ACADEMIA International Journal for Social Sciences
Volume 4, Issue 4, 2025 ISSN-L (Online): 3006-6638

# Regional Integration and Export Performance: Evidence from Pakistan's Trade with Shanghai Cooperation Organization (SCO)

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**Received:** 11-08-2025 **Revised:** 21-09-2025 **Accepted:**16-10-2025 **Published:** 08-11-2025

## ABSTRACT

*This study provides a comprehensive assessment of regional trade dynamics within the Shanghai Cooperation Organization (SCO), focusing on Pakistan's export trends following its accession as a permanent member in 2017. The study conducts detailed pre- and post-accession analyses of exports, trends show significant growth in trade with Central Asian partners such as Uzbekistan and Kazakhstan. Empirically, the Difference-in-Differences (DID) approach is applied within a gravity model framework using panel data for 2011–2023 to estimate the causal impact of SCO membership on Pakistan's exports. The results are robust and statistically significant, indicating that SCO integration has positively influenced Pakistan's overall export performance. Traditional gravity variables including GDP, population, distance, and shared language or border also behaved as expected, validating the broader applicability of the gravity model in this context. Robustness checks including event studies, and alternative estimations using Fixed Effects (FE) and Poisson Pseudo-Maximum Likelihood (PPML) further validate the results. The results suggest that SCO membership has continued to be a favorable determinant of Pakistan export performance. Moreover, the study indicates the importance of strategic infrastructure initiatives like CPEC and B&R initiatives, sectoral convergence, and regional interdependence act as key facilitators of trade expansion. To best avail of trade facilitation potential of SCO, Pakistan must follow targeted trade policy, enhance its engagement with Central Asian markets, bordering its export diversification, and improve institutional coordination in the regional arrangement.*
***Keywords:*** *Regional Integration, SCO, Exports, Pakistan, Difference-in-Differences*

## INTRODUCTION

The Shanghai Cooperation Organization one of the largest organizations formed in 2001 transitioned from security forum to regional economic cooperation, trade investment, infrastructure development and cultural exchange. SCO currently has nine permanent members including China, Russia, India, Iran, Pakistan, and Central Asian economies Kazakhstan, Kyrgyzstan, Tajikistan, and Uzbekistan cover a significant population, land, resources and markets. With shifting of world towards regional connectivity, the SCO got more importance in promoting economic cooperation especially in Central, South Asia and

Europe. Pakistan Membership in the SCO holds strategic significance as it is vital to bilateral and multilateral trade, whereas it also enable access to Central Asian republics as well as biggest consumer markets in China and Russia. Pakistan can strengthen its economic cooperation and enhance its trade competitiveness foreign direct investment and accelerate its integration into value chain under SCO framework. Therefore, this study builds upon the idea that strengthen economic cooperation under SCO reinforced by development of infrastructure and logistics, policy formulation and trade and investment facilitation is a significant factor to achieve sustainable growth and development as well as regional stability.

Security cooperation and regional integration are the main pillar for global economic and geopolitical landscape especially when two neighboring states have same strategic interest. Many research studies investigate that regional integration frequently strengthen economic cooperation which often leads to formation of trading hubs that make the most of resources. This will not only enhance productivity and efficiency but also induce investment and employment opportunities which will in turn sustainable growth and long-term stability (Ahmad et al., 2024; H. Khan et al., 2025; H. Khan & Edwin, 2024; Manhas et al., 2025; Shah Zaib, 2023).

Covering over 60% of the Eurasian landmass and encompassing nearly 40% of the global population, in recent times SCO becomes one of the largest organizations in the globe. Originally, it mainly emphasized on border management, security related issues, counter terrorism then gradually shifting towards economic cooperation and trade. Such advancement replicated in the outline of an initiatives such as regional transport corridors, trade facilitation, and development of infrastructural projects under BRI and CPEC. Additionally, the SCO bloc with collective GDP crossing $23 trillion reveals such an economic bloc with highest possible for trade, investment, and regional economic connectivity (SCO Business Council, 2023). Whereas China and Russia are the leading trading members of SCO bloc with addition of Central Asian economies play a vital role and country like Pakistan and India grasp strategic locations in international trade and infrastructure connectivity (Aslam & Tariq, 2021; H. Khan & Edwin, 2024; Nawaz et al., 2024).

Furthermore, SCO provides Pakistan the platform for a multilateral solution to well entrenched political and territorial issues, greater regional peace, and potential socio-economic development initiatives. Through its active participation, Pakistan can also work toward resolving border conflicts, strengthening people-to-people ties, and engaging in cross-border infrastructure and energy projects that could have far-reaching developmental impacts (Enayatollah Yazdani & Ma Yanzhe, 2023; Nizamani, 2018; Xu & Rogers, 2023). Pakistan, as a small and open economy, contributes only marginally to global trade. Its export sector has long been constrained by several structural issues, including a low share of value-added goods, overreliance on agriculture and textiles, and limited market diversification. In 2022, approximately 80% of Pakistan’s exports originated from the agriculture and textile sectors, reflecting minimal advancement into higher-value or technology-driven industries. Additionally, 35.4% of the country’s total exports were directed to just five major trading partners, with the United States alone accounting for nearly 16%. This narrow export base and geographic concentration have rendered Pakistan's economy increasingly dependent and vulnerable to external shocks (Abdullahi et al., 2022; Handoyo et al., 2024; Iqra University, Pakistan & Aslam, 2024).

In the case of Pakistan limited empirical research that specifically analyze Pakistan trade performance within the SCO framework. Pakistan became a permanent member of the SCO in 2017, yet few research have examined the significance of this integration on Pakistan trade flows, sectoral trade performance, and market diversification (Aslam & Tariq, 2021; Bano & Mujahid, 2022; Mir Sherbaz Khetran, 2019; Rab & Zhilong, 2018). Most prior research on Pakistan’s trade focuses on bilateral trade agreements,

individual export markets, or the China-Pakistan Economic Corridor(Imran et al., 2024; Nizamani, n.d.; Zahra et al., 2022) rather than analyzing Pakistan's export trends within the broader SCO trade network. While existing literature extensively explores regional integration and its economic impacts, limited attention has been given to the specific context of the SCO and its influence on Pakistan's export performance.

Given these substantial gaps, this study aims to bridge the academic and policy void by providing a comprehensive, empirical evaluation of Pakistan's evolving trade relationship within the bloc. It utilizes trade data from recognized international sources such as UN COMTRADE, WITS, and ITC to assess sectoral trade interdependencies, growth trends, and Pakistan's positioning in the SCO trade structure. By applying advanced empirical methodologies Difference-in-Differences (DID), the study examines pre- and post-2017 trade performance.

The main objectives of this paper are threefold. First, to evaluate the pre- and post-integration export trends between Pakistan and SCO member countries. Second, to empirically estimate the impact of SCO membership on Pakistan's total exports using the DID framework. Third, to derive policy implications that could strengthen Pakistan's regional export competitiveness and economic integration within the SCO framework. By focusing on total exports rather than sector-specific trade, this paper provides a comprehensive perspective on Pakistan's aggregate export performance in the regional context. This study makes several contributions to the existing literature. It adds to the empirical evidence on the trade effects of regional integration by focusing on a relatively understudied regional bloc the SCO and a key developing member state, Pakistan. It extends the application of the gravity model framework through a Difference-in-Differences design, offering robust estimates of the post-membership trade effects. Finally, it provides policy insights into how Pakistan can better leverage regional institutions and connectivity projects like CPEC to strengthen export performance and reduce trade concentration.

## LITERATURE REVIEW

Regional economic integration has become a critical driver of global trade, fostering cooperation among nations to enhance economic growth, trade competitiveness, and market access. Various blocs like EU, ASEAN, and NAFTA, have demonstrated the impact of trade agreements in promoting regional economic development and trade expansion. Shanghai Cooperation Organization (SCO), although primarily known for its political and security associations, has appeared as a key platform for regional economic integration.

The regional integration and export performance is rooted in classical and modern trade theories. According to Ricardo, if a nation is more competent in production compared to other trading partner, common benefits can still be attained from trade if each emphasis on producing what they can produce at a lesser opportunity cost. This theory rises the idea that under regional integration, removing trade restrictions and strengthening cooperation between trading partners lets them to maximize efficiency and productivity to gain mutual benefits (Ricardo, 1817). In New Trade Theory, (1970) Paul Krugman explaining role of economies of scale and market size in enhancing trade and economic growth by emphases on economic integration. Similarly, Krugman discuss that countries can benefitted from trade not only due to differences in resources or technologies but also by paying attention on industries with larger markets as in classical theories (P. Krugman, 1985). Similarly, the Gravity Model of Trade (Anderson & Van Wincoop, 2001) has become the dominant empirical framework for analyzing trade flows. It suggests that bilateral trade is positively related to economic size (GDP) and inversely related to geographic distance, while regional agreements act as trade-enhancing mechanisms by reducing friction and improving market access.

Within the context of regional organizations such as the SCO, these theoretical foundations imply that membership can influence trade by improving infrastructure, harmonizing regulations, and facilitating cross-border logistics. A large body of empirical work supports the view that regional integration contributes positively to export performance. Studies on the European Union (EU), ASEAN, and NAFTA demonstrate significant increases in intra-bloc trade and export diversification following integration (Van Der Marel & Shepherd, 2013) find that countries participating in regional trade agreements experience trade increases of 30, 40 percent relative to non-members. These studies highlight that the benefits of integration are not limited to tariff reduction but also stem from non-tariff improvements such as trade facilitation and institutional cooperation.

Empirical assessments of SCO-related trade suggest a gradual rise in intra-regional trade volumes since 2010, especially after the inclusion of India and Pakistan in 2017. (Çam Karakaş et al., 2019) finds that trade among core SCO members (China, Russia, and Central Asian states) has grown steadily, driven by energy exports, industrial goods, and infrastructure projects. However, intra-SCO trade remains below potential due to logistical bottlenecks, tariff disparities, and limited product diversification. Pakistan's export sector has historically faced structural challenges including a narrow export base, limited product diversification, and fluctuating competitiveness. Empirical research highlights that Pakistan's trade is highly concentrated in a few destinations and dominated by low-value-added goods (Kamal et al., 2022; Mahmood & Jongwanich, 2018). Several studies have applied the gravity model to analyze Pakistan's trade flows and determinants. For example, (Mahmood & Jongwanich, 2018) found that GDP, distance, and population significantly influence Pakistan's exports, while regional agreements positively affect trade volumes. Similarly,(D. M. A. Khan, 2021; Singh & Magray, 2017) emphasize that regional cooperation under the China Pakistan Economic Corridor (CPEC) has enhanced logistical connectivity and export potential, particularly by linking Pakistan with Central Asian and Eurasian markets. Nonetheless, the empirical evidence specifically linking SCO membership to Pakistan's total export performance remains limited. Very few studies examine whether Pakistan's accession to the SCO in 2017 has produced measurable improvements in its aggregate exports. For instance, (Hussain & Zulfiqar Ali Shah, 2022) suggest that SCO membership offers long-term potential for trade growth, but quantitative verification of such effects using econometric methods remains scarce.

Lot of studies have done to assess the significance of regional integration within the SCO, however, in the context of intra-SCO sectoral trade analysis as well as Pakistan exports performance with the bloc is still unexplored. This study has one of the objectives to cover this gap by directing a comprehensive analysis, contributing empirical investigation into trade flows and emerging opportunities for Pakistan.

**Theoretical Framework and Model Specification**

Theoretical and empirical foundation of the study to analyze Pakistan's export performance within the Shanghai Cooperation Organization (SCO). Building on the conceptual logic of international trade, the study adopts the Gravity Model of Trade as the core theoretical framework, which explains bilateral trade flows based on economic size and distance. To capture the causal effect of Pakistan's 2017 accession to the SCO, the study extends the gravity framework by incorporating the Difference-in-Differences (DID) approach, allowing for a rigorous evaluation of the pre- and post-integration export dynamics between Pakistan and SCO member states.

The Gravity Model of Trade provides the primary theoretical framework for explaining bilateral trade flows between countries. The model's conceptual foundation originates from Tinbergen (Tinbergen, 1962) , who first observed that international trade between two countries is directly related to their economic size and inversely related to the geographical distance between them drawing an analogy from

Newton's law of universal gravitation. The gravity model serves as the fundamental empirical framework for analyzing international trade flows. It suggests that trade between two countries increases with their economic size (GDP and population) and decreases with geographical distance. To better explain trade patterns, additional factors such as shared borders and common languages are often included, as they enhance communication and lower transaction costs.

While the gravity model explains the structural determinants of trade flows, it does not identify the causal effects of specific policy changes or integration events. To overcome this limitation, the present study adopts the Difference-in-Differences (DID) approach one of the most widely used quasi-experimental techniques in applied economics to estimate the causal impact of Pakistan's accession to the Shanghai Cooperation Organization (SCO) in 2017 on its export performance. The DID methodology originated in labor economics. Ashenfelter-1978 and Card and Krueger (1994) were among the first to apply difference in difference (DID) (Fredriksson & Oliveira, 2019). Since then, the DID framework has become a cornerstone in empirical economics and has been increasingly applied in international trade and integration research (Beyer, 2025; Dung et al., 2024; Liang et al., 2025; Liu & Lin, 2024; Ponnusamy, 2022; Zeng et al., 2024; T. Zhang et al., 2022; X. Zhang et al., 2023).

In the context of this study, the DID framework is integrated within the gravity model to isolate the causal impact of Pakistan's integration with the Shanghai Cooperation Organization (SCO) on its export performance. The following DID-augmented gravity model specify to empirically test the Pakistan Exports performance with SCO after its association.

$$EX_{ijt} = \alpha + \beta_1 SCO_{ijt} + \beta_2 GDP_{it} \times \beta_2 GDP_{jt} + \beta_3 POP_{ijt} \times \beta_3 POP_{ijt} + \beta_4 DIST_{ijt} + \beta_5 LNG_{ijt} + \beta_6 BDR_{ijt} + \nu i + \delta t + \varepsilon it$$

The empirical model includes several variables grounded in trade theory. The central DID-treatment variable is the SCO membership dummy, which captures the policy effect of regional integration by distinguishing between member and non-member countries, reflecting how Pakistan's accession in 2017 may have enhanced trade through improved market access and cooperation. Economic size and market potential are represented by GDP, expected to positively influence exports as larger economies generate higher trade demand. Population measures market size and labor availability, similarly expected to boost exports by expanding consumer bases and production capacity. Distance acts as a proxy for trade costs, anticipated to negatively affect exports due to higher transport expenses. The border dummy captures the effect of geographical proximity, with shared borders facilitating trade through reduced costs and stronger connectivity. Common language reflects cultural and communication ties that ease transactions and foster trade relations. α, represents the intercept term, ν, represents country fixed effects, δ, represents time fixed effects, and ε, denotes the error term in the model. Collectively, these variables capture economic mass, trade resistance, and integration effects, providing a robust framework for analyzing how SCO membership influences Pakistan's total exports.

In this study the dataset employed comprises of a balanced panel of 32 countries, with both treatment and control groups, observed over 13 years (2011–2023). This gives a total of 416 country-year observations. The data used in this study was sourced from several reputable databases, including the World Indicator Trade Solution, WITS, International Trade Center, ITC, World Development Indicators, WDI and the CEPII database. To assess market size, consumption, and demand potential between Pakistan and its trading partners, the study applied data on gross domestic product, GDP and population from the WDI. In addition, information on linguistic similarities, border commonalities, and geographical distance data was obtained from the CEPII database.

## DATA ANALYSIS

This chapter offers both descriptive and empirical analyses of exports performance of Pakistan after its membership with SCO. Descriptive section evaluates pre and post yearly exports performance to SCO members. This calculation provides the ground foundation for empirical analysis and help in guiding trade policy. The empirical section consists on by conducting econometric models to evaluate the effect exports performance of Pakistan after its integration with SCO. Applying the Difference in Differences estimation technique along with augmented Gravity model, the study captures the impact of SCO integration on Pakistan exports flow.

### Exports to SCO Countries: Pre and Post Yearly Overview

Table 01 presents the pre and post integration overview of Pakistan total exports within SCO region. During the pre-integration period (2010–2016), Pakistan's exports increased gradually from 1,778,955 in 2010 to 2,230,843 in 2016, recording average yearly, growth rate of around 3.7 percent. Even though the tendency was stable, the pace of growth remained relatively moderate, reflecting limited trade expansion before Pakistan's full integration into the SCO. In contrast, the post-integration period (2017–2023) shows a more accelerated export performance, as exports rose from 2,228,463 in 2017 to 3,045,981 in 2023, with average yearly growth rate approximately 5.6 percent. The progress momentum particularly stronger in the later years, peaking at 7 percent in 2023, indicating deeper trade linkages and possible benefits derived from Pakistan's regional cooperation under the SCO framework. Overall, the comparative trend suggests that Pakistan's formal membership in the SCO contributed positively to enhancing its total exports to member countries.

***Table 01: Pre and post overview of Total Exports with SCO***

| Pre-Integration | | | Post-Integration | | |
|---|---|---|---|---|---|
| **Year** | **Exports to SCO** | **Growth Rate** | **Year** | **Exports to SCO** | **Growth Rate** |
| 2010 | 1778955 | -- | 2017 | 2228463 | -- |
| 2011 | 1846226 | 3.78149 | 2018 | 2323210 | 4.251675 |
| 2012 | 1904008 | 3.12974 | 2019 | 2450165 | 5.464637 |
| 2013 | 1984432 | 4.22393 | 2020 | 2575578 | 5.118553 |
| 2014 | 2058589 | 3.73694 | 2021 | 2691735 | 4.509939 |
| 2015 | 2140015 | 3.95543 | 2022 | 2846392 | 5.745625 |
| 2016 | 2230843 | 4.24427 | 2023 | 3045981 | 7.012 |

Source: Author calculation based on ITC & WITS

The figure 01 shows that Pakistan's export growth rate to SCO members improved noticeably after joining the organization in 2017. During the pre-SCO period (2011–2016), growth remained moderate and stable, averaging around 4%. However, in the post-SCO years (2018–2023), exports accelerated, reaching above 7% by 2023. This clear upward shift suggests that regional integration under the SCO has positively influenced Pakistan's export performance through enhanced cooperation and trade facilitation.

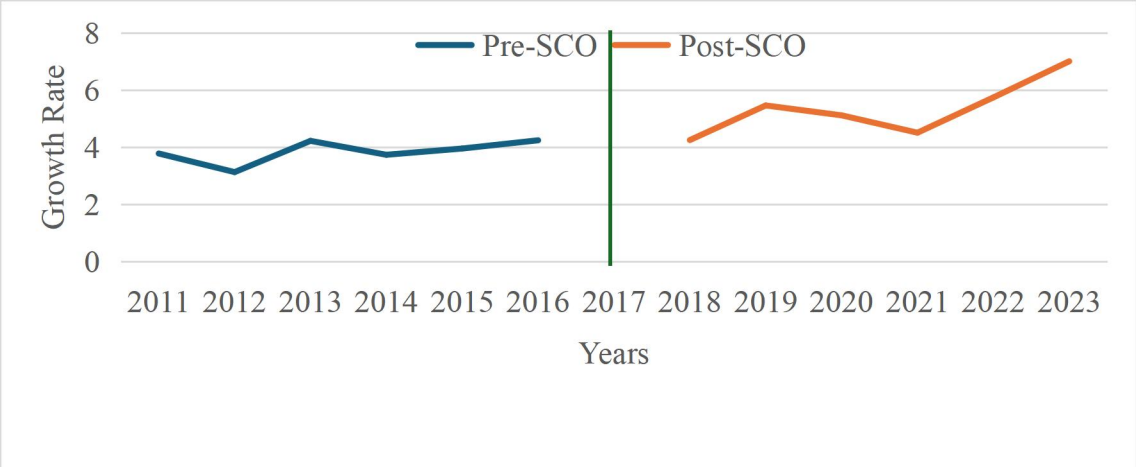


*Figure 01: Pre and post overview of exports with SCO*
Source, Author's compilation based on table 01

**Empirical Analysis**

The empirical analysis assesses the significance of exports performance of Pakistan after its integration with SCO, by applying different sequence of econometric strategies. The analysis starts with examination of parallel trend assumption through pretreatment event study, confirming that exports of Pakistan tailed comparable trajectory with control group before SCO membership and thus justifying the Difference in Differences approach. After this, the DID model is conducted along with augmented Gravity model, the study captures the impact of SCO integration on Pakistan exports flow. To strengthen the robustness of baseline results, supplementary alternative estimation techniques applied such as PPML and FE. These methods are useful to address possible prejudices rising from ignored heterogeneity and international trade shocks.

**Descriptive Statistics**

Table 02 summarizes the descriptive statistics of the study variables. The SCO dummy has a mean of 0.415, indicating that about 41% of observations involve SCO members, with balanced variation. Around 55% of country pairs share a common language and 44% a common border, reflecting strong cultural and geographic linkages. The logs of GDP (mean = 36.63) and population (mean = 34.46) show wide economic and demographic differences among partners, while distance (mean = 11.53) captures geographical diversity. Pakistan's export variable (mean = 13.50; SD = 1.96) indicates substantial trade variation, confirming the dataset's suitability for robust empirical analysis.

**Table 02: Descriptive Statistics for the variables**

| Variables | Mean | Standard Deviation | Minimum | Maximum | Observations |
|---|---|---|---|---|---|
| SCO (Dummy) | 0.415 | 0.493 | 0 | 1 | 416 |
| GDP (ln) | 36.626 | 1.987 | 35.543 | 38.766 | 416 |
| Population (ln) | 34.461 | 1.087 | 32.768 | 36.786 | 416 |
| Distance (ln) | 11.525 | 1.870 | 6.753 | 11.545 | 416 |
| Language (Dummy) | 0.454 | 0.497 | 0 | 1 | 416 |
| Border (Dummy) | 0.545 | 0.497 | 0 | 1 | 416 |
| Total Exports (ln) | 13.500 | 1.956 | 9.230 | 22.540 | 416 |

Source: Author calculation

**Multicollinearity Assessment**

To confirm the dependability of the regression results in examining the effect of SCO on exports of Pakistan, which is crucial to examine for multicollinearity between the explanatory variables. The Variance Inflation Factor (VIF) is applied as a diagnostic tool to capture the degree of multicollinearity, a higher VIF value designates a stronger correlation with other predictors in the model. The Variance Inflation Factor results for total exports Table 03 indicate that multicollinearity is not a significant issue among the explanatory variables. All estimated VIF values consist well below the range of 10 which is conventional threshold, with the highest border (3.22) and GDP (3.19). Population, distance, and language all fall within a lower range (1.45–1.72), while SCO membership has the lowest VIF (1.22). The mean VIF of 2.06 further confirms that collinearity is at an acceptable level. These findings suggest that each predictor provides unique information to the model, allowing for reliable estimation of their effects on total export performance.

***Table 03 VIF Assessment***

| (Variables) | (VIF) | (1/VIF) |
|---|---|---|
| SCO | 1.22 | 0.310206 |
| GDP | 3.19 | 0.313830 |
| Population | 1.72 | 0.582250 |
| Distance | 1.57 | 0.637597 |
| Language | 1.45 | 0.691223 |
| Border | 3.22 | 0.822981 |
| Mean VIF | 2.06 | -- |

Source: Author calculation

**Pre-Treatment Trends (Event Study): Parallel Trends Assumption**

Before estimating the baseline DID model, a pretreatment event study was conducted to verify the parallel trends assumption, a key requirement for causal validity. The test examined whether Pakistan's exports to SCO (treatment) and non-SCO (control) countries followed similar trends before SCO accession. The corresponding Figure 02 visually supports this finding, showing parallel export movements before 2017 and divergence afterward. Together, the statistical and graphical evidence validate the DID model's assumptions and confirm that Pakistan's export growth post-2017 reflects a genuine treatment effect of regional integration rather than random or preexisting trends.

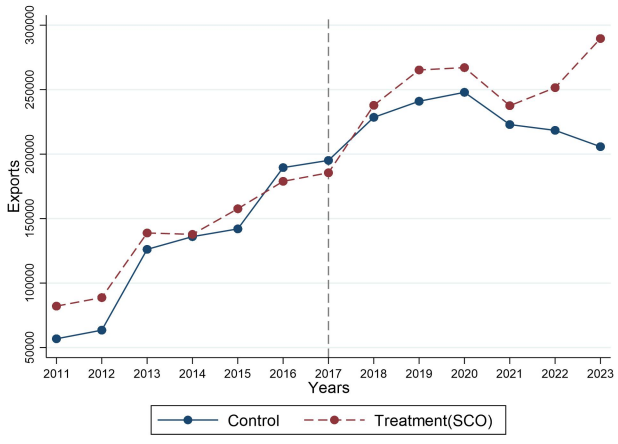


*Figure 02: Graphical Representation of Parallel Trend Assumption*

Source: Author calculation (Stata Generated)

**Baseline DID Results for Total Exports**

The baseline DID estimation for Pakistan's total exports provides an overall assessment of the country's exports performance within the SCO framework. By comparing pre- and post-integration tendencies between the control and treatment groups, the analysis isolates net SCO impact membership on Pakistan aggregate exports. Such approach captures whether regional integration has translated into broader export expansion, beyond sectoral distinctions, and whether Pakistan has leveraged the SCO platform to improve its overall trade orientation in the region.

*Table 04: DID Baseline Results*

| VARIABLES | DID Estimates |
|---|---|
| $SCO_{ijt}$ | 0.468*** |
| | (0.397) |
| $GDP_{it} \times GDP_{jt}$ | 0.630*** |
| | (0.0562) |
| $POP_{it} \times P0P_{jt}$ | 0.531*** |
| | (0.114) |
| $DIST_{ijt}$ | -0.403** |
| | (0.164) |
| $LNG_{ijt}$ | 2.914** |
| | (1.186) |
| $BDR_{ijt}$ | 3.102*** |
| | (0.267) |
| Constant | 19.85*** |
| | (2.139) |
| Observations | 416 |
| R squared | 0.681 |
| Country Fixed Effect | Yes |
| Time Effect | Yes |

"Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1"

The DID estimation results (Table 04) reveal that the interaction term for SCO membership is positive and highly significant ($\beta = 0.468$, $p < 0.01$), indicating that Pakistan's integration into the SCO has significantly boosted its total exports. This suggests that enhanced regional cooperation, improved logistics, and connectivity under the SCO framework have facilitated greater trade flows. The coefficient for combined GDP ($\beta = 0.630$, $p < 0.01$) confirms that larger partner economies generate higher trade volumes, consistent with gravity model predictions. Similarly, partner population ($\beta = 0.531$, $p < 0.01$) positively affects exports, underscoring the importance of market size. Distance exhibits the expected negative and significant relationship ($\beta = -0.403$, $p < 0.05$), implying that geographical proximity remains a critical determinant of trade intensity. The language variable ($\beta = 2.914$, $p < 0.01$) also shows a strong positive impact, emphasizing that common linguistic ties enhance communication and institutional trust. Likewise, the border variable ($\beta = 3.102$, $p < 0.01$) indicates that shared borders significantly facilitate trade through reduced transportation costs and cultural familiarity.

The model's explanatory power is robust ($R^2 = 0.681$), with country and time fixed effects capturing unobserved heterogeneity. Overall, these findings confirm that SCO membership has had a substantial positive impact on Pakistan's total exports, while economic scale, demographic potential, and geographical proximity further strengthen trade. Although distance still constrains exports, initiatives like

CPEC and BRI are mitigating this effect by enhancing connectivity within the SCO region.

**Robustness Analysis by Changes to Estimation Method**

To access the robustness of the treatment estimations effect of Pakistan membership with SCO on its exports, the study applied different estimation techniques such as PPML and FE to justify the consistency of the baseline DID estimations. In Table 06 the coefficients of these alternative techniques are consistently positive and statistically significant. Furthermore, the outcomes of both models align with the Gravity model that the coefficients of the control variables have the expected directions.

To determine the most suitable estimation method among the fixed effect and random effects model, the Hausman test conducted. In Table 05 test estimates are 26.67 with 3 degrees of freedom, and the P-value 0.023. Meanwhile the P-value is lesser than the 5% significance threshold, therefore the null hypothesis signifying that the Random Effects model is rejected. Hence the Fixed Effects model is considered more appropriate for this study. A detailed comparison of the coefficients can be found in the Appendix.

**Table 05: Hausman Test Results**

| Test Statistics | Degrees of Freedom | P-Value | Decision | Preferred Model |
|---|---|---|---|---|
| 26.67 | 3 | 0.0023 | Reject $H_0$ | Fixed Effect |

Fixed Effects model offers a more reliable estimation in a sense of controlling time-invariant differences among traders, like historical relations and geographic factors. By concentrating on within country differences over time, it offers a more dependable estimation of the effect of Pakistan exports after its membership with SCO. however, the coefficient may a little change, the estimation confirms reliable treatment effect by evaluating for country-specific and global variations. PPML model is well-suited designed model for international trade data, particularly when dealing with zero trade flow and non-negative values. PPML more effective for issues like heteroskedasticity and zero trade data, contributing reliable estimations in spite of these challenges.

While in comparison of the DID, FE and PPML results all estimations steadily display a positive effect of SCO integration on Pakistan exports performance. These steady estimates in all models strengthens the consistency of the results, ensuring that the treatment effect is consistent and not attained by the limitation of any single estimated model.

Table 06: Fixed Effect and PPML Results

| VARIABLES | Fixed Effect | PPML |
|---|---|---|
| $SCO_{ijt}$ | 0.930*** | 1.222*** |
| | (0.308) | (0.174) |
| $GDP_{it} \times GDP_{jt}$ | 0.764*** | 0.502*** |
| | (0.275) | (0.079) |
| $POP_{it} \times P0P_{jt}$ | -0.157 | 0.204** |
| | (0.946) | (0.088) |
| $DIST_{ijt}$ | -0.0274 | -1.272*** |
| | (0.0193) | (0.109) |
| $LNG_{ijt}$ | -- | -3.102*** |
| | | (0.267) |
| $BDR_{ijt}$ | -- | 0.498*** |
| | | (0.186) |

| VARIABLES | Fixed Effect | PPML |
|---|---|---|
| Const | -20.76 | -11.66*** |
| | (33.88) | (2.160) |
| Observations | 416 | 416 |
| R-squared | 0.579 | 0.689 |
| | | |
| Time FE | Yes | Yes |
| Country FE | Yes | Yes |

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

The DID analysis confirms that Pakistan's accession to the SCO significantly boosted its total exports, reflecting stronger trade linkages, improved connectivity, and reduced barriers after 2017. Pre-treatment results validated the parallel trends assumption, while post-2017 data showed clear export gains driven by regional cooperation. Even after controlling for GDP, population, distance, and cultural factors, the positive impact of SCO membership remained robust. Robustness tests further confirmed that this effect was genuine, not random. Overall, SCO integration has progressively strengthened Pakistan's export performance, especially since 2019, supported by CPEC, infrastructure projects, and institutional collaboration.

## CONCLUSION

This study examined Pakistan's export performance with SCO member countries using descriptive and empirical analyses, focusing on pre- and post-integration periods. The descriptive evidence reveals that Pakistan's exports have shown a clear upward trend since joining the SCO in 2017, particularly after 2019. The empirical analysis, employing the Difference-in-Differences (DID) method, provides robust statistical confirmation that Pakistan's SCO membership has significantly enhanced its export performance. The interaction term (SCO) was positive and highly significant, indicating that post-2017, Pakistan's exports to SCO countries experienced a substantial uplift. Traditional gravity variables including GDP, population, distance, and shared language or border also behaved as expected, validating the broader applicability of the gravity model in this context. To further reinforce these results, robustness tests were conducted. The parallel trends assumption was validated through event study analysis visually. The alternative estimation methods (Fixed Effects and PPML) consistently upheld the significance and direction of the main findings. These layers of validation enhance the credibility of the conclusion that SCO membership has positively impacted Pakistan's exports.

## POLICY RECOMMENDATIONS AND LIMITATIONS

Based on the above comprehensive conclusion of this dissertation, a set of formal policy recommendations are made for enhancing Pakistan export performance in the Shanghai Cooperation Organization SCO. In the context of Pakistan exports to SCO countries, the positive post-integration growth signals the need for a targeted national export strategy tailored to SCO markets. Pakistan must identify high-potential products for each SCO country and develop bilateral trade roadmaps that are aligned with mutual economic interests. Exporters should be supported with financial incentives, logistics facilitation, and market intelligence, particularly in high-growth sectors like information and communication technology (ICT), copper products, apparel, and food processing. As the empirical analysis shows that GDP, population, shared borders, and common language are significant drivers of trade, Pakistan should strengthen cultural diplomacy, language training programs, and cross-border trade

agreements to capitalize on these advantages. Moreover, the empirical results affirm the positive impact of geographic proximity, thus underlining the importance of improving infrastructure and logistics to reduce transaction costs.

Despite providing valuable insights into Pakistan's export performance within the SCO framework, this study has certain limitations that should be acknowledged. First, the analysis focuses mainly on the post-2017 period Pakistan's full membership phase offering a clear pre- and post-integration comparison but covering a relatively short time span (2017–2023). This limited duration may not fully reflect the long-term structural impacts of regional integration. Second, the study emphasizes exports without a parallel assessment of imports or overall trade balance. While useful for evaluating export growth, future research should also analyze bilateral trade balances to capture Pakistan's competitiveness and trade dependency within the SCO region. Third, although the Difference-in-Differences (DID) method provides a strong empirical framework, its reliability depends on assumptions like parallel trends and absence of spillover effects. Despite validation through event study potential unobserved factors such as policy changes, global crises, or COVID-19 disruptions may still influence the estimated effects.

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