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Does Comparative Advantage Lead to Intra-Industry Trade? An Empirical Analysis in the Case of Uzbekistan

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Abstract: The study examines the interrelation between a country's comparative advantage and the intra-industry trade accelerated by economies of scale, in the case of Uzbekistan. The paper first estimates the degree of comparative advantage and intra-industry trade by calculating the Revealed Comparative Advantage (RCA) index and the Intra Industry Trade (IIT) index in the prominent product categories for Uzbekistan. As suggested theoretically by the monopolistic competition model for new trade theory and factor endowment model, a system of simultaneous equation model is developed to examine the impact of comparative advantage on the intra-industry trade. Econometrically, 2SLS and SUR regression models are used to estimate the equations. The study concludes that the comparative advantage has a positive volume effect on the intra-industry trade. The depreciating Uzbek currency against the US dollar positively affects the degree of intra industry trade and many product categories. In contrast, there is a set of products where trade is solely based on comparative advantage or intra-industry trade. To boost trade performance, the economy must focus on products with a relatively higher degree of intra-industry trade and a stronger comparative advantage.

Keywords: Comparative Advantage; Intra Industry Trade; New Trade Theory; RCA Index; G-L IIT index; 2SLS Regression; SUR Regression; Technology Transfer; Economy Development.

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1. Introduction

A key idea in international trade, comparative advantage, describes the advantages of two nations specializing in producing commodities that they can do so at the lowest opportunity cost. Suppose nations focus on producing goods more effectively and at lower opportunity costs. In that case, it implies that all nations can benefit from trade by importing less expensive commodities from other nations, allowing them to produce goods at a reduced cost. Ricardo [10] first presented this idea in his Principles of Political Economy and Taxation. Another significant idea that has been influenced by globalization is intra-industry trade. In countries specializing in producing a large variety of commodities within a single industry, such as the

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automobile industry, intra-industry trade refers to the trade among comparable goods and services. Differences in product quality, design, or marketing strategies lead to intra-industry trading among nations Krugman [5].

Certainly, the ideas of comparative advantage and intra-industry trade are two fundamental ideas that help explain global patterns in trade [2]. These ideas demonstrate how nations can specialize in producing the commodities they can do so most cheaply, resulting in reduced costs and higher-quality products [8]. As a result, there is an increase in global competition, which raises living standards for many. In order to make wise judgments and create policies that encourage trade and economic progress, policymakers must comprehend and respect these ideas [9].

Understanding the notion of comparative advantage is essential for understanding the advantages of intra-industry trade because it demonstrates how nations can obtain economies of scale by manufacturing more of a given good, which lowers costs and boosts competitiveness [11]. A better interchange of information and technology transfer is also a result of different nations producing similar goods, which boosts productivity and creativity. The European Union, where intra-industry trade has been rising since the 1970s, is a clear example of this tendency.

Within the CIS region, Uzbekistan is emerging as a significant trading country. The Uzbek economy has been expanding consistently over the previous few years, with significant trade indices like GDP, exports, and imports exhibiting encouraging trends. 2019 Uzbekistan's GDP increased to $57.6 billion from $49.7 billion in 2018. The economy's exports increased from $11.3 billion to $13.7 billion in 2019. The top export items were cotton, natural gas, and gold. 2019 Uzbekistan's imports increased to $14.7 billion from $13.9 billion. Food, chemicals, and machinery are among the most significant imports. Uzbekistan's negative trade balance decreased from $2.6 billion in 2018 to $996 million in 2019. The FDI increased from $1.9 billion in 2018 to $2.3 billion in 2019.

The country has many natural resources, such as minerals, gas, and oil. Cotton, gold, and natural gas production and export provide a comparative advantage. Over 70% of all exports are cotton, the main product of the nation. The second-largest exporter and sixth-largest producer of cotton, respectively, is Uzbekistan. The nation is ninth in the world for gold output and has sizable gold reserves. Russia, Kazakhstan, and China are Uzbekistan's top trading partners regarding trade within industries Word Bank [14]. Uzbekistan's trade with China has grown considerably in recent years. Due to its underdeveloped industrialization and inadequate diversification of manufacturing activity, the nation still has a low level of intra-industry trade.

2. Literature Review

A thorough empirical analysis of the ability of gold to hedge against unfavorable changes in inflation and exchange rates is conducted by Sui et al. [6] for three countries: Turkey (extremely dollarized), Peru (lowly dollarized), and the United States (benchmark). They found that gold can always protect against currency movements and inflation fluctuation for Turkey and the United States. Still, they failed to do so during Turkey's hyperinflationary period. In Peru, gold is a good hedge if the change of CPI is above 3.29% or the currency depreciation rate is above 3.24%. We demonstrate that gold is a hedge (haven) against inflation or fluctuating exchange rates.

Okubo and Watabe [13] look at FDI networks using data from Japanese foreign affiliates. The study first looks into foreign affiliates' industry and location trends to determine the FDI network structure. Then, intra-firm trade with third countries is investigated. However, only large businesses often build production networks and engage in third-country intra-firm trade. Third-country sales and sourcing within the company boundary are active. Awareness of third-country intra-firm commerce requires an awareness of the size of the business (parent and affiliate sizes as well as the number of affiliates) as per the study.

Yomogida [7] investigates the function of oligopolistic rivalry in global trade when nations have various technological advancements. In the study, markets are divided among nations, demand structures are identical with constant elasticity, and the cost of transportation constrains commerce. Each county can have the necessary amount of competition under an oligopoly. With such thresholds, the author demonstrates how tiny or significant technological gaps can promote or prevent two-way trade. The study also considers that antitrust laws can have the opposite effect in an open economy.

Regarding trade competitiveness and intra-industry trade, Uzbekistan has many possibilities. The cotton industry is one of the main sectors in which Uzbekistan has a comparative advantage. The cotton industry in Uzbekistan, which is among the top five cotton producers in the world, has long been a crucial part of the nation's economy Guzalova [4]. Most of Uzbekistan's exports are cotton, and the nation has been able to preserve its position as a leader in the world cotton market. However, the cotton sector also confronts substantial obstacles, such as low productivity. The study examines factors contributing to Uzbekistan's competitive advantage in cotton production, such as access to natural resources, technology, and labor. It also discusses challenges faced by the cotton industry in Uzbekistan, such as competition from other countries and environmental concerns.

The mining industry is another area where Uzbekistan has a comparative edge. Chepel investigates an overview of the development and present situation of the mining sector in Uzbekistan [1]. As per the study, the nation has considerable potential for further exploration and development due to its abundant natural resources, including gold, copper, and uranium. Nevertheless, there are also concerns with licenses, rules, and the environment of the mining industry, which must be considered. The study also examines the history of mining in Uzbekistan with a focus on the growth of the sector from its inception in the early 20th century to the present. It is concluded that the mining sector in Uzbekistan has suffered and still faces several difficulties, including political unrest and environmental issues. Despite these difficulties, the industry has expanded and contributed significantly to the growth of the nation's economy, according to the author.

The potential for intra-industry trade in Uzbekistan is also significantly influenced by its economic links with neighboring nations. Sulaymonova [12] investigates the intra-industry trade between Uzbekistan and Central Asian nations. The author addresses the value of intra-industry trade for Central Asia's economic growth and highlights the need for more study in this area. The article also examines the trade relations between Uzbekistan and other Central Asian nations, including Tajikistan, Turkmenistan, Kazakhstan, and Kyrgyzstan. Though intra-industry trade has grown recently, the author observes that there is still potential for development in diversifying the industries engaged and raising the trade volume. The nation has close economic ties with China, Kazakhstan, and Russia but faces difficulties expanding its trading ties with other nations. As per the study, the potential for intra-industry trade in Uzbekistan could be increased by enhancing transportation infrastructure and lowering trade obstacles.

3. Some Critical Questions

The literature on Uzbekistan's comparative advantage and intra-industry trade concludes by highlighting the nation's potential in several industries and outlining essential issues that must be resolved to achieve this potential fully. Tentatively, the development of Uzbekistan's trade competitiveness and intra-industry trade potential seems to depend on increasing productivity, fortifying institutions, and addressing infrastructure and policy difficulties. A few important questions emerge from this:

- In recent times, what sets of goods and commodities have Uzbekistan postulated as comparative advantages, and what are the ones that postulate intra-industry trade?
- Is there any relationship between the degree of comparative advantage and the intra-industry trade? Or, more precisely, does the economy's comparative advantage influence intra-industry trade?

These are the prime questions that the study will try to examine using the following methodology.

4. Methodology

We rely on the Revealed Comparative Advantage Index (RCA), an index used to analyze a country's comparative advantage in a particular product. It is determined by comparing the proportion of a particular product's exports to that country's total exports with the proportion of the same product's global exports to global total exports. RCA helps countries discover their strengths and weaknesses in international trade and develop strategies to increase their competitiveness. Balassa introduced the concept of RCA in 1965. It can be calculated in its simplest form as below:

$$\mathbf{RCA\ (I,j) = (X(I,j) / X(i)) / (X(j) / X(g))}$$

Where X(I,j) is the exports of country I in product j, X(i) is the total exports of country I, X(j) is the total global exports of product j, and X(g) is the total global exports of all products.

Intra-industry trade Index (IIT) refers to the trade of similar products within the same industry among different countries. The IIT index is useful for evaluating the degree of intra-industry trade and is calculated using the Grubel-Lloyd (GL) index [3]. The IIT index ranges from 0% to 100%, where a higher index implies a higher level of IIT. The formula for the IIT index is as follows.

$$\mathbf{IIT\ (I,j) = 1 - \ |X(I,j) - M(I,j)| / X(I,j) + M(I,j)}$$

X represents exports, M represents imports, I represents the commodity/sector, and j represents the country.

We collect the data for 36 product categories at SITC 3-digit classification as defined by UNCTAD on Uzbek's exports and imports to the rest of the world. We also collect data on all these products at the world level. This data is collected from 2011 to 2021. The data is organized in the form of a panel. This data set will be used to answer both questions. In the first stage, we calculate the IIT and RCA indexes (these will be new estimates as opposed to the available estimates with various sources). In the second stage, we build an econometric estimation model to explain the intra-industry trade, taking comparative advantage as the explanatory variable.

To address the second question, we consider an implicit relation between the degree of RCA and IIT. It seems true that both determine each other; however, we will consider IIT as the dependent variable and RCA as the explanatory variable. Therefore, the estimation model we build is based on simultaneous equation modeling. We use the 2SLS and Seemingly Unrelated regression models on the constructed panel data to estimate the equations. The panel is made for the RCA and IIT index for the top 10 products from 2011-2021. This gives us 110 observations in the dataset, which is a fair estimate. The system of simultaneous equations is defined below.

$$IIT_{it} = \alpha + \beta_1 RCA_{it} + \beta_2 ex_t + \beta_3 grp_{it} + \varepsilon_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots 1$$

$$RCA_{it} = \alpha + \beta_4 IIT_{it} + \mu_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots 2$$

The above system of equation IIT is the intra industry trade index, RCA is the Revealed Comparative Advantage index for the 10 top product categories calculated from 2011-2021. I and t represent the product categories and years. In this model, we take IIT and RCA as endogenous variables and are primarily interested in how RCA impacts the IIT index. Two exogenous variables are chosen to enter, i.e., ex and grp, where ex is the exchange rate of Uzbekistani Soums visa-vis US$. It can be argued that the Uzbek currency has been constantly depreciating against the dollar over time. This is expected to increase the value of exports (in theory, this is referred to as the value effect of depreciating currency).

The value effect is expected to influence the degree of IIT and index value positively. Therefore, estimating the exchange rate will be used as a control variable. Since 2SLS requires a valid instrument variable, we add the growth rate in industrial production (grp) for proximate product categories in the data as an excluded exogenous variable that will be used as an instrument. The variable to be instrumented is the RCA index, which is the regressor. The reason for choosing GRP as an instrument is the relationship between the capacity to produce and export. This is expected to explain the volume effect of increasing exports on the degree of the IIT index.

5. Results and Discussion

5.1. IIT and RCA Index

Although we calculate the IIT and RCA index from 2011 to 2021 for all 36 product categories, it is useful to take insights from the latest year, i.e., 2021. Table 1 represents the calculated index for various products for the year 2021. The calculations reveal that out of 36 selected products, 13 products show a high degree of intra-industry trade (value of index > .33). Highest among these products are Knitted or crocheted fabrics, n.e.s., Plastics in primary forms and Food and live animals (Value of Index > .90).. In contrast, Manufactured goods, Crude materials, inedible, except fuels, Iron & steel bars, rods, angles, shapes & sections and Mineral fuels, lubricants and related materials follow the above products.

As per the interpretation of the index value, we can conclude that trade in all 13 products is heavily skewed towards intra-industry trade. These product categories are expected to be low on the RCA index. The index value is between 0.33 and 0.10 for 15 product categories representing a potential intra-industry trade. Among these, some important products are Non-ferrous metals, Polymers of ethylene in primary forms, Motor vehicles for transporting persons, Cotton fabrics, woven and Electrical machinery, apparatus and appliances, n.e.s. Showing index values near to 0.33. Table 1 summarizes the calculated values.

Table 1: IIT Index Selected Products, Year 2021

Product	IIT Index Year 2021
Knitted or crocheted fabrics, n.e.s.	0.97
Plastics in primary forms	0.96
Food and live animals	0.92
Manufactured goods	0.79
Crude materials, inedible, except fuels	0.77
Iron & steel bars, rods, angles, shapes & sections	0.70
Mineral fuels, lubricants, and related materials	0.58
Miscellaneous manufactured articles	0.53
Textile yarn and related products	0.52
Chemicals and related products, n.e.s.	0.52
Fertilizers other than group 272	0.49
Cereals and cereal preparations	0.44
Silver, platinum, and other metals of the platinum group	0.37
Non-ferrous metals	0.32
Polymers of ethylene, in primary forms	0.29

Motor vehicles for the transport of persons	0.25
Cotton fabrics, woven	0.25
Electrical machinery, apparatus and appliances, n.e.s.	0.23
Non-metallic mineral manufacturers, n.e.s.	0.23
Articles of apparel & clothing accessories	0.21
Textile yarn	0.19
Vegetables and fruits	0.18
Commodities and transactions, n.e.s.	0.15
Textile fibers and their wastes	0.15
Wheat (including spelt) and meslin, unmilled	0.15
Petroleum, petroleum products, and related materials	0.13
Petroleum oils or bituminous minerals > 70 % oil	0.12
Medicinal and pharmaceutical products	0.11
Radio-actives and associated materials	0.08
Cotton	0.06
Natural gas, whether or not liquefied	0.03
Gas, natural, and manufactured	0.03
Copper	0.02
Gold, non-monetary (excluding gold ores and concentrates)	0.01
Zinc	0.01
Ores & concentrates of precious metals; waste, scrap	0.00

Source: Authors Calculation based on data retrieved from UNCTAD, Handbook of Statistics, 2023.

The products showing an index value less than 0.10 are the ones where the country has sufficient natural resources. The intra-industry trade among these products is expected to be based on comparative advantage; therefore, we expect the RCA index to be high on these products. Interestingly, many products that show a high degree of intra-industry trade are industrial goods based on the manufacturing industry. It gives us intuition that the economy's efforts to increase industrial output are giving an edge to boost intra-industry trade.

Following are the calculations of the RCA index, which reveals the degree of comparative advantage for the same product categories. Of 36 products, 9 show a high comparative advantage, and 18 show a moderate comparative advantage (index value > 1 but less than 10). At the same time, 9 products have an index value of less than 1, showing that the country does not have a comparative advantage in exporting these products. Following Table 2 summarizes the index value:

Table 2: RCA Index Selected Products, Year 2021

Product	RCA Index Year 2021
Textile yarn	34.92
Zinc	30.67
Natural gas, whether or not liquefied	29.00
Cotton	23.74
Gas, natural, and manufactured	21.25
Radio-actives and associated materials	19.66
Gold, non-monetary (excluding gold ores and concentrates)	19.38
Textile fibers and their wastes	14.84
Copper	12.24
Polymers of ethylene, in primary forms	10.46
Miscellaneous manufactured articles	8.13
Cotton fabrics, woven	7.29
Textile yarn and related products	6.97
Commodities and transactions, n.e.s.	6.89
Plastics in primary forms	5.99
Vegetables and fruits	5.95
Non-ferrous metals	5.75
Knitted or crocheted fabrics, n.e.s.	5.02
Fertilizers other than group 272	4.90

Iron & steel bars, rods, angles, shapes & sections	2.85
Manufactured goods	2.37
Silver, platinum, and other metals of the platinum group	1.71
Mineral fuels, lubricants, and related materials	1.64
Food and live animals	1.57
Ores & concentrates of precious metals; waste, scrap	1.18
Cereals and cereal preparations	1.15
Crude materials, inedible, except fuels	1.04
Wheat (including spelt) and meslin, unmilled	0.85
Chemicals and related products, n.e.s.	0.71
Articles of apparel & clothing accessories	0.63
Non-metallic mineral manufacturers, n.e.s.	0.34
Medicinal and pharmaceutical products	0.29
Motor vehicles for the transport of persons	0.17
Petroleum oils or bituminous minerals > 70 % oil	0.15
Electrical machinery, apparatus and appliances, n.e.s.	0.11
Petroleum, petroleum products, and related materials	0.08

Source: Authors Calculation based on data retrieved from UNCTAD, Handbook of Statistics, 2023.

For some products with low RCA, the IIT index ranges from moderate to high. This indicates the relative strength of intra-industry trade in these product categories (Figure 1).

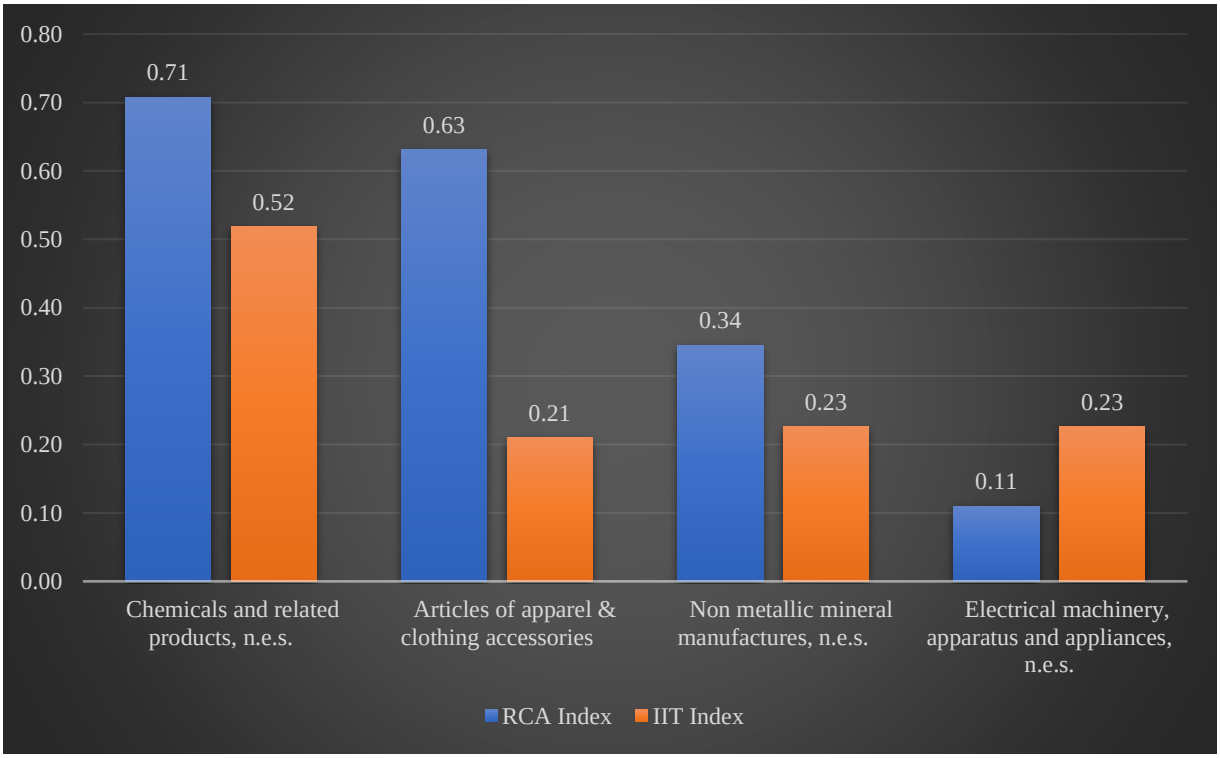

Figure 1: Comparison of RCA and IIT, Selected Product Categories

Source: Authors Calculation based on data retrieved from UNCTAD, Handbook of Statistics, 2023.

Furthermore, there are a few product categories where RCA is moderate to high, along with a high IIT index. This is depicted in the following Figure 2:

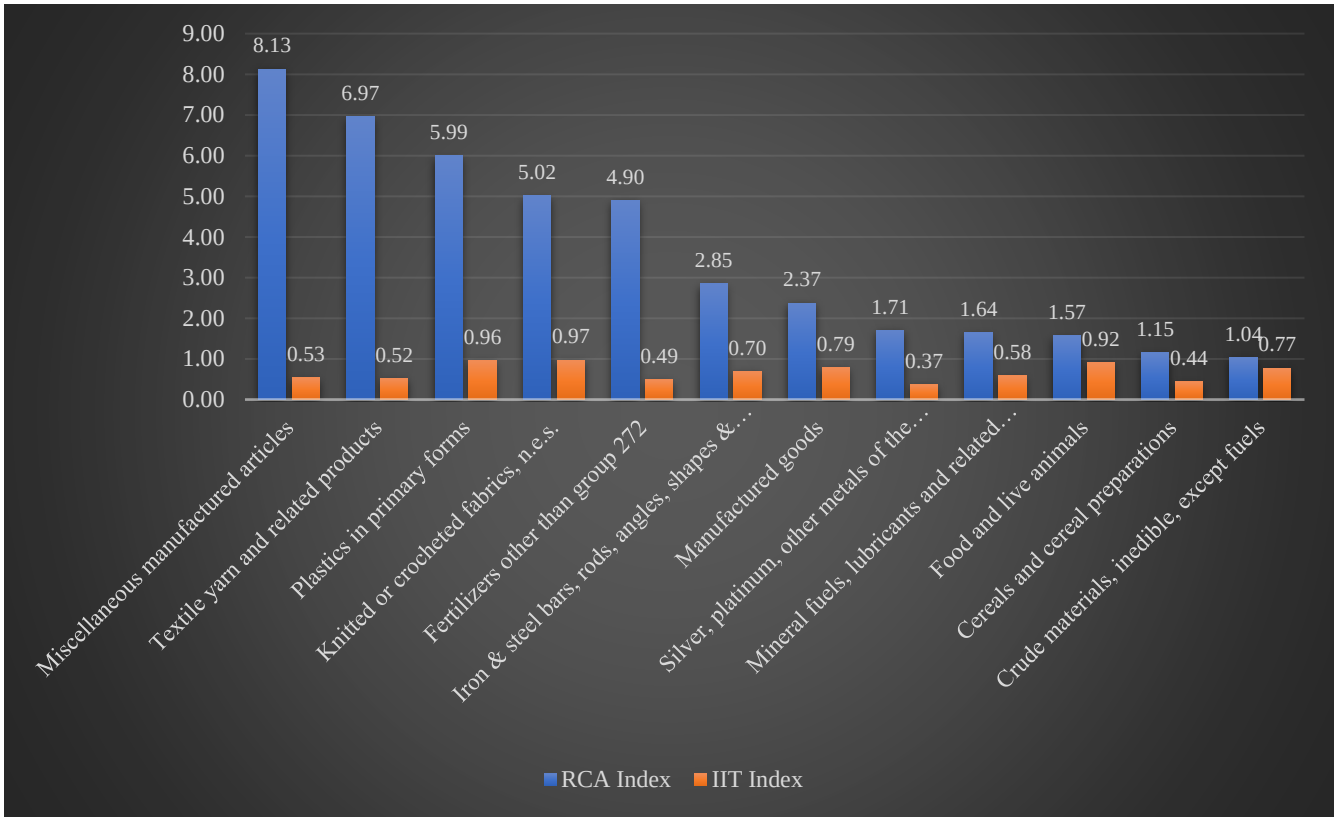

Figure 2: Comparison of IIT and RCA, Selected Product Categories

Source: Authors Calculation based on data retrieved from UNCTAD, Handbook of Statistics, 2023.

Interestingly, this shows that in the above product categories, the comparative advantage that the country enjoys, which is baked by the abundance of natural resources, supports the intra-industry trade. The economy can expand production and intra-industry trade opportunities by utilizing its competitive edge over others.

5.2. Results for Emperical Model: 2SLS and SUR

Given the equations, we first run the Hausman specification test to check the simultaneity in the system of equations. We conclude that the OLS estimates are inconsistent since we find simultaneity in the relation as per the test ($p<0.05$ of the predicted y as explanatory variable). At the next stage, we estimate this relation using the 2SLS (Table 3).

Table 3: Instrumental variables (2SLS) regression

iit	**Coef.**	**St.Err.**	**t-value**	**p-value**	**Sig**		
rca	.12023	.004	3.82	0	***		
ex	.0976	0.047	1.96	.043	**		
Constant	.771	.156	4.95	0	***		
Mean dependent var	0.716		SD dependent var		0.195		
R-squared	0.286		Number of obs		90		
F-test	2.311		Prob > F		0.105		
*** p<.01, ** p<.05, * p<.1							
Source: Authors estimates based on STATA							

Alternatively, we also run the Seemingly Unrelated Regression (SUR) with the expectation of more robust results. The results are displayed in following Table 4.

Table 4: Seemingly Unrelated Regression

Equation	Obs	Parms	RMSE	"R-sq"	Chi^2	P
IIT	90	2	.1884386	0.2603	43.20	0.0000
RCA	90	1	32.39909	0.0447	41.34	0.0000

	Coef	Std.Err	z	P>z	Sig
iit					
rca	.15056	0.021	6.050	0.000	***
ex	0.0865	0.000	2.04	0.04	**
cons	0.770	0.043	17.850	0.000	***
rca					
iit	-103.150	16.043	-6.430	0.000	***
_cons	100.153	11.946	8.380	0.000	***

**** p<.01, ** p<.05, * p<.1*
Source: Authors estimates based on STATA

The results of both models coincide. As expected, the RCA index, which reveals the degree of comparative advantage, has a statistically significant positive impact on the degree of intra-industry trade. A unit increase in the RCA index leads to a 12 to 15% rise in the degree of IIT. These are prominent findings that have not been reflected in any of the earlier studies in the context of the Uzbek economy. The control variable, i.e., exchange rate, also positively affects the IIT index. This was also expected since the Uzbek currency depreciated substantially against US dollars. The coefficient in both models is statistically significant, and a unit rise in the exchange rate leads to an 8 to 9% rise in the index.

6. Conclusion

The study was initiated by examining the degree of comparative advantage and intra-industry trade in prominent product categories that the Uzbek economy exports and imports to the rest of the world. For the first time, the study postulates fresh RCA and IIT index estimates for the economy's exports instead of the available secondary estimates. It was found that there are many products where the RCA is dominant, showing that trade is based on comparative advantage in these product categories. The study also shows an equal number of products based on intra-industry trade. Strikingly, the study finds that there are common product categories where RCA and IITS indexes are relatively higher, indicating that the comparative advantage the country enjoys boosts its intra-industry trade in these product categories. As a policy implication, it is suggested that these are the most promising sectors where the economy must concentrate to boost trade performance. Expanding this argument further, the study also shows the interrelation between IIT and RCA, concluding that the degree of comparative advantage positively impacts intra-industry trade. Therefore, to strengthen the intra-industry trade, it is recommended that the comparative advantage be optimized and the trade performance be increased via boosting intra-industry trade.

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