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The Nexus Between Conflict, Trade Openness, and Economic Growth: Evidence from Developing Countries Using Driscoll–Kraay Standard Errors

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	Abstract
<p>Hajra Amber Department of Economics, Lahore Leads University, Lahore, Pakistan</p> <p>Muhammad Ghulam Shabeer Assistant Professor, Department of Economics, Akhuwat Institute kasur, Pakistan Email: imgshabeer@gmail.com</p> <p>Hafiz Muhammad Qasim* Assistant Professor, Department of Economics, Akhuwat Institute kasur, Pakistan Email: hmq.economist@gmail.com</p>	<p>This study examines how conflict and trade influence economic growth in developing countries. It uses panel data for 96 countries across Asia, Africa, and Latin America over the period 1982 to 2024. The analysis applies panel data techniques, including pooled OLS, fixed effects, and random effects models. Model selection tests support the fixed effects specification. Diagnostic tests detect autocorrelation and heteroskedasticity. To address these issues, the study employs Driscoll and Kraay standard errors to obtain robust estimates. The results show a consistent negative relationship between military expenditure and economic growth. Higher military spending reduces both GDP and national income. In contrast, trade openness and merchandise exports are positively associated with growth. Physical capital and secondary school enrollment also contribute positively. The findings suggest that conflict diverts resources away from productive activity, while trade integration supports expansion through market access and specialization. Policies that limit unproductive military spending, strengthen institutions, and promote trade and investment can help sustain growth in developing economies.</p>
<p>Keywords:</p>	<p>Conflict, Trade, Economic Growth, Panel Data Econometric Analysis.</p>



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Introduction

African countries suffering with conflict from 80's i.e. internal conflicts and external conflicts. Approximately more than 35 armed conflicts have been done by African Countries. Africa is the second largest continent consisting of 54 regions having 1.216 billion of the population. According to the Marx in 19th century proposed his conflict theory which explains the fight over limited resources in nations among groups causes conflict. Due to the scarcity of resources and unavailability of the food leads the African countries toward the conflict (Mazrui, 2003). The main reasons of the conflict in African countries are poverty, unavailability of food, corruption, political instability (Annan, 2014).

Asia is the largest continent of the world, containing 48 countries. In Asian countries, most of the countries facing conflicts i.e. Afghanistan, India, Pakistan, Sri-Lanka. Due to the religious tension, ethnic tension, political instability, unemployment and less resource availability the conflict takes place in the continent (Cooper, 1994).

Latin America consisting of 33 countries and some of the countries of the continent faced conflict i.e. Civil conflicts and armed conflicts. The continent fight over the corruption, access to the better education, crime and drugs (Levine, 1986).

The study probes the relationship between conflict, trade and economic growth. As the previous studies confirm the negative relation between Economic growth and conflict (Collier & Hoeffler, 1998, 2004; De Groot, 2010). Conflict may be internal conflict or external conflict. By internal conflict _ means the conflict between two groups within the nation or country. While the fight between two borders of the countries is referred as external conflict (Aziz & Asadullah, 2017). Some other studies argued that military spending by government improves the economic growth by the confidence increase to investment in country. It allows foreign investors to invest (R. Barro & Sala-i-Martin, 2004; Dunne, Smith, & Willenbockel, 2005). Whereas some of the studies concluded that economic growth reduces as military expenditures by government increases (R. P. Smith, 1977).

Koubi (2005) also examines the war and economic performance in short run. According to him, the war is sinful for the growth of the country and concluded that if 10% increase in conflict in country it will decline the growth to 2.1%. And by phoenix-effect the other study explains the long-run effect of conflict on growth. In result the phoenix theory explains that the countries grow much faster in their peace time as compare to conflict period (Organski & Kugler, 1980). Possibly everyone proves the negative impact of conflict with economic growth. The one paper shows the effect of one country on neighboring countries, in result scans the negative effect on neighboring countries (Ades & Chua, 1997).

Economic growth is the main purpose of the nations. Growth models explains how capital accumulation, labor and technology increase the GDP of the countries (R. J. Barro, 1991). According to him, conflict slow down the economy by 0.01-0.13. Furthermore, high-intensity conflicts reduce economy rapidly as compare to the low-intensity conflicts. (Solomon et al., 2012). While, studies prove the trade has positively effects on the economic growth (Dollar & Kraay, 2002; Frankel & Romer, 2017; Manwa et al., 2019; Nye et al., 2002). According to Dollar & Kraay, 2002, the countries grower faster who has better institutions and trade more. The paper shows the positive impact of trade on growth with institutions.

In current study we examine the relationship between growth and conflict by using panel data having time period 1982-2024 of 96 developing countries i.e. Asian, African and Latin American countries. The empirical results are in favor of literature. By applying econometric panel data techniques i.e. Fixed Effect Model (FEM), Random Effect Model (REM), Pooled OLS, diagnostic tests prove the presence of the heteroscedasticity and auto-correlation in the model. Driscoll-Kraay standard error is used to overcome the problem of the heteroscedasticity and auto-correlation. From literature, concluded the negative impact of conflict on growth. The results show the positive impact of trade on growth while conflict affects the economy negatively.

The current paper examines the relationship between trade, conflict and growth. As its clear from literature trade grows economy positively (Dollar & Kraay, 2002; Kali et al., 2007; Kim et al., 2016). While, conflict reduces growth of the economy (Aziz & Asadullah, 2017; Collier & Hoeffler, 1998; Ray & Esteban, 2017; Starr, 2010). To test our hypothesis i.e. the trade effects the growth and conflict declines the economic growth in sample countries, we conduct the econometric techniques to prove it empirically. In current study we examine the relationship between growth and conflict by using panel data having time period 1982-2024 of 96 developing countries i.e. Asian, African and Latin American countries. By applying econometric techniques of panel data i.e. Fixed Effect Model (FEM), Random Effect Model (REM) and Pooled OLS (Greene, 2003; Gujarati & Porter, 2009) and after these estimates we use FEM with Driscoll-Kraay standard error for the significant statistical results and to overcome the problem of heteroscedasticity and auto-correlation (Driscoll & Kraay, 1998).

The present research work aims the following objectives:

To empirically investigate relationship between conflict and growth in developing countries.

To analyze the impact of conflict on trade in sample countries.

To empirically investigate the impact of conflict and trade on Economic Growth in developing countries.

This study investigates the following research questions:

Does conflict affect the Economic Growth in sample countries?

Is there exist any relationship between conflict, trade openness and Economic Growth?

Does conflict reduce Trade openness in sample countries?

This research tests the following hypotheses:

There is positive relationship between trade and economic growth in developing countries.

Conflict has negative impact on economic growth.

The conflict has negative impact on trade in developing countries.

LITERATURE REVIEW

Groot (2010) examines the impact of conflict on economic growth of neighboring countries. The paper using the panel data from 1960-2000 divided into 8 periods each period consists of 5 years. The paper shows the strongly negative effect of conflict on the effecting country and area around it by using recent data and made new type of contiguity matrix.



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Koubi et al. (2012) study explains the relationship between climate variability, economic growth and civil war. The study used the panel data from 1980-2004 for all countries. Economic growth data is collected from Penn World Table, civil conflict from UCDP/PRIO database and climate variability is measured as precipitation and temperature. Further, the study focuses the only African countries. Because African countries are agricultural base, which explains that the climate variability has no impact on civil conflict but climate affects the growth.

Solomon et al. (2012) draws a critical question about conflict that how many types of conflict and how it slow down the growth? To explain this question in paper conflict variables are drawn from correlates of war (COW) of 10 countries, time period 1970-2000. In the result growth and conflict has negative relation and it defines that conflict slows the economy. Military conflict reduces growth less than high intensity conflict.

Murdoch & Sandler, (2002) explains the civil war effects on economic growth and how civil war affected the country and the neighboring countries. Neo-classical steady growth model is used to test empirically to explain the spillover effect in long run and short run. three models derived in which 1 and 2 shows steady state growth, considered as long run period. Whereas 3 model is considered as short run model in which the internal conflicts declines the growth within countries and its neighbors.

Aziz and Asadullah, (2017) study the Post-cold war data which explains the military spending on armed conflict and its impact on economic growth. The data is collected from WDI, UCDP and Barro and Lee database. All of the developing countries short out whose data is unavailable and make a balance panel from 1990-2013. Cobb Douglas Production function is used to explain the results. Conflict has negatively related with growth. Internal conflicts effect the growth more as the external conflicts.

Adhvaryu et al. (2018) examines the conflict by taking two parties, fight over limited resources and defines that economic prosperity is a function of conflict equilibrium which depends on the neighbor resources and country resources.

Adhvaryu et al. (2021) present a model, take two parties who engaged in conflict over limited resources. Conflict equilibrium determines not only on neighbor resources but also on country resources. If the neighbor countries have rich resources drive growth than own resources.

Starr, (2010) interpret the relationship between conflict and growth in Sub-Saharan Africa by using bivariate panel vector auto-regressive model. The data is collected from WDI, Penn World and Armed Conflict dataset of time period 1960-2005, in results there exist conflict which have negative impact on growth. As Sub-Saharan Africa suffers from low level of growth due to high rate of poverty, so growth policies should be implemented.

Dollar and Kraay, (2002) suggests that the countries having institutes trade better and the countries having more export than import become more rich. Here, the impact of institutes and trade on growth are explains. Property right and rule of law effects the investors and market size determined through the population or through the access of foreign trade. Growth increases by trade and by having better institutes.

Van Tran, (2020) collected data of 66 developing countries over time period 1971-2017 to explains the relationship between trade openness and environmental quality. International trade is important for the development in any economy and trade openness increases day by day in developing countries. By using GMM estimator and environmental Kuznets curve explains the relation between trade and environment. Air pollutant is the dependent variable, CO₂ emission is the proxy of environmental quality, OP is trade openness, growth is measured by GDP and all of the data is collected from World development indicators. As increase in trade openness leads to increase in CO₂ emission. And negative sign of environmental pollutant shows that trade openness has negative impact on environment.

Acemoglu et al. (2019) arises the question that democracy causes growth in the country. By using dynamic panel model of 175 countries having time period 1960-2010 show the impact of democracy on GDP, there exist strongly positive relationship between democracy and Growth. Democracy increases the growth by encouraging investment, schooling and by doing public reforms. But in underdeveloped countries democracy is constraint on growth.

DATA AND METHODOLOGY

Chapter 3 briefly discussed the variables used in this paper and about their data sources. Furthermore, it explains the technical definitions of the variables. Theoretical framework, econometric methodology used in this study.

Data Sources

The current paper investigates the impact of conflict and trade on growth. The aims of this study is to probe correlation between trade, conflict and economic growth, by using panel data analysis in 97 developing countries, sample countries consist of three regions i.e. Asian, African and Latin American¹. To test the hypothesis, we used data of a cross-sectional unit over time, period from 1982-2024 of developing countries. The data of Economic growth, such as, Real GDP constant, Real GNI constant, Real GDP per capita, Real GNI constant have been collected from WDI². And the data of Gross fixed capital formation constant, Labor force, Total Population is also collected from WDI. Trade variables are measured by using Trade% GDP, Exports of goods and service, imports of goods and services, merchandise export current in sample countries are also collected from World Development Indicators(WDI).

Theoretical Framework.

This section round about the theories correlated with growth, trade and conflict. Enhancing the living standard of people of the country is known as Economic Growth (Jhingan, 2022). While, the purchasing and selling of the goods and services between two nations are denotes as trade (Salvatore & Salvatore, 2012). Whereas, fight over limited resources is known as conflict. (Bartos & Wehr, 2002)

Growth Theories.

The most commonly three main theories of growth. Classical's, Neo-Classical's and endogenous growth theories. Classical's economists Harrod and Domar in 1930's and 1940's argues that the growth depends on the amount of capital that is available for the investment. The rate of Capital accumulation is proportional to the rate of saving. Furthermore, there was self-reinforcement, as division of labor increases output, it induces the further division of labor then increases growth. theory based on the marginal and surplus principles. The marginal principles exhibit the rent in the national output and surplus principles explains the share between wages and profits. The model production function assumes the factors land, labor and capital, subjected to the diminishing marginal productivity due to perfectly inelasticity of land and its other variables. Malthus, 1986 introduces the three factors i.e. war, disease and shortage that would control human population that overdoes the earth carrying capacity or how many people live in the given area considered the amount of resources. Solow, 1956 and Swan, 1956 postulate that labor, capital and technology plays a vital role in the steady economic growth. Whereas



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endogenous growth model exhibits that the labor, physical capital, technology are the main factors of economic development. While, the technology (exogenous variable) enhances the productivity of labor and then increases output (N Gregory et al., 1992; Romer, 1990).

Trade Theories.

There exist four main theories of international trade. The mercantilist's Theory, Classical's theory, modern theory and the new trade theories. In 16th century, the group of men; bankers, officials, merchants, philosophers propose the theory of trade. According to them(mercantilist's) if the nation wants to become richer and powerful, they have to export more and import less. The nation has more bullions are more dominant and powerful. Mercantilists used to measure the nation's wealth by the stock of precious stones i.e. gold, silver, precious stones and coins(Salvatore & Salvatore, 2012).

Whereas the Classical's theory; absolute advantage and on comparative advantage. Smith, 1776 developed the absolute advantage theory in which he explains, the trade between two countries possible only if they both have absolute advantage in the production of one good. They both specialized in that good in which they have absolute advantage and then export it to other country who have absolute disadvantage in it.

(Ricardo, 1891) explains the theory of comparative advantage. According to him, the trade between two nations takes place when the first nation has absolute disadvantage in both commodities are less and second nation has high absolute disadvantage in both commodities. In this situation, the country produces the good in which they have less absolute disadvantage and export to the other nation and import goods in which absolute disadvantage is high.

(Bertil, 1933; Heckscher, 1919; Samuelson, 1953) postulate the theory of H-O model (Heckscher-Ohlin model). In which he suggests that the labor rich country exports the labor-intensive goods and imports a capital-intensive good. Grubel & Lloyd, (1971) developed a modern industry based theory of trade named intra-industry trade refers to the exchanging of goods belonging to same industry. Furthermore, introduce an index number 0 and 1, where 0 means no trade and 1 means perfect trade. Vernon, 1966 explains a theory of Product life cycle, in which he introduces the four stages of product; i: introduction, ii: growth, iii: maturity, iv: decline.

Conflict Theories

Conflict theories are based on four main theories, Karl Marx theory, Weber theory, feminist theory and modern theory. Marx (1818) proposed his view about conflict in which he argues that the capitalist exploit workers for their labor and don't share the fruits of these labor equally. This misuse is what permits the leading class to dominate politics and forces their philosophy to these workers of the world. Whereas, Weber put forward Karl's theory. According to him conflict based on three sources i.e. social, economic, political and religious power affects the nation and making classes into groups. (Marx and Engels 1847). Wollstonecraft (1848). But according to Modern theories societies produces differences due to inequality. Conflict only overcome through a fundamental change in societies

Model Specification

The below equations exhibits the functional relationship between conflict, trade on economic growth. To check the relationship between conflict, trade openness and economic growth, explores the growth model of endogenous presented by (Grossman & Helpman, 1990; Mankiw et al., 1992; Romer, 1990).

- lgdpcc= f (lgfcf, lmexcurr, lses, lmexp) (1)
- lgdpcc= f (lgfcf, lto, lses, lmexp) (2)
- lgdpcc= f (lgfcf, lex, lses, lmexp) (3)
- lgnic= f (lgfcf, lmexcurr, lses, lmexp) (4)
- lgnic= f (lgfcf, lto, lses, lmexp) (5)
- lgnic= f (lgfcf, lex, lses, lmexp) (6)

The econometric models of above functional forms are given below:

- $GDPc_{it} = \beta_0 + \beta_1 \lgfcf_{it} + \beta_2 \text{lmex.curr}_{it} + \beta_3 \text{ses}_{it} + \beta_4 \text{lmexp}_{it} + \varepsilon_{1it}$ (7)
- $GDPc_{it} = \alpha_0 + \alpha_1 \lgfcf_{it} + \alpha_2 \text{lto}_{it} + \alpha_3 \text{ses}_{it} + \alpha_4 \text{lmexp}_{it} + \varepsilon_{2it}$ (8)
- $GDPc_{it} = \beta_0 + \beta_1 \lgfcf_{it} + \beta_2 \text{lex}_{it} + \beta_3 \text{ses}_{it} + \beta_4 \text{lmexp}_{it} + \varepsilon_{3it}$ (9)
- $GNIc_{it} = \alpha_0 + \beta_1 \lgfcf_{it} + \beta_2 \text{lmex.curr}_{it} + \beta_3 \text{ses}_{it} + \beta_4 \text{lmexp}_{it} + \varepsilon_{4it}$ (10)
- $GNIc_{it} = \alpha_0 + \beta_1 \lgfcf_{it} + \beta_2 \text{lto}_{it} + \beta_3 \text{ses}_{it} + \beta_4 \text{lmexp}_{it} + \varepsilon_{5it}$ (11)
- $GNIc_{it} = \alpha_0 + \beta_1 \lgfcf_{it} + \beta_2 \text{lex}_{it} + \beta_3 \text{ses}_{it} + \beta_4 \text{lmexp}_{it} + \varepsilon_{6it}$ (12)

Where:

L= Natural log

α_0 and β_0 is the slop coefficients.

lgdpc_{it}= Gross Domestic Product constant

lgnic_{it} = Gross National Income constant.

lgfcf_{it}= Gross Fixed Capital Formation constant.

lmexcurr_{it} = Merchandise export (current US\$).

lses_{it} = School education secondary (% gross).

lmexp_{it} = Military expenditures (% of GDP).

lto_{it} = Trade openness.

lex_{it} = Exports.

It= cross-sectional units over time period.



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$\varepsilon_{1it}, \varepsilon_{2it}, \varepsilon_{3it}, \varepsilon_{4it}, \varepsilon_{5it}, \varepsilon_{6it}$ = Error terms used in the models.

Variable Description

This section explains about the variables used in the paper, their source and their technical definitions.

Table 3.1: List of Variables

Sr. No	Variables	Abbreviation	Description	Source
1	Gross Domestic Product constant(2015 US\$)	lgdpc	Monetary and market value of all finalized goods and services produced with in a year.	WDI
2	Gross National Income constant(2015 US\$)	lgnic	Value of all the foreign and domestic goods produces within a year.	WDI
3	Gross Fixed Capital Formation constant	lgfcf	Change in the stock of raw materials, all finished and semi-finished goods.	WDI
4	Merchandise Export current(US\$)	lmercurre	Value of goods shipping by exporter in U.S dollar.	WDI
5	Trade Openness.	Lto	$\text{ExpGSc} + \text{ImpGSc} / \text{GDP}$	WDI
6	Exports	lex	$\text{ExpGSC} / \text{GDP}$	WDI
7	Military Expenditure	Lmexp	The portion of budget spend on the army forces by nation.	WDI

Panel Data Modelling

Pooled OLS:

When conducting a panel data, the first step is to run Pooled OLS. In pooled OLS we ignore the cross sectional and time series nature of data and simple run a grand regression having same intercept for all observations by assuming that the error term is independently and identically distributed with zero mean and variance (Greene, 2003).

$$Y_{it} = \alpha_1 + Z_{it} \alpha_1 + Z_{it} \alpha_2 + \dots + Z_{itk} \alpha_k + \varepsilon_{itk} \dots \dots \dots (13)$$

Where:

i= cross – sectional units.

t = no. of countries.

Fixed Effect Model (FEM).

Fixed Effect Model (FEM) is estimated after Pooled OLS in panel data approach. In Fixed Effect Model, we simply estimate a regression of all variables by assuming that all cross-section units have its own intercept dummy variable. (Arellano, 2003; Baltagi & Baltagi, 2008; Gujarati & Porter, 2009)

$$Y_{it} = \beta_{1i} + \beta_2 Z_{it} + \beta_3 LF_{it} + \varepsilon_{itk} \dots \dots \dots (14)$$

Where:

i= cross – sectional units.

t = no. of countries.

and ε = shows error term or residual.

β_{1i} is the dummy intercept in the Fixed Effect Model as compare to Pooled OLS. The “i” on the intercept term shows the separate intercept for each variable over cross-sections not over time.

Random Fixed Effect Model (RFEM).

Random effect model is also name as error components model; in which we correct error term. In this error term is considered as random variable, where as in FEM the error term is assumes to be constant (Arellano, 2003; Greene, 2003; Gujarati & Porter, 2009). For instance; equation is:

$$C_{it} = \beta_{1i} + \beta_2 Z_{it} + \beta_3 LF_{it} + \varepsilon_{it} \dots \dots \dots (15)$$

where;

$$\beta_{1i} = \beta_1 + \varepsilon_i \dots \dots \dots (16)$$

By putting value of β_{1i} in equation 5.

$$C_{it} = \beta_1 + \varepsilon_i + \beta_2 Z_{it} + \beta_3 LF_{it} + u_{it} \dots \dots \dots (17)$$

In equation 7 there exist two stochastic terms, cross sectional as well as time series.

$$w_{it} = \varepsilon_i + u_{it} \dots \dots \dots (18)$$

Here, ε_i is the random stochastic term, with zero mean value and variance.



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Model Choice Test.

An econometrician introduces the model choice test for the selection of appropriate model in panel data. In panel data approach after estimated Pooled OLS, Fixed Effect Model (FEM) and random effect model (REM) we used a model choice test. To decide whether use random effect model or Fixed Effect Model. We estimate a “Hausman Test” and “F-test” for the model choice.

Hausman Specification Test.

Hausman Specification test is purposed by Jerry A. Hausman. Test is used to select whether Fixed Effect Model is appropriate or random effect model is the best choice for the model.

H_0 : Random Effect model.

H_1 : Fixed Effect Model.

In Hausman test the null hypothesis is random effect model (REM) and alternative hypothesis is Fixed Effect Model (FEM). If P-value is less than 0.05 reject H_0 .

F-Test / Fixed Effect Test.

F-test is also known as Fixed Effect Test. This test is used to make choice between Pooled OLS and Fixed Effect Model(FEM). The null hypothesis is Pooled OLS is best choice and alternate hypothesis is Fixed Effect Model(FEM)(Arellano, 2003; Baltagi & Baltagi, 2008; Gujarati & Porter, 2009).

P-value < 0.05, reject H_0

Diagnostic Tests

In this section different diagnostic tests are explaining that are used in the paper to diagnose the robustness. Diagnostic test checks the Heteroscedasticity, autocorrelation or serial correlation (Arellano, 2003; Gujarati & Porter, 2009).

Wooldridge Test for Serial Correlation

Wooldridge test was proposed by (Drukker, 2003; Wooldridge, 2002). The main assumption of OLS is the absence of serial correlation between error terms and the independent variables. So, to overcome the serial correlation issue in panel data model we use Wooldridge Test.

Hypothesis Testing:

H_0 : No Serial Correlation.

H_1 : Serial Correlation.

In this test null hypothesis is there exist no serial-correlation in the model and alternative shows there is serial-correlation in the model. For decision rule, if the P-value is less than 0.05 then reject H_0 .

Modified Wald Test for Group-Wise Heteroscedasticity.

Wald test for Heteroscedasticity presented by (Kenward and Roger 1997), which is used to test the heteroscedasticity in the panel data model. It examines whether the error term in regression is normally distributed, having no issue of heterogeneity.

Hypothesis Testing:

H_0 : No Heteroscedasticity.

H_1 : Heteroscedasticity.

The null hypothesis there is no heteroscedasticity and there exist heteroscedasticity is alternative hypothesis. If P-value is less than 0.05 then reject H_0 .

Fixed Effect with Driscoll-Kraay Standard Error.

In economics to check the presence of heteroscedasticity and auto-correlation we applied diagnostic tests. To fulfil the assumption of the constant variance and mean of error term. Due to the presence of heteroscedasticity and auto-correlation in the current paper. This paper moves toward the Fixed Effect Model with Driscoll-Kraay standard error(Driscoll & Kraay, 1998). Driscoll Kraay standard errors provide robustness against heteroskedasticity, serial correlation, and cross sectional dependence(Hoechle, 2007).

RESULTS AND DISCUSSION

Chapter 4 discussed about the data, data sources, variables, panel data model, Model specification test, diagnostic tests. In this section of the paper briefly discuss about the results, tables, interpretation, descriptive statistics, correlation and covariance (measure of variability), model estimation i.e. Fixed Effect Model and Driscoll and Karay standard error.

Descriptive Statistics

Table 4.1: Descriptive Statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
Lgdpc	3730	24.302	1.778	19.81	30.391
Lgdppcc	3730	7.926	1.295	5.112	11.644
Lgnic	2495	24.541	1.745	20.323	30.382
Lgnipcc	2495	7.963	1.205	5.268	11.09
Lgfcf	2781	22.982	1.909	15.292	29.169
Lpoptotl	3820	17.955	3.103	12.533	26.875
Ltrdgdgdp	3356	8.859	8.304	-3.863	26.936
Lexgsc	3149	20.654	3.874	12.318	28.491



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Limgsc	3038	17.311	9.019	2.446	28.326
Lmexcurr	3924	22.202	2.117	15.425	28.844
Lsep	3114	3.424	1.904	-2.788	5.053
Lses	2701	4.04	.771	.91	5.11
Lset	2577	2.772	1.494	-4.313	4.956
Lmexp	3127	1.245	1.274	-10.974	4.765
Lto	1245	21.541	1.767	14.277	25.253
Lex	1255	17.471	1.827	9.793	21.804
Lim	2774	.164	4.224	-2.192	23.915
Lic	3061	2.017	.425	-1.772	2.485
Lec	3027	2.19	.281	.693	2.485
Lrt	3051	1.372	.435	-2.526	1.792
Lmp	2877	1.002	.603	-2.526	1.792
Let	3031	1.223	.49	-2.526	1.792
Llf	3074	15.516	1.598	4.615	20.495

Authors own estimation

Table 4.1 reports the descriptive statistics for all variables, including their mean, standard deviation, and range.

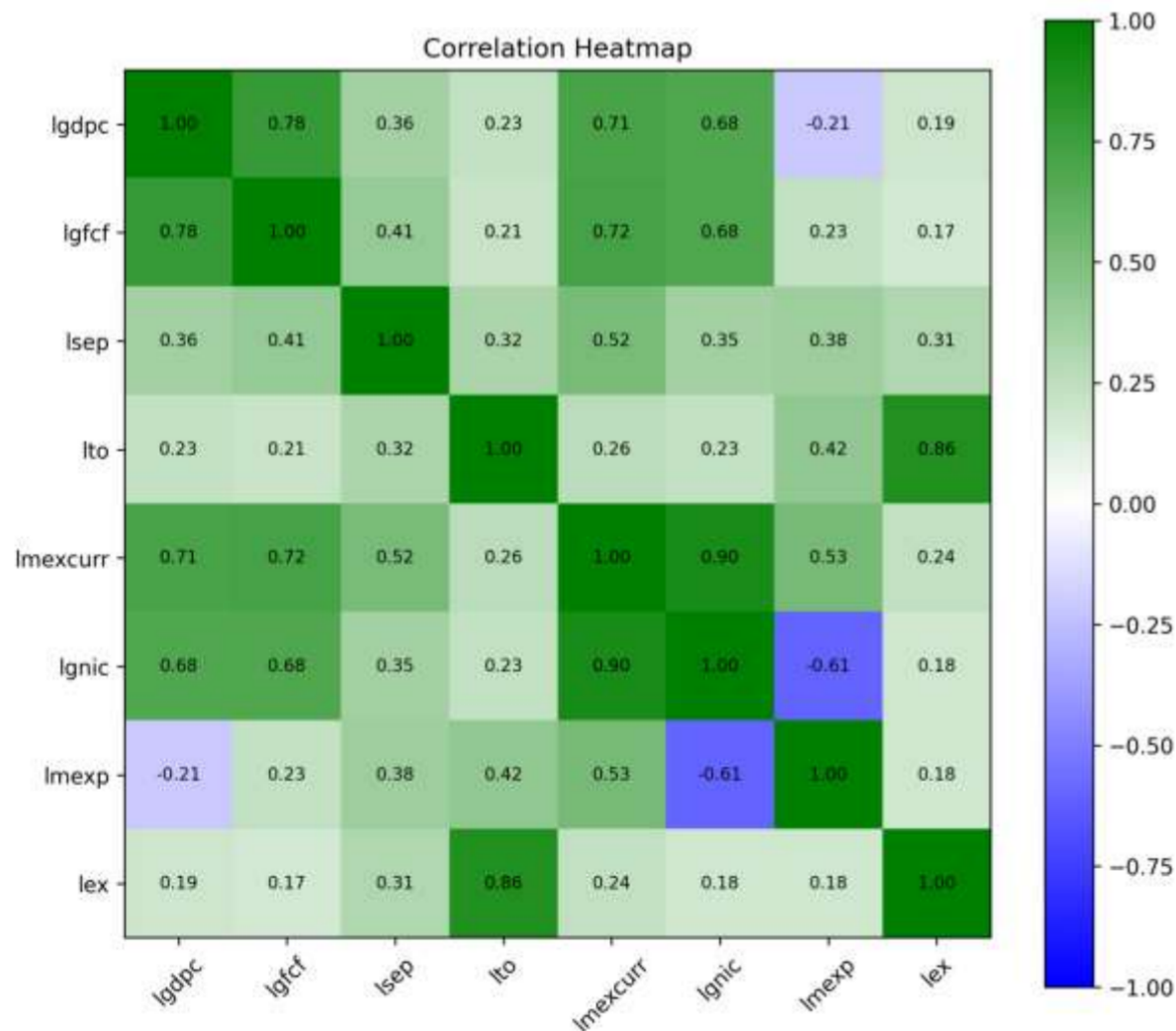
The main macroeconomic variables—GDP, GNP (lgnic), and their per capita measures—show moderate variation, with relatively close standard deviations and reasonable minimum–maximum ranges. Gross fixed capital formation and population also display acceptable dispersion, though population varies slightly more across observations.

Trade-related variables exhibit greater variability compared to other indicators. Education variables show moderate spread, with secondary enrolment being the most stable. Military expenditure varies considerably across the sample.

Institutional and conflict indicators (internal conflict, external conflict, religious tension, military in politics, and ethnic tension) demonstrate relatively low dispersion, suggesting limited fluctuation. Overall, the ranges and standard deviations indicate no significant outliers in the dataset.

Correlation and Covariance

Figure 4.1: Matrix Correlation



This heatmap presents the pairwise correlation coefficients among the study variables. Green cells indicate positive correlations. Darker green reflects stronger positive association. Blue cells indicate negative correlations. Darker blue reflects stronger negative association. Values inside each cell report the exact correlation coefficient. The



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matrix shows very strong positive correlations between lgdpc and lgnic, and between lmexcurr and lgnic. Trade related ariables also display moderate to strong positive associations with income measures

Fixed Effect Model dependent variable LGDPC.

This study used the panel data approach, so that's why Fixed Effect Model is used to test hypothesis of the paper i.e. Trade and conflict effects economic growth in developing countries. Literature proves that conflict negatively effects the economic growth of the effecting country. While trade has positive relation with growth.

Table 4.3 shows the result of Fixed Effect Models having dependent variable Gross Domestic Product constant and independent variables Secondary school enrollment, Trade openness, Gross Fixed Capital formation constant, Military expenditure, Exports, Merchandise export current.

Table 4.3 FEM dependent variable is LGDPC.

VARIABLES	(1) FEM	(2) FEM	(3) FEM
Lses	0.186*** (0.0364)	0.212*** (0.0359)	0.150*** (0.0164)
Lto	0.0187 (0.0121)		
Lgfcf	0.601*** (0.0191)	0.597*** (0.0186)	0.239*** (0.0112)
Lmexp	-0.241*** (0.0249)	-0.254*** (0.0243)	-0.0670*** (0.00962)
Lex		0.00488 (0.0116)	
Lmexcurr			0.292*** (0.00745)
Constant	10.03*** (0.447)	10.35*** (0.405)	12.10*** (0.151)
Observations	550	559	1,679
R-squared	0.852	0.861	0.901
Number of id	29	29	73
Hausman Test	85.59*** 0.0000	81.94***	-569.85
Prob>chi2		0.0000	

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.

Table 4.3 displays the results of Fixed Effect Model having 3 models, 1st model explain the relationship between economic growth (dependent variable), Military expenditure (independent variable) and foreign trade (independent variable). If one percent increase in trade, increases the growth by 0.0187%. Trade has positively affect the growth. While one percent increase in military expenditure decreases the growth by -0.241%, highly negative and statistically significant. Probability value of Fixed Effect Model-1 is 0.01, less than 0.05. So, we reject null hypothesis (H₀: Pooled OLS). Table 4.3 shows the Hausman specification test value 85.59 with Probability value 0.00, less than 0.05 reject null hypothesis. Fixed Effect Model is more appropriate. While, 2nd model of Table 4.3 explains that if one percent change in exports, increases the growth by 0.0048% and one unit change in military expenditure reduces growth by -0.254%. Probability value of Hausman specification test 0.00 that is less than 0.05, rejects the null hypothesis (H₀: Pooled OLS) respectively. And in 3rd model, if one unit change in merchandise export increases the growth by 0.292%. While, military expenditure has negative impact on growth. It reduces the growth by -0.067%. Hausman specification test is insignificant having negative value -569.85%. The results of table confirm the positive impact of trade on growth and proves that conflict negatively affects the sample countries

Fixed Effect Model dependent variable LGDPC.

Table 4.4 FEM dependent variable is LGNIC.

VARIABLES	(1) FEM	(2) FEM	(3) FEM
lses	0.140*** (0.0398)	0.165*** (0.0382)	0.180*** (0.0177)
lto	0.00848 (0.0131)		



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lgfcf	0.596*** (0.0205)	0.598*** (0.0195)	0.231*** (0.0124)
lmexp	-0.344*** (0.0314)	-0.351*** (0.0297)	-0.0604*** (0.0108)
lex		-0.00112 (0.0118)	
lmexcurr			0.287*** (0.00835)
Constant	10.59*** (0.476)	10.64*** (0.418)	12.23*** (0.166)
Observations	412	421	1,406
R-squared	0.873	0.885	0.892
Number of id	25	25	71
Hausman Test	236.84	259.61	-395.84
Prob>chi2	0.0000	0.0000	

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 4.4 exhibits the results of Fixed Effect Model, dependent variable Gross National Income constant. 1st model of the table explains, if one unit change in trade openness, the economic growth increases by 0.0084% and military expenditures decreases the growth by -0.344% highly statistically significant. If one unit change in exports decline growth by -0.00112%. While if one unit change in military expenditure growth will decline by -.0351%. Hausman specification test results are highly significant in 1st and 2nd model which leads towards the rejection of null hypothesis i.e. H₀: Pooled OLS. While 3rd model Hausman is not significant.

In short, tables prove the negative impact of conflict in tester countries and positive effect of trade on growth in sample countries. To remove the insignificance of the model we move toward the Driscoll and Kraay standard error

Fixed Effect Model with Driscoll-Kraay Standard Error dependent variable LGDPC

By using Stata 15.0 we check the autocorrelation and heteroscedasticity of the model. The commands xttest3 and xtserial for auto-correlation and heteroscedasticity. The null hypothesis of Xttest3 is No heteroscedasticity and xtserial is no 1st order auto correlation. The table values show the presence of auto-correlation and heteroscedasticity. So, to remove the presence of these problem from the model we move toward Driscoll and Kraay (1998).

Table 4.5. FEM with Drisc/Kraay standard error dependent variable LGDPC.

VARIABLES	(1) Model 1	(2) Model 2	(3) Model 3
Lses	0.186*** (0.0621)	0.212*** (0.0602)	0.150*** (0.0254)
Lto	0.0187 (0.0162)		
Lgfcf	0.601*** (0.0454)	0.597*** (0.0402)	0.239*** (0.0138)
lmexp	-0.241*** (0.0457)	-0.254*** (0.0443)	-0.0670*** (0.0112)
Lex		0.00488 (0.0156)	
lmexcurr			0.292*** (0.0181)
Constant	10.03*** (1.104)	10.35*** (0.912)	12.10*** (0.401)
Observations	550	559	1,679
Number of groups	29	29	73
Hausman Test	85.59***	81.94***	-569.85
Wooldridge test for autocorrelation in panel data	114.142***	110.116***	91.710***
Modified Wald test for GroupWise heteroscedasticity	18006.59***	1.2e+28***	65125.43***



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in fixed effect
regression model

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 4.5 shows the results of Driscoll-Kraay standard error in which dependent variable is lgdpc and independent variable is log of secondary school enrollment, log of trade openness, log of gross fixed capital formation, log of exports, log of merchandise export and log of military expenditure.

With statistically significant impact of secondary school enrollment on Growth, if one unit change in lses it will increase the lgdpc by 0.186%. While, if one unit change in trade openness it will rise the economic growth by 0.0187%. And if one unit change in lgfcf it will exceed the growth by 0.601% with statistically significant probability. Military expenditure has negative statistical significant affects the dependent variable (lgdpc), if one unit change in lmexp it will decline the lgdpc by -0.241%. One unit change in exports will lead an increase in the growth by 0.0048% and merchandise exports has positively associated with economic growth. If one unit change in lmexcurr the economic growth will rise to 0.292%.

Then we concluded from the above table Military expenditure has negatively related with growth. As conflict increases growth declines. Whereas, trade openness, merchandise export, secondary school enrollment, gross fixed capital formation are positively connected with economic growth.

Table 4.6. FEM with Drisc/Kraay standard error dependent variable LGNIC.

VARIABLES	(1) Model 1	(2) Model 2	(3) Model 3
Lses	0.140** (0.0601)	0.165** (0.0613)	0.180*** (0.0287)
Lto	0.00848 (0.0196)		
Lgfcf	0.596*** (0.0523)	0.598*** (0.0458)	0.231*** (0.0186)
lmexp	-0.344*** (0.0389)	-0.351*** (0.0336)	-0.0604*** (0.0131)
Lex		-0.00112 (0.0172)	
lmexcurr			0.287*** (0.0228)
Constant	10.59*** (1.184)	10.64*** (0.985)	12.23*** (0.405)
Observations	412	421	1,406
Number of groups	25	25	71
Hausman Test	236.84	259.61	-395.84
Wooldridge test for autocorrelation in panel data	91.710	92.785	230.629
Modified Wald test for GroupWise heteroscedasticity in fixed effect regression model	65125.43	59964.30	1.2e+07

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 4.6 exhibits the Driscoll-Kraay standard error results having 3 models. 1st model of the table explains if one unit change in secondary school enrollment increases the economic growth by 0.140%. Trade openness positively affects the growth, one-unit change in lto it will increase the lgdpc by 0.008%. If one unit change in lgfcf, it will grow lgdpc by 0.596% statistically significant. Military expenditure negatively associated with economic growth. If one unit change in lmexp it will decline the lgnic by -0.344%. If one unit change in export it will decrease growth by -0.001. If one unit change in merchandise current it will increase 0.287%.

So, in short we say that there exists negative relationship between conflict and growth. While other variables of the model exhibit the positively linked with Economic growth.

CONCLUSION AND POLICY IMPLICATIONS

In this chapter of the study we broadly discuss about the conclusion and policy implications. On the basis of empirical findings.

Conclusion

In this paper, we investigate the relationship between Conflict, Trade openness, and economic growth. We explore different papers and theories that confirm the reasons for conflict in sample countries. The current paper explains the relationship between conflict, trade openness, and economic growth by using a panel data approach. We explain military expenditures to explain the impact of conflict on economic growth. Whereas, trade openness is measured as a sum of imports and exports to GDP (Yanikkaya, 2003).



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The previous studies support the positive impact of trade on EGR (Groot et al., 2022; Dollar & Kraay, 2002; Frankel & Romer, 2017; Manwa et al., 2019). Whereas, the negative relation between conflict and economic growth (Collier & Hoeffler, 1998, 2004; Dunne et al., 2005; Solomon et al., 2012; Ray & Esteban, 2017).

In this study, we use Real Gross Domestic Product as dependent variables. Gross fixed capital, Human capital, export penetration, trade openness, merchandise export and military expenditure are treated as explanatory variables. All of the variables data are collected from WDI of period 1982-2024 of 96 developing countries.

The panel data techniques are applied to estimate the model and drive the empirical results of the paper. Firstly, run Pooled OLS, Fixed Effect Model (FEM), and Random Effect Model (REM). (Baltagi, 2008; Greene, 2003) The presence of heteroscedasticity and auto-correlation was confirmed by the diagnostic tests. To overcome the robustness of the model we used Fixed effect with Driscoll-Kraay standard error (1998).

Fixed Effect Model (FEM) 1-3 explains the variable impact on Economic growth. In FEM model-1, Human capital, Physical Capital, Trade openness and Military expenditures enter and identifies the negative impact of conflict on growth and the positive relation of trade on economic growth. Human capital contributes to positive effect. While physical capital increases the growth.

Model-2 of FEM uses Export penetration as a trade openness variable, confirms the positive impact on economic growth. Whereas, with statistically significant estimates physical capital, human capital increases the economic growth and military expenditure has negatively correlated with economic growth.

3rd FEM confirms the negative effect of military expenditures. $lgfcf$ and $lsec$ rises the economic growth. While, merchandise exports has positively correlate with economic growth. The FEM model result has uncertainties and statistically insignificant.

FEM with Driscoll-Kraay standard error is run to overcome the robustness of the model 1-3. The Model-1 of Driscoll-Kraay standard error confirms the negative impact of military expenditures on economic growth. Trade openness, Physical capital and Human capital contributed the economic growth positively with statistical significance.

2nd - model of D/K std. error confirms the positive relation of $lgfcf$ and $lsec$ on $lgdpc$ and $lgnic$. While military expenditure and export penetration has negatively correlated with economic growth with statistically significant probability values. D/K std. error model-3 shows the negative statistically significant effect of military expenditure on growth.

Human capital, physical capital and merchandise exports contributes positively to the economic growth.

The paper concluded that in sample countries there exist negative relation between conflict and economic growth. As military expenditures increase the economic growth falls. While, trade openness increases the economic growth. Economic growth rises if the trade openness rises.

Policy Implications

This section recommends the policy implications in the light of empirical findings of this paper. In sample countries, panel data models, diagnostic tests, and standard error models are applied to explain the relationship between conflict and trade openness on economic growth. The finding confirms the negative impact of conflict on economic growth and the positive relation of economic growth with trade openness. While, physical capital, human capital, and other indicators of trade openness i.e. export penetration and merchandise export contribute positively to economic growth.

In this research paper, trade openness is used to measure the trade impact on economic growth. Through empirical evidence, there exists a positive relationship between trade openness and economic growth. Policymakers should make effective policies in sample countries to increase the Gross Domestic Product and Gross National Income by supporting the production process in the industry with a comparative advantage. Focus on the specialization process and then serve the country as well as outside of the country.

To test the hypothesis of the paper "conflict has no relationship with the economic growth". The literature confirms the negative relationship between conflict and economic growth. The empirical study of current paper confirms the negative impact of conflict on economic growth. The paper uses military expenditure to measure the conflict.

Military expenditures should be cut down and put these expenses by government in human capital for the development and economic growth in the sample countries.

The government and policy makers should boost the investment confidence by making strong institutes which prevent people of the nations from conflict. It will help to increase the foreign investment and will provide employment in the sample countries.

Trade openness and merchandise export current has positively associated with Economic growth. While other indicator of trade openness i.e. exports penetration is negatively related with Economic growth. As the conflict arises the exports of the country decreases. Policy makers should make such policies that will enhance the quality of domestic goods and then raise exports that will help an increase in Economic Growth.

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