India–Korea CEPA: A Multi-Method Assessment of Trade in Articles of Iron and Steel

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Abstract

This paper critically assesses the India and Korea's Comprehensive Economic Partnership Agreement (CEPA) trade impact, focusing on articles of iron and steel (HS Chapter 73). The study used a multimethod assessment to provide a rigorous evaluation of bilateral trade outcomes under India-Korea CEPA by using descriptive analysis to understand the tariff cuts and trade trends followed by difference-in-differences (DiD) method, and SMART partial-equilibrium simulation to disentangle residual effects. Korea by the year 2016, completely eliminated its tariff on Indian exports yet the exports recorded a modest growth. On contrary, Korea's exports saw a sharp increase post India's tariff cuts but later diminished due to safeguard measures and improved domestic capacity by India. The DiD results shows negative coefficients for exports and imports with non-FTA partners which implies that CEPA underperformed as compared to counterfactual. SMART simulations confirm these asymmetric results with India's export gains supported by positive residual non-tariff effects. However, Korea's tariff-driven benefits, as predicted, were offset via safeguard duties plus policy frictions.

Overall, the results reveal asymmetric and limited trade gains under India-Korea CEPA. The study highlights that balanced durable trade benefits results not just from tariff reduction but improved competitiveness and properly managed non-tariff barriers. Specially India needs to manage the policy related measures along with structural frictions to secure more durable trade gains

Keywords

India-Korea CEPA, Articles of Iron and Steel (HS Chapter 73), Difference-in-Difference, SMART Simulation

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Introduction

India with the Republic of Korea (ROK) have deepened economic ties progressively within two decades. The Comprehensive Economic Partnership Agreement (CEPA) signing in 2009 was a momentum. It came into force in 2010, committing both of these countries to substantial tariff reductions. It covers nearly 93% of India's export items going to Korea and 85% of Korea's export items sent to India (Banik & Kim, 2022). Subsequent visits such as Prime Minister Narendra Modi's official visit to Seoul during May 2015 and President Moon Jae-in visiting New Delhi during July 2018 further reinforced such a bilateral framework. CEPA aligns to Korea's "New Southern Policy," identifying India as a key partner, as Korea is an important part of India's "Look East Policy," and the two governments have set a USD 30 billion trade target by 2030 (GOI, 2021). Within this expanding partnership, however, a rather impressive asymmetry reveals the iron with steel sector (HS 73). India's exports of articles for iron and also steel to Korea grew from around USD 2.7 million to about USD 45.3 million from the year 2000 to the year 2023. During that time, Korea's exports to India grew from USD 17.3 million exceeding USD 308.7 million. Even with Korea completely scrapping tariffs by 2016 and India substantially cutting tariffs. India's exports responded modestly as compared to Korea's export trends for similar years. HS 73 turns into quite a compelling case for the evaluation of CEPA's trade impact due to this divergence in liberalization commitments.

The India-Korea Comprehensive Economic Partnership Agreement (CEPA) is being reviewed as well as upgraded, in order to better meet the objectives originally envisaged also to reflect the evolving requirements for both parties (Sahoo et al., 2023). Evaluating its outcomes is even more vital for HS 73, since it is a strategically important industry. As an important input for infrastructure and industrial development this sector has been at the core for bilateral trade dynamics because it is globally one of the most important industries. Korea completely eliminated tariffs, and India substantially cut tariffs, but trade outcomes in iron and steel have remained uneven. These outcomes do reflect structural competitiveness gaps in addition to non-tariff barriers that still persist. All recent assessments highlight the sector's growing vulnerabilities including the CRISIL (2025) forecast of India's rising steel demand, the Joint Plant Committee's (2025) warning of domestic supply constraints, and the OECD's (2025) outlook on global overcapacity. India is seen as a key growth driver globally according to World Steel in Figures 2025 within a softening world demand backdrop in general, a view that is echoed in Indian public sources anticipating strong domestic consumption growth through 2025. Therefore, timely investigation of CEPA's limitations can be performed via a closer examination of trade flows, patterns, as well as impacts and inform evidence-based inputs into its forthcoming revision.

Despite the importance of the steel sector, strict causal evaluations about CEPA's impact are scarce when using counterfactual approaches. A multi-method evaluation of CEPA's impact on India, Korea trade in articles of iron and steel (HS 73) addresses this gap. The analysis (i) describes trade flows including tariff trajectories, (ii) benchmarks bilateral trade outcomes against non-FTA partners using a difference-in-differences (DiD) approach, and (iii) simulates SMART partial-equilibrium to disentangle tariff-driven and residual non-tariff effects. The study provides evidence through disentangling of tariff-driven effects. These approaches do together enable a comprehension of CEPA's impact in a more thorough way on bilateral trade's most sensitive segment.

The reminder of the paper is organized as follows: the literature review (Section 2) and methodological framework (Section 3) evaluate trade outcomes, and the empirical findings (Section 4) integrated descriptive analysis, a difference-in-differences (DiD) approach, and SMART partial-equilibrium simulations. Section 5 contains policy implications, and Section 6 is the conclusion. Thus, the study contributes to sector-specific and evidence-based literature and further debates the performance in addition to future revision of India's FTAs.

Literature Review

The economic evaluation of trade agreements has is mainly along two complementary trajectories: simulation-based models (partial-equilibrium (PE) and computable general equilibrium (CGE) frameworks), and econometric approaches that estimate causal effects relative to a counterfactual. Both approaches underscore the central fact that tariff liberalization alone does not guarantee trade growth; trade outcomes are derived by sectoral competitiveness, non-tariff measures (NTMs), and policy effectiveness. In the India–Republic of Korea CEPA, implemented in 2010, these frictions are particularly salient for articles of iron and steel (HS 73), a segment subject to trade remedies and industrial policy interactions. For HS 73, this study explicitly integrates tariff line SMART simulations along with a sectoral difference in differences (DiD) design under CEPA. Then the study separates effects tariffs driven, with residual non-tariff effects.

Ahmed (2010) employed SMART partial-equilibrium model coupled with the GTAP CGE framework is one of the earliest systematic evaluations of CEPA. His results suggested the idea that both bilateral trade as well as consumer surplus would increase under a full liberalization. However, the welfare distribution was uneven since Korea would gain more, and India risked welfare losses under certain closures. The study highlighted gains within sensitive sectors like iron and steel would likely be offset by tariff revenue losses and safeguard use. To help delineate both the potential and the limits involved

in tariff-driven integration, the methodology draws upon Jammes and Olarreaga (2005) for SMART mechanics and upon Hertel (1997) and Narayanan and Walmsley (2008) for the GTAP model and database.

Ex post studies highlight varied CEPA results among sectors. Banik and Kim (2022) do find a structural asymmetry that the Republic of Korea retains a comparative advantage for merchandise goods while India's relative strength is in services, and this does imply that India's persistent overall deficit under CEPA is driven by merchandise trade rather than services. Korea's exports into India are still focused on manufactures of high value like machinery, iron and steel, and electrical equipment, a pattern where India's export basket orients more low value goods and raw material.

At one time, Cho (2012), Taneja, Kalita, and Saluja (2012), and Seshadri (2015) document how tariff preferences expanded market access on paper. However, Indian exporters frequently faced standards along with certification hurdles, restrictive rules of origin, then low utilization, limiting effective gains. Gupta (2024) shows India's services exports for Korea increased on a more strong level than imports out of Korea after CEPA. India's bilateral services surplus increased because of this.

Several studies highlight the sector-specific treatment which steel requires. Steel ranks among the most policy-distorted industries globally OECD (2023) reports stress. It is subject to repeated safeguard and anti-dumping and countervailing actions. India, according to Taneja et al. (2014), used steel protection after CEPA's start since it curbed Korea's actual export profits. Industrial competitiveness in steel, Yedla and Cho (2019) further note, is shaped via capacity expansion policies, global supply cycles, environmental regulations, along with tariffs. These findings suggest interpreting tariff liberalization together with global price dynamics and domestic industrial policies.

Studies on CEPA have relied heavily up to this point on ex-ante simulation (Ahmed, 2010), descriptive trade indices (Taneja et al., 2012, 2014; Seshadri, 2015), and also sectoral competitiveness analysis (Yedla & Cho, 2019). However, for thorough causal evaluation with counterfactual methods it is still underexplored, especially for sensitive sectors such as steel. For infrastructure, industrial demand, also construction, India has high steel demand growth of 8.5%-9% in 2025, recently reported by CRISIL and Indian Steel Trend Report. However, this might sharply increase the imports since domestic production grows slowly because plant maintenance lags plus capacity utilization constrains (Joint Plant Committee, 2025; CRISIL, 2025). Also, joint global action should quickly work to stabilize this area. Steel overcapacity worldwide shall probably greatly grow near 2027, fueling demand. OECD 2025, this will result in lower prices. Consequently, there will be a lessening of profit margins.

The reviewed literature stresses about three consistent findings. CEPA's advantages were asymmetric initially: India had greater force in services and Korea made firm gains in goods trade (Banik & Kim, 2022; Gupta, 2024). Second, export growth has been insufficient as a result of tariff liberalization alone, for outcomes have been restricted through NTBs, safeguard measures, as well as supply-side constraints (Ahmed, 2010; Taneja et al., 2014). Sectoral case studies show iron and steel face greater frictions than overall trade implies therefore they require deeper evaluation. Yet even with wide-ranging simulation exercises, no study has simulated tariff-lines. Also, no study has approached the topic by way of counterfactual econometrics. This paper fills in that gap through applying of SMART simulations with a difference-in-differences framework to HS 73 trade. Analysis highlights the effects that are asymmetric and limited regarding CEPA within India-Korea trade.

Methodology

This study employs a thorough methodological framework toward evaluating the trade impact on articles of iron and steel (HS Code Chapter 73) of the India, Korea Comprehensive Economic Partnership Agreement (CEPA). Since the steel sector has a globally sensitive and protected nature, the analysis integrates empirical trade data with predictive simulation techniques. UN Comtrade has been accessed for bilateral trade data, and the World Integrated Trade Solution (WITS) for tariff schedules. The World Bank WDI and the WTO Tariff Database provide other supplementary indicators. The study period spans 2000, 2023 for it enables a strong comparison of pre- and post-CEPA trade outcomes.

Difference-in-Differences (DiD) Method

To assess the trade impact regarding India's Free Trade Agreements (FTAs) on the articles of iron and steel sector (HS Chapter 73), the Difference-in-Differences (DiD) approach is employed in this study. The method isolates FTA implementation's effect while controlling for global trade shocks along with other time-varying factors. It is especially well suited for policy evaluation work. Even though a formal regression model has not been used, this manual implementation of DiD can assess the policy's impact simply and intuitively using available data. In this framework, trade with non-FTA countries serves as the control group, while India's trade with FTA partner countries is defined as being the treatment group. Trade values get compared across both the pre-FTA period and the post-FTA period.

The DiD estimator is calculated as:

$$DiD = \left(\overline{Y}_{Treatment,Post} - \overline{Y}_{Treatment,Pre} \right) - \left(\overline{Y}_{Control,Post} - \overline{Y}_{Control,Pre} \right)$$

Where,

- Y Treatment, Pre: Average trade value (exports/imports) with the treatment group before the implementation of the agreement.
- Y Treatment, Post: Average trade value with the treatment group after the implementation of the agreement.
- Y Control, Pre: Average trade value with the control group of countries, before the agreement period.
- Y Control, Post: Average trade value with the control group after the agreement period.

By comparing the change within trade values from the pre- to the post-FTA times, the DiD estimator isolates the net effect within the FTA across both the treatment group and also the control group. A positive DiD value shows that trade with FTA partners grew faster than with control countries. A negative DiD value implies that trade toward FTA partners performed worse relative to the counterfactual because this suggests limited or adverse effects of the agreement, while a positive value reflects a favourable impact.

Simulation Analysis of Trade Scenarios with FTA Partner

The second phase utilized within the World Integrated Trade Solution (WITS) platform's SMART model. SMART is a partial equilibrium model that simulates trade flow changes when policy interventions cut tariffs. The model estimates trade effects via integrating elasticity assumptions alongside actual tariff data, with this integration providing a standardized approach to project expected changes following FTA implementation (Jammes &Olarreaga, 2005). We did conduct some SMART simulations specifically for Chapter 73. These simulations worked toward a focused prediction for the Total Trade Effect following India's FTA with South Korea.

Steps to calculate residual non-tariff effect based on Actual Value

STEP 1
Extract the Export Values for India
i.e., Actual value (2023)
STEP 2
Calculate the New Value
(Initial Value+Total Tariff Effect (TTE) from SMART model)
STEP 3
Residual Non-Tariff Effect
(Actual Value-New Value)

Notes- Initial value is the trade value before the implementation of FTA, and Actual Value is the present trade value (2023).

A three-step approach calculates the residual non-tariff effect that is based on actual value in order. Tariff reduction and elimination cause increases to exports, which this method allows us to separate. Actual export value is extracted out from WITS. That extraction is for 2023. New value is calculated secondly via adding total tariff effect from the SMART model with initial trade value. The residual non-tariff effect is calculated by subtracting actual value from that new value at the last.

Steps to calculate the tariff and residual non-tariff effect based on predicted value

Step 1 Extract the Export Values for India as well as Partner country
Step 2 Calculate the Average Annual Growth Rate of India as well as Partner and non-FTA partners
Step 3 Calculate the difference Average Annual Growth rate (AAGR)
Step 4 Calculate the New Value i.e., Simulated FTA Value (Exp*(1+Difference AAGR)
Step 5 Estimate the FTA Total Trade Effect =New Value- Initial Value
Step 6 Residual Non-FTA effect = FTA Total Trade Effect -TotalTariff Effect from SMART Model

Notes- Initial value is the trade value before the implementation of FTA

Actual Value is the present trade value.

We implemented for us a linear cut method, based upon trade which is following a natural growth trajectory even without FTA intervention. This approach began after it calculated the Annual Average Growth Rate (AAGR) of India's iron and steel trade with FTA partner during post-implementation years. We then compared these rates against what was the AAGR of India's trade with non-FTA countries during corresponding periods. We found the "net effect" from the FTA through examination of the difference between those growth patterns. This did effectively control for more broader global trade conditions that then might have influenced trade flows regardless of preferential agreements.

To construct a scenario that is counterfactual that represents trade patterns projected when FTA is absent. We did implement the FTA year by adjusting the initial trade value bit by bit to calculate the net growth differential. Across all the years, this methodology employs multiplication of the base trade value by the adjusted AAGR (1+adjusted growth rate) simply. A simulated trade path is shown by this

here in light of the absence of a Free Trade Agreement for India. For ascertaining the FTA impact on trade, the anticipated value is compared with the observed trade value. A negative value indicates underperformance despite a concessional tariff agreement. A positive effect rather shows results exceeding predictions. Studying actual trade results and creating forecasting gives real support and empirical justification for theory. The global market is unstable as there exist protectionist policies at a global level that go along with those tariff reduction measures. On account of all of these factors, the method does provide quite reliable evidence-based results that help analyse the impact of FTA on the trade outcomes in iron and steel sector.
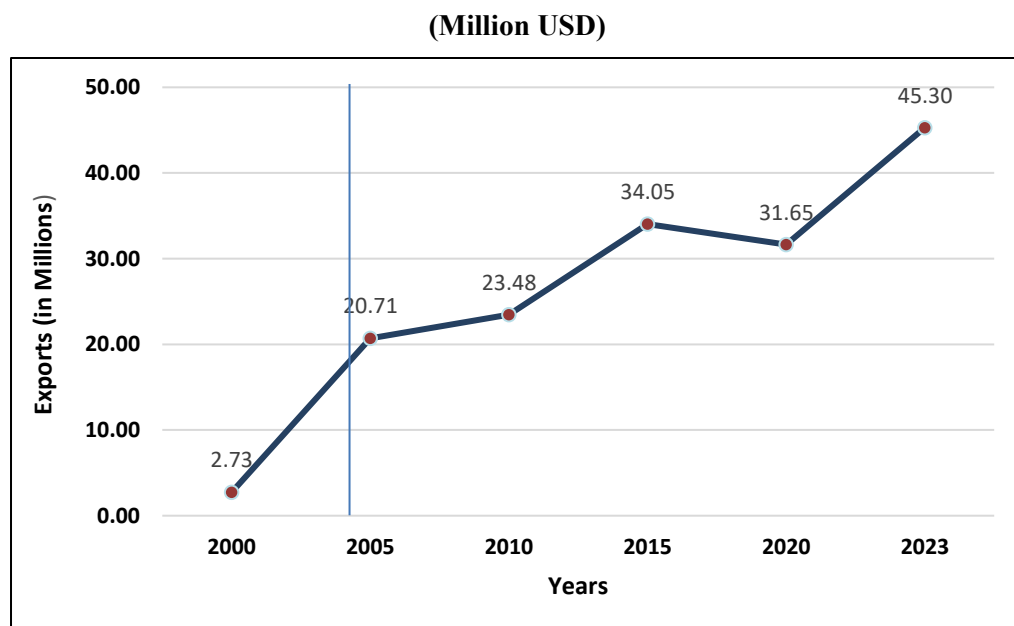
Empirical Results:

Descriptive Analysis

Having established the methodological framework for analysis we now turn to the empirical evidence as to how India's Free Trade Agreement have shaped bilateral trade relationships with South Korea. In this section we present a detailed examination toward tariff trajectories as well as trade flow between India and South Korea with which it has implemented free trade arrangement. This analysis covers a time frame spanning approximately two decades (2000-2023) in order to capture periods both before and after FTA implementation.

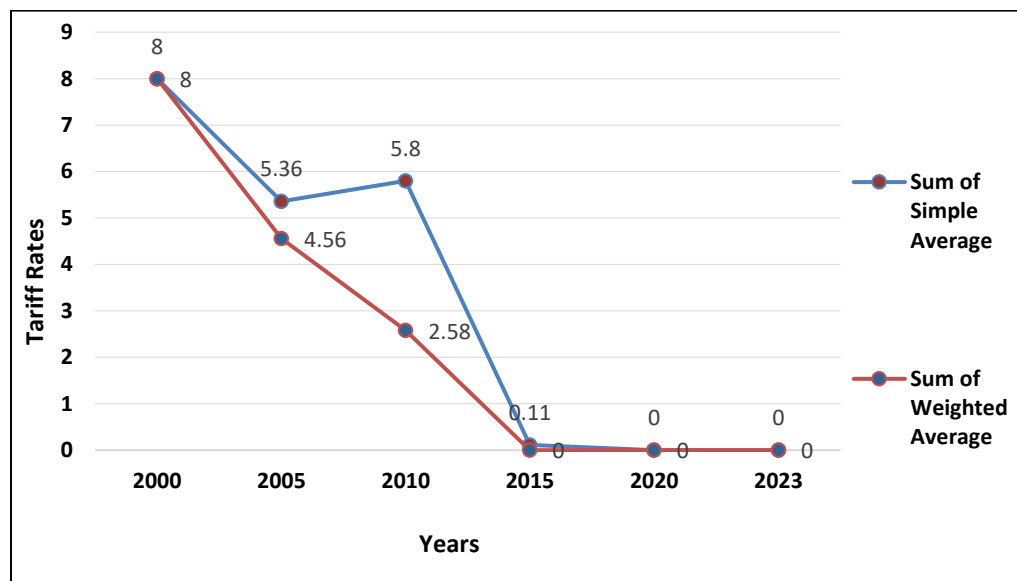### Assessment of Trade Volumes and Tariff Rates

This section focuses on trade volume as well as tariff structures since these jointly impact India and South Korea trade. Examining these jointly matters to obtain for a much clearer perspective of how these policies affect the bilateral trade flow.

Figure 1 Indian Export of Articles of Iron and Steel to South Korea (Source: WITS Database**)**

(Million USD)

India's exports to South Korea of articles of iron and as steel in Figure 1 have grown overall since 2000, but the trajectory does not fully align with tariff concessions secured under the Comprehensive Economic Partnership Agreement (CEPA) also has been uneven. Exports rose from a modest USD 2.73 million back in 2000 to USD 20.71 million in 2005 because India integrated increasingly into global value chains, as demand increased in Korea. By 2010 CEPA was implemented, and exports that year reached USD 23.48 million. This figure indicates just slight growth for the prior five years. Exports sharply increased right after the FTA as they reached USD 34.05 million in 2015 suggesting tariff cuts likely offered some stimulation. However, momentum faltered soon thereafter because exports fell slightly to around USD 31.65 million in 2020 plus this coincided with global steel market volatility while possibly reflecting particular supply-side constraints including Korean competition. In 2023 exports reached USD 45.30 million with a strong recovery the highest level reviewed. The export trajectory when it is taken together highlights that while CEPA eased some expansion tariff elimination acting alone did not generate transformative or sustained growth in India's iron and steel exports directed to Korea.

Figure 2 South Korea Tariff Rates on Imports of Articles of Iron and Steel from India
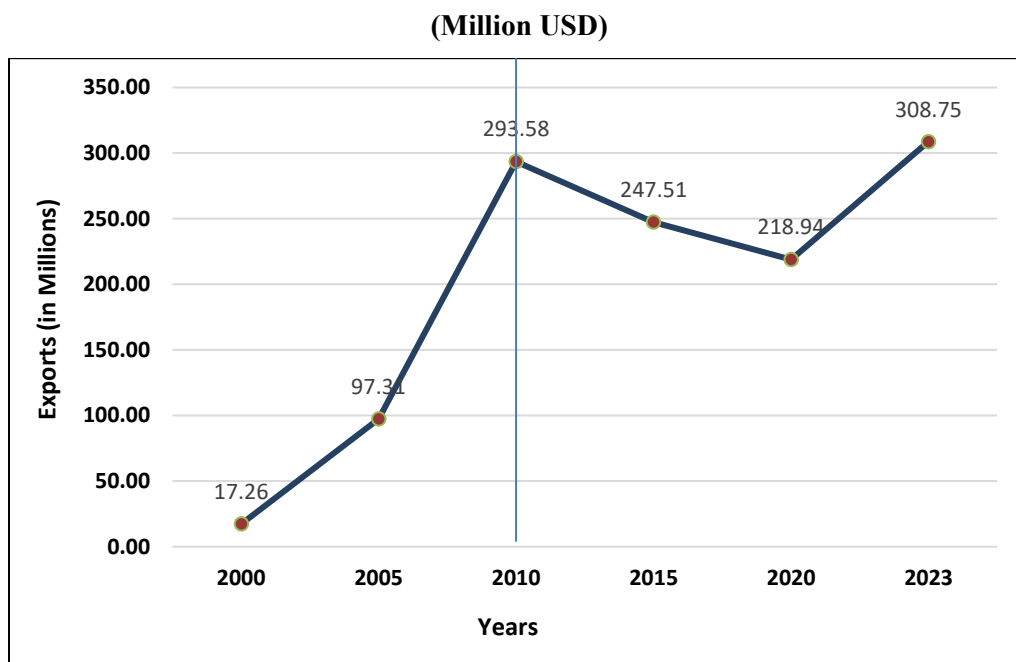

Source: WITS Database

South Korea's tariff profile that is for Indian articles of iron and steel in figure 2 shows a clear and deliberate path for liberalization which culminated in complete duty-free access after 2016. In 2000, both the simple average with weighted average tariff rates stood at approximately 8 percent for that signified substantial entry barriers. Tariff levels had fallen moderately by 2005, with the weighted average reaching 4.56 percent. The simple average stayed elevated at 5.36 percent reflecting protection's gradual reduction even before CEPA. Following entry of the agreement into force back in

2010 tariff rates declined quite sharply so by 2015 the simple average had dropped to 2.58 percent while the weighted average fell quite close to zero (0.11 percent) which was consistent with Korea's phased tariff elimination commitments. From 2016 and after that, both the tariff measures converged at 0 percent since that ensured that Indian exporters faced absolutely no tariff barriers within the Korean market. India's exports did not expand proportionately, as Figure 1 shows, even despite this full liberalization. Non-tariff factors such as quality standards, supply competitiveness, and global market dynamics continued to constrain India's ability to fully exploit tariff concessions provided by Korea because CEPA effectively dismantled tariff barriers, as this disconnects underscores.

India's exports to Korea did not increase in proportion (Figure 1) though South Korea's tariffs on Indian iron and steel items fell to zero by 2016 (Figure 2). Tariff elimination under CEPA was indeed necessary, but was insufficient to drive of sustained export. Competitiveness problems along with non-tariff barriers had a key impact.

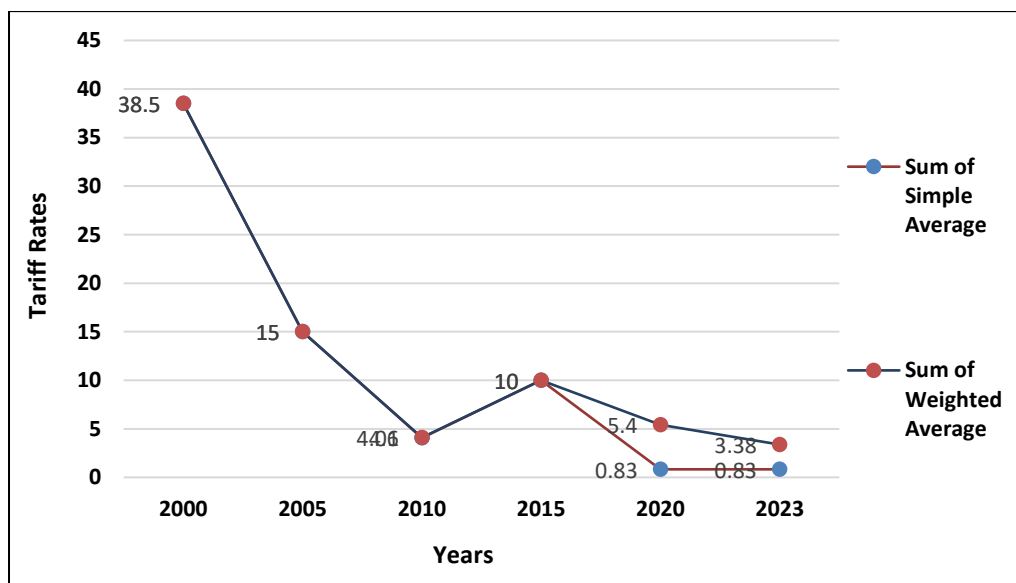**Figure 3 South Korea Export of Articles of Iron and Steel to India**

Source: WITS Database

South Korea's exports of articles of iron and steel to India within figure 3 did grow rather sharply in both the pre- and immediate post-CEPA years, even though subsequent trends reveal volatility, and also partially taper off. India's need grew for better steel products as Korea was competitive regarding value-added steel goods so exports rose from USD 17.26 million in 2000 to USD 97.34 million in 2005. Korean exports surged dramatically up to USD 295.58 million by 2010, the year CEPA came into force, tripling in just five years. Tariff concessions were well-positioned and exploited by Korean firms. Therefore, this spike suggests firms captured Indian market share immediately upon CEPA's

implementation. However, momentum softened thereafter because exports declined down to USD 247.51 million in 2015 and further down to USD 218.94 million in 2020. The decline coincides with India's steel capacity growing domestically as global demand is shocking along with India stressing a policy on self-reliance in steel production. Korean exports did slightly exceed their peak back in 2010 by 2023. However, these exports rose to USD 308.75 million. Korea's strength within high-grade specialized steel categories reflects this recovery where Indian producers are less competitive. India's industrial policies and cyclical global steel conditions constrained sustained growth however the pattern highlights Korea's early substantial export gains under CEPA overall.

Figure 4 Indian Tariff Rates on Imports of Articles of Iron and Steel from South Korea

Source: WITS Database

India's tariff regime on Korean iron and steel articles reveals an obvious liberalization trend in figure 4, albeit with reversals reflecting India's overall industrial policy issues. Average tariff rates in 2000 were prohibitively high at 38.5% because they strongly protected the domestic steel industry. By 2005, tariffs already fell steeply to 15%, with India committed to the WTO as gradually integrating into global trade. By 2010, the weighted average reduced further to 4.06%. Notably, the simple average rose to 10%, a reflection of varied deregulation across tariffs. After CEPA's implementation, tariffs declined further, with tariffs reaching 0.83% (weighted) as well as 5.7% (simple average) by 2020. Tariffs averaged minimal amounts by 2023 (around 0.8, 3.4%). This confirms India is committed to nearly complete tariff liberalization with Korea in this sector. Indian tariff barriers saw an important reduction, in particular on high-volume import lines, as the trajectory reveals, which is the first of a couple of important dynamics: India also maintained a bit higher tariffs on some sensitive products (reflected in the divergence between simple and weighted averages), consistent with its strategy for

protection of vulnerable segments of the domestic steel industry.

Figures 3 and 4 when they are considered together depict those asymmetric benefits of CEPA: despite total tariff elimination, India's exports to Korea (Figure 1 above) grew only modestly, while Korea's exports to India surged sharply after tariff reductions. The data do suggest that CEPA favored Korea more in the sector of iron and steel. This sparks inquiries as to whether India was prepared for leveraging reciprocal market access.

Results of Difference in Difference Method

While the descriptive analysis highlighted broad trends as well as asymmetries in India, Korea trade in articles of iron and steel (HS 73), which does not establish causality. A Difference-in-Differences (DiD) framework is used in order to address this certain issue. CEPA's effects are then benchmarked against a counterfactual shown by India's trade with non-FTA partners. DiD estimates are in Table 1 and these estimates compare changes during pre-FTA and post-FTA times. Positive values indicate trade performs more strongly with Korea in relation to the control group, whereas negative values reflect performance weakens under CEPA compared to the counterfactual.

Table 1 Difference-in-Differences Results for India–Korea Trade

(Top 10 vs. All Non-FTA Countries)

Top 10 Non-FTA Countries (Control Group)		
	(log DiD)	% Change
Total Trade	-0.13	-12.38
Exports	-0.15	-13.66
Imports	-0.23	-20.88
All Non-FTA Countries (Control Group)		
	(log DiD)	% Change
Total Trade	-0.08	-7.55
Exports	-0.15	-13.66
Imports	-0.14	-12.65

Source: Author's own calculation

Note: Estimation based on exports, imports, and total trade between 2000-2023 for HS code Chapter 73 Articles of Iron and Steel

Table 1 reports difference-in-differences (DiD) estimation results for India, Korea bilateral trade since the Comprehensive Economic Partnership Agreement (CEPA) started in 2010. Since estimations use of the natural logarithm for trade values, coefficients can be interpreted roughly as percentage changes from a counterfactual without CEPA implementation. Two alternative control groups considered were all non-FTA trading partners along with India's top-10 non-FTA trading partners. Alternative control

groups allow testing for results robustness. Checking of outcomes sensitivity to the selection of a control group is also enabled.

Total Trade

The DiD coefficient for total India, Korea trade is negative in both specifications given total bilateral trade did perform worse relative to India's non-FTA partners following the CEPA. If top-10 non-FTA partners form the control group, the coefficient is −0.132 equalling a 12.4% drop in overall trade versus the counterfactual. The estimated effect is smaller in its magnitude when all non-FTA countries are used (−0.079, that is, or a 7.6% decline). These estimates difference highlight how choosing a control group matters: the narrower set of top-10 partners, as well as who compare more closely to Korea in trade intensity, suggests a sharper adverse effect, while the broader set of partners leads to mild decline.

Exports (India to Korea)

India's exports to Korea stay constantly negative under both specifications. In the event that a comparison is against all non-FTA countries or against the top-10 non-FTA group, the DiD estimate is −0.147 (≈ 13.7% decline). This kind of result is of course particularly important. One stated objective of the CEPA was increasing India's export access to the Korean market. Instead, exports appear to have grown less (or declined more) than they would have without the agreement, which suggests either preferences were utilized to a limited extent, barriers existed for specific products (such as non-tariff measures), or Korea's other FTA partners competed strongly.

Imports (Korea to India)

Imports show the most substantial adverse impact. when the top-10 non-FTA partners are the control group, the DiD estimate is −0.234, also that translates to a 20.9% decline in imports relative to the counterfactual. The magnitude falls to −0.135 (≈ 12.7% decline) with the broader control group used, remaining strongly negative. This suggests the idea that Korean exporters did not gain so substantially from that CEPA. Likewise, India's imports from non-FTA partners changed in that period. Possible explanations include that India substitutes inside its import basket, that suppliers outside Korea are cheaper or more competitive, or that Korea reorients its own trade toward other markets.

Overall, the results show for positive trade effects expected in either direction were not generated by the India, Korea CEPA. Imports alongside exports saw relative decreases, yet the magnitude differed among groups. The estimates happen to be consistently negative throughout all specifications so this lends credibility to the conclusion that the CEPA's impact was not expansionary for bilateral trade.

Estimating import sensitivity to the control group also signals that choosing appropriate counterfactuals carefully matters as well as suggesting that India traded with its closest non-FTA partners were unfavourable for Korea in the post-CEPA years. Exports persistently suffer from a negative effect, which underscores structural constraints in India's export competitiveness. Tariff concessions alone have limited power because they fail to increase exports.

Simulation Analysis of Trade Scenarios with FTA Partners

Our investigation explores how simulated trade values differ quite from actual values for India's articles of iron and steel exports (Chapter 73) with Korea FTA partner country after their agreement. Developed by the World Bank as well as UNCTAD, the study used a partial equilibrium tool i.e., SMART model to simulate the different trade flows due to FTA implementation. Based on the adjusted growth rates, the simulated values through linear projection, using non-FTA trends as the benchmark. We sought out to isolate just what the net impact of all these trade agreements was through this specific approach. We also intended to make a determination as to whether or not these agreements delivered on their promised benefits in real-world trade volumes.

Table 2 Tariff and Non-Tariff Effect based Actual Values in Chapter 72

(Values in USD '000)

(India as exporter)

Country	India
FTA Implementation Year	2010
Actual Value (2023)	45297.37
New Value (Initial Value + Total Tariff Effect from SMART)	26579.37
Residual Non-Tariff Effect	18718.37

Author's own calculation

In contrast to South Korea, India's export performance presents a more favourable outcome under the CEPA framework. In 2023, what was the actual export value of India to South Korea. It was USD 45,297.37 ('000). This is greatly higher than the predicted tariff-based value of USD 26,579.37 ('000). A positive non-tariff residual effect in the amount of USD 18,718.37 ('000) was yielded here.

India's steel exports expansion was because of factors beyond tariff liberalization as a positive residual indicates. Trade complementarities linking India with South Korea along with demand-side drivers within the Korean market or also India's steel products competitive positioning may get included. Tariff liberalization also likely spurred exports. India's export performance also increased through helpful market dynamics or non-tariff elements.

Table 3 Tariff and Non-Tariff Effect based Predicted Values in Chapter 72

(Values in USD '000)

(India as exporter)

Country	India
FTA Implementation Year	2010
Initial Trade Value	24496.49
New Value	45580.57
FTA Total Trade Effect	21084.08
Total Tariff Effect from SMART	2082.88
Residual Non-Tariff Effect	19001.20

Author's own calculation

Table 3 presents India's iron and steel exports' decomposition toward South Korea under the CEPA. The estimated simulated FTA total trade effect for the studied period is USD 21,084 thousand. The tariff-induced effect explains just USD 2,083 thousand of this increase via SMART simulations. As a contrast, the non-FTA residual effect, which amounts to USD 19,001 thousand, constitutes the major share of all the observed export growth. This indicates India's exports toward South Korea largely expanded due to non-tariff and structural factors. These exports were not driven largely by preferential tariff reductions. The limited magnitude of tariff-induced gains may reflect Indian exporters' relatively low utilization of preferential tariffs, competition from alternative suppliers within the Korean market, or product composition mismatches. These are elements that potentially explain the reasons tariff benefits are not fully realized. These results highlight that while India exported more goods to South Korea during the CEPA period, tariff liberalization explains only a little of this growth.

Table 4 Tariff and Non-Tariff Effect based Actual Values in Chapter 73

(Values in USD '000)

(South Korea as exporter)

Country	South Korea
FTA Implementation Year	2010
Actual Value (2023)	308748.73
New Value (Initial Value + Total Tariff Effect from SMART)	351877.65
Residual Non-Tariff Effect	-43128.92

Author's own calculation

The results in table 4 indicate that actual trade outcomes differed from predictions based on tariffs, while tariff liberalization under the India, Korea CEPA (2010) was expected to create meaningful trade expansion. In South Korea's actual export value to India during 2023 was USD 308,748.73 ('000). The

predicted trade value based upon initial trade as well as tariff effect was USD 351,877.65 ('000). USD 43,128.92('000) resulted in a negative residual non-tariff effect.

Due to the fact that non-tariff factors acted as constraints and did offset gains from tariff liberalization, then a negative residual value is highlighted. India's non-tariff measures and safeguard duties on steel products, competitive disadvantages for Korean exporters, or shifts in global demand and supply conditions may explain Korea's reduced trade potential despite tariff concessions.

Table 5 Tariff and Non-Tariff Effect based Predicted Values in Chapter 72

(Values in USD '000)

(South Korea as exporter)

Country	South Korea
FTA Implementation Year	2010
Initial Trade Value	303565.52
New Value	366376.4
FTA Total Trade Effect	62810.92
Total Tariff Effect from SMART	48312.12
Residual Non-Tariff Effect	14498.80

Author's own calculation

The results presented within Table 5 reveal India's iron and steel import decomposition from South Korea under CEPA. The simulated FTA total trade effect amounts up to USD 62,811 thousand. Imports likely will rise from the pre-FTA year (2009) to the post-FTA year (2023); this shows that impact. Out of this, the tariff-induced effect, as SMART simulations obtained, accounts to USD 48,312 thousand, which indicates that tariff liberalization shaped the expansion of imports. At about USD 14,499 thousand, the calculated residual non-FTA effect suggests that tariff concessions alone cannot fully explain a part of the observed increase. Non-tariff factors including global demand dynamics, changes in consumer preferences, as well as supply chain linkages may explain this residual component. Based on results, tariff preferences drove India's import expansion from South Korea dominantly. However, non-tariff factors contributed greatly to this import expansion too.

The combined analysis regarding tariff and non-tariff effects underscores the asymmetric outcomes of the India, Korea CEPA in Chapters 73 based on both predicted and actual values. Tariff liberalization generated substantial predicted trade gains for South Korea as an exporter then the actual outcomes fell short; however, negative residual non-tariff effects suggested that restrictive non-tariff measures, safeguard duties, along with adverse market conditions partly offset tariff concessions. In contrast, India's export performance was characterized through strong tariff-driven gains as well as additional positive residual non-tariff effects. India's export growth exceeded tariff concessions due to competitive advantages plus market complementarities as this performance indicated. Findings imply CEPA tariff cuts crucially affected bilateral trade though gains varied

due to supportive or restrictive non-tariff factor interplay. To be sure of more balanced trade outcomes, these findings point to the need for a periodic review of CEPA provisions, targeted policy support, and a closer monitoring of non-tariff barriers for both partners.

Synthesis and Policy Implications

Results of this combined analysis sketches a consistent and subtle story of Comprehensive Economic Partnership Agreement between India and Korea using econometric estimation, and simulation. By the year 2016, Korea rapidly liberalized its tariffs upon Indian articles of iron and steel. Whereas, descriptive statistics reveals an uneven and modest growth path in Indian exports. A sharp surge can be seen in Korean exports in the initial post-FTA years. These gains later decline due to the expansion of Indian domestic steel capacity and policy related choices such as safeguard duties.

The difference-in-differences calculation further completes this picture by revealing how both the countries experienced a decline in bilateral trade as compared to non- FTA partners. The negative coefficients of DiD reveals how CEPA did not led to any trade dynamism as compared to the non-FTA partners. SMART simulation results separate the trade outcomes into tariff driven effect and residual non-tariff effects. Here, an interesting twist takes place when India's residual non-tariff value comes out to be positive, implying the other factor's role in supporting India's trade beyond the liberalization effect. Whereas, this residual effect turns out to be negative in case of South Korea, implying the role of safeguard measure as well as non-tariff barriers. These outcomes highlight the benefits that India is getting from non-tariff factors while Korea's gain are being curtailed by structural and policy frictions.

Understanding the lessons derived from this analysis is utmost important. From policy perspective, elimination of tariff does not guarantee gains from trade growth. Following measure must be adopted by India to harness trade gains; investment to compete in exports in is necessary as much is the quality upgradation and better exploitation of opportunities and schemes arising out of the preferential agreements which leads to better market access. In case of Korea, following points are worth highlighting, the role of non-tariff barriers and safeguard duties can lead to offsetting the trade gains. It is important to review FTA clauses actively so that the asymmetries and reciprocal outcomes can be better addressed. Uneven and short-lived gains must not be the focus; trade strategy should focus and actively work towards attaining durable trade gains.

Conclusion

The study concludes that the Comprehensive Economic Partnership Agreement (CEPA) between India-Korea has not resulted in trade expansion in case of articles of iron and steel despite tariff

liberalization. It was expected that the trade liberalization would result in intensification of bilateral trade between the two countries. The layered methodology in the paper helps understand the different aspects of trade. Tariff cuts and trade trends before and after the implementation of CEPA form the first layer. Notably, Korea completely revoked the tariff by 2016, and India also revised its tariff schedules with sharp reduction. However, on close observation it is worth highlighting that despite complete tariff elimination by Korea on Indian exports of article of iron and steel, India's export was modest and volatile, while Korean exports experienced a sharp increase initially, declining later. The decline in Korea's export can be due to India's production capacity expansion and safeguard duties. This paradox is later reinforced by the econometric evidences presented in the paper.

The study performed difference-in differences estimations to understand the net effect of CEPA by comparing CEPA trade with counterfactual i.e., top 10 non-FTA partners and all non-FTA partners. For both exports and imports, negative coefficients have been recorded. It throws light upon the fact that the CEPA has not supported bilateral trade flows instead it has underperformed its counterfactual. This forms the second econometric layer of the paper in understanding India-Korea CEPA.

Further, trade outcomes can be explained by performing simulation using SMART model which forms the third layer of the paper explaining the 'why' behind trade outcomes. Indian exports recorded positive residual non-tariff effects, which suggests that despite tariff impact, other factors such as complementarities or product level factors supported trade. Whereas, Korea on the other hand recorded negative residual effect, indicating to the interplay and importance of the role of non-tariff measures, and safeguard duties in place by the other country.

Thus, the central finding of the paper is the asymmetric and limited benefits of this CEPA. Looking from an economic lense, this highlights policy-related as well as structural frictions.
In case of India, cost disadvantages, quality gaps and other compliance are some of the structural challenges which limits its ability to perform. Korea's trade diversification and India's extensive use of safeguard measures are policy related frictions. It can be concluded that complementary industrial strategies and management of non-tariff barriers play a very important role beside the tariff liberalization. In the absence of control over these factors it is difficult to reach durable trade integration.

The study is one of the few multi-method assessments of CEPA in case of articles of iron and steel. It combines descriptive analysis to under the tariff cuts and the impact of it on the trade trends, DiD to reveal the net effect beyond descriptive method, and SMART partial-equilibrium simulation to

understand disentangle residual effects. This gives a deeper understanding of drivers of trade outcomes. It also broadens the understanding of the asymmetric nature of liberalization impact, stating how policy related decisions and structural frictions can led to different results for countries under same agreement.

Lastly, for policymakers, this study highlights major factors. In case of India, it is of utmost importance to improve the utilization of preferential access resulting from various agreements. Further to strengthen export competitiveness, India should complement FTAs with improved quality standards, and improved supply side bottlenecks. To ensure reciprocity in trade outcomes, it is essential to maintain transparency and monitor non-tariff barriers. Most importantly, the review clause in trade agreements should be fully harnessed to align with commitments to reach long term policy goals. Only than countries signing FTA will experience sustained and balanced trade growth resulting from liberalization.

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