Importance of Trade Integration and Trade Complementarity Inflow on the Relationship between China and Europe and Central Asia

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ABSTRACT

The study aim is to investigate the industrial, agricultural, and technological bilateral trade relationship between China and the Europe and Central Asia region over the period of 2000 to 2019 by employing the Revealed Comparative Advantage index (RCA export), Trade Complementarity Index (TCI), and Trade Integration Index (TCD). The estimated results show that there is a strong bilateral trade relationship between China and Europe and Central Asia. The estimated results of the Trade Complementarity Index (TCI) indicate that between 20 industries, 17 have strong TCI, which show that the exports and imports between China and Europe and Central Asia are matched; only three of the industries, which are vegetable, fuels, and minerals are not strongly matched; the Trade Integration Index (TCD) between China and Europe from 2000 to 2019 is less than 1 which explains that the trade integration index between China and Europe is weak, which indicates that Chinese trade does not depend strongly on Europe and Central Asia; Additionally, the estimated results of the Revealed Comparative Advantage index (RCA export) between China and Europe show that there is a strong revealed comparative advantage between China and Europe for all 20 industries.

Keywords: Integration index; Industries; Agriculture; Technologies; Revealed comparative advantage; Trade complementarity

Abbreviations: TII: Trade Intensity Index; RCA: Revealed Comparative Advantages; TCI: Trade Complementarity Index; TCD: Trade Integration Index; GDP: Gross Domestic Product

INTRODUCTION

Bilateral trade is a key component for a country to increase its economic growth [1]. In the study, we are investigating the impact of bilateral trade on economic growth between China and Europe and Central Asia during the period of 2000 to 2019, for bilateral trade relationship, we are applying the Revealed Comparative Advantage index (RCA export), Trade Complementarity Index (TCI), and Trade Integration Index (TCD). The RCA indicates the export strength of Chinese products to Europe and Central Asia, TCI examine that is the export of China match with import of Europe and Central Asia, and TCD explain the trade dependency of China on Europe and Central Asia from 2000 to 2019. China is the second largest agricultural and goods economy in the world [2]. The total economy of Europe had 13.3 trillion euros in 2020 which is why

in the study; we are checking the bilateral trade relationship between China and Europe and Central Asia [3]. Bilateral trade has a positive impact on Russian economic growth. Bilateral trade is an exchange of goods and services between two countries to promote investment and trade, bilateral trade agreements make policies easy to reduce tariffs and increase investment and trade volume [4]. Chinese economy does not just depend on export. Trading is the activity of purchasing and selling or exchanging products and services for money. A market is a structure or network that facilitates trade. Trade also includes the conveyance of goods or services from one person or business to another [5]. Bartering, which is the direct exchange of products and services for other commodities and services, was the first form of trade. Bartering is the act of exchanging goods without using cash. The use of pricey metals in one bartering

group later increased, and they were significant both symbolically and practically. Most transactions between modern traders involve a medium of exchange, like money. The rise in the market value of the goods and services an economy produces over time, adjusted for inflation, is known as economic growth. It is typically calculated as the rate of growth in real gross domestic product, or real GDP.

China economy performance

China is one of the largest trade patterns in the world and has one of the strongest economies which contribute more than 30% of the world economy [6]. China opened up its trade policy after 1978, and China grew its economy very fast and strongly which took China now in the top world's second strongest economy [7]. According to OEC in August 2022 China has a positive trade balance which has a total worth of 79.4 billion dollars including 315 billion dollars in export which is 9.27% less than in 2021 and 236 billion dollars in imports worth, the top main export products of China in 2022 are telephones which have a total worth of 17.1 billion dollars, computers have a total worth of 15.7 billion dollars, integrated circuits export worth have 11.9 billion dollars, semiconductor devices have total 5.97 billion dollars export worth total exports worth and electric batteries have a total worth of 5.64 billion dollars. The top five imports products in August 2022 are integrated circuits total import worth 33.3 billion dollars, crude petroleum has 30.5 billion dollars import worth, iron ore total import worth is 10.8 billion dollars, gold has 10.4 billion dollars and petroleum gas import worth in 2022 have total worth is 7.53 billion dollars. The top main exporters of China in 2022 are the United State which has export a total worth of 49.8 billion dollars from China, Hong Kong has total export worth from China 22.1 billion dollars, Japan has 15 billion dollars' worth of export from China, South Korea export from China 13.9 billion dollars export worth and Vietnam has 12.4 billion dollars export worth of products from China. Import main partners are Taiwan from which China imports a total of 19.7 billion dollars' worth of products, from South Korea, China imports a total of 17 billion dollars' worth of products, Japan is the third largest import partner China from Japan, China import total worth of 15.4 billion dollars, from the United State, China imports 13 billion dollars' worth of products and Australia from which China import total worth of 12.5 billion dollars products [8].

The Chinese economy is rapidly increasing for the past three decadents after opening up China policies about trade and investment for trade partners. OEC world in 2020 China had a total GDP of 15.98 trillion dollars which in Chinese currency was 101.36 trillion yuan, in 2020 China become the world's second-largest economy, because of the COVID-19 world economy going not well from 2019 to till now that also affected the Chinese economy 2019 growth rate of around 6% which in 2018 was around 10%, according to world bank Chinese total GDP in 2020 was 14.78 trillion dollars which had GDP per capita 10500.40 dollars per person which have growth rate 2.3% annually which is around 4% less than 2019 and inflation rate in 2020 was 2.9%, total chinses GDP in 2022 is 19. 91 trillion dollars which is around 5 trillion dollars higher than 2020, GDP growth rate in 2021 was 8.1% which is 5% higher than

year 2020 and now in 2022 China GDP growth rate is 5.1 which again lower than 2021 around 3% because of COVID-19 again closed many cities in China, total GDP per capita in 2022 is 14090 dollars per person, total Chinese exports in 2021 was 3.36 trillion dollars, total agriculture products had 2.2% in total GDP and manufacturer products had 74.3% share in total GDP and fuel industry had 2.4% share in total GDP, main trade partners of China are United States which had total 16.7% share in total Chinses exports, European-Union had 17.2% of total share in total Chinese exports, China had total 12.73% exports share with South and East Asia countries, Export with Hong Kong China had 12.16% share and Japan had 5.91% total Chinese export share, if we talk about total import of China from the world in 2021 had 2.69 trillion dollars, total import share in 2021 in agriculture industry China had 7.5%, total fuel China import from the world is 21.23% share in total export and in manufacture industry China has total 64.4% share of total Chinese import, top Chinese import patterns in 2021 are European-Union from which China import total 12.82%, second South and East Asia from which China import total 12.58%, from South Korea China import 9.58% share, from Japan China import total 8.45% share, from Taiwan China total import state are 8.32% and China import share from United States is 7.4%.

Europe and Central Asia region economy growth

European-Union had total population 748 million dollars in 2021 and euro is a currency which used in the Europe from 1999, total GDP of Europe in 2018 is 22.9 trillion dollars and GDP per capita in 2017 was 27330 dollars, top seven countries in Europe region who have economy worth more than 1 trillion dollars from seven the first county is Germany which have total GDP 4.3 trillion dollars, France is in second position which have 3.2 trillion dollars GDP worth, United Kingdom on third position who have total 3.1 trillion dollars GDP, Italy is on fourth position which had total GDP 2.1 trillion dollars, Russia is on fifth position which had total GDP 1.7 trillion dollars, Spain is on top Sixth position in Europe region which had total GDP 1.5 trillion dollars and Netherlands had total GDP 1 trillion dollars, in agriculture sector Europe is a most advanced agriculture technique which increase agriculture sector significantly from past years, in 2022 Europe total worth reached at 28.3 billion euros which is 25% higher than 2021 and total exports in agriculture sector had worth 15.8 billion euros and total import worth reached 12.5 billion euros in 2021, total 40% of export in agriculture sector Europe had to United Kingdom, China and United States, total exports to United Kingdom from Europe is 894 million euros in 2020 export including vegetables, eggs, beer and cider, total export to China in 2020 is 414 million euros which includes poultry and eggs and cereals and export to the United States in 2020 is 323 million euros which includes poultry and eggs and cereals, and top four country agriculture importers are United States, Brazil, United Kingdom and Ukraine from them Europe import almost 35% of agricultural products, from United Kingdom and Japan imports worth reached to 1 billion euros from where Europe import wine and wine related products and poultry and eggs [9].

In 2022 first-quarter trade gap in the Europe region is 16.4 billion euros compared with last year's surplus of 22.5 billion euros because of Russia and Ukraine war energy crisis is very high in Europe which is 128.7 billion euros worth during the first few mothers of 2022, imports of Europe from the world become increasingly more than 34% which had total worth 266.5 billion euros and exports also increase 14% which had total worth 250.1 billion euros, China is the biggest trade partner in 2022 which had total trade worth 91.9 billion euros, average growth rate from last ten years around 5%. European-union top export industries are nuclear reactors, machinery, and mechanical appliances and boilers had a total of 15.5% of the total GDP and had the total worth 340 billion dollars, second-largest export industry is pharmaceutical products which had 10.6% of total GDP of Europe which had total worth 233 billion dollars, third biggest industry is vehicles and railway and spare parts industry which had 10.4% of total GDP which had total worth 228 billion dollars, fourth biggest industry is all-electric equipment's and final products had 9% of total GDP which had total worth 197 billion dollars [10].

Objectives of study

- To explain resistances are resisting the bilateral trade relationship between China and Europe and Central Asia.
- To investigate that which factors effects geographically, diplomatically, and culturally bilateral trade between China and Europe and Central Asia.
- To examine that China trade, depend on the Europe and Central Asia region.

LITERATURE REVIEW

To test the bilateral trade relationship between countries researchers offer several models including, explained the comparative advantages explain the trade relationship between countries. Examined the comparative advantages has a key to checked the industries' trade relationship between countries. To check the bilateral trade impact on economic growth the comparative advantage is an important tool to measure the bilateral relationship between countries. Examine the Trade Complementary Index (TCI) based on comparing the export and import Revealed Comparative Advantage index (RCA). For the past few years, China is the world's largest economy which had a total of 15.98 trillion dollars in 2020 and depends on trade more than 34% of the economy according to the world bank report, after China opened up the trade policies in 1978, Chinese economy growing very fast, in 1985 China trade relationship was started with Europe and Central Asia, in ten years from 1985 to 1994 total trade worth between China and Europe was 14.3 billion dollars to 45.6 billion dollars, than in 2007 passed a new agreement with China in which more than 24 sectors trade partnership started between China and Europe that make trade relationship more strong between China and the Europe and Central Asia. Higher comparative advantages have higher the country's net-export productivity. To increase the economic growth of the country need to increase the comparative advantages of industries [11].

Bilateral trade impact on economic growth

Mazlan, Hassan et al., investigate the performance of trade of one country with another country after using inter Trade Intensity (TI) and make innovations in the TI model to check and measure country market potential. Chen and Researcher examine the positive and strong trade relationship between China and Europe. The trade relationship between China and Africa to explain how to improve the economic growth of China for that they used the intra-industry trade index (G-L index), Trade Intensity Index (TTI), and Revealed Comparative Advantage index (RCA) to check the trade performance and relationship between China and Africa, Trade intensity index between China and Guinea explain the inter-dependence of these two countries in terms of trade if trade intensity index greater than 1 between China and Guinea is very strong and continually increase from 2013 to 2015 which mean there is good relation of trade between China and Guinea but trade intensity index between Guinea and China values are less than 1 which shows us that there is the weak relationship of trade between Guinea and China.

Ishchukova and Smutka showed the trade performance of Russia's agriculture sector and also give information that whether or not trade partners of comparative advantage of Russia does significantly change over the period of 1998 to 2010, they used the comparative advantages Index to check the performance of the agriculture industry of Russia from 1998 to 2010 after they analyze the data by used RCA said that the performance of export in agriculture sector significantly growing from 1998 to 2010. Mainly in the agriculture industry wheat, barley, oil seeds, and sunflower oil significantly increased the growth of their products during the period of 1998 to 2010, The most from 2002 to 2007 primary products like wheat, barley, cow milk sunflower seeds increased their growth very fast. According to Goyal and Vajid, there is no nation in the whole world that is independent and never relies on other countries, they explain trade relationships between India and UAE after 11 years of data from 2006 to 2016 between UAE and India to using the trade intensity index, and results showed that bilateral trade volume reached 50 billion dollars in 2016 and the main source of trade is excluding oil which is 36 billion dollars which is total 10% international trade of UAE which put India in top three trade partners from last ten years, and India import also increase from last ten years results also showed that export intensity index between India and UAE higher than import intensity index which gives us information that India relay on UAE, their results explain that there is the good trade relationship between India and UAE. Indian industries have good market value in the world [12].

Hoen and Oosterhaven explains the Revealed Comparative Advantages RCA standard measure range in between 0 and infinite, or between -1 and +1 or RCA value relay between 0 to 1, estimated results of the revealed comparative advantages (RCA) said that the value of RCA must be in between 0 and infinite, and if RCA values are less than 1 between two countries it's mean country A didn't rely much on county B but if Revealed Comparative Advantages RCA values higher than 1 it's mean country A depend on county B, as much as RCA

values are greater than 1 it's mean as much strong county A depend on country B. China trade has positive and significant impact on global economy, they also explained that there has positive and significant impact of investment on bilateral trade between China and Poland. Somesh K Mathur examine the losses and benefits of the Indian economy to join the free trade area in RCEP and BRICS member countries after they analyze the data to use Revealed Comparative Advantages RCA and trade intensity index TII from 2013 to 2014 of 14 different products, results showed that's In terms of just good trade, India benefits more from the RCEP than it does from the BRICS. Messerlin and Wang examine three main challenges to effects the trade relationship between China and Europe, first china following the US trade policies for Europe is not suitable, second Chinese industries do not develop similarly to Europe, third Europe is the richest region than China so, yet Europe does not need good trade relationship with China [13].

Xu and Li explain the bilateral trade and economic association between China and the EU, since a few years ago, Europe has been China's top trading partner, demonstrating the strength of the two countries' bilateral commercial relations. The main reason behind that is China opened up its trade policy in 1978 and after China become a WTO member in 2001, the relationship between China and the EU become stronger. Ibrahim and Shehu study explains a simple descriptive analysis and trade complementarity index from 2000 to 2014 between Nigeria and India, they said that Nigeria's import from India is not much different than export between Nigeria and India, fuel is the major product which Nigeria export to India, total Nigeria export to India is 31.98 billion and total Nigeria import to India is 45.21 billion, for their study they took ten main products to analyze the simple descriptive analysis and the Trade Complementarity Index TCI from 2000 to 2014 to check the bilateral trade relationship between Nigeria and India, their results showed that fuel is the main export that Nigeria export to India which is almost 97% of total export, raw materials, rubber, thereof articles have total 1% export, aluminum, edible fruits and nuts, lac, gums, and vegetables all are other 1%. If we talk about imports which they mention in their study machinery, nuclear reactors, boilers, railway, vehicles, roll stock, and tram are major imports which Nigeria imports from India which was 18% in 2000 and in 2014 is 14%, cereals, electronic machines, and sound recorders are around 9% import and plastics, iron and steel 5%, 4% and 3% total Nigeria import from India [14].

García-Herrero explain the relationship between European-Union and China regarding trade, investment, and China's key strategic projects and the belt and road initiative, China is a major trade partner with the European-Union, and Bilateral Trade going stronger over the last few years, as for investment European-Union companies invest more foreign direct investment toward China and the belt and road initiative provides a significant offer potential trade increase for European-Union by improving their trade connectivity between China and Europe. Li, Wang et al., used the technique to measure the Trade Complementarity Index (TCI) in which he multiplies the revealed comparative advantages export RCA and the revealed comparative advantages import RCA, finding

showed the significant and positive association between China and the United State during the period of 2007 to 2016. Benedictis and Tajoli explained that the openness up export of Europe has a significant and positive impact on economic growth of Europe. The study's goal is to examine the bilateral trade relationship between China and Europe and Central Asia region from 2000 to 2019 using the trade Revealed Comparative Advantages (RCA), Trade Complementarity Index (TCI), and Trade Integration Index (TCD) indices [15].

Study design

Europe and Central Asia have a total of 58 countries; we took average values of all independent and dependent variables which we mention below. The time series study design has been used in the study, the time series data deal with a consistent interval of collected data points, which regressed the bilateral trade and economic growth between China and Europe and Central Asia. The study has nine independent variables which are China's products export to Europe and Central Asia, China's export to the world, China's total export, world total export, China's import to Europe and Central Asia, China's import to the world, China total import, world total import, and Europe and Central Asia total import and economic growth GDP is dependent variable, and 20 products which China export or import from other countries or regions. To check the impact of bilateral trade between China and Europe and Central Asia on Chinese economic growth, we collected data from (WITS 2022) and over the period of 2000 to 2019 at 20 years of data [16].

Econometric models

There are three main models in the study to estimate the results which are the Revealed Comparative Advantage index (RCA), Trade Complementary Index (TCI), and Trade Integration index (TCD). Balassa gave a new concept to measure the comparative advantage product of one country to another, to check the trade relationship between two countries. Balassa and Balassa examine the comparative advantages is a key to check the industries relationship between countries. According to Vollrath to check the bilateral trade impact on economic growth the comparative advantages is an important tool to measure. Xu, Li and Li, Wang et al., examine the Trade Complementary index (TCI) based on comparing the export and import Revealed Comparative Advantage index (RCA). Drysdale gave a model to calculate the Trade Integration Index (TCD) to check the trade relationship between two countries. Linnemann and Van Beers export and import are contributing significantly to check the trade intensity between two countries. Finger and Kreinin to increase the volume of export very important to develop the economic growth of a country [17].

Research models

Revealed Comparative Aavantage Index (RCA): Based on Balassa and Balassa trade theory, is employed to demonstrate how productivity differences between nations influence their trade patterns. The RCA index by Balassa is typically calculated as follows:

$RCA_{ij} = Z_{ij}/Z_{it})/(Z_{wj}/Z_{wt})$

Where;

Z_{ij} and Z_{wj} represent the total exports of the country i's of j products and the products j exports of the world respectively,

Z_{it} and Z_{wt} represent the values of total exports of country I and total export of the world.

The country has revealed comparative advantage in that product if the RCA index value is larger than one, and vice versa, a nation is thought to have a strong export position in a certain product if it has a revealed comparative advantage in it. A country's export strength in product i is inversely correlated with the value of its RCA for that product i. If RCA>1, the country i said to have a strong export relationship with j, but if a country has RCA <1 there must be Comparative Disadvantage in the commodity [18].

Trade complementarity index: In previous many studies researchers similar as Ferto and Hubbard, Qiaoyu Li and Li used method where they get TCI to multiply RCA import and RCA export.

TCI=RCA export × RCA import

Trade complementarity index (import)=$RCA_{ij}=Z_{ij}/Z_{it}/Z_{wj}/Z_{wt}$

Where;

Z_{ij} and Z_{wj} represent the total imports of the country is of j products and the products j imports of the world respectively.

Z_{it} and Z_{wt} represent the values of total imports of country I and total import of the world.

The country has revealed comparative advantage in that product if the RCA index value is larger than one, and vice versa, a nation is thought to have a strong import position in a certain product if it has a revealed comparative advantage in it. A country's import strength in product i is inversely correlated with the value of its RCA for that product i. If RCA>1, the country i said to have a strong import relationship with j, but if a country has RCA<1 there must be comparative disadvantage in the commodity [19].

TCI=RCA export × RCA import

According to Xu and Li, the TCI of both countries will be higher if imports and exports of each nation is equal, and vice versa. It is commonly accepted that a TCI>1 suggests a close trade relationship and stronger import and export complementarity than other levels of the market, whereas a TCI<1 indicates the opposite.

Trade integration index: Drysdale refers to the proportion between the volume of a country's export to a trade partner and the volume of that partner's imports from the rest of the globe, the closer the trading ties between the two nations, the higher the value. The formula is:

$TCD_{ij}=X_{ij}/X_i/M_j/M_w$

Where:

TCD_{ij} =Refers to the degree of trade dependence of i countries to countries j;

X_{ij}=Refers to that county I's exports to country j;

X_i=Mentions the total exports of i countries;

M_j=Indicates the total imports of country j;

M_w=Explain the total exports of the world's.

Figure 1 examines the export change of China to Europe and Central Asia from 2000 to 2019, the figure showed that the top three export products include capital goods which had a total export share of 15% in 2000 which increased by 7%, now 22% in 2019, consumer goods which had a total export share of 25% which decreased 5% and in 2019 total export share are 21%, and Elec and Mach had 16% total export share in 2000 which increased 5% total export share are 21% in 2019.
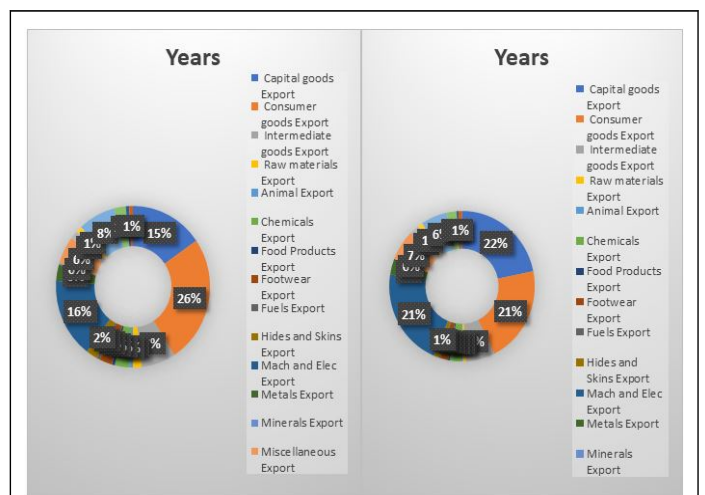
Figure 1: Explain the export of China to Europe and Central Asia from 2000 to 2019.

Figure 2 shows the change in China's imports to Europe and Central Asia between 2000 and 2019. The top three import products are capital goods, which had a total import share of 26% in 2000 but decreased by 10% to 22% in 2019, rubber and plastic, which had a total import share of 14% but decreased by 4% to 11% in 2019, and Elec and Mach, which had a total import share of 23% in 2000 but decreased by 13% to 10% in 2019.
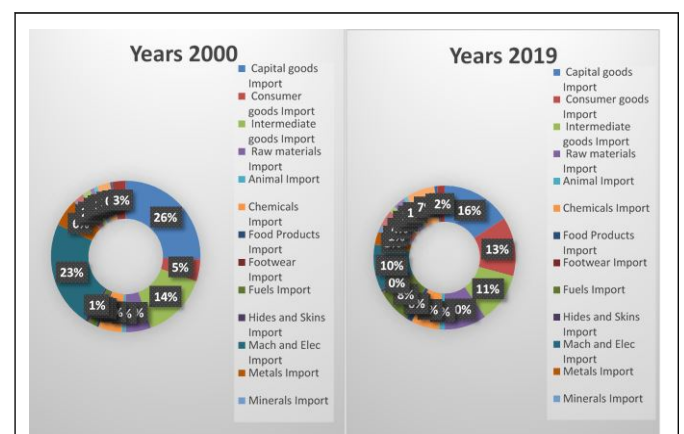

Figure 2: Explain the import of China to Europe and Central Asia from 2000 to 2019.

In Figure 3, we mention all values of the trade integration index between China and Europe and Central Asia from 2000 to 2019, in X-exes we took years values from 2000 to 2019, and in Y-exes, we took all values of the trade integration index between China and Europe from 2000 to 2019, all values are less than 1 and lays between 0.40 to 0.60 which indicate that the relationship of trade integration index between China and Europe from 2000 to 2019 are weak not so strong because all values of trade integration index between China and Europe and Central Asia. Table 1 summary of Revealed Comparative Advantage index (RCA) between China and Europe and Central Asia.

In Table 1, we mention the descriptive statistic of the Revealed Comparative Advantage index (RCA) between China and Europe which give us information about the average, maximum, minimum, and standard-deviation for China's 20 products (transportation, plastic or rubber, vegetable, stone and glass, wood, textiles and clothing, mach and elec, footwear, metals, fuels, miscellaneous, hides and skins, minerals capital goods, animal, consumer goods, chemicals, intermediate goods, food products, and raw materials). Table 2 Revealed Comparative Advantage index (RCA) between China and Europe and Central Asia.
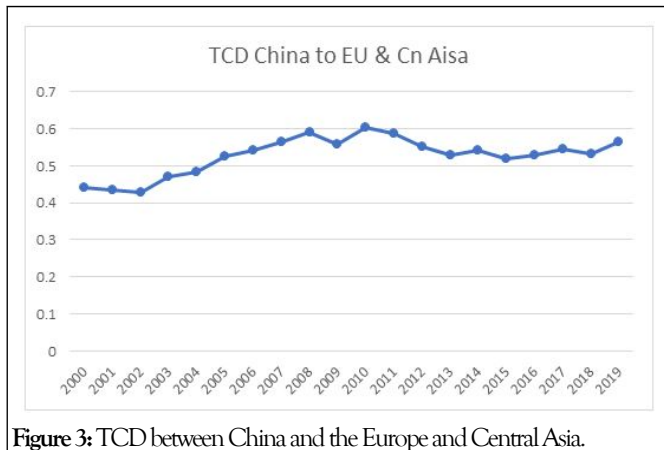
Figure 3: TCD between China and the Europe and Central Asia.

Table 1: Descriptive statistics of first seven products.

Variables	Avg.	Mix.	Min.	Std. dv.
Capital goods	2.98	5.927	1.668	1.258
Animal	2.793	4.827	1.669	1.007
Consumer goods	3.372	5.548	2.122	1.076
Chemicals	3.11	6.931	1.854	1.486
Intermediate goods	2.426	4.463	1.491	0.906
Food products	1.912	3.178	1.12	0.658
Raw materials	2.383	3.748	1.647	0.672
Mach and elec	2.995	5.851	1.735	1.227
Footwear	3.935	6.049	2.688	1.041
Metals	2.824	5.335	1.705	1.107
Fuels	1.094	2.17	0.51	0.583
Miscellaneous	3.161	5.551	2.058	1.035
Hides and skins	4.66	8.709	2.852	1.771
Minerals	3.116	5.833	0.972	1.864

Transportation	3.255	6.932	1.45	1.612
Plastic or rubber	2.941	5.616	1.762	1.12
Vegetable	2.295	3.561	1.391	0.73
Stone and glass	2.632	5.236	0.945	1.355
Wood	2.7	4.596	1.684	0.865
Textiles and clothing	3.237	4.803	2.138	0.82

Table 2, describes how transportation, plastic or rubber, vegetable, stone and glass, wood, textiles and clothing, mach and elec, footwear, metals, fuels, miscellaneous, hides and skins, minerals, capital goods, animal, consumer goods, chemicals, intermediate goods, food products, and raw materials industries affect the relationship between China and Europe and Central Asia when we observe Table 2, estimated results of RCA examine that all values are higher than 1, this implies that there has strong revealed comparative advantage index between China and North America from 2000 to 2019, the lowest value is 0.510 which belongs to 2016 of fuels industry and the highest value belongs to 2000 of hides and skins industry column which is 8.710, all values are decrying from 2000 to till now in 2019 which mean the relation going weak yearly and the top five strongest revealed comparative advantage index between China and Europe is chemicals, hides and skins, capital goods minerals, and footwear industries. Additionally, there has a strong bilateral trade relationship between China and Europe from 2000 to 2019. Table 3 Summary of Revealed Comparative Advantage index (RCA import) between China and the Europe and Central Asia.

Table 2: Revealed Comparative Advantage index (RCA) of first seven products.

Export	Capital goods	Animal	Consumer goods	Chemicals	Intermediate goods	Food Products	Raw materials	Mach and elec	Foot Wear	Metals	Fuels	Miscellaneous	Hides and Skins	Minerals	Plastic or Rubber	Vegetable	Stone and Glass	Wood	Textiles and Clothing
2000	5.927	4.696	5.548	6.931	4.463	3.178	3.586	5.851	6.049	5.335	1.938	5.551	8.709	5.833	5.616	3.561	5.236	4.596	4.202
2001	5.206	4.827	4.916	6.049	4.080	3.039	3.748	5.106	5.182	4.848	2.061	4.961	7.780	5.530	4.828	3.536	4.695	4.207	3.821
2002	4.122	3.138	4.458	5.001	3.452	2.614	2.832	4.153	4.990	4.093	1.534	4.616	6.702	5.545	4.209	3.011	3.767	3.344	3.538
2003	4.070	3.123	4.164	4.339	3.064	2.452	2.653	4.106	4.671	3.699	1.597	3.933	6.335	4.986	3.941	2.728	3.406	2.832	3.406
2004	3.720	2.873	3.884	3.656	2.719	1.916	2.670	3.808	4.234	3.138	2.170	3.359	6.197	4.914	3.494	2.791	3.364	2.829	3.259
2005	3.632	3.345	4.140	3.609	2.744	2.220	2.741	3.691	4.968	3.115	1.520	3.491	6.365	4.950	3.512	2.705	3.648	3.147	3.817
2006	3.506	3.555	4.207	3.563	2.909	2.294	2.934	3.473	4.800	3.380	1.460	3.679	4.854	4.656	3.452	2.894	3.718	3.219	4.401
2007	3.653	3.670	4.172	3.236	3.110	2.654	2.981	3.618	4.848	3.702	1.448	3.613	4.768	5.052	3.499	2.666	3.834	3.562	4.291
2008	3.641	3.994	4.354	3.119	2.933	2.502	3.046	3.596	4.899	3.391	1.436	3.799	4.937	4.043	3.436	3.185	3.831	3.521	4.803
2009	2.806	3.182	3.452	2.737	2.367	1.877	2.447	2.809	3.919	2.776	0.578	3.120	4.153	2.130	2.682	2.364	2.989	2.894	3.695
2010	2.562	2.627	3.021	2.405	2.069	1.674	2.224	2.583	3.525	2.335	0.641	2.763	3.746	2.457	2.408	2.031	2.345	2.634	3.269
2011	2.345	2.354	2.822	2.170	1.949	1.582	2.023	2.368	3.471	2.222	0.791	2.576	3.666	1.992	2.382	1.901	1.730	2.394	3.065
2012	1.969	2.000	2.414	2.011	1.764	1.369	1.787	2.023	3.093	1.970	0.727	2.236	3.214	1.563	2.107	1.788	1.229	2.125	2.605
2013	1.709	1.828	2.288	1.923	1.629	1.353	1.773	1.773	2.953	1.873	0.634	2.058	3.072	1.241	1.971	1.655	1.067	1.948	2.511
2014	1.768	1.713	2.309	1.874	1.561	1.376	1.819	1.836	3.022	1.776	0.528	2.165	3.143	1.367	1.988	1.655	0.945	1.930	2.593

2015	1.668	1.669	2.233	1.858	1.499	1.296	1.720	1.735	2.698	1.750	0.517	2.153	2.852	1.179	1.848	1.588	1.253	1.779	2.339
2016	1.853	1.747	2.387	1.998	1.593	1.300	1.711	1.887	3.012	1.804	0.510	2.318	3.287	1.289	1.951	1.508	1.334	1.823	2.472
2017	1.850	1.857	2.318	1.976	1.577	1.222	1.666	1.865	2.993	1.783	0.533	2.329	3.210	1.282	1.913	1.513	1.390	1.770	2.362
2011	1.737	1.757	2.122	1.854	1.491	1.120	1.656	1.757	2.688	1.705	0.639	2.166	3.051	1.343	1.762	1.391	1.344	1.684	2.138
2019	1.850	1.908	2.223	1.883	1.540	1.198	1.647	1.868	2.693	1.789	0.622	2.338	3.167	0.972	1.827	1.436	1.518	1.762	2.146

The descriptive statistic of the import Revealed Comparative Advantage index (RCA) between China and Europe showed in Table 3. Which give us information about the average, maximum, minimum, and standard-deviation for China's 20 products (transportation, plastic or rubber, vegetable, stone and glass, wood, textiles and clothing, mach and elec, footwear, metals, fuels, miscellaneous, hides and skins, minerals capital goods, animal, consumer goods, chemicals, intermediate goods, food products, and raw materials). Additionally, results of RCA imports of 20 products showed that all strong import comparative advantage. Table 4 Trade Complementarity Index (TCI) between China and the Europe and Central Asia.

Table 3: Descriptive statistics of first seven products.

Variables	Avg.	Mix.	Min.	Std. dv.
Raw materials	1.811	3.867	1.066	0.86
Capital goods	2.441	6.421	1.344	1.512
Animal	4.688	9.104	2.246	2.231
Consumer goods	3.773	5.743	3.185	0.706
Chemicals	3.362	6.583	2.35	1.195
Intermediate goods	2.401	4.213	1.522	0.784
Food products	3.264	5.964	2.32	0.807
Mach and elec	2.222	6.181	1.039	1.478
Footwear	2.212	2.978	1.499	0.494
Metals	3.168	6.673	1.957	1.435
Fuels	1.712	2.538	1.23	0.303
Minerals	0.908	1.857	0.541	0.354
Hides and skins	3.599	5.495	3.063	0.591
Miscellaneous	2.369	4.728	1.629	0.892
Transportation	6.355	12.573	4.434	2.201
Plastic or rubber	1.596	2.531	1.136	0.422
Vegetable	0.471	1.854	0.158	0.395
Stone and glass	3.924	7.63	0.937	1.691
Wood	3.576	6.371	2.084	1.446
Textiles and clothing	1.4	1.87	1.1	0.209

In Table 4, we explain the Trade Complementarity Index (TCI) between China and Europe from 2000 to 2019 which gives us knowledge about the complementarity of China and Europe region. Table 3 we mention transportation, plastic or rubber, vegetable, stone and glass, wood, textiles and clothing, mach and elec, footwear, metals, fuels, miscellaneous, hides and skins, minerals capital goods, animal, consumer goods, chemicals, intermediate goods, food products, and raw materials products industries results to check the Trade Complementarity index (TCI) between China and Europe and Central Asia, results showed that between 20 industries, 17 have strong Trade Complementarity Index (TCI) between China and Europe meaning the export and import of China and Europe and Central Asia are matches, only three of them which are vegetable industry, fuels industry, and minerals industry do not have strong mean the export and import of Trade Complementarity Index (TCI) between China and Europe do not match, all values are decrying from 2000 to till now in 2019 which mean the relation going weak yearly, the strongest industry between these seven industries is chemicals industry.

Table 4: Trade Complementarity Index (TCI) between China and the Europe and Central Asia

TCI	Raw materials	Minerals capital goods	Animal	Consumer goods	Chemicals	Inter mediate goods	Food Products	Mach and elec	Foot Wear	Metals	Fuels	Minerals	Hides and Skins	Miscellaneous	Plastic or Rubber	Vegetable	Stone and Glass	Wood	Textiles and Clothing
2000	13.866	38.60	41.616	28.914	45.631	18.800	18.956	36.164	9.492	35.602	4.153	10.832	47.857	24.318	14.037	6.603	39.952	29.279	4.791
2001	12.731	32.226	43.943	28.235	36.777	16.604	13.868	28.928	8.225	30.751	3.976	8.602	36.427	23.455	12.219	3.497	32.655	26.310	4.478
2002	9.682	17.390	23.417	21.646	25.814	12.469	9.568	16.395	8.900	20.802	3.893	8.434	26.230	16.942	9.027	2.297	23.126	19.255	3.891
2003	6.133	13.362	19.455	17.972	16.928	9.603	7.878	12.607	7.000	16.800	2.828	5.505	20.543	9.914	7.498	1.509	17.758	12.415	4.213
2004	5.738	10.459	17.256	13.614	12.394	7.044	5.110	10.354	7.763	11.423	4.129	4.355	19.941	6-482	6.170	0.725	15.481	11.905	4.063
2005	5.869	8.303	22.100	13.186	11.709	6.999	6.476	8.150	10.458	10.975	2.856	4.659	19.903	6.090	5.984	1.223	15.956	13.834	5.173
2006	6.194	7.756	22.582	13.739	10.888	6.685	7.411	7.105	10.469	10.198	2.822	3.891	15.147	6.119	5.720	0.830	16.446	14.539	6.078
2007	5.852	7.811	20.965	14.149	9.271	6.987	9.621	7.250	11.222	11.031	2.629	4.549	15.552	5.884	5.942	0.605	18.026	16.130	5.959
2008	4.703	8.353	20.993	14.769	9.971	6.948	8.596	7.793	13.223	10.708	2.037	3.487	18.776	6.902	6.188	0.556	16.772	15.249	7.467
2009	3.578	5.816	13.835	11.494	8.124	5.201	5.184	5.559	10.116	8.446	0.739	2.003	15.937	5.754	4.312	0.454	10.069	9.958	5.058
2010	2.812	4.356	9.278	10.115	6.144	3.753	3.884	4.059	8.793	5.579	0.788	2.002	13.092	5.797	3.338	0.375	7.046	7.110	4.477
2011	2.512	4.086	7.279	10.228	5.252	3.403	4.228	3.767	9.999	5.132	1.193	1.565	13.200	5.735	3.031	0.301	4.368	6.269	3.949
2012	2.094	2.990	5.810	9.103	4.949	2.936	3.818	2.613	9.211	4.221	1.174	1.246	11.211	3.909	2.614	0.293	2.647	5.113	3.234

2013	1.905	2.390	4.625	8.042	4.520	2.583	3.556	2.107	8.706	3.845	0.958	0.897	9.772	5.821	2.303	0.470	1.850	4.139	3.157
2014	1.938	2.705	4.165	8.428	4.780	2.377	3.782	2.316	8.609	3.563	0.767	0.928	9.627	5.390	2.549	0.493	0.885	4.022	3.755
2015	2.041	2.302	4.720	7.927	5.409	3.241	3.792	1.970	6.318	3.739	0.828	0.762	9.104	3.688	2.386	0.975	4.162	3.896	3.640
2016	2.143	2.657	5.636	8.846	6.180	3.826	4.466	2.152	6.543	3.942	0.906	0.786	11.144	4.385	2.715	0.728	5.260	4.375	4.217
2017	1.994	2.661	5.073	8.250	5.751	3.306	4.235	2.122	5.720	3.673	0.900	0.779	11.220	4.610	2.434	0.602	4.876	4.127	3.912
2018	1.956	2.333	4.040	6.873	4.767	2.672	3.520	1.826	4.814	3.337	1.006	0.726	10.541	5.045	2.002	0.629	3.770	3.523	3.574
2019	2.007	2.601	4.285	7.321	5.603	3.011	3.727	2.038	4.615	3.802	1.039	0.526	12.429	4.998	2.116	0.909	4.192	4.205	4.013

Table 5 indicates the trade integration index between China and Europe and Central Africa from 2000 to 2019, results explain that all values of the trade integration index are less than 1, which explains that the trade integration index between China and Europe is weak, the lowest value belongs to 2002 and the value is 0.4287 and the highest value of the trade integration index is belongs to 2010 and the value is 0.6039. Estimated results investigate that China's export does not just depend on Europe and Central Asia, similar as Feio and Doledec, Wang, Shuai et al., and Zeiler, Smielewski et al.

Table 5: Trade integration index between China and the Europe and Central Asia.

Years	Export $ (China to Europe)	Export $ (China to world)	Import $ (Europe to world)	Total world Import in $	TCD
2000	46654730.17	249202551	2726996764	6439960780	0.4421
2001	49985351.32	266098208.6	2688894568	6221183374	0.4346
2002	60465210.28	325595969.8	2826288862	6524445035	0.4287
2003	92429966.35	438227767.4	3408236341	7618997364	0.4715
2004	128222974.1	593325581.4	4164779621	9298447509	0.4825
2005	175184623.1	761953409.5	4573125712	10477384853	0.5268
2006	230401829.4	968935601	5337264711	12131723074	0.5405
2007	311938961.3	1220059668	6303370415	13930241289	0.5650
2008	376857592.1	1430693066	7165331743	16079717595	0.5912
2009	289686824.8	1201646758	5340803215	12375452301	0.5587
2010	383354206.5	1577763751	6099448386	15160923659	0.6039
2011	446762489.4	1898388435	7250956885	18073303526	0.5866
2012	432253314.1	2048782233	6928571708	18068903760	0.5502
2013	445356321	2209007280	7071118489	18504822695	0.5276
2014	480285772.6	2342292696	7033078026	18549078001	0.5408

2015	437722775.9	2273468224	5991457096	16176398129	0.5198
2016	423479174.5	2097637172	6038937279	15776742244	0.5274
2017	467132342.5	2263370504	6690090969	17620453934	0.5436
2018	516588354.5	2494230195	7346777291	18875211883	0.5321
2019	541539780.2	2498569866	7078515204	18449266347	0.5649

DISCUSSION

Estimated results by applied the Revealed Comparative Advantage index (RCA), Trade Complementarity Index (TCI) and Trade Integration Index (TCD) examine the bilateral trade relationship between China and Europe and Central Asia for 20 years of data during the period of 2000 to 2019. The categories of product which are especially suitable due to the climatic and geographical conditions Chinese exports has a great advantage in the Europe and Central Asia market, there are 20 major industries product including stone and glass, plastic and rubber, textiles and clothing, vegetable, transportation, wood capital goods, intermediate goods, consumer goods, animal, raw materials, chemicals, products industries, food footwear, hides and skins, fuels, mach and elec, minerals, metals, and miscellaneous industries to export Europe and Central Asia region to increased economic growth. To check the significant impact of bilateral trade on Chinese economic growth, it is necessary to compare the result of our study with previous studies, results of the Revealed Comparative Advantage index (RCA) showed that all 20 industries' products have strong comparative advantage between China and Europe and Central Asia, which shows that China export all 20 industries product in large amount to Europe and Central Asia but fuel industry does not have strong comparative advantage which indicates that China does not export fuel to Europe and Central Asia, and if talk about the import Revealed Comparative Advantage (RCA), between 20 industries 18 have strong (RCA import) but two industries, which are minerals and vegetable industries do not have strong (RCA import). Results of RCA (export and import) examine that there does not have resistance to resist the bilateral trade relationship between China and Europe and Central Asia which make the bilateral trade relationship strong. Oosterhaven, Nurgazina, and Lu et al., explains there has a significant and positive trade relationship between Netherlands and Poland after applied Revealed Comparative Advantage (RCA). Cox and Weingast there have a positive bilateral trade relationship between China and Africa. Results of the Trade Complementarity Index (TCI) indicate that between all 20 industries 17 have strong Trade Complementarity Index (TCI) but three industries between them include fuels, minerals and vegetables have weak Trade Complementarity Index (TCI) which gave us knowledge that there has strong bilateral trade relationship between China and Europe and Central Asia similar to Chen, Xie, Wang, Shuai and Huot and Kakinaka. Results also investigate that there not have factors that affect geographic, diplomatic, and cultural bilateral trade between China and Central and Asia. Min He and Garcia-Herrero applied RCA and TCI to explain the bilateral trade relationship of agricultural products between China and Belt and Road countries, Belt and Road increases the trade volume between China and Belt and Road connected countries. The Trade Integration Index (TCD) results explain that there has a weak Trade Integration Index (TCD) relationship between China and Europe and Central Asia, which gave us knowledge that China's trade does not depend on Europe and Central Asia. Chen and Researcher, Nurgazina, Lu and Yang, Fang et al., examine that there is a strong positive trade relationship between China and Europe [20].

CONCLUSION

The study's aim is to examine the bilateral trade relationship between China and Europe and Central Africa from the period 2000 to 2019. To find the trade relationship between China and Europe and Central Africa we used the Revealed Comparative Advantage index (RCA export), Trade Complementarity Index (TCI), and Trade Integration Index between (TCD) models to check the bilateral trade relationship between China and Europe and central Africa. Estimated results of the Revealed Comparative Advantage index (RCA export) between China and Europe give us the idea that there have strong RCA between China and Europe in all 20 different industries, past studies give us knowledge that the revealed comparative advantage index between China and other countries or regions have strong positive effect which proof that our study results are good enough to explain the association between China and Europe region about the revealed comparative advantage index is very strong but most of the industries of almost all countries in the whole World for past few years relay on China. According to Yu, Cai, Laursen, and French, et al., RCA import to check the trade relationship between countries. The estimated outcomes of the Trade Complementarity Index (TCI) between China and Europe from 2000 to 2019, results showed that between all these 20 industries 17 are strong the Trade Complementarity Index (TCI) between China and Europe mean the import and export of China and Europe and Central Asia are matches, only three of them which are vegetable industry, fuels industry, and minerals industry do not have strong mean the export and import of Trade Complementarity Index (TCI) between China and Europe do not match.

The Trade Integration Index (TCD) between China and Europe of 20 years of data from 2000 to 2019, results indicates that all values of the Trade Integration Index are lower than 1 which explains that the trade integration index between China and

Europe is weak which explains that Chinese trade does not depend on Europe. There are limitations in study, the data sample we took for study based on Europe and Central Asia over the period of 2000 to 2019 which give us information that there is gap to take data sample from different countries and regions and period also available for change, in study we applied The Trade Integration Index between (TCD), the Revealed Comparative Advantage index (RCA export) and the Trade Complementarity Index (TCI) to check the impact of bilateral trade relationship of China on Europe and Central Asia economic growth but for future research there is gap to fulfill to add more independent variables such as capital stock, investment, trade openness, real exchange rate, financial development and employment etc., in models to check more accurate impact bilateral trade on economic growth, and to apply other research models like the production function, term of trade, Trade Intensity Index (TII), intra-industry trade index GL and gravity model etc., to check the bilateral trade impact on economic growth. Based on the outcomes of our study, the export volume of 20 products of China to Europe and Central Asia in past few years decreased annually and the three products industries vegetable, fuels, and minerals have weak comparative advantages and trade integration which indicates that three products China does not have a good export relationship. we suggest that China need to make strike policies for investors to invest in the country also government can change investment policies that are more friendly for international investors to increase export productivity, and government can provide funds to local investors to increase export production which takes part in economic growth, we also suggest that revise the export and import policies to decrease the import and increase export which is rapidly decreasing from past recent years.

FUNDING

ACKNOWLEDGMENTS

DATA AVAILABILITY STATEMENT

Upon request to the corresponding author, the data sets created for this study are made available. Data available at request.

REFERENCES

1. Balassa B. Trade liberalisation and "revealed" comparative advantage1. Manch Sch. 1965;33(2):99-123.

2. Balassa BMC. 'Revealed' comparative advantage revisited: An analysis of relative export shares of the industrial countries, 1953-1971. Manch Sch. 1977;45:327-344.

3. Benedictis L, Tajoli L. Openness, similarity in export composition, and income dynamics. J Int Trade Econ Dev. 2007;16:93-116.

4. Chen J. The fossil energy trade relations among BRICS countries. Energy. 2021;217:119383.

5. Chen X. China-EU Trade and Economic Relations (2003-2013). Glob Econ Obs. 2014;2(1):41.

6. Cox GW, Weingast BR. Executive constraint, political stability, and economic growth. Comp Polit Stud. 2018;51(3):279-303.

7. Drelich-Skulska B. China's trade policy towards Central and Eastern Europe in the 21st century, example of Poland. Folia Oeconomica Stetinensia. 2014;14:149-174.

8. Drysdale P. Japan, Australia, and New Zealand: The prospect for Western Pacific economic integration. Econ Rec. 1969;45(3):321-342.

9. Feio MJ, Doledec SJEI. Integration of invertebrate traits into predictive models for indirect assessment of stream functional integrity: A case study in Portugal. Ecol Indic. 2012;15(1):236-247.

10. Ferto I, Hubbard LJJWE. Revealed comparative advantage and competitiveness in Hungarian agri–food sectors. Econ Rec. 2003;26(2):247-259.

11. Finger JM, Kreinin ME. A measure of 'export similarity' and its possible uses. Econ J. 1979;89(356):905-912.

12. French SJJOIE. Revealed comparative advantage: What is it good for? J Int Econ. 2017;106:83-103.

13. Goyal K, Vajid A. An Analysis of India's trade intensity with UAE. J Commer Trade. 2018;13(1):27-31.

14. Han J. The impact of terms of trade changes on economic welfare: Evidence from China. Mod Econ. 2012;3:429-436.

15. Hoen AR, Oosterhaven J. On the measurement of comparative advantage. Ann Reg Sci. 2001;40:677-691.

16. Huot N, Kakinaka MJAEB. Trade structure and trade flows in Cambodia: A gravity model. ASEAN Econ. Bull. 2007;24(3):305-319.

17. Ibrahim K, Shehu A. Nigeria-India bilateral trade relations: An Analysis of Trade Complementarity Index (TCI). SSRN Electron J. 2017;4(4):190-198.

18. Ishchukova N, Smutka L. Revealed comparative advantage of Russian agricultural exports. Acta Univ Agric et Silvic Mendelianae Brun. 2013;61:941-952.

19. Laursen KJEBR. Revealed comparative advantage and the alternatives as measures of international specialization. Eurasian Bus Rev. 2015;5(1):99-115.

20. Li Q. Trade complementarity of Sino-US wind energy products: Based on UN comtrade data. Int Energy J. 2018;18: 271-282.