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ASSESSING AND EXPLAINING TRADE AGGLOMERATION IN THE CONTEXT OF GLOBAL TRADE

Jadhav Chakradhar* and A V Manjunatha**

Abstract

The advent of WTO regulations, the internet revolution, and improvements in logistics have reshaped the traditional view that geographical distance is the primary determinant of trade relationships. As a result, countries, for various reasons—regardless of the distance—have started to form closer ties. In this context, the paper first defines the concept of trade agglomeration. It empirically investigates the factors influencing trade patterns among 15 countries identified for their trade agglomerations, from1995 to 2022.The results show that factors such as GDP, population, trade openness, globalisation, FDI, internet penetration, and average governance indicators have a significant and positive impact on trade flows. In contrast, trade policy uncertainties, tariffs, and the real exchange rate have a significant and negative impact on trade. Countries like Denmark, Turkey, the Philippines, Portugal, and Romania stand out with a predicted trade-to-total trade ratio above one, indicating a relatively higher potential for trade expansion. Interestingly, the analysis finds that at higher quantiles, the impact of trade policy uncertainties on trade flows is significant and negative, whereas at lower quantiles, it has no significant effect. The findings suggest that countries agglomerate for trade based on shared interests driven by political and economic gains.

Keywords: Trade Agglomeration, Liberal Democracy, Trade Policy Uncertainty, globalisation

Introduction

For many decades, the academic community and policymakers have debated the effects of international trade on economic growth. In his seminal work, Romer (1990) argued that trade fosters economic growth by facilitating the transmission and distribution of knowledge among trade partners. Trading with foreign markets compels producers to adapt to new technology, fostering innovation. In this regard, most of the previous literature has attributed this effect of international trade on economic growth to trade liberalisation. Trade liberalisation has become widespread over the last four decades, especially among the developing and emerging economies. This shift responds to the perceived limitations of development strategies based on import substitutions and the influence of international financial and trade institutions. Economists generally consider that open economies experience faster growth than closed economies (Edwards, 1993; Kim, 2011).

In recent decades, globalisation has become a key force reshaping global economic integration and interdependence, deepening economic connections across borders. International trade is an essential component of globalisation, serving as a vital engine in the global integration process.

* PhD Scholar, Agricultural Development and Rural Transformation Centre (ADRTC), Institute for Social and Economic Change (ISEC), Bangalore. Email: chakradhar@cess.ac.in, jadhav@isec.ac.in. (Corresponding author)

** Assistant Professor, Centre for Ecological Economics and Natural Resources (CEENR), Institute for Social and Economic Change (ISEC), Bangalore. Email: manjunath@isec.ac.in, manjublore@gmail.com.

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However, the debate shows that there are major differences in trade integration. Only a few nations account for most of the global commerce, with most trading operations focused on specific groupings of countries.

Until the formation of the WTO, global trade was dominated by a few countries, with trade agglomeration emerging as a key focus considering recent global shifts. While prior studies predominantly examined factors like distance and GDP as drivers of trade flows (Head, 2003; Kumar and Ahmed, 2015; Starck, 2012; Yotov *et al*, 2016), trade has historically clustered within specific regions or countries. However, the contemporary global economy shows a notable rise in trade partnerships among geographically distant nations, suggesting that distance is now less of a barrier—a development underexplored in current literature.

Here, emerging players are referred to as *"emerging trade agglomeration countries".* These agglomerations typically form informal groups, each leveraging their unique comparative advantages to enhance their competitive position in the global market. The concept of comparative advantage in this context involves a combination of economic and non-economic factors. In this context, the present study aims to shed light on the drivers behind trade agglomerations among selected countries from 1995 to 2022.

Economic factors are fundamental in shaping the contours of trade agglomeration. A country's GDP and population size indicate market potential and labour force availability, influencing both the demand for and supply of trade able goods and services. Foreign direct investment (FDI) and the real effective exchange rate (REER) act as crucial connectors between national economies and the global trade network, representing a country's level of economic integration and price competitiveness, respectively. Additionally, trade openness and the proliferation of internet users reflect a nation's level of engagement with the global market and its digital infrastructure, both vital for participation in modern trade ecosystems. These factors must be understood within broader trade facilitation and logistics. Non-economic factors also play a significant role in shaping trade dynamics. Indicators such as the Liberal Democracy Index (LDI) and governance metrics reflect the political and institutional environment, which is crucial for establishing a stable, transparent, and effective framework for trade. Stable governance promotes an environment conducive to trade by reducing risks, creating predictable conditions, and encouraging investment. In this context, trade policy uncertainties (TPU) emerge as a critical concern, underscoring the risks and costs associated with unpredictable or inconsistent trade policies.

Data Sources and Description of the Variables

The primary goal of this study is to identify the factors influencing trade agglomeration in countries following the establishment of the WTO. Our country selection procedure unfolds in two key stages. In the first stage, we computed the average total trade over the last five years (2018–2022) for the top 43 countries, which collectively account for approximately 94% of global trade. In the second stage, we calculated the compound annual growth rate (CAGR) for two distinct periods—2003–2012 and 2013–2022—to assess each country's trade performance over these extended times pans.

Following this analysis, countries are categorised into three groups based on their trade performance—high, medium, and low—across the two periods. Special attention was given to nations that demonstrated upward mobility, moving from medium to high, low to high, or low to medium performance levels (Appendix A, Table 1.1).These countries are identified as burgeoning trade agglomerations, reflecting their dynamic transformation within the global trade landscape and marking a shift away from the traditional dominance of certain countries. The study period (1995–2022) was selected to align with the research objective. The countries selected for analysis are Belgium, Canada, the Czech Republic, Denmark, Hong Kong (China), Ireland, Italy, Norway, Poland, Portugal, Romania, Spain, Mexico, Turkey, and the Philippines. The total trade value data, measured in thousands of USD, were collected from the World Integrated Trade Solution (WITS) database. Additional variables such as GDP (in current USD), total population, and the simple average applied tariff rate percentage were sourced from the World Development Indicators (WDI) online database. The KOF Globalisation Index, obtained from Gygli *et al*, (2019), captures the economic, social, and political dimensions of globalisation across countries, with a range of1 to 100, where higher scores represent higher levels of globalisation. The Liberal Democracy Index, sourced from the V-Dem Institute (Lindberg *et al*, 2014), operates on a scale from 0 to 1, with scores closer to 1 indicating a higher degree of liberal democracy.

While previous research has often used the Polity Project dataset, which lacks comprehensive data on national democracies after 2013, our study relies on the V-Dem dataset, which provides more detailed and robust measurements compared to the Polity IV dataset. Data on trade policy uncertainty were sourced from Handley and Limão (2022), who developed a news-based index to inform firms' beliefs about TPU. These indices compute the proportion of newspaper articles on trade policy that include keywords related to TPU—such as tariffs, quotas, and antidumping—alongside uncertainty-related terms like risk, instability, and unpredictability. FDI data, measured in millions of current USD, were gathered from the United Nations Conference on Trade and Development (UNCTAD) database. In contrast, data on the Real Effective Exchange Rate (REER) index (base year 2010 = 100) were sourced from the Centre for International Prospective Studies and Information (CEPII). To assess the impact of information and communication technology on trade flows, the number of internet users within the last three months was used as a proxy, with data collected from the Our World in Data website.

Identifying a suitable measure for Governance and Institutional Quality (GI) posed a challenge. In this study, GI is measured by averaging six governance dimensions from the World Bank's Worldwide Governance Indicators (WGI): voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption. These dimensions are highly interrelated, indicating that they assess a broader governance concept (Langbein and Knack, 2010). Several studies have adopted this approach to derive a composite governance index (e.g., Easterly, 2002; Al-Marhubi, 2004; Bjørnskov, 2006). Before the analysis, all variables were transformed into natural logarithms to address data measurement errors, multicollinearity, and heteroscedasticity. This study utilises a balanced panel dataset comprising 420 observations across 15 countries over 28 years ($T = 28$, $N = 15$), resulting in 420 observations (calculated as $T \times N = 28 \times 15 = 420$). Table 1 provides a comprehensive overview of the variables, data sources, and measurement units.

Table 1: Description of Variables and Data Sources Used in the Study

Sl.No.	Variables	Unit	Description	Source
1	$lntrade_{it}$	1000 USD$	Total trade in goods in country 'i' at time 't'	WITS*
2	$lnGDP_{it}$	Current USD$	Gross domestic product in country 'i'	WDI, World Bank**
3	$lnPOP_{it}$	Total population	Total population in country 'i' at 't' time.	WDI, World Bank**
4	$lnTO_{it}$	Export and imports % GDP	(Export + Import)/GDP*100	WDI, World Bank**
5	$lnSAT_{it}$	Percentage (%)	Average tariff rate applied by country 'i' at time 't'	WDI, World Bank**
6	$lnKOFGI_{it}$	Index score (1-100)	Index score in country 'i' at time 't', KOF Globalisation index ranges from 1 to 100, where a higher score indicates a higher level of globalisation	Gygli *et al*, (2019)
7	$lnLDI_{it}$	Index score (0-1)	Liberal Democracy Index (LDI) operates on a scale from 0 to 1, where a score closer to 1 signifies a higher level of liberal democracy within a country.	V-Dem institute https://v-dem.net/
8	$lnTPU_{it}$	Index score (0-1)	Index score in country 'i' at time 't', TPU index ranges from 0 to 1; a higher score indicates a higher level of trade policy uncertainty.	Handley and Limão (2022)
9	$lnFDI_{it}$	Current USD million	Foreign direct investment inflows in a country 'i' at 't' time	UNCTAD
10	$lnREER_{it}$	Real effective exchange rate index (2010 = 100)	Real effective exchange rate in country 'i' at 't' time, in natural logarithm	CEPII***
11	$lnINT_{it}$	Number of people using the internet	Number of people who used the internet in the last three months	Our world in data
12	$lnGI_{it}$	Per centage	Average value of governance indicators (voice and accountability, government effectiveness, regulatory quality and rule of law) in the country 'i' at time 't'	Authors' calculation
13	RCEP	1/0 dummy	RCEP Dummy = 1 if a country is a member of the RCEP trade bloc; 0 otherwise	Authors' calculation
14	EU	1/0 dummy	EU Dummy = 1 if a country is a member of the RCEP trade bloc; 0 otherwise	Authors' calculation
15	NAFTA	1/0 dummy	NAFTA Dummy = 1 if a country is a member of the RCEP trade bloc; 0 otherwise	Authors' calculation

Source: Authors' compilation, note: *WITS= World Integrated Trade Solution, **WDI= World Bank Development Indicators, ***CEPII=Centre for International Prospective Studies and Information.

Rationale for the Selection of the Variables

Key variables such as GDP and population not only influence but also strengthen the process of trade agglomeration, as indicated by variables listed from serial numbers 5 to 13. The LDI has been incorporated to capture the political dimensions of nations, with the assumption that this variable acts as a driver of trade agglomeration (Milner and Kubota, 2005). When political factors such as LDI are integrated into trade decisions, nations tend to prioritise trading partners that share similar political values and governance standards. This fosters fairness, stability, and respect for human rights in global trade relations. Additionally, FDI and the REER Index are used as indicators of the relative economic stability of the countries under study. The density of internet access and the level of governance further

contribute to creating a favourable environment for trade within a country. Beyond these 13 variables, three dummy variables—RCEP, EU, and NAFTA—are included to assess the impact of regional trade agreements on total trade.

Analytical Framework

The study utilised various econometric techniques, including Feasible Generalised Least Squares (FGLS), Two-Step System Generalised Method of Moments (GMM), and Panel Quantile Regression. Trade flows are projected based on coefficients derived from the FGLS model. Panel data analysis presents multiple benefits over traditional time series and cross-sectional approaches (Baltagi, 2005). It effectively accounts for individual heterogeneity, mitigates issues with collinearity, and enriches the dataset with more variability and information, consequently enhancing the degrees of freedom (Wooldridge, 2002). These advantages lead to econometric estimations that are precise and robust. The panel data methodology has widespread use in trade research to identify potential factors influencing trade flows (Kumar and Ahmed, 2015; Nguyen, 2010; Waheed and Abbas, 2015). Traditional methods for estimating panel data employ either fixed effects (FE) or random effects (RE) models based on the nature of the relationship between the dependent variables and the explanatory variables. Hausman (1978) suggests that the selection between an FE and RE model is appropriate when the cross-sections of the panel are independent but subject to other robust estimation issues. Hence, equation (1) can be estimated through FE and RE methodologies, which the subsequent one-way error component model briefly represents:

$$Y_{it} = \alpha_1 + \beta X_{it} + \gamma_{it} + \varepsilon_{it} \quad (1)$$

i=1,….. n; t=1,……..T.

where β represents the regression coefficient, X_{it} denotes a set of explanatory variables, μ_{it} is the residual component, γ_{it} captures the unobserved effects specific to individuals and ε_{it} constitutes the remaining disturbance. Here, 't' specifies the temporal dimension, while 'i' refers to individual entities. The fixed effects model is limited by the need to estimate numerous parameters, reducing degrees of freedom due to subject-specific effects. To address this, the random effects model is often recommended, as it assumes individual variations are uncorrelated with predictors, unlike the fixed effects model, which treats these variations as related to other variables. This allows the inclusion of time-invariant variables in the random effects model. The Hausman test is employed to determine the appropriate model. However, in the presence of autocorrelation and heteroscedasticity, the fixed effects model can produce biased results (Le *et al*, 2019; Le *et al*, 2015).

The functional form of the econometric model that we used is as follows:

$$lntrade_{it} = f(lnGDP_{it}, lnPOP_{it}, lnTO_{it}, lnKOFGI_{it}, lnSAT_{it}, lnLDI_{it}, lnTPU_{it}, lnFDI_{it},$$

$$lnREER_{it}, lnINT_{it}, lnGI_{it}, \text{RCEP}, \text{EU}, \text{NAFTA}) \quad (2)$$

First, we examine the impact of trade openness on trade flows. Second, the equation assesses the impact of globalisation on trade flows. The reason for performing these estimates separately is that trade openness is a sub-component of the overall globalisation index. Including both variables in a

single model may result in confounded findings. This method aids in distinguishing between the consequences of trade openness, a measure of a country's readiness to engage in international commerce, and the multidimensional implications of globalisation, which include economic, social, and political components. Hence, model 1 and model 2 are performed using the following regression equations:

$$lntrade_{it} = \alpha_i + \beta_1 lnGDP_{it} + \beta_2 lnPOP_{it} + \beta_3 lnTO_{it} + \beta_4 lnSAT_{it} + \beta_5 lnLDI_{it} + \beta_6 lnTPU_{it} + \beta_7 lnFDI_{it} + \beta_8 lnREER_{it} + \beta_9 lnINT_{it} + \beta_{10} lnGI_{it} + \beta_{11}\mathrm{RCEP}_{it} + \beta_{12}\mathrm{EU}_{it} + \beta_{13}\mathrm{NAFTA}_{it} + \delta_i + \delta_t + \mu_{it} \quad (3)$$

where i = 15 selected countries; t is time period from1995 to 2022.

$$lntrade_{it} = \alpha_i + \beta_1 lnGDP_{it} + \beta_2 lnPOP_{it} + \beta_3 lnKOFGI_{it} + \beta_4 lnSAT_{it}s + \beta_5 lnLDI_{it} + \beta_6 lnTPU_{it} + \beta_7 lnFDI_{it} + \beta_8 lnREER_{it} + \beta_9 lnINT_{it} + \beta_{10} lnGI_{it} + \beta_{11}\mathrm{RCEP}_{it} + \beta_{12}\mathrm{EU}_{it} + \beta_{13}\mathrm{NAFTA}_{it} + \delta_i + \delta_t + \mu_{it} \quad (4)$$

$lntrade_{it}$	Total trade of country 'i' at time 't', represented in natural logarithm
$lnGDP_{it}$	Gross domestic product of country 'i' at time 't', represented in natural logarithm
$lnPOP_{it}$	Total population of country 'i' at time 't', represented in natural logarithm.
$lnTO_{it}$	Trade openness in country 'i' at time 't', represented in natural logarithm
$lnKOFGI_{it}$	Index value of globalisation in country 'i' at time 't', represented in natural logarithm
$lnSAT_{it}$	Average tariff rate applied by country 'i' in percentage, at time 't', represented in natural logarithm
$lnLDI_{it}$	Liberal democracy index score in country i at time t, represented in natural logarithm
$lnTPU_{it}$	Index value of trade policy uncertainty in country 'i' at time 't', represented in natural logarithm
$lnFDI_{it}$	Foreign direct investment inflows in a country 'i' at 't' time, in natural logarithm
$lnREER_{it}$	Real effective exchange rate in country 'i' at 't' time in, natural logarithm
$lnINT_{it}$	Number of internet users in country 'i' at 't' time, in natural logarithm
$lnGI_{it}$	Average value of governance indicators in country 'i' at time 't', represented in natural logarithm.
RCEP	Dummy variable indicating if a country is a member of the RCEP trade bloc
EU	Dummy variable indicating if a country is a member of the EU trade bloc
NAFTA	dummy variable indicating if a country is a member of the NAFTA trade bloc.
δ_i	Dummy variable captures the country's fixed effect
δ_t	Dummy variable captures the time-fixed effect
μ_{it}	Idiosyncratic error term

The country-fixed effect captures reporter- and partner-specific factors, such as trade facilitation measures and multilateral resistance terms (Anderson and van Wincoop, 2003). The fixed time controls the volatility in global trade, which might affect the flow of trade between countries (Mawusi, 2020). Prior to estimating panel models, three preliminary tests, namely the Wooldridge test for autocorrelation (Wooldridge, 2003), the modified Wald statistic/Breusch pagan test for heteroscedasticity (Greene, 2003), and the Lagrange multiplier (LM) test for cross-sectional dependence

proposed by Pesaran (2015) are performed. The results suggest the presence of serial autocorrelation, heteroscedasticity, and cross-sectional dependence under fixed-effect specifications.

Feasible Generalised Least Squares Model

Based on prior studies (Le *et al*, 2019; Le *et al*, 2015), the proposed models are estimated using the FGLS procedure. However, the Prais-Winsten panel-corrected standard error (PCSE) technique could be an alternative procedure for estimation. In this study, we utilise FGLS, a method originally developed by Parks (1967), to investigate the existence of a significant link among variables. FGLS approach is known for producing unbiased and consistent parameter estimates when dealing with correlated and heteroskedastic errors across panels (Le *et al*, 2019). It enables accurate estimation under conditions such as *AR (1)* autocorrelation within panels, cross-sectional correlation, and group-specific heteroscedasticity across panels. Therefore, the FGLS estimator is selected for its consistency and efficiency. Moreover, FGLS variance-covariance estimates are typically acceptable when time points (*T*) are more than cross-section units (*N*), i.e., *T>N* (Beck and Katz, 1995), which is the case in our study. Hence, Equations (3) and (4) are estimated using the FGLS econometric techniques. The equation used in the FGLS method remains consistent with Equations (1) and (2).

Two Stem- System GMM Approach

Another difficulty is the previous method's failure to deal with endogeneity, which occurs when explanatory factors are linked with the error term, which is a prevalent scenario in panel data trade analysis due to missing variables, measurement errors, or simultaneity (Chakradhar and Gupta, 2024). Estimating baseline models with traditional panel data methods may lead to bias due to endogeneity and reverse causality. Prior studies reveal a complex, bidirectional relationship between trade openness and economic growth, where causality is not strictly one-way (Fukase, 2010; Gries *et al*, 2012; Heo *et al*, 2021). Economic growth can drive trade openness by enhancing a country's trade capacity, while openness promotes growth by expanding market access, technology transfer, and foreign investment opportunities (Gries and Redlin, 2012; Rachdi and Mbarek, 2011). This reciprocal link introduces endogeneity through reverse causality and simultaneity, challenging model accuracy. Fixed-effects instrumental variables (2SLS) methods are suggested in such cases, though identifying robust instruments that correlate with endogenous variables without influencing regressors remains difficult (Greene, 2003).

Consequently, this study employs the system GMM method, offering a choice between the difference GMM estimator and the system GMM estimator (Arellano and Bover, 1995; Blundell and Bond, 1998). Although the difference GMM estimator by Arellano and Bond (1991) is widely applied for dynamic panel data, Blundell and Bond (1998) argue that system GMM is preferable for persistent data. By supplementing difference equations with levels, system GMM improves estimation efficiency through additional instruments (Arellano and Bover, 1995; Blundell and Bond, 1998). This approach mitigates issues of omitted variables, measurement error, and endogeneity (Arellano and Bover, 1995; Blundell and Bond, 1998).System GMM offers distinct advantages over other estimators: it accounts for non-observable effects, manages endogeneity in explanatory variables via lagged instruments, and is well-

suited to persistent, short-panel data. These benefits hold asymptotically for large T, aligning with the study's structure (N=15, T=28, with N<T). To ensure validity, the system GMM estimator meets two key diagnostics (Roodman, 2011): the Arellano-Bond test confirms no autocorrelation in first-differenced residuals, and the Sargan-Hansen J-test verifies instrument set validity, ensuring robust results. The GMM approach thus uses lagged values of endogenous variables as instruments, avoiding weak instruments and ensuring the predetermined variables remain uncorrelated with error terms.

The regression equation for system GMM is as follows:

$$lntrade_{it} = \alpha_i + \beta_1 lntrade_{it-1} + \beta_2 lnGDP_{it} + \beta_3 lnPOP_{it} + \beta_4 lnTO_{it} + \beta_5 lnSAT_{it} + \beta_6 lnLDI_{it} + \beta_7 lnTPU_{it} + \beta_8 lnFDI_{it} + \beta_9 lnREER_{it} + \beta_{10} lnINT_{it} + \beta_{11} lnGI_{it} + \beta_{12} \mathrm{RCEP}_{it} + \beta_{13} \mathrm{EU}_{it} + \beta_{14} \mathrm{NAFTA}_{it} + \mu_{it} \quad (5)$$

$$lntrade_{it} = \alpha_i + \beta_1 lntrade_{it-1} + \beta_2 lnGDP_{it} + \beta_3 lnKOFGI_{it} + \beta_4 lnTO_{it} + \beta_5 lnSAT_{it} + \beta_6 lnLDI_{it} + \beta_7 lnTPU_{it} + \beta_8 lnFDI_{it} + \beta_9 lnREER_{it} + \beta_{10} lnINT_{it} + \beta_{11} lnGI_{it} + \beta_{12} \mathrm{RCEP}_{it} + \beta_{13} \mathrm{EU}_{it} + \beta_{14} \mathrm{NAFTA}_{it} + \mu_{it} \quad (6)$$

Here, $lntrade_{it-1}$ indicates the lagged value of total trade.

Panel Quantile Regression with Non-Additive Fixed Effects

Numerous studies have applied quantile regression analysis to explore how independent variables influence different points of the dependent variable's conditional distribution (Albulescu *et al*, 2019). This method extends beyond the traditional OLS approach and offers several advantages. First, quantile regression acknowledges that the effect of independent variables varies across different quantiles of the dependent variable's distribution, capturing country-specific heterogeneity (Bitler *et al*, 2006). Second, as noted by Koenker and Hallock (2001), quantile regression is less sensitive to outliers and provides robust, efficient results even when error terms deviate from normality. This makes it particularly suitable for our analysis of the performance of 15 countries where significant variation exists, allowing for an understanding of disparities rather than focusing on average effects.

The quantile regression methodology was first proposed by Koenker and Bassett (1978). The general form of cross-sectional conditional quantile regression of $y_i$and given x_i is as follows:

$$Q_{y_i}(\tau/x_i) = x_i^T \beta_\tau \quad (7)$$

where $Q_{y_i}(\tau/x_i)$ denotes the τ^{th} conditional quantile of y_i, whereas x_i shows the explanatory variables in the model—the τ lies between zero and one. β_τ measures the effects of the x_i on the conditional τ^{th} quantile of the conditional distribution of the y_i. However, the cross-sectional quantile regression does not account for the country's unobserved heterogeneity. Consequently, a substantial amount of literature has been developed on panel quantile regression with additive fixed effects (Albulescu et al., 2019).A panel quantile regression with fixed effects is defined as follows:

$$Q_{y_{it}}(\tau_k/\alpha_i, x_{it}) = \alpha_i + x_{it}\beta(\tau_k) \quad (8)$$

In Equation (8), y_{it} is the conditional quantile concerning i and t. $\beta(\tau_k)$ represents the slope coefficient of interest and α_i is the country-specific fixed effects parameters. The value of the fixed effects parameters depends on $\tau \in (0,1)$.

Powell's (2022) panel data quantile regression introduces an innovative method by integrating non-additive fixed effects. Unlike the traditional model proposed by Koenker (2004), where unobserved fixed effects are treated as constant parameters that are jointly estimated with the covariate effects across different quantiles without allowing for variation in these parameters due to fixed effects, Powell's model acknowledges the variability in parameters of interest attributed to non-additive disturbances. This model maintains the intrinsic characteristic of quantile regression, which is the non-separability of the disturbance term. In Powell's framework, the estimation of quantile regression for panel data is adapted to accommodate non-additive fixed effects, a significant departure from models that assume a separable disturbance term. The technique builds on the structural quantile function (SQF), which does not rely on the assumption of a separable disturbance term. This assumption is crucial for traditional quantile estimation methods but is relaxed in Powell's approach to better capture the complexity and heterogeneity inherent in panel data. This approach produces point estimates for the coefficients of interest that can be interpreted similarly to those obtained from cross-sectional regression analyses despite the more complex underlying model structure. This can be written as follows:

$$y_{it} = \sum_{j=1}^{k} D_{it}\, \beta_j\, U_{it}^{*} \tag{9}$$

where y_{it} shows the total trade values of selected countries and D_{it} denotes the vector of the independent variable in the model. β_j is the coefficient of the explanatory variable and U_{it}^{*} error term. The model is linear in parameters, and $D_{it}\beta(\tau)$ is strictly increasing in τ. Further, Powell's (2022) technique allows this probability to change across individuals and even within individuals if the fluctuation is orthogonal to the instruments. The study considers the following panel quantile non-additive fixed effect regression model for the analysis:

$$Q_{y_{it}}(\tau \backslash \alpha_i, x_{it}) = \alpha_i + \beta_{1\tau} lnGDP_{it} + \beta_{2\tau} lnPOP_{it} + \beta_{3\tau} lnTO_{it} + \beta_{4\tau} lnSAT_{it} + \beta_{5\tau} lnLDI_{it} + \beta_{6\tau} lnTPU_{it} + \beta_{7\tau} lnFDI_{it} + \beta_{8\tau} lnREER_{it} + \beta_{9\tau} lnINT_{it} + \beta_{10\tau} lnGI_{it} + \mu_{it} \tag{10}$$

$$Q_{y_{it}}(\tau \backslash \alpha_i, x_{it}) = \alpha_i + \beta_{1\tau} lnGDP_{it} + \beta_{2\tau} lnPOP_{it} + \beta_{3\tau} lnKOFGI_{it} + \beta_{4\tau} lnSAT_{it} + \beta_{5\tau} lnLDI_{it} + \beta_{6\tau} lnTPU_{it} + \beta_{7\tau} lnFDI_{it} + \beta_{8\tau} lnREER_{it} + \beta_{9\tau} lnINT_{it} + \beta_{10\tau} lnGI_{it} + \mu_{it} \tag{11}$$

where y_{it} shows the total trade of selected 15 countries, and τ (tau) represents the quantile being estimated.

Estimation of Trade Potential

To estimate the trade potential for a group of selected countries, we applied the FGLS methodology to derive coefficients, which then helped us forecast the trade potential. The trade potential is calculated as follows.

$$TP_{it} = \frac{\sum \overline{PT_{it}}}{\sum AT_{it}} \tag{12}$$

where TP_{it} show the trade potential of country i at t time. $\sum \overline{PT_{it}}$ indicates the predicted trade and AT_{it} is the actual trade. Moreover, we examine the absolute difference between predicted trade potential (P) and actual trade (A). Countries yielding a positive (P-A) value are marked as having prospects for trade enhancement in selected countries. In contrast, a negative (P-A) value indicates that countries have fully realised their trade potential with these countries. A P/A ratio exceeding one indicates opportunities for trade expansion, while a ratio below one indicates the opposite.

Results and Discussion

The estimation analysis is structured in three phases: first, FGLS and two-step system GMM models are used to estimate factors influencing trade agglomeration; second, the trade potential of 15 agglomerated countries is calculated; and third, panel quantile regression is applied. Table 2 presents descriptive statistics for the study variables, including mean, standard deviation, minimum, and maximum values. The natural logarithm of trade has a mean of 19.341 and a standard deviation of 0.909, indicating moderate variation. The natural logarithm of GDP has a mean of 27.065 and a standard deviation of 1.49, with values ranging from 22.82 to 30.87. Variables like tariffs (-3.507 to 2.985), internet users (standard deviation of 1.612), and FDI (standard deviation of 1.328) show high variability. In contrast, globalisation (0.124) and REER (0.145) exhibit lower variability, indicating greater consistency across observations.

Factors Affecting Trade Agglomerations

Table 2: Descriptive Statistics of the Variable Used in the Study

Variable	Mean	Std. Dev.	Minimum	Maximum
$lntrade_{it}$	19.341	0.909	16.716	21.075
$lnGDP_{it}$	27.065	1.49	22.82	30.868
$lnPOP_{it}$	16.835	1.088	15.099	18.664
$lnTO_{it}$	4.46	0.531	3.629	6.093
$lnKOFGI_{it}$	4.344	0.124	3.999	4.522
$lnSAT_{it}$	1.02	0.867	-3.507	2.985
$lnLDI_{it}$	-0.477	0.431	-2.263	-0.108
$lnTPU_{it}$	-1.836	0.754	-4.423	0.09
$lnFDI_{it}$	9.177	1.328	4.533	12.292
$lnREER_{it}$	4.539	0.145	3.865	5.028
$lnINT_{it}$	15.606	1.612	9.734	18.416
$lnGI_{it}$	0.758	0.513	-0.428	1.413
RCEP	0.067	0.25	0	1
EU	0.6	0.49	0	1
NAFTA	0.133	0.34	0	1

Note: Summary of statistics are computed using log transformed data; the total number observations is 15*28.

Source: Authors' calculation.

The average governance index varies moderately throughout the sample, with a mean indicating a general tendency towards favourable governance standards across the observed organisations. However, the range of values indicates that the dataset contains both poor and high governance quality, emphasising the diversity of governance practices and standards across the observations. The LDI indicates a modest amount of heterogeneity in liberal democratic ideals across observations. The average score of -0.477 on a logarithmic scale implies that the countries in the sample may have lower degrees of liberal democracy. This variable is critical for understanding the range of liberal democratic governance among the countries analysed, as it indicates differing political settings and levels of democracy. It will be interesting to explore how this variability affects the formation of trade agglomerations.

First, we perform various diagnostic tests to evaluate the assumptions underlying the model. Due to financial integration and globalisation, there is a notable cross-sectional dependency among macroeconomic variables (Paramati *et al*, 2016). Traditional panel data estimation methods, including RE and FE models, tend to produce inconsistent results and unreliable inferences when faced with cross-sectional dependence. To address this challenge, we utilise the cross-sectional dependence (CD) test formulated by Pesaran in 2015. The tests conducted include the cross-sectional dependency test using Pesaran's (2015) approach, the first-order serial correlation test following Wooldridge's (2003) methodology, and tests for panel group-wise heteroscedasticity, employing methods like the Lagrange Multiplier (LM) test, the Likelihood Ratio (LR) test, and the Wald (1943) test. The outcomes of the diagnostic tests are detailed in Tables 3 and 4.

The results from the Pesaran test indicate a rejection of the null hypothesis of cross-sectional independence at a 1% significance level across all the variables used in the study, suggesting the presence of cross-sectional dependencies within the panel data. Similarly, the application of Wooldridge's test for serial correlation leads to the rejection of the null hypothesis that there is no first-order serial correlation, again at a 1% significance level. This finding highlights issues of serial correlation in the data. Additionally, the Wald tests for panel group-wise heteroscedasticity shows the rejection of the null hypothesis of homoscedasticity across the panel groups at a 1% significance level, indicating the presence of heteroscedasticity.

Table 3: Results of diagnostic tests for serial correlation and heteroscedasticity

Test	Error Process	Test Statistic	Chi (2) Value
Wooldridge test	Serial correlation	Chi (2)	163.30***
Modified Wald test	Heteroscedasticity	Chi (2)	384.15***

Note: Heteroscedasticity: Modified Wald test for group-wise heteroscedasticity in fixed effect regression model; H_0: sigma(i)^2 = sigma^2 for all i: No heteroscedasticity. Serial correlation: Wooldridge test for autocorrelation in panel data; H_0: no first-order autocorrelation. ***Significance at the 1% level. Probability levels are very near zero.

Source: Authors' calculations based on fixed effect regression.

Table 4: Results of Pesaran's (2015) CD test

Variables	CD test
$lntrade_{it}$	49.874***
$lnGDP_{it}$	46.932***
$lnPOP_{it}$	23.397***
$lnTO_{it}$	24.388***
$lnSAT_{it}$	34.495***
$lnKOFGI_{it}$	50.015***
$lnLDI_{it}$s	8.916***
$lnTPU_{it}$	10.030***
$lnFDI_{it}$	14.566***
$lnREER_{it}$	14.784***
$lnINT_{it}$	53.222***
$lnGI_{it}$	4.673***

Notes: Under the null hypothesis of cross-section independence, CD ~ N (0,1). P-values close to zero indicate data are correlated across panel groups. ***Significance at the 1% level; all the significance almost at the near-zero probability.

Source: Authors' calculations are based on fixed effect regression.

Table 5 presents FGLS estimation results: Model 1 shows the impact of trade openness on total trade, while Model 2 highlights globalisation's effect on trade. Table 5 reveals that the GDP of selected countries has a significant and positive effect on trade, with a significant level of 1% and 5 % in model 1 and model 2, respectively. This implies an increase in the GDP of countries of 1%, which corresponds to a modest 0.057 % and 0.016 % rise in selected countries' trade in both models. The positive coefficient associated with a country's GDP underscores the notion that higher income levels in the countries led to a greater demand for trade.

Table 5: Results of Estimation of FGLS

Dependent variable: Total Trade	(1)	(2)
Variables	**Trade Openness**	**Globalisation**
$lnGDP_{it}$	0.057***	0.016**
	(0.013)	(0.012)
$lnPOP_{it}$	0.762***	0.548***
	(0.039)	(0.031)
$lnTO_{it}$	0.810***	
	(0.064)	
$lnKOFGI_{it}$		4.726***
		(0.319)
$lnSAT_{it}$	-0.010	-0.036*
	(0.020)	(0.020)
$lnLDI_{it}$	0.221**	0.555***
	(0.098)	(0.086)
$lnTPU_{it}$	0.012	-0.042
	(0.020)	(0.021)
$lnFDI_{it}$	0.026*	0.105***
	(0.015)	(0.015)
$lnREER_{it}$	-1.178***	-1.552***
	(0.128)	(0.135)
$lnINT_{it}$	0.180***	0.033*
	(0.013)	(0.017)
$lnGI_{it}$	0.775***	0.137*
	(0.078)	(0.083)
RCEP	-1.278***	-0.944***
	(0.086)	(0.072)
EU	-0.381***	-0.399***
	(0.064)	(0.056)
NAFTA	-0.158**	0.067
	(0.071)	(0.070)
Constant	-8.302***	-22.269***
	(1.018)	(1.755)
Time fixed effect	Yes	Yes
Country fixed effect	Yes	Yes
Wald chi2(14)	3938.11***	3769.59***

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Source: Authors' calculations. Total number of observations are 15*28.

The population acts as a proxy for market size. Our results confirm that a 1% increase in the market size of countries is associated with a 0.762% and 0.48% rise in total trade. Notably, the effect of population size on trade surpasses the influence of GDP in these countries. This highlights the role demographic factors have in driving consumption and trade. Population size influences total trade by driving domestic demand, enhancing production capacity, and expanding labour supply, thereby increasing both imports and exports (Knack and Azfar, 2003).

Regression results indicate a strong correlation between trade openness and total trade, suggesting that countries with higher openness are more integrated into the global economy. Hence,

new players have emerged in the world trade. The coefficient of trade openness is positive, at a significant level of 1%. Globalisation has notably benefited from economic strategies that emphasise deregulation and the relaxation or complete removal of barriers to international trade, foreign investment, and financial flows. The drive towards trade liberalisation has taken place on multiple fronts: multilaterally, through rounds of global negotiations, bilaterally and regionally, via preferential trade agreements, and even unilaterally in some cases. The success of several newly industrialised countries in Asia and the West, which harnessed export-driven growth models, has influenced a broader shift towards policies that underscore the critical role of trade in achieving industrialisation and economic development. Thus, this development enabled nations to identify superior markets and create trade clusters, even in the absence of formal trade agreements. As a result, countries are engaging in trade with the intention of harnessing the benefits produced by economic globalisation and forming informal trade agglomerations. Interestingly, our findings reveal that the globalisation index coefficient is positive and significant, with a value surpassing all other parameters analysed in the study. This indicates an increase in the globalisation of countries of 1%, which corresponds to a 4.726% rise in selected countries' trade.

The results of the liberal democracy index have a positive impact on trade flows, but the level of significance is not as high as LPI and trade openness. Previous research pointed out that strong democracy establishes peace in society (Mandelbaum, 2019), which attracts investment (Doces, 2010; Pastor and Sung, 1995) and boosts economic growth and trade. With the surge in internet connectivity worldwide, there has been an unprecedented increase in the accessibility of global markets, enabling even the smallest businesses to engage in international trade. This digital revolution has facilitated the rise of e-commerce platforms, allowing companies to reach a wider audience than ever before. As a result, the barrier to entry for engaging in global commerce has dramatically lowered, leading to increased economic growth and opportunities in both developed and developing countries. In both models, the variable number of internet users is found to be significantly affecting trade. Furthermore, the analysis identifies that the exchange rate negatively impacts the trade. FDI inflows frequently boost international commerce by providing funding for growing local industries and allowing access to new markets. This symbiotic connection boosts the host country's export capability while boosting imports of raw materials and intermediate commodities used in production. Hence, the FDI variable significantly affects trade flows in both models, but the magnitude is higher once we consider or control the effects of globalisation. Interestingly, we found that TPU doesn't have any significant impact on trade-agglomerated countries. This implies that market forces encourage the growth of international economic partnerships, especially in the face of uncertainty. It suggests that the inherent advantages and efficiency achieved from improved trade links are significant enough to outweigh any possible hazards or disruptive consequences that uncertainty may bring. Furthermore, it asserts that when the benefits of trade agglomeration resulting in higher efficiency and productivity are substantial, they could outweigh and alleviate the negative effects of uncertainty in the selected economics. High-quality institutions are critical for building a trade-friendly climate because they uphold the rules of law, enforce contracts, and offer a consistent regulatory framework. These variables are critical for both domestic and foreign enterprises because they lower the costs and risks connected with trading. When

institutions are robust and transparent, they can successfully regulate and facilitate commerce by enforcing trade agreements, safeguarding property rights, and combating corruption. This can attract foreign investment and improve market competitiveness and trade. Furthermore, institutional quality influences a country's capacity to participate in and benefit from global commerce. Countries with stronger institutions are more likely to engage in international commerce, recruit varied trade partners, and join global value chains. This is because excellent institutions foster confidence among trade partners and create a stable environment for long-term investment. In contrast, poor institutions can act as a trade barrier, isolating countries from the global market and stifling economic progress. Thus, strengthening institutional quality is regarded as a critical approach for countries seeking to improve their trade prospects and achieve long-term economic growth. The relationship between institutional quality and commerce is complicated and multifaceted, including numerous economic, political, and social dimensions, and it plays a key role. Hence, given this theoretical background, we assume that trade agglomeration hinges on the quality of institutions. In both models, we found that the average value of institutions has a positive and significant impact on the total trade in the trade-agglomerated countries.

Utilising conventional panel data methodologies to estimate the baseline model, as discussed earlier, may lead to skewed outcomes due to challenges related to reverse causality and endogeneity. Hence, to address these issues, we have employed the two-step robust system GMM approach as suggested by Arellano and Bover (1995) and Blundell and Bond (1998). The estimated results of FGLS remain the same, but the magnitude of the coefficient is different in system GMM estimation (Table 6). Upon addressing the complexities of reverse causality and endogeneity, our findings indicate a notable adjustment in the estimated impact of globalisation on trade flows. Specifically, the magnitude of the globalisation coefficient experiences a significant reduction, shifting from an initial estimate of 4.726% using FGLS to 1.844% when employing the GMM approach.

Furthermore, an intriguing aspect of our analysis lies in the effects of various Regional Trade Agreements (RTAs) on trade flows. Notably, the influence of the Regional Comprehensive Economic Partnership (RCEP) on trade dynamics remains consistent with the estimates derived from the FGLS model. However, the analysis reveals a distinctive and significant positive impact of the North American Free Trade Agreement (NAFTA) and European Union (EU) RTA dummies on trade flows, diverging from initial findings, compared to the reference group (countries that are not part of RTAs). This positive effect can be attributed to the composition of the sample economies involved in the study. Specifically, Canada and Mexico, key members of NAFTA, appear to significantly benefit from their participation in the agreement, enhancing trade flows among the member countries. Similarly, the EU RTA dummy's positive impact is particularly pronounced, reflecting the substantial representation of EU countries within the selected sample. Most of the nations examined are part of the EU, suggesting that membership within this regional bloc positively influences their total trade. This observation is aligned with the understanding that EU integration facilitates trade among its members through reduced trade barriers, harmonised regulations, and a unified market.

Table 6: Estimations-based Generalised Method of Moments

Dependent variable: Total trade	**(1)**	**(2)**
Variable	**Trade openness**	**Globalisation**
$lntrade_{it-1}$	0.237***	0.159***
	(0.043)	(0.048)
$lnGDP_{it}$	0.465***	0.628***
	(0.055)	(0.049)
$lnPOP_{it}$	0.853***	1.148***
	(0.157)	(0.156)
$lnTO_{it}$	0.806***	
	(0.135)	
$lnKOFGI_{it}$		1.844***
		(0.502)
$lnSAT_{it}$	-0.025**	-0.046***
	(0.010)	(0.010)
$lnLDI_{it}$	0.341***	-0.470***
	(0.087)	(0.091)
$lnTPU_{it}$	-0.035*	-0.042
	(0.015)	(0.016)
$lnFDI_{it}$	-0.008	-0.007
	(0.007)	(0.008)
$lnREER_{it}$	-1.473***	-1.165***
	(0.164)	(0.168)
$lnINT_{it}$	0.060***	0.043**
	(0.011)	(0.017)
$lnGI_{it}$	0.656***	0.686***
	(0.143)	(0.157)
RCEP	-3.738***	-5.090***
	(0.687)	(0.679)
EU	1.370***	1.085***
	(0.202)	(0.260)
NAFTA	3.375***	3.305***
	(0.318)	(0.383)
Constant	4.831**	3.797
	(2.273)	(3.386)
Observations	405	405
No. of instruments	54	41
Arellano-Bond test for AR (1)-p-value	0.032	0.046
Arellano-Bond test for AR (2)- p-value	0.176	0.283
Hansen j-test	538.27	385.73
p-value	0.000	0.000

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

The system GMM technique incorporates the Hansen J-test, which is used to evaluate the validity of the over-identifying restrictions in GMM estimation. Additionally, the AR (2) test, known as the Arellano-Bond test, is utilised to detect the presence of second-order autocorrelation in the first differences of the residuals.

Source: Authors' calculations.

Results of Trade Potential

In accordance with the previous literature (P. Kumar, Sahu, and Ansari (2021), Waheed and Abbas (2015), Batra (2006), and Irshad *et al*, (2018)), coefficients obtained from the FGLS model were utilised to estimate the trade potential of 15 countries from 1995 to 2022. Next, we have taken the average value of all the indicators reported in Table 7. The results show the average trade potential of agglomerated countries from 1995 to 2022. Countries like Denmark, Turkey, the Philippines, Portugal, and Romania stand out with P/A ratios significantly above 1 (1.804, 1.785, 1.860, 1.445, 1.442, respectively), indicating that there is great potential for trade expansion.

Table 7: Average trade potential of agglomerated countries during 1995-2022

Countries	Total trade (A)	Predict trade (P)	P-A	P/A
Belgium	5892.857	3601.786	-2291.071	0.611
Canada	6903.571	6965.357	61.598	1.009
Czech Republic	2251.786	1736.643	-515.581	0.771
Denmark	1651.071	2977.857	1327.036	1.804
Hong Kong, China	5485.714	2660.357	-2826.036	0.485
Ireland	2110.714	2360.714	249.964	1.118
Italy	8014.286	5889.286	-2124.744	0.735
Mexico	5775.000	2657.857	-3117.143	0.460
Norway	1735.714	1215.286	-521.285	0.700
Philippines	1127.857	2097.500	969.714	1.860
Poland	2963.571	2941.286	-22.372	0.992
Portugal	1142.857	1651.571	508.679	1.445
Romania	1001.429	1444.214	443.242	1.442
Spain	5125.000	5275.357	150.993	1.029
Turkey	2871.786	5126.964	2258.321	1.785

Note: All values are expressed in millions of US dollars. "Predicted trade" (P) represents the yearly average forecasted trade data for the period 1995 to 2022. The difference between predicted and actual trade is denoted by "P-A," and the ratio of predicted to actual trade is represented by "P/A," which is also averaged for the same period.

Source: Authors' calculations.

This suggests a robust potential for further trade expansion with these countries, driven perhaps by factors such as economic complementarities, strong diplomatic relations, or effective trade agreements. On the other hand, countries like Mexico, Belgium, the Czech Republic, and Hong Kong, China, with P/A ratios below 1 (0.735, 0.611, 0.771, and 0.485, respectively), reflect a shortfall in reaching their predicted trade potentials. This indicates a cautious approach towards these countries, potentially exploring ways to bolster trade through negotiations, removing trade barriers, or enhancing competitiveness in key sectors.

Noteworthy are Canada and Spain, with P/A ratios just over 1 (1.009 and 1.029, respectively), indicating a slight overachievement against predictions and suggesting a stable but modest potential for

trade expansion. These countries have likely capitalised on their existing trade agreements and economic policies effectively but might need to explore new areas for trade growth. Countries such as Ireland, with a P/A ratio of 1.118, and Poland, with a P/A ratio of 0.992, also demonstrate a notable potential for expanding trade.

Results of Panel Quantile Regression Analysis

The chosen economies within the trade agglomeration countries exhibit diverse and heterogeneous levels of development with respect to their total trade and other indicators taken for the analysis. Given this heterogeneity, traditional mean-based regression models fall short of capturing the nuanced impacts of these variables. Therefore, we employed the panel quantile regression. This method allows us to analyse the influence of these variables across different quantiles, providing a more detailed and comprehensive understanding of their impact at various levels of economic and institutional development. To achieve this objective, we conducted analyses across the 10^{th}, 20^{th}, 30^{th}, 40^{th}, 50^{th}, 60^{th}, 70^{th}, 80^{th}, and 90^{th} quantiles, respectively. The estimated results of panel quantile regression are reported in Table 8.

Our panel quantile regression analysis reveals that the impact of independent variables on total trade varies significantly across different quantiles (Table 8). The influence of GDP on trade varies across different levels of economic distribution. Specifically, as we move towards higher quantiles, the positive impact of GDP on trade becomes more pronounced. The population selected significantly boosts trade at a 1%, 5 %, and 10 % significance level across various quantiles, except for the 10th and 20^{th}quantiles. This analysis shows that an increase of 1% in population can lead to a trade in the economy of between 0.533 % and 0.754% at the 80^{th} and 90^{th} quantiles. Given these insights, we advocate higher GDP and high population act as major drivers of agglomeration trade among the 15 countries. Regarding trade openness, our analysis uncovers a variable impact on trade across different quantiles.

As we move to higher quantiles, the influence of trade openness on trade becomes more pronounced, highlighting its critical role in fostering trade expansion and encouraging regional clustering. The impact of average applied tariff rates is negative and significant across quantiles; however, at lower quantiles, the simple average tariff rate does not significantly affect trade, implying that low tariffs can still promote trade. Notably, the effect of TPU on trade flows is negative and significant at higher quantiles, whereas it has no impact at lower quantiles, suggesting that TPU adversely affects trade at elevated levels. While FGLS results suggested no TPU effect, quantile regression reveals that high TPU can negatively impact trade. FDI strengthens trade more at higher quantiles, whereas it is insignificant at lower quantiles. The exchange rate exerts a consistent negative effect across quantiles, as does the number of internet users. Governance indicators show a positive, significant effect across all quantiles, except the 90^{th}, indicating that strong governance fosters trade partnerships and is a key driver of trade agglomeration.

Table 8: Panel Quantile Regression: Trade Openness

Variables	10th	20th	30th	40th	50th	60th	70th	80th	90th
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
$lnGDP_{it}$	0.410***	0.405***	0.400***	0.396***	0.490**	0.492***	0.498**	0.568***	0.560***
	(0.038)	(0.032)	(0.028)	(0.026)	(0.024)	(0.026)	(0.033)	(0.040)	(0.050)
$lnPOP_{it}$	0.568	0.428	0.315**	0.205*	0.033**	0.137**	0.360***	0.533***	0.754***
	(0.379)	(0.317)	(0.279)	(0.259)	(0.248)	(0.275)	(0.328)	(0.393)	(0.499)
$lnTO_{it}$	1.299***	1.308***	1.315***	1.321***	1.332***	1.342***	1.356***	1.366***	1.379***
	(0.115)	(0.098)	(0.087)	(0.079)	(0.074)	(0.080)	(0.100)	(0.122)	(0.154)
$lnSAT_{it}$	-0.003	-0.002	0.021	-0.001	-0.002*	-0.003**	-0.025**	-0.017**	-0.029**
	(0.021)	(0.018)	(0.016)	(0.014)	(0.013)	(0.015)	(0.018)	(0.022)	(0.028)
$lnLDI_{it}$	0.537*	0.540**	0.543*	0.546**	0.550**	0.554***	0.560***	0.564***	0.569***
	(0.097)	(0.083)	(0.073)	(0.066)	(0.062)	(0.067)	(0.085)	(0.103)	(0.130)
$lnTPU_{it}$	0.008	0.005	0.004	0.002	-0.001	-0.013**	-0.027**	-0.049**	-0.013**
	(0.020)	(0.017)	(0.015)	(0.014)	(0.013)	(0.014)	(0.017)	(0.021)	(0.026)
$lnFDI_{it}$	0.047	0.018	0.028**	0.069	0.039	0.010**	0.011**	0.012**	0.012**
	(0.014)	(0.012)	(0.011)	(0.010)	(0.009)	(0.010)	(0.013)	(0.015)	(0.019)
$lnREER_{it}$	-1.511**	-1.512**	-1.513*	-1.513***	-1.515*	-1.516*	-1.518**	-1.519***	-1.521***
	(0.144)	(0.123)	(0.108)	(0.098)	(0.092)	(0.100)	(0.125)	(0.153)	(0.192)
$lnINT_{it}$	0.097***	0.093***	0.089***	0.086***	0.080***	0.075***	0.068***	0.063***	0.056**
	(0.020)	(0.017)	(0.015)	(0.014)	(0.013)	(0.014)	(0.018)	(0.021)	(0.027)
$lnGI_{it}$	0.294*	0.292**	0.291**	0.290***	0.288***	0.287***	0.285**	0.283***	0.281**
	(0.151)	(0.129)	(0.114)	(0.103)	(0.097)	(0.105)	(0.132)	(0.160)	(0.202)
Observations	420	420	420	420	420	420	420	420	420

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Source: Authors'calculation.

Table 9 shows the results of a panel quantile regression analysis by controlling the effects of globalisation, focusing on the impact of various variables on total trade. We made a key observation: the significant and consistently positive impact of the globalisation index across all quantiles. The coefficients decreased from 5.135 at the 10th quantile to 4.780 at the 90th, indicating that globalisation plays a critical role in facilitating trade across all levels of trade intensity, though its relative importance slightly decreases as trade increases. This suggests that countries more integrated into the global economy experience higher trade, with the impact being more pronounced at lower levels of trade activity and acting as the major driver of trade agglomeration. TPU shows a nuanced impact on trade. Initially, its coefficients are slightly positive or neutral, but as we move to higher quantiles, the impact becomes slightly negative, particularly after the 70th quantile. This shift suggests that while TPU may not significantly deter trade at lower levels of trade intensity, it becomes a hindrance as trade increases, potentially due to the greater risks and costs associated with uncertainty in more substantial trade engagements. Our variable of interest and governance indicators demonstrate a consistently positive and significant impact on trade across most quantiles, with a slight decrease in the magnitude of the impact as trade increases. This underscores the importance of strong governance mechanisms in supporting trade. High-quality governance infrastructure facilitates trade by ensuring a stable and predictable business environment, which is critical for both domestic and international traders. The fact

that the positive impact slightly diminishes at higher quantiles might suggest that while good governance is fundamental to enabling trade, its relative incremental benefit on trade might decrease as countries achieve higher levels of trade intensity.

Panel Quantile Regression analysis reveals the importance of globalisation, governance quality, and the nuanced role of TPU in influencing trade volumes across different levels of economic activity. Globalisation and governance quality are consistently beneficial for trade, highlighting the need for policies that further integrate economies into the global market and enhance governance standards. Meanwhile, the negative impact of TPU at higher quantiles emphasises the importance of stable and predictable trade policies to facilitate trade, especially for economies with large trade.

Table 9: Panel Quantile Regression: Globalisation

Variables	10th	20th	30th	40th	50th	60th	70th	80th	90th
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
$lnGDP_{it}$	0.323***	0.329***	0.331***	0.333***	0.336***	0.340***	0.343***	0.346***	0.350***
	(0.063)	(0.045)	(0.039)	(0.036)	(0.034)	(0.037)	(0.044)	(0.054)	(0.067)
$lnPOP_{it}$	0.121	0.173	0.195	0.212	0.238**	0.267*	0.295***	0.325**	0.358**
	(0.466)	(0.329)	(0.286)	(0.264)	(0.251)	(0.274)	(0.324)	(0.398)	(0.492)
$lnKOFGI_{it}$	5.135***	5.057***	5.024***	5.000***	4.961***	4.917***	4.875***	4.830***	4.780***
	(0.681)	(0.481)	(0.418)	(0.385)	(0.367)	(0.400)	(0.474)	(0.581)	(0.719)
$lnSAT_{it}$	-0.031	-0.031*	-0.031**	-0.031**	-0.031**	-0.031**	-0.031*	-0.031	-0.031
	(0.025)	(0.017)	(0.015)	(0.014)	(0.013)	(0.014)	(0.017)	(0.021)	(0.026)
$lnLDI_{it}$	0.486	0.534*	0.553***	0.568***	0.592***	0.618***	0.644***	0.671***	0.701***
	(0.145)	(0.103)	(0.089)	(0.082)	(0.079)	(0.086)	(0.101)	(0.124)	(0.154)
$lnTPU_{it}$	0.023	0.017	0.014	0.012	0.009	0.006	0.003**	-0.001**	-0.005**
	(0.029)	(0.021)	(0.018)	(0.017)	(0.016)	(0.017)	(0.020)	(0.025)	(0.031)
$lnFDI_{it}$	0.008	0.008	0.007***	0.207**	0.107*	0.047**	0.036***	0.106***	0.306**
	(0.021)	(0.015)	(0.013)	(0.012)	(0.011)	(0.012)	(0.014)	(0.018)	(0.022)
$lnREER_{it}$	-0.798***	-0.852***	-0.874***	-0.892***	-0.918***	-0.949***	-0.978***	-1.009***	-1.044***
	(0.211)	(0.149)	(0.130)	(0.120)	(0.114)	(0.124)	(0.147)	(0.180)	(0.223)
$lnINT_{it}$	0.022	0.018**	0.016*	0.014**	0.012	0.010***	0.007***	0.305**	0.102***
	(0.033)	(0.024)	(0.020)	(0.019)	(0.018)	(0.020)	(0.023)	(0.028)	(0.035)
$lnGI_{it}$	0.488**	0.480***	0.477***	0.475***	0.471***	0.467***	0.462***	0.458**	0.453**
	(0.217)	(0.153)	(0.133)	(0.123)	(0.117)	(0.127)	(0.151)	(0.185)	(0.229)
Observations	420	420	420	420	420	420	420	420	420

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

Source: Authors' calculation.

Conclusions and Policy Implications

This study defines and empirically examines the concept of *trade agglomeration*, which refers to the clustering of trade activity among groups of countries based on shared economic and non-economic drivers rather than mere geographical proximity. In contrast to traditional notions of trade driven primarily by distance, trade agglomeration is shaped by factors such as economic scale, globalisation, institutional quality, and digital connectivity. We examine trade flows across 15 selected countries from 1995 to 2022, applying econometric techniques including Feasible Generalised Least Squares, System Generalised Method of Moments, and Panel Quantile Regression. Our findings suggest that factors such

as GDP, population size, globalisation, trade openness, and governance quality are significant contributors to trade agglomeration. The influence of these factors, particularly globalisation and governance quality, highlights the need for policies fostering trade liberalisation and governance improvement to sustain and expand trade agglomerations. Countries such as Denmark, Turkey, the Philippines, Portugal, and Romania exhibit high trade potential, indicating untapped opportunities for trade expansion. Furthermore, regional trade agreements like the European Union and NAFTA contribute positively to trade flows within member countries, emphasising the role of strategic trade agreements.

Policymakers are encouraged to strengthen trade agglomerations through strategic trade agreements aligning with economic and political objectives. Policies to enhance institutional quality, reduce trade policy uncertainty, and increase digital infrastructure can facilitate smoother trade interactions and attract foreign investment. Additionally, countries with lower-than-expected trade potential should focus on reducing trade barriers and enhancing competitiveness to close the trade gap. Addressing trade policy uncertainty is essential to reduce the risks associated with unpredictable trade environments, especially for high-trade economies. These policy directions aim to build resilient, inclusive, cooperative trade agglomerations, supporting sustained economic growth and global integration.

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Appendix A

Table1.1: Comparative analysis of country-level CAGR transitions across two decades: 2003-2012 versus 2013-2022

	High	**Medium**	**Low**
High	China, Vietnam	India, United Arab Emirates, Indonesia, Chile, Brazil, Slovak Republic	Qatar, Russia, Saudi Arabia
Medium	Turkey, Poland, Romania, Czech Republic, Norway, Hong Kong-China, Mexico,	Australia, Thailand, Korea, Malaysia, Hungary, Netherlands, Germany, United States, Austria	South Africa, Singapore, Switzerland Japan, Sweden
Low	Philippines, Ireland	Canada, Italy, Spain, Portugal, Denmark, Belgium	France, Finland United Kingdom

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Dr V K R V Rao Road, Nagarabhavi P.O., Bangalore - 560 072, India
Phone: 0091-80-23215468, 23215519, 23215592; Fax: 0091-80-23217008
E-mail: sobin@isec.ac.in; Web: www.isec.ac.in