average, we use annual observations, as averaging out may lead to loss of observations and degrees of freedom.\(^4\) The time frame reflects trade openness aspects for a long period of time capturing both no interaction with the rest of world in the seventies as well as more participation in the world trade in the later eighties and nineties.

In section 2, we discuss Garfinkel et al. (2004) in more detail, highlighting their channels, explicitly or by extension, about conflict initiation and duration. The argument is that the primary goods sector (for example, agriculture in Latin America) is where one is (i) most likely to see a conflict for control of resources, (ii) that the relative prices of these goods are likely to change as a result of trade liberalization (which can be indirectly captured through changes in the level of goods being exported or imported) and (iii) depending on the relative price change, we would therefore expect to see openness either stimulating and sustaining conflicts or abetting conflicts. In section 3, we briefly summarize the existing empirical literature and identify the explanatory factors that help us check for the validity of trade and openness argument in the Latin American context. Sections 4 and 5,

\(^4\) See Fearon (2005) for more discussion on the usage of annual data in place of five-year average observations.
based on the previous section’s discussion, explain data and methodologies used in the present study. All results are reported in section 6. There is a sizeable literature on conflicts that has identified many possible factors affecting conflict occurrence (and, to a lesser extent, duration). Using this literature to identify additional covariates, we reestimate the models using ordinal regressions, Markov switching models and hazard models. The earlier results remain quite robust to the addition of these covariates. Finally, section 7 concludes with the conjecture about whether the stimulus to conflict initiation and duration caused by the expansion of agricultural goods exports is sufficiently large so as to generate what Garfinkel et al. (2004) call the “natural resource curse”.

Analytical Framework of Garfinkel, Skaperdas and Syropoulos (2004): What is the implication for Latin America?

The framework of Garfinkel, Skaperdas and Syropoulos (2004) focuses on domestic conflict over a tradable resource. They show that trade may reduce welfare if it leads to the intensification of conflicts and loss of resources associated with conflicts. In their paper, they ask the following questions:

(i) Does more openness, by making participants richer and more open to deal making, reduce conflict?

(ii) Does greater openness induce more wasteful competition and conflict by making some resources and commodities more valuable?

In their model, $p_{oil}$ denotes the relative price of “oil”, a resource over which there is domestic conflict. Once the gains and costs of conflicts are sorted out, then the parties resort to trading of the resources they control. Resource prices are different under the free trade regime and under the no trade scenario. Benchmark prices of the contested resource
are denoted by \( p_{\text{autarky}} \), i.e., the oil price under no trade or autarky situation and \( p_{\text{international}} \), i.e., the price of oil in the international market, which signifies that there is participation in world trade. Using their analytical framework, they compare and show the following:

(i) \( p_{\text{international}} < p_{\text{autarky}} \): In this case, there are gains from trade, as contenders will have the incentive to import that resource rather than fighting over that. The range of prices over which this happens depends on the country’s resource endowments and degree of insecurity.

(ii) \( p_{\text{international}} = p_{\text{autarky}} \): In this scenario, there is no gain from trade and the level of conflict will be equal in both the cases of autarky and free trade.

(iii) \( p_{\text{international}} > p_{\text{autarky}} \): If this happens, then the country will export the resource and free trade will induce more conflicts as stakes from conflict are higher. Gains from trade may be less than the costs of arming.

(iv) \( p_{\text{international}} \gg p_{\text{autarky}} \): In this situation, the country exports the resource and free trade is welfare-improving as the gains from trade dominate the losses associated with intensified conflict.

Based on their framework, take the case where the conflict is over land. To be specific, parties in conflict want to control “land” that provides them with opportunities to produce agricultural goods or extract natural resources that they can trade in the world market and generate income. This conflict over a resource has been played out time and again in Latin America, where land distribution is skewed\(^5\). When countries open up and start trading agricultural goods that use land as an input, the prices of these goods go up as

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\(^5\) See Lipton, Eastwood and Kirsten (2002) where they point that the land gini in Latin American countries is 0.86, which is the highest among all the world regions.
compared to their autarkic price. Consequently, stakes from conflicts over land are now higher as that generates more returns once parties control and use that resource for future production of agricultural goods, which induces more conflicts afterwards. From the empirical analysis point of view, the over-reliance of agricultural exports perfectly fits into this case, as we find this over-dependence leads to low intensity conflict sustenance overtime. Agricultural exports as a part of total exports remains significant and positive for all the four models where this is used as a covariate, depicting a positive correlation with domestic conflict. Taking all exports variables together, estimates in presence of effective controls like landlocked region and arable land area as a proportion of total land area, show that agricultural exports and basic metals exports as a proportion of total exports helps to sustain domestic conflict. The reason may tally with Garfinkel et al.’s (2004) conjecture. With the domestic market opening up for trade, Latin American countries export agricultural goods and basic metals having a comparative advantage in these. As prices of tradables increase, returns from resources used to produce these goods also go up. Consequently, grabbing these resources become beneficial for the parties engaged in production of those tradable goods. This process will lead to a start of conflict or can elevate an existing conflict from a low intensity to high intensity one.

Based on the findings from the analytical model, we form the following hypotheses for empirical investigation: (i) due to increased trade openness (measured in terms of exports and imports of goods as a percentage of GDP) the overall conflict intensities in Latin American countries decline, and that can be termed as a positive contribution from the

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6 See Ocampo (2004) for an important discussion articulating this point and the related consequences. Also see Fraga (2004) for an informative perspective on Latin America.

7 Recent empirical findings on trade openness and growth provide contradicting evidences on the generic “trade is beneficial for growth and income earning opportunities” idea. For example, Rodriguez and
relative price difference; (ii) the above result is not always true, as some of countries show increased conflicts once they open up. The reason for this increase may again lie with the relative price difference of goods these countries are exporting. After showing the above two results, we analyze conflict duration over time and find that over-reliance on agricultural goods export does not reduce conflict completely, but on the other hand, it helps to sustain low-intensity domestic conflicts overtime. Another conjecture from the above discussion regarding less trade openness and increased conflicts can be treated as fallout of (i) above which can be confirmed ex post based on the empirical findings. The empirical approach in this paper initially exploits three alternative modeling techniques (ordinal regression, Markov switching and proportional hazard models) to explain conflict intensity and duration based on only trade and openness variables as explanatory variables after controlling for underlying country area, elevation, asset inequality, distance from the coastline, ethno-linguistic fragmentation and arable land area as a proportion of total land area. Thereafter, we use other explanatory variables over and above the trade and openness variables to check the robustness of the results involving trade and openness variables.

Looking at Garfinkel et al.’s (2004) claim in (iv) above, one finds that if the international price of the contested resource is sufficiently higher than the autarkic price, then more gains from trade will outweigh the costs of arming and therefore, free trade is beneficial.

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Rodrik’s (2000) cross-national evidence do not show unambiguous improvement in growth in presence of trade openness. On the contrary, Lee, Ricci and Rigobon (2004) argue for beneficial effects of trade openness on economic growth. Bardhan (1970) and Dodzin and Vanvakidis (2004) offer a related perspective on the lesser return and slow growth of some sectors in an economy that formed the basis of earlier trade protection and infant industry argument in developing countries. As Latin American countries relied on trade protection in the seventies and eighties before opening up, the income earning opportunities in those countries may be severely limited, which also provided the background for domestic conflict. Therefore, more trade openness leading to lowering conflict intensity can be a plausible hypothesis to be explored in the present study.
The empirical result in this paper from food, beverages and tobacco exports as a percentage of total exports show moderate to high conflict mitigation probabilities from the ordinal and Markov switching models (0.23 from ordinal and 0.63 from Markov switching model) and high conflict mitigation probabilities over the years from the Cox proportional models (with the odds ratios more than one in cases where food, beverages and tobacco exports variables are used as covariates).

Apart from the above links with the Garfinkel et al.’s (2004) paper, we also find that in presence of increased openness, high intensity domestic conflicts reduce to low intensity conflicts, where openness measured by trade as a percentage of GDP and conflict is measured by casualties. This result remains robust when we control for underlying economic, socio-political and institutional factors. However, intertemporal effects of openness on domestic conflict seem to be weak, as we do not find any significant effect of openness towards conflict sustenance overtime. Final results from all the empirical approaches therefore point to the evidence that trade openness and associated measures (in terms of product exports and imports as a proportion of total trade) do have a role to play in explaining both increase and decrease in domestic conflict in the Latin American region between 1973 and 1995. A favorable policy mechanism for complete conflict mitigation needs to address these important aspects from the empirical analysis, which is related to the newly proposed analytical framework of Garfinkel et al. (2004).
Related Literature

Previous works on international and domestic conflicts focus on a range of economic and non-economic issues to explain initiation, sustenance and mitigation of this problem. In doing so, the studies employ various techniques like multinomial logit, probit, Markov switching and hazard model to analyze the main determinants of conflicts. However, past research rarely takes any methodological approach to look for the reasons behind conflict initiation and sustenance at the same time (except for Collier and Hoeffler, 1998). This practice has largely been supported by the belief that conflict initiation and sustenance issues are separate incidents caused by different factors. As a result, merging occurrence and duration issues can lead to oversimplification of heterogeneous effects that may be present to explain those two separate problems. Based on the underlying economic reasoning, we believe that it is not only important to look for the main reasons for conflict, but also it is quite desirable to address the sustenance issue of conflict at the same time, as that will help in formulating conflict resolution strategies. In this paper we look at both aspects of conflict initiation and sustenance simultaneously in the following way. After controlling for other non-economic factors, we investigate if the same economic factors responsible for conflict occurrence are also behind conflict sustenance over time. In what follows, we provide an overview of the approaches researchers taken in the past to identify the appropriate factors for our study addressing domestic conflicts in the Latin American region.

Among the economic issues for conflict identified in the literature, the natural resource curse type arguments play one significant role, especially explaining conflict (or civil war) in the African region. From this viewpoint, studies cite one empirical regularity:
prevalence of conflict in a region with abundant and easily extractable natural resources. In this kind of situation, the population residing there has the advantage of appropriating that resource without much effort. Selling these resources domestically as well as in the world market generates a steady financial return that can be channeled to sustain conflict. This is known as the “natural resource curse”. In accordance to that, Collier and Hoeffler (2004) report that risk of conflict in the world can be attributed mainly to the share of primary commodity exports in GDP, which indirectly captures the natural resource curse problem. Primary products exports include oil, diamond, metal, food and beverages exports. However, primary product exports as an aggregate measure may not have good explanatory power in describing conflict as for some regions and for some countries, the proportion of natural resources export may be negligible. As a result, individual export components of primary products exports and their returns need to be analyzed to gain insights on domestic conflicts. For the present study, we take agricultural exports as a share of total exports to add more explanatory power, if any, for both the conflict initiation and sustenance processes. Instead of taking food and beverages export and metal exports together, we use these variables separately to analyze their potential linkages with conflict process. Collier et al.’s (1998, 2004) study, apart from the primary products export, also point to other economic and non-economic factors, for instance, income growth prior to conflict, ethnic dominance, social fractionalization, geographic dispersion, mountainous terrain, and the time which has passed since any previous conflict, that influence ongoing conflicts across the world. We use some of these factors as our controls. To be specific, we use countries land area, arable land area as a proportion of total land area, elevation, landlock, land inequality, and ethno-linguistic
fractionalization as our control variables. We also report the results using effective controls of arable land area as a proportion of total land area and landlock as these two provide good intuition in explaining domestic conflict in Latin America. Latin America is characterized by high level of land and asset inequality. Now, keeping the high level of land inequality constant, possession and return from arable land becomes the point of contention and leads to conflict. This effect is neatly captured in our paper.

Apart from specific economic factors like primary products’ exports, researchers use general economic variables like overall income and structure of an economy as well as non-economic variables like, education and literacy to analyze the conflict process. Income and education are used in the literature as proxies for effective income earning opportunities with the idea that increased income and educational achievement, measured by increased school enrollment can check domestic conflict in a number of ways. For instance, with increased income earnings opportunities, propensity to join a rebellion to earn a living diminishes as the opportunity cost of joining the rebellion becomes very high. Hegre (2002) argue, using different models and measures of openness, that economic development as a result of increased openness (or globalization) is an effective detriment for onset of civil wars. Collier and Hoeffler (2004) find that economic factors are important determinants of conflict in Africa. Blomberg and Hess (2002) show those periods of economic recession are coincidental with violent conflicts. Fearon and Laitin (2003) also support the lack of economic development hypothesis for conflict occurrence, as lack of development over time encourages unemployed people to join rebel groups. This indirect inducement to join a rebellion increases in a difficult geographic region as possible retaliation by states security forces can be easily evaded due to hostile
geographical terrain. In this way, any conflict can sustain over time. Hegre (2002) and Fearon and Laitin (2003) also emphasize that rural population may play an important role in the conflict initiation process, with the idea that a large rural population with low income earning opportunities and facing chronic underdevelopment may have higher resentment and a higher propensity to rebel. This can be aggravated by paucity of land due to the concentration of arable land in the hands of high income farmers and lower agricultural development to convert one crop land to a multi-crop one. We proxy these effects by including four variables, rural population as a percentage of total population ($R_{potp}$), rural population annual growth rate ($R_{pog}$), arable land area as a proportion of total land area ($L_{ual}$) and land gini coefficient ($L_{gini}$), in our empirical models. Landgini and arable land used as a percentage of land area are used as control variables. We find that $L_{ual}$ remains robust and consistent in explaining onset and duration of conflict. Improved educational opportunity has an indirect effect on the economy as it promotes human capital accumulation in the long run, which increases labor force productivity. The idea is that as workforce accumulates skills to do regular productive economic jobs, the opportunity cost of joining something unproductive rises manifold. Therefore, better educated workforce may have lesser inclination to accept rebels’ jobs. As a result, secondary school enrollment is used as a proxy to higher income earning opportunity. In accordance to the above mentioned arguments, we also use growth rate of per capita GDP ($G_{pcg}$) \(^8\) and secondary school-level education attainment ($S_{si}$) to reflect the dynamics of

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\(^8\) We are aware that there may be a possible endogeneity problem here in the sense that conflict itself affects per capita GDP growth. But as our dependent variable reflects how many deaths occurred due to the conflict between government forces and the rebels over time, we think that the death count does not directly affect the GDP growth rate. It at best reflects the overall scenario regarding the security situation of any country.
increased income earning opportunities and find that both of these variables perform well in terms of explaining conflict initiation and sustenance processes.

Investigations into international and domestic conflicts also look at institutional factors related to political and democratic structures of countries. The idea is that democratic countries actively support political rights and participation in political process by all fractions of society reduces domestic conflict risk. Reynal-Querol’s (2002) arguments for example, is supportive of this “political center” idea that points to lack of democracy and absence of political mechanism to achieve peaceful conflict resolution. Rodrik (2000) argues that democratic institutions provide ways of regulating and managing social conflicts through participatory means and rules of law, and hence dissipate the adverse consequences of external shocks. Skaperdas (1992) and Garfinkel (1994) provides theoretical support to this view, with the argument that democratic institutions reduce the severity of conflict between nations with possibility of raising welfare through increasing the amount of resources available for global consumption. Mansfield and Pollins (2001) call for greater conceptual clarity on how domestic political institutions filter the interests of various societal actors and groups. Inspite of a consensus view in the literature that political instability and civil war are positively related, there are differences across studies regarding the time lag as well as using proper proxies to capture political institution better. Also, there is no evidence so far on how absence or presence of

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9 See the latest World Bank Report, “Breaking the Conflict Trap: Civil War and Development Policy” for a discussion regarding two other political views involving left and right centric ideas.

10 Also, looking at political regimes and civil war, empirical studies differ in their conclusion of whether there is an “inverted U-shaped” relationship between democracy and civil war. This pattern basically takes care of the fact that more autocratic states and purely democratic states across the world experience less conflicts as compared to the states experiencing mid-level of democracy or semi-autocracy. Studies by Muller and Weede (1990), Ellingsen (2000) and Hegre, Ellingsen, Gates and Gleditsch (2001) show that there is a possibility of “inverted U” relationship, but Elbadawi and Sambanis (2000, 2002) find that the
democracy may affect conflict in an open economy framework, except for Ross (2001) and Wantchekon (2000). Keeping all these issues in mind, we take “political rights”, \(Plrg\), as one of the explanatory variables to check for the robustness of trade and openness variables. We believe that it is a much better proxy than the measure of democracy, as better political rights are always associated with proper democracies.

Looking at the duration of civil war, Collier et al. (2001), using hazard models, argue that duration can be attributed to some non-economic factors, like, ethnic diversity, forest cover and development of un-policed international arms market in the eighties. Therefore, according to them, the issue of primary commodity dependence can be judged more as an issue for conflict initiation than sustenance over time. The emergence of illegal arms markets tries to find an answer into a large perspective of financing of armed conflicts as pointed out by Skaperdas and Syropoulos (2001, 2002). On the other hand, in our analysis, we use trade and openness variables (which can be treated as a part of primary commodities export) to understand how these factors can affect overall conflict. Our results point to some important facts regarding conflict survival, when we use these variables, which provide another insight into the domestic conflict survival process in Latin America.

Deviating from reasons of conflict based on socio-political and economic motives, some studies use complex nonlinear alternative models. These works rely on statistical properties of the data rather than underlying socio-political or economic intuitions that relationship is not very robust. Collier and Hoeffler (2004) and Fearon and Laitin (2003) also find no support for this inverted U-shaped relationship hypothesis at all.

\(^{11}\) These studies, using cross-sectional statistical data show that the correlation between democracy and mineral resource dependence is negative.

\(^{12}\) We have checked for robustness by dropping political rights and using democracy index of Marshall and Jaggers (2002). The results do not appear to provide extra information and so we report results including \(Plrg\) as one of the explanatory variables.
can explain domestic conflict. The studies use generalized additive models (See Beck and Jackman, 1998), support vector machines (For reference, consult Vapnick, 1995 and Vapnick, 1998) as well as boosting, regression and classification trees, kernel methods and mixture models (See, for example, Hastie, Tibshirani and Friedman, 2001). Some studies like O’Brien (2002) use a pattern classification algorithm (fuzzy analysis of statistical evidence, FASE) to analyze relations between country macrostructural factors and historical instances of country instability. His results show forecast accuracy for occurrence and the level of intensity of country-specific instabilities for five years in advance. Blomberg and Hess (2002) use a Markov probability model where transitions between states of peace and conflict influence each other and the state of the economy. They find that occurrences of recession significantly increases the probability of internal conflict. To better explain the factors that initiate conflicts from a previous no conflict situation or from a low-intensity conflict situation to high intensity conflict scenario in presence of trade openness, we rely on pure statistical properties of the data sample. The basic idea to employ a new methodology comes from the fact that even if we try to control all the possible factors that can generate a background for conflict initiation, it becomes virtually impossible to build a comprehensive framework taking care of all the possible factors. That calls for special treatments in the existing data sample so that the explanatory power of the possible factors and especially trade and openness factors can be improved from a purely statistical or methodological viewpoint. Therefore, we use Markov switching analysis as employed in a recent analysis by Blomberg and Hess (2002). However, our analysis is different from theirs in that unlike them we control and condition a large number of economic and socio-political covariates in the empirical
analysis. Furthermore, throughout our analysis, we categorize all the covariates or variables in two different segments as above and below average to understand the underlying data pattern more effectively.

**Description of the Data**

In the present study, the dependent variable is “domestic conflict” for seventeen Latin American countries from 1973 to 1995.\(^{13}\) For this variable, we collected data from the “Armed Conflict Dataset” by Gleditsch, Wallensteen, Eriksson, Sollenberg and Strand (2002). Domestic conflict in this dataset is defined as “internal conflict within a country between a government and one or more opposition groups, with no interference from other countries”. Within this conflict, there are four different sub-categories: (1) *No Internal Conflict*: (denoted by 0); (2) *Internal Minor Armed Conflict*: at least 25 battle related deaths per year and fewer than 1000 battle-related deaths during the course of the conflict (denoted by 1); (3) *Internal Intermediate Armed Conflict*: at least 25 battle related deaths per year and an accumulated total of at least 1000 deaths, but fewer than 1000 per year (denoted by 2); and (4) *Internal War*: at least 1000 battle-related deaths per year (denoted by 3). The time period is between 1973 and 1995. The choice of time frame is guided by data availability for some of the explanatory variables as well as virtual nonoccurrence of internal conflicts in most of the sample countries before this time period (except for Colombia and Guatemala). Collier, Hoeffler and Soderbom (2001) argue that sustenance of civil war can be attributed to emergence of unpoliced international arms market in the eighties, so our choice of time period also addresses this issue. Though our focus is on the internal conflict and not on the civil war per se, but the

\(^{13}\) The sample countries are: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, and Venezuela.
manifestation of conflict is guided by possession of arms by conflicting factions and therefore the choice of the time period.

We use various measures of trade openness and trade variables as covariates or explanatory variables in our analysis. Those include, (i) trade openness, which takes ratio of exports and imports as a percentage of GDP to capture the feedback of the trade effect on conflict (Open); (ii) proportion of agricultural exports in total exports (Ag); (iii) food, beverage and tobacco export as a percentage of trade (Fbtex); (iv) basic metal export as percentage of trade (Bmeex); (v) food and beverages import as a percentage of trade (Fbim) and (vi) fuel imports as a percentage of total trade (Fuim). Data for all of these variables are collected from various issues of the Statistical Abstracts of Latin America.

GDP growth per capita (Gdpg), Rural population as a percentage of total population (Rpotp), rural population annual growth rate (Rpog) are included as explanatory variables in our analysis. Data for these three are downloaded from the World Development Indicator web site of the World Bank. In our study, we also include the infant mortality rate (Imr) data for the following purpose. Higher infant mortality rates indirectly implicate the effectiveness of health infrastructure in a country. This might indirectly capture the level of governance.\textsuperscript{14} Data on Imr are collected from the US Census Bureau’s International Programs Center web site.\textsuperscript{15} Data on Ssi are taken from the Barro-Lee dataset and it denotes secondary school attainment.

To further corroborate the implication of openness variables, we use another index, socio-political index (Spi). This essentially captures the underlying grievance motive, if any, present in this region, which can further affect the conflict situation. Trade variables

\textsuperscript{14} There are some other studies, like The State Failure Task Force reports use IMR also as an independent variable to explain conflict.

\textsuperscript{15} The web site address is:- http://www.census.gov/ipc/www.
reflect the amount of trade between countries as well as with the rest of the world. To produce the tradable goods, a conducive business friendly environment is necessary. In that sense, underlying socio-political situation, which helps in policy formulations play very important role for proper economic functioning of an economy. We use principal components method to calculate this index with weights on the following socio-political variables: cabinet changes (\(Cabc\)), constitutional changes (\(Conc\)), assassinations (\(Assi\)), guerrilla activities (\(Guer\)), revolutions (\(Revo\)), strikes (\(Str\)), government crises (\(Gov\)), coups (\(Coup\)), party fractionalization (\(Part\)), purges (\(Pur\)), and riots (\(Riot\)).\(^{16}\) Data on the above-mentioned variables are taken from Social Indicator Database of the World Bank. This is another new approach from the existing literature, as the literature includes assassinations, coups as well as revolutions as dependent variables to perform robustness check. What we have done here is to control for these effects (in seven out of ten different versions of the models) and still find that openness and other trade variables explains a significant percent of conflict occurrence and duration.

For control variables, we use the countries’ land area (\(Larea\), in million square kms., taken from the Center for International Development, Harvard University’s web site\(^ {17} \)), arable land area as a proportion of total land area (\(Lual\), taken from World Development Indicators), elevation (\(Elev\), mean elevation, hundred meters above sea level, taken from the Center for International Development, Harvard University’s web site), landlock (\(Llock\), percent of land area beyond hundred km. of ice-free coast, taken from the Center for International Development, Harvard University’s web site), land inequality (\(Lgini\),

\(^{16}\) We can think of these variables as potential breeding ground of a predator (a la Grossman and Kim (1995)) because presence of these activities signals weak state mechanism. Incidentally, the State Failure Task Force takes “revolutionary wars” and “adverse or disruptive regime transitions” as different events to identify state failures.

\(^{17}\) The web site is:- http://www.cid.harvard.edu/cidglobal/economic.htm.
Empirical Methodology

We use two different classes of models for inference on the factors that affect the intensity of conflict, ordinal regression models and Markov switching models. So far, in the literature, researchers do not employ the panel ordinal regression technique, mainly because of the fact that the dependent variable was not categorized like what we have. Therefore, this paper applies a new technique to understand the conflict dynamics as we apply a hitherto unexploited methodological approach. For investigating factors affecting duration of conflict in the Latin American region, we use the standard cox proportional model with time-varying covariates. In the following subsections, we provide a brief summary of these models and a rationale as to why these are suitable and useful in our context.

Review of Ordinal Regression

The nature of the dependent variable of interest is ordinal, as levels of conflict intensities are based on the number of deaths occurring. Therefore, more deaths imply a higher level of conflict intensity and a natural order on the values of the dependent variable. The standard method for inference on ordinal data is the ordinal regression model. Using ordinal regression allows us to make probabilistic predictions about conflict intensities while we identify economically important and statistically significant factors that affect conflict.

\footnote{The original data source mentions that the data is not ordinal, but according to the classification schemes, they do capture the movements from one intensity of conflicts to another. Therefore, statistically speaking, we can use the panel ordinal regression methodology.}
The dependent variable domestic conflict (CONF, denoted by $c$ for the empirical analysis) is reported as four different responses (ordered categories), so these kind of polytomous data on a set of predictors can be best captured by the ordered logit or probit regression.

Based on Zavoina and McElvey (1975), the model is built around a latent regression\(^{19}\) as:

$$c^* = \beta'x + \varepsilon$$

(1)

where $c^*$ represents the unobservable, “true”, level of intensity of conflict that it varies freely and it connected with the observed intensity categories as follows:

\[
\begin{align*}
    c &= 0 & \text{if } & c^* \leq 0 \\
    c &= 1 & \text{if } & 0 < c^* \leq \mu_1 \\
    c &= 2 & \text{if } & \mu_1 < c^* \leq \mu_2 \\
    & \vdots & & \vdots \\
    c &= J & \text{if } & \mu_{J-1} \leq c^*
\end{align*}
\]

(2)

The $\mu$’s are unknown threshold parameters to be jointly estimated with the structural parameter vector $\beta$. We assume that $\varepsilon$ is normally distributed across observations with mean 0 and variance 1.

The corresponding probabilities, i.e. the probabilities for each observed intensity level, are then given by:

\[^{19}\text{To avoid cluttering the notation we omit the sample indexes from what follows.}\]
\[
\begin{align*}
\Pr o b (c = 0) &= \Phi (-\beta'x) \\
\Pr o b (c = 1) &= \Phi (\mu - \beta'x) - \Phi (\beta'x) \\
&= \Phi (\mu_j - \beta'x) \\
\Pr o b (c = J) &= 1 - \Phi (\mu_{j-1} - \beta'x)
\end{align*}
\]

The following constraint in the threshold parameters is also required in order to have that all the probabilities are positive:

\[0 < \mu_1 < \mu_2 < \ldots < \mu_{j-1}\] (4)

Beck, King and Zeng (2000) show that standard logit estimation tends to underestimate the rare events probability and therefore needs suitable corrections; we apply their recommended corrections in our analysis. Then, we first estimate ten different versions of ordinal models involving only openness and trade variables in two ways, first in presence of all the six controls and second, in presence of only the two effective controls. After that, we re-estimate those models incorporating seven other covariates chosen based on the past empirical literature and our conjecture about the conflict problem in the Latin American region. The signs of the parameter estimates reflect our conjecture about the covariates, for instance, an estimate with a positive sign will denote that the covariate positively influences conflict process. In reporting of results, we tabulate the percentage of times these models show correct results in terms of prediction categories. Greene (2000) mentions that reporting of results from ordinal models generally ignore the direction of change of the dependent variable from the underlying model estimation although this issue may represent model validation. We, therefore, for the first time, include the correct prediction results in our analysis addressing the model validity issue.
Markov Switching Analysis

The Markov switching specification has a dual use in this study. First, the specification can aid in measuring the extent that particular conflict intensity in period $t$, either high or low, affects the probability that the country will be in a particular state, of either high or low conflict, in period $t+1$. Therefore, using this technique, we address the question of persistence of past conflict intensity on current conflict intensity, as identified and debated in the existing empirical literature. The second use of a Markov switching specification is in analyzing how existing conflicts interact with other economic and socio-political variables to determine the future probability of initiating conflicts. In that case, the basic objective is to identify factors that determine transition from one state of conflict at time period $t$ to either remain in that state at time period $t+1$ or to revert to another state at time period $t+1$. For the present analysis, we assume that any country is experiencing two states at all times, namely, “domestic conflict” or “no domestic conflict or peace”. Domestic conflict at time period $t$ is determined by the occurrences of conflict (i.e., it is taking the value 1) in time period $t$. Therefore, no domestic conflict in period $t+1$ is determined by a value of 0 (i.e., no conflict occurrences) in period $t+1$. Since, both cannot occur together at the same period, these events are mutually exclusive from a statistical viewpoint. We denote conflict in period $t$ by $C_t$ and no conflict in period $t$ by $N_t$. Taking a first-order Markov process, initially we look for the past periods’ influence on current periods’ conflict process.

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20 Though the sample data are categorized into four different intensities, we replace the higher intensity categories with only one category to indicate that there is conflict.
Let $\phi_{ij}$ be the conditional probability that the country is in state $i = C, N$ in period $t$ and in state $j = C, N$ in period $t+1$. The $(2\times2)$ transition probability matrix between the economy’s state in period $t$ and $t+1$ is therefore:

$$
\begin{bmatrix}
\Pr(C_{t+1} | C_t) & \Pr(N_{t+1} | C_t) \\
\Pr(C_{t+1} | N_t) & \Pr(N_{t+1} | N_t)
\end{bmatrix} = 
\begin{bmatrix}
\phi_{CC} & \phi_{CN} \\
\phi_{NC} & \phi_{NN}
\end{bmatrix} \tag{5}
$$

where $\Pr$ denotes probability and each row of the above transition matrix sums to 1. Therefore, this $(2\times2)$ Markov transition matrix only requires us to estimate two parameters as $\phi_{CN} = 1 - \phi_{CC}$ and $\phi_{NN} = 1 - \phi_{NC}$. Let, $n_{ij}$ be the number of occurrences of state $i$ in period $t$ and in state $j$ in period $t+1$, and let $n_i$ be the number of occurrences of state $i$ in period $t+1$, so that for the $(2\times2)$ Markov matrix, $n_{CC} + n_{CN} = n_C$ and $n_{NC} + n_{NN} = n_N$.

The log-likelihood function, $\ln(L)$ for the $(2\times2)$ Markov process can be written as follows:

$$
\ln(L) = n_{CC} \ln(\phi_{CC}) + n_{CN} \ln(1-\phi_{CC}) + n_{NC} \ln(1-\phi_{NC}) + n_{NN} \ln(\phi_{NN}) \tag{6}
$$

and the corresponding maximum likelihood estimators of the probabilities are

$$
\hat{\phi}_{CC} = \frac{n_{CC}}{n_C}, \quad \hat{\phi}_{NN} = \frac{n_{NN}}{n_N},
$$

that is the corresponding sample proportions on the number of transitions.

For the joint determination of domestic conflict and economic and socio-political variables, we approach through building from the simple case of joint occurrence of conflict and trade openness. Thereafter, we incorporate other socio-political and
economic variables to analyze the joint determination of domestic conflict. In what follows, we are looking at the joint determination of domestic conflict and various measures of trade openness. The basic purpose here is to analyze how trade openness (domestic conflict) affects the future probability of starting conflicts (trade openness). Therefore, the interest lies in determining how conflict is jointly affected by trade openness and vice versa. Take first the case of jointly determining the probability of domestic conflict, $C_{t+1}$ and trade openness, $O_{t+1}$. Say, state 1 denotes joint occurrence of domestic conflict, $C_{t+1}$ and trade openness, $O_{t+1}$; state 2 denotes joint occurrence of domestic conflict, $C_{t+1}$ and no trade openness or autarky, denoted by $A_{t+1}$; state 3 denotes joint occurrence of no domestic conflict or peace, $N_{t+1}$ and trade openness, $O_{t+1}$ and state 4 denotes joint occurrence of no domestic conflict or peace, $N_{t+1}$ and no trade openness or autarky, $A_{t+1}$. Then, one can find the probabilities of domestic conflict occurrence conditioned either on only trade and openness variables or after taking care of other covariates in addition to the trade and openness variables. Therefore, after conditioning, we re-estimate a $(2 \times 2)$ transition matrix of probabilities, where elements, $\phi_{ij}$ for $i, j = 1, 2$ specify transitions from state $i$ in period $t$ to state $j$ in period $t+1$. The Markov transition matrix and the maximum likelihood estimates for the $(2 \times 2)$ matrix follow the probability matrix presented above.

In the appendix tables, we report the estimated $\phi_{CC}$, $\phi_{NC}$ and $\phi_{NN}$ coming both from models involving only trade and openness variables as well as models incorporating other socio-political and economic variables in addition to the openness and trade variables.
Cox Proportional Hazard Model

Unlike the above mentioned ordinal regression and Markov switching models, which look at the factors responsible for domestic conflict occurrence and changes in its intensity, the Cox proportional hazard model addresses “duration” or “survival” ability of conflicts based on certain explanatory variables or covariates. Here, we take the number of years, as the time that the conflict process itself will survive. As far as the “status variable” goes, we take $Plrg$ that is the political rights variable as the benchmark point, with the value of 1 denoting the highest level of political rights and democracy, and that signifies stability of the system.

Denoting “spell length”, i.e., different duration variables for measurement as $T$, one can interpret that the probability that the spell of length of conflict will be at least “$t$” as “survival function”, with the form:

$$C(t) = 1 - F(t) = \text{Prob}(T \geq t) \quad (7)$$

where,

$$F(t) = \int_0^t f(c)dc = \text{Prob}(T \leq t) \quad (8)$$

The “hazard rate” then becomes the rate at which conflict spells are completed after duration $t$, given that they last at least until $t$. The “hazard function” therefore tries to answer the query that given the conflict spell has lasted until time $t$, what is the probability that it will end in the next short interval of time.

This looks like:

$$\lambda(t) = -d \ln C(t)/dt \quad (9)$$
After making these adjustments, we have estimated ten different models with only trade and openness variables and the same ten models with additional covariates being added into the original models for conflict survival process. For estimation purposes, we use Cox’s (1972) partial likelihood estimation method. The model specifies that:

\[ \lambda(t_i) = \exp \left( -\beta' x_i \right) \lambda_0(t_i) \]  

(10)

where the function \( \lambda_0 \) is the “baseline” hazard, which needs to be estimated. As Cox’s partial likelihood estimator is employed here, therefore, one needs to estimate only \( \beta \), and not \( \lambda_0 \). Note that this estimator removes individual covariate specific heterogeneity in the sample. This works in the following way. Suppose that the sample contains \( K \) distinct exit times from conflict, \( T_1, \ldots, T_K \). For any time \( T_i \), the risk set \(^{22}\) denoted \( R_i \), is all countries whose exit time is at least \( T_i \). The risk set is defined with respect to any moment in time \( T \) as the set of countries that have not yet exited from conflict prior to that time. For every country \( j \) in risk set \( R_i \), \( t_j \geq T_i \). The probability that a country exits at time \( T_i \) given that exactly one country exits at this time is:

\[ \Pr ob \left[ t_j = T_i \mid R_i \right] = \exp \left( \beta' x_i \right) / \sum_{j=1}^{R} \exp \left( \beta' x_j \right) \]  

(11)

In appendix tables, we show parameter values of this estimated \( \beta \). Note that, now negative \( \beta \) denotes a situation where the “hazard of conflict” is going to increase and positive \( \beta \) represents a scenario that dampens the conflict survival probability. We also look at the level of significance and the odds ratios from individual covariates to

\(^{21}\) A later version of that technique is also used by Raknerud and Hegre (1997) and Collier, Hoeffler and Soderbom (2001) addressing the conflict survival question.

\(^{22}\) For our purpose, it means, those countries still “at risk” of conflict at time \( T_k \).
conclude about the survival probability of domestic conflict. Odds ratios hovering around one signifies more risk of the event happening as a result of the explanatory factor.

**Empirical Results and Discussions**

**Results from Panel of Countries: Initiation and Sustenance Issues of Trade and Openness Variables**

We report two sets of results in the first appendix, one with all control variables (reported with *All Controls* in the table heading), and another with only effective controls (denoted by *Effective Controls*), i.e., *Lual* and *Landlock*. The choice of effective control is determined by the level of significance for these variables. Tables 1, 2, 6 and 7 in the first appendix report estimation results from proportional ratio (i.e., the ordinal model, denoted by *OM* in the rest of the paper), response category probabilities from the ordinal models, and proportional hazard models (denoted by *CM* in the rest of the paper) involving all the controls, respectively. Tables 3, 4 and 8 report the same results involving effective controls. Table 5 reports results from Markov switching models (denoted by *MS* for the rest of the paper). The last three rows in tables 1 and 3 contain the number of valid observations, Cox and Snell pseudo $R^2$, and -2 log-likelihood information criteria addressing issues of model fit and validity. The last two rows of tables 6 and 8 have the number of valid observations and -2 log-likelihood information criteria. Model 10 in all tables contains the six trade variables in the present sample. Similarly, for all the tables, model 9 has both export and import variables, model 8 has all the export variables and model 7 has all the import variables in the sample. The rest 6 models in the tables incorporate each of the six trade and openness variables in our

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23 Markov switching analysis is carried out for those countries where there is both conflict and no-conflict within the time frame. As a result, some countries are not included as they do not show any conflict within the sample period. We have done this check separately from this truncated sample without imposing any controls, the results of which are available upon request.
sample, viz., total value of exports and imports as a percentage of GDP, denoted by $Open$ (model 1); agricultural exports as a part of total exports, denoted by $Ag$ (model 2); food, beverages and tobacco exports as a proportion of total exports, denoted by $Fbtex$ (model 3); basic materials exports, denoted by $Bmeex$ (model 4); fuel imports as a percentage of total imports, represented by $Fuim$ (model 5) and food and beverages import, denoted by $Fbim$ (model 6).

Overall, imposing all controls (see table 1) and effective controls (see table 3), agricultural exports as a proportion of total exports show moderate to high conflict initiation probabilities (0.22 from $OM2$ in tables 2 and 4 and 0.56 from $MS2$ in table 5), but high conflict sustenance probability as the odds ratio becomes 0.98 from $CM2$ in tables 7 and 8. Models 8, 9 and 10, which include agricultural exports as one explanatory or conditional variable, also show moderate to high conflict initiation probabilities from ordinal regressions (0.22 on average for these three models) and Markov switching modeling techniques (with probabilities of conflict initiation ranging from 0.52 to 0.60 for these three models). However, conflict sustenance results for these models from tables 7 and 8 show high overall odds ratio (ranging from 0.92 to 0.98), pointing to the fact that interaction with other trade and openness variables takes various different scenarios with some enhancing and some mitigating conflicts for the sampled countries in this region. For instance, food, beverages and tobacco exports as a percentage of total exports shows moderate to high conflict mitigation probabilities (as the corresponding signs from tables 1 and 3 is now negative) from the ordinal and Markov switching models (0.23 from $OM3$ in tables 2 and 4 and 0.63 from $MS3$ in table 3) and high conflict mitigation probabilities over the years from the cox proportional models (with the odds ratios either close to or
more than 1 in models 8, 9 and 10 for food, beverages and tobacco exports variable in tables 7 and 8). On the other hand, fuel imports as a percentage of total imports clearly shows moderate to high conflict initiation probabilities from the ordinal and Markov switching models (0.23 from OM5 in tables 2 and 4 and 0.59 from MS5 in table 5) and high conflict sustenance probabilities from the cox proportional techniques with odds ratio taking almost 0.90 on average for four models (CM5, CM7, CM9 and CM10) in tables 7 and 8, where this variable is used as a covariate. Therefore, overall results support conjectures from Garfinkel et al.’s (2004) model, where relative prices of traded goods play important role to either abet or initiate conflict. These empirical results also show their explanatory powers in sustaining domestic conflicts overtime. As can also be seen from these tables, arable land area as a proportion of total land area and landlocked region emerge as the most significant and consistent controls with all the right signs to explain both the occurrence and sustenance issues of domestic conflict.

Results from tables 1 and 3 show that agricultural exports as a part of total exports remain significant and positive for all the four models (OM2, OM8, OM9 and OM10), depicting a positive relationship with domestic conflict. Openness, which includes overall levels of exports and imports as a percentage of GDP, reduces conflict. Taking all exports variables (model 8), we find that agricultural exports and basic metal exports as a proportion of total exports increase domestic conflict after imposing all the controls, but not so if we only impose Lual and Landlock. We get similar results for fuel imports too, when we used it together with other export and import variables in model 10. In terms of model fitting information, we find that model 10 is the best for both the tables; however, number of valid observations is also the lowest in this case. Tables 2 and 4 report
estimated cell probabilities for various conflict categories (denoted by categorical values of $c$) from the above ordinal regression models involving openness variables. The last rows of these tables also contain percentage of times these models show correct results in terms of prediction categories. Model 7 with all controls (table 2) and model 3 with effective controls (table 4) show the best results in correctly predicting different categories of conflict in percentage terms. Table 5 reports Markov switching results from state of conflict to state of peace based on underlying openness and trade variables movement. Individual agricultural exports variable (see $MS2$ for reference) remains significant in explaining switchover from no conflict stage to conflict stage next period (with a probability of 0.56, coming from $\phi_{0c}$, i.e., $1-\phi_{NN}$). Models involving all trade and openness variables, $MS8$, $MS9$ and $MS9$ show higher incidence of domestic conflict next period if there is conflict in previous periods. Therefore, trade and openness variables play important role to explain conflict initiation, with the probabilities ranging from 0.52 to 0.60 for the above three models. Tables 6 to 8 report the survival issues or duration of conflicts explained by the above mentioned trade and openness variables in this region. $OR$ denotes odds ratio coming from these explanatory variables or covariates. From both cases involving all and effective controls, openness variable loses explanatory power as compared to the agricultural exports variable. From table 8 with effective controls, agricultural exports and fuel imports remain significant in escalating conflict over the years. Taking all controls, from table 6, agricultural exports remain weakly significant in explaining conflict duration and food, beverages and tobacco exports remain very significant in explaining conflict mitigation. These findings are consistent with the results from table 1.
The above findings may tally with Garfinkel et al.’s (2004) conjecture. With the domestic market opening up for trade, Latin American countries identify their comparative advantage in agricultural goods production. That influences prices of these tradables as compared to the autarkic price of these goods when there was no trade. As prices of these tradables increase, returns from resources used to produce these goods also go up. Consequently, grabbing these resources become beneficial for the parties engaged in production of those tradable goods. This process will lead to a start of conflict or can transfer one existing conflict from a low intensity to high intensity one.

**Results from Panel of Countries: Robustness of Trade and Openness Variables**

Tables 9, 10, 14 and 15 report robustness results from ordinal models, response categories for ordinal models, Cox proportional techniques and odds ratio from the cox model in presence of all controls. Tables 11, 12, 16 and 17 report the same results for models involving effective controls. Markov switching probabilities are reported in Table 13. The robustness checks are done in the following general-to-specific way. We take the individual trade variables models (models 1 to 5), all import variables (model 7), all exports variables (model 8), all imports and exports variables (model 9) and all the openness and trade variables (model 10) and add seven other explanatory variables (as well as controls) based on our earlier discussion about their relevance and validity. Then we drop the insignificant ones from our analysis and report significant and consistent results.

Overall results from all these nine tables after adding covariates as identified earlier show some interesting features. For example, agricultural exports as a proportion of total exports now has the same conflict initiation probabilities from ordinal model (0.22 from
OM2 in tables 10 and 12) as like in tables 2 and 4 earlier. Markov switching result now show a lower conflict initiation probability in comparison to earlier scenarion with no extra covariates (0.49 from MS2 in table 13 as compared to 0.56 from MS2 in table 5 earlier). Conflict sustenance results incorporating agricultural exports as a proportion of total exports as a covariate however show marginal improvements in tables 15 and 17 with the average odds ratio for four models (CM2, CM8, CM9 and CM10) show almost 1 as compared to average odds ratio of almost 0.9 for those models in tables 7 and 8. Similarly, for other models involving all the openness and trade variables (models 8, 9 and 10 in all these tables) also replicate the above trend coming out from the agricultural export variable. As compared to initiation and sustenance results in tables 2, 4, 7 and 8, now the initiation and sustenance results in tables 10, 12, 15 and 17 with additional covariates point that food, beverages and tobacco exports as a percentage of total exports can now better explain conflict mitigation. These findings show that other explanatory variables do have significant roles to play for initiating and sustaining domestic conflicts for the sampled countries in our study. However, what remains important is the fact that, in presence of seven other economic and socio-political covariates, these trade and openness variables can retain their explanatory powers for domestic conflict initiation.

Looking at the results in tables 9 and 11, agricultural exports as a percentage of total exports remain significant, positive and report better performance than the earlier scenario with no additional covariates. Similarly, food, beverages and tobacco exports show better explanatory power in conflict mitigation. Sustenance issue involving agricultural exports now has mixed performance (look at tables 14 and 16). In presence of all controls, agricultural exports is not significant in explaining sustained conflict, but
it is significant in explaining conflict duration when effective controls are used (see \textit{CM9} and \textit{CM10} in table 16). Overall openness shows conflict mitigation as like model 1 in tables 1 and 3, but is not effective in explaining conflict sustenance over time. All imports model (\textit{OM7}) show that food and beverages import mitigates conflict. All imports and exports model (\textit{OM9}) and all openness and trade variables model (\textit{OM10}) point to robustness of two export variables, agricultural exports and food, beverages and tobacco exports, though the first one is instigating and the second one is abetting conflict. Among other explanatory variables across all models, GDP per capita growth, secondary school enrollment, socio-political index, political rights index, rural population as a proportion of total population as well as rural population growth show correct signs with various degrees of significance levels across all models.

Tables 10 and 12 report estimated cell probabilities for various categories of conflicts from the ordinal models with additional variables added as covariates. As like tables 2 and 4, following Greene (2000), we also report the correct direction of change predictions. Direction of change results show that \textit{OM5} performs the best. Models involving agricultural exports and other exports variables (\textit{OM2}, \textit{OM8} and \textit{OM9}), apart from other covariates, especially rural population as a percentage of total population and socio-political index also show higher level of correct prediction probability with right signs. From the estimated conflict categories, these models also report higher medium category of conflict (denoted by $c = 2$) than the low level (denoted by $c = 1$) signaling that conflict initiation can be explained by over-reliance on exports variables apart from adverse socio-political scenario and increased concentration of rural population vis-à-vis total population.
Tables 14 and 16 do not report political rights, as we control that to attain stability of the models in the long run. From table 16, agricultural exports as a percentage of total exports show consistent survival probability for models 9 and 10, where it is estimated with other export and import variables. As compared to table 6, now food, beverages and tobacco exports show consistent survival results with correct signs for all control model. Fuel imports show positive feedback to conflict survival process in two out of four models where it is used as a covariate in presence of all the controls. Overall openness variable loses the relevance in explaining conflict over time in comparison to tables 6 and 8 results earlier. Table 14 also points that growth rate of per capita GDP (Gpcg) is not very consistent in explaining conflict over the years in presence of all the controls. Similarly, socio-political index, in presence of all controls, is not able to explain conflict sustenance in a convincing way. These results point that the trade variables, especially agricultural exports as a percentage of total exports and fuel imports as a percentage of total imports remain very significant in explaining conflict survival over the years. From these robustness results, it is true that other economic and socio-political covariates can explain various degrees of conflicts. However, trade variables, in particular, agricultural exports and fuel imports, matter the most in analyzing domestic conflicts in the long run.

**Concluding Remarks**

To explain domestic conflict in Latin America between 1973 and 1995, we rely on a plausible channel of the prices of trade variables as proposed in Garfinkel, Skaperdas and Syropoulos (2004). The existing literature on domestic and international conflict pays attention either to the world countries or the African region to explain various reasons behind conflicts. However, as Sambanis (2004) points out, much attention is needed
towards region-specific domestic conflict analysis as the regions differ on various socio-political and economic aspects. In accordance to that, we try to answer one research question regarding domestic conflicts in Latin America. In general, after opening up their domestic markets to participate more in world trade from the mid-eighties, there is a significant drop in domestic conflict in the Latin American region. Therefore, apparently, trade may be beneficial in mitigating conflict. However, the issue may lead to over-reliance on primary commodities exports which may actually enhance domestic conflicts, as is happened in the African countries after they started interacting with world markets. Naturally, careful attention is needed to track down the reasons that may initiate, enhance and endure domestic conflicts even after more participation in the world market. Garfinkel et al. (2004) provide such an analytical, general framework with price of the tradable resource playing the most important role in explaining domestic conflict over that resource. From an empirical perspective, it is difficult to track down the relative prices of resources as proposed in their framework. Therefore, we use an indirect approach of taking the level of tradable goods’ output and relate that with the prices or returns to the resources needed to produce those goods. The idea is that as a country opens up to world trade, the prices of exportables and importables change depending on whether that country has a comparative advantage in some of the exportables being produced or comparative disadvantages from some of the importables being shipped into that country. There is strong evidence that Latin American countries have comparative advantage in agricultural goods exports. For some of the countries in the region, opening up to trade reduces the relative price of agricultural goods even below that price level under autarky, which helps to mitigate conflict, as argued in the Garfinkel et al. (2004)
framework. On the other hand, some of the countries in the sample show that agricultural goods prices actually go up beyond the international level and that lead to a increase in conflict. In this study, we also go beyond Garfinkel et al.’s (2004) essentially static framework and explore how trade and openness variables play a role for sustaining conflicts overtime in the Latin American region within the selected time frame. Employing panel ordinal technique and Markov switching analysis, we find that agricultural export as a percentage of total exports play one important role for conflict occurrences in this region, even if after controlling for various socio-political and economic factors that the literature already identified to explain domestic conflicts. Our results also point that overall trade openness reduces Latin American domestic conflict. However, the sustenance issue, explained through cox proportional analysis shows that only over reliance on agricultural exports has the capacity to explain domestic conflict overtime in the Latin American countries, and not the trade openness. Therefore, even if overall trade openness is beneficial for abetting conflicts, it’s role overtime conflict mitigation is minimal. Instead, one needs to put more focus on the optimal reliance of agricultural exports for conflict resolution. As is explained in the Garfinkel et al. (2004) framework, the relative price may play one important role in that aspect. Therefore, future research will be focused on these lines, apart from the underlying socio-political scenario to analyze domestic conflicts.
References


### Table 1. Openness Variables: Regression Results, Full Sample, with All Controls

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<td>11.98*** (2.46)</td>
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<td>0.19** (0.05)</td>
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<td>0.07 (0.11)</td>
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<td>-0.49 (1.22)</td>
<td>-2.21*** (1.26)</td>
<td>-1.27 (1.26)</td>
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<td>360</td>
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<td>296</td>
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<td>490.62</td>
<td>384.09</td>
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</table>
Notes for Table 1: (i) *** denotes 1 percent, ** denotes 5 percent and * denotes 10 percent level of significance. (ii) Obs. denotes number of valid observations in each model estimation. (iii) Pseudo $R^2$ denotes Cox and Snell value of Pseudo $R^2$. (iv) $-2LL$ denotes $-2$ Log Likelihood values of final models with intercepts.

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<th>OM7</th>
<th>OM8</th>
<th>OM9</th>
<th>OM10</th>
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<td>0.055</td>
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<td>$c = 3$</td>
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<td>0.114</td>
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<td>0.114</td>
<td>0.104</td>
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<tr>
<td>Right Pred.</td>
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<td>74.42</td>
<td>69.82</td>
<td>74.42</td>
<td>74.72</td>
<td>74.68</td>
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<td>68.03</td>
<td>62.56</td>
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Notes for Table 2: (i) $c$’s denotes different categories of conflict. (ii) Right Pred. reports the correct in-sample predictions in different categories of conflicts in percentage terms.
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<th>OM8</th>
<th>OM9</th>
<th>OM10</th>
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<td></td>
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<td>-3.38*** (0.87)</td>
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<tr>
<td><strong>Ag</strong></td>
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<td>0.05*** (0.01)</td>
<td></td>
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<td>0.05*** (0.01)</td>
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<td>0.05*** (0.01)</td>
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<td>0.05*** (0.01)</td>
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</tr>
<tr>
<td><strong>Fbtex</strong></td>
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<td>-0.04*** (0.02)</td>
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<td></td>
<td>-0.04* (0.03)</td>
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<td>-0.04** (0.03)</td>
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<tr>
<td><strong>Bmeex</strong></td>
<td></td>
<td></td>
<td>-0.04** (0.02)</td>
<td></td>
<td>0.01 (0.01)</td>
<td>0.01 (0.01)</td>
<td>0.01 (0.02)</td>
<td>0.02 (0.03)</td>
<td>-0.15** (0.08)</td>
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<tr>
<td><strong>Fuim</strong></td>
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<td></td>
<td></td>
<td>0.01 (0.01)</td>
<td></td>
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<tr>
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<td></td>
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</tr>
<tr>
<td><strong>Lual</strong></td>
<td>0.09*** (0.03)</td>
<td>0.14*** (0.03)</td>
<td>0.15*** (0.03)</td>
<td>0.13*** (0.03)</td>
<td>0.14*** (0.03)</td>
<td>0.14*** (0.03)</td>
<td>0.16*** (0.04)</td>
<td>0.17*** (0.04)</td>
<td>0.14*** (0.04)</td>
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</tr>
<tr>
<td><strong>Lock</strong></td>
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<td>1.80*** (0.59)</td>
<td>1.56*** (0.58)</td>
<td>1.56*** (0.58)</td>
<td>1.55*** (0.82)</td>
<td>3.74*** (0.82)</td>
<td>3.72*** (0.82)</td>
<td>1.87*** (0.86)</td>
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<td><strong>Obs.</strong></td>
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<td>344</td>
<td>372</td>
<td>360</td>
<td>373</td>
<td>373</td>
<td>373</td>
<td>330</td>
<td>328</td>
<td>296</td>
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<tr>
<td><strong>Pseudo $R^2$</strong></td>
<td>0.083</td>
<td>0.191</td>
<td>0.097</td>
<td>0.092</td>
<td>0.076</td>
<td>0.076</td>
<td>0.076</td>
<td>0.240</td>
<td>0.243</td>
<td>0.308</td>
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<td><strong>−2LL</strong></td>
<td>544.18</td>
<td>430.97</td>
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<td>538.98</td>
<td>407.87</td>
<td>406.12</td>
<td>337.05</td>
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</table>

**Notes for Table 3:** (i) *** denotes 1 percent, ** denotes 5 percent and * denotes 10 percent level of significance. (ii) **Obs.** denotes number of valid observations in each model estimation. (iii) **Pseudo $R^2$** denotes Cox and Snell value of Pseudo $R^2$. (iv) **−2LL** denotes −2 Log Likelihood values of final models with intercepts.
Table 4. Response Category Probability: Ordinal Regression, Full Sample, with Effective Controls

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<tr>
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<td>c = 0</td>
<td>0.746</td>
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<td>0.044</td>
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<td>0.061</td>
<td>0.063</td>
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<tr>
<td>c = 3</td>
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<td>0.112</td>
<td>0.106</td>
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<td>Right Pred.</td>
<td>68.54</td>
<td>68.54</td>
<td>74.68</td>
<td>70.84</td>
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<td>72.89</td>
<td>73.15</td>
<td>65.47</td>
<td>65.22</td>
<td>60.87</td>
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Notes for Table 4: (i) c’s denotes different categories of conflict. (ii) Right Pred. reports the correct in-sample predictions in different categories of conflicts in percentage terms.

Table 5. Openness Variables: Markov Switching Probabilities

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<td>0.860</td>
<td>0.850</td>
<td>0.915</td>
<td>0.878</td>
<td>0.931</td>
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<tr>
<td>(\phi_{NC})</td>
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<td>0.564</td>
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<td>0.594</td>
<td>0.609</td>
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<td>0.599</td>
<td>0.520</td>
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<td>(\phi_{NN})</td>
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<td>0.306</td>
<td>0.406</td>
<td>0.391</td>
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Notes for Table 5: (i) \(\phi_{CC}\) denotes conflict in period “t+1” if there was conflict in period “t”. (ii) \(\phi_{NC}\) denotes conflict in period “t+1” if there was no conflict in period “t”. (iii) \(\phi_{NN}\) denotes conflict in period “t+1” if there was no conflict in period “t”.
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<td>Fbtex</td>
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<tr>
<td>Fuim</td>
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<tr>
<td>Lual</td>
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<td></td>
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<tr>
<td>Lgini</td>
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<td>22.64*** (6.08)</td>
<td>38.03*** (8.85)</td>
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<tr>
<td>Elev.</td>
<td>-0.09 (0.13)</td>
<td>0.06 (0.13)</td>
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<td>-0.12 (0.16)</td>
<td>0.38*** (0.15)</td>
<td>0.18 (0.21)</td>
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<tr>
<td>Elf</td>
<td>-10.34*** (3.96)</td>
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<td>-24.28*** (6.23)</td>
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<td>-3.01*** (0.86)</td>
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</table>
Notes for Table 6: (i) *** denotes 1 percent, ** denotes 5 percent and * denotes 10 percent level of significance. (ii) Obs. denotes number of valid observations in each model estimation. (iii) Pseudo $R^2$ denotes Cox and Snell value of Pseudo $R^2$. (iv) $-2LL$ denotes $-2$ Log Likelihood values of final models with intercepts.

Table 7. Openness Variables: Odds Ratio, Full Sample, with All Controls

<table>
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Notes for Table 7: (i) OR represents Odds Ratio from different models.
Table 8. Openness Variables: Proportional Model Results and Odds Ratio, Full Sample, with Effective Controls

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Notes for Table 8: (i) *** denotes 1 percent, ** denotes 5 percent and * denotes 10 percent level of significance. (ii) OR represents Odds Ratio from different models. (iii) Obs denotes number of valid observations in each model estimation. (iv) –2LL denotes –2 Log Likelihood values of final models with intercepts.
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**Notes for Table 9:** (i) *** denotes 1 percent, ** denotes 5 percent and * denotes 10 percent level of significance. (ii) Obs. denotes number of valid observations in each model estimation. (iii) Pseudo R^2 denotes Cox and Snell value of Pseudo R^2. (iv) –2LL denotes –2 Log Likelihood values of final models with intercepts.
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**Notes for Table 10:** (i) $c$ 's denotes different categories of conflict. (ii) *Right Pred.* reports the correct in-sample predictions in different categories of conflicts in percentage terms.
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Table 11. Openness Variables with Covariates: Ordinal Regression Results, Full Sample, with Effective Controls (continued)

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Notes for Table 11: (i) *** denotes 1 percent, ** denotes 5 percent and * denotes 10 percent level of significance. (ii) Obs. denotes number of valid observations in each model estimation. (iii) Pseudo $R^2$ denotes Cox and Snell value of Pseudo $R^2$. (iv) $-2LL$ denotes $-2$ Log Likelihood values of final models with intercepts.

Table 12. Response Category Probabilities from Robustness Regression: Full Sample, with Effective Controls

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Notes for Table 12: (i) $c$’s denotes different categories of conflict. (ii) Right Pred. reports the correct in-sample predictions in different categories of conflicts in percentage terms.
Table 13. Openness Variables with Covariates: Markov Switching Probabilities

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Notes for Table 13: (i) $\phi_{CC}$ denotes conflict in period “$t+1$” if there was conflict in period “$t$”. (ii) $\phi_{NC}$ denotes conflict in period “$t+1$” if there was no conflict in period “$t$”. (iii) $\phi_{NN}$ denotes conflict in period “$t+1$” if there was no conflict in period “$t$”.
### Table 14. Openness Variables with Covariates: Proportional Model Results, Full Sample, with All Controls

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Table 14. Openness Variables with Covariates: Ordinal Regression Results, Full Sample, with All Controls (continued)

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Notes for Table 14: (i) *** denotes 1 percent, ** denotes 5 percent and * denotes 10 percent level of significance. (ii) $Obs.$ denotes number of valid observations in each model estimation. (iii) $Plrg$ is the status variable in all of the above model estimation procedure. (iv) $-2LL$ denotes $-2$ Log Likelihood values of final models with intercepts.
### Table 15. Openness Variables with Covariates: Odds Ratio, Full Sample, with All Controls

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Notes for Table 15: (i) OR represents Odds Ratio from different models. (ii) Plrg is the status variable in all of the above model estimation procedure.
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Notes for Table 16: (i) *** denotes 1 percent, ** denotes 5 percent and * denotes 10 percent level of significance. (ii) Obs. Denotes number of valid observations in each model estimation. (iii) Plrg is the status variable in all of the above model estimation procedure. (iv) –2LL denotes –2 Log Likelihood values of final models with intercepts.

Notes for Table 17: (i) OR represents Odds Ratio from different models. (ii) Plrg is the status variable in all of the above model estimation procedure.

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