

Trade Patterns in Food Imports to China: Commodities, Trends, and Shifts (1992-2020)

Patrones comerciales en las importaciones de alimentos a China: productos, tendencias y cambios (1992-2020)

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Abstract

Our research unveils how China's food-related imports from 1992 to 2020 changed in composition by decreasing the imports of some commodities in favor of others. Their origins suggest that some countries are being substituted as commercial partners for specific commodities.

We empirically identified outliers by setting inter-quartile limits at the commodity level and by origin. Unit-root and normality tests were applied. Finally, Spearman or Pearson correlation coefficients were computed where appropriate.

Results indicate that imports are stabilizing during the studied period. China increased its imports of Sugar and cereals to the detriment of edible preparations, live animals, trees, and oilseeds. Some Asian countries are capturing part of the market once dominated by North America or Europe. Finally, lower dependence on partners was found for meat, gums, cocoa, and edible preparations.

This methodology might help those analyzing the effects of trade agreements, country specialization, and strategic decisions.

Resumen

Nuestra investigación revela cómo las importaciones chinas de productos alimenticios de 1992 a 2020 han cambiado en composición disminuyendo las importaciones de algunas mercancías a favor de otras. Sus orígenes sugieren que algunos países están siendo sustituidos como socios comerciales en mercancías específicas. Empíricamente identificamos anomalías estableciendo los límites intercuartiles a nivel de clasificación de mercancías y por su origen. Se aplicaron pruebas de raíces unitarias y de normalidad. Finalmente, se aplicaron coeficientes de correlación de Spearman o de Pearson cuando era apropiado.

Los resultados indican que las importaciones se están estabilizando en el periodo estudiado. China incrementó sus importaciones de azúcar y cereales en detrimento de categorías como preparaciones comestibles, animales y plantas vivas, y oleaginosas. Algunos países asiáticos están capturando parte del mercado que era dominado por Norteamérica o Europa. Finalmente, se encontró una menor dependencia de los socios comerciales para las categorías carne, gomas, cacao y preparaciones comestibles. Esta metodología podría ayudar a quienes estudian los efectos de los acuerdos comerciales, la especialización del país, y decisiones estratégicas.

Keywords: Food, Trade, Substitutability, China, Imports.

Palabras clave: comercio, substitubilidad, China, importaciones.

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1. Introduction

The People's Republic of China (China-Beijing), like any global power, while changing inside, shapes to a different extent the international system and the global market. Thanks to improving their income, the Chinese have increased the quantities and widened the varieties of the products they eat.

The trade structure of the Asian country has been studied from different perspectives throughout the last couple of decades, unveiling a shift from low and medium-tech towards high-tech and basic products, including food (Hao & Xiaoqing, 2015; Fung et al., 2013; Wang et al., 2010). Lu & Li (2010) explain how different Chinese trade is when countries are divided by income, imports come from developing countries whereas exports go to middle-income countries.

Different studies suggest that the future of that country will shape many nations worldwide. As stated by Villoria (2009), the increase in Chinese imports has influenced the general levels of agricultural products around the globe, bringing benefits to some African countries along the way. The pressure for such products seems obvious, for feeding more than 1.3 billion people poses several challenges for a country that has to balance out both food security and a deepening of capital that implies a higher life quality accompanied by the demand for higher-value products.

China has consistently been one of the largest markets in the world, and its addition to the World Trade Organization in December 2001 only meant a greater trade flux in both directions.

Several researchers have documented shifts in consumption patterns caused by income increases in the Asian country. An example of this is well-documented in a paper by Scott & Suarez (2012), where they assured that the increased intake of potatoes was accompanied by the increased consumption of other commodities as was the case of cereals; similarly, Xiong & Song (2018) studied the same for avocados. Ren et al. (2018) reviewed the impact of income changes on food-products demand in rural China exposing a higher elasticity on meats, dairy, and aquatic products in different income scenarios. On the same path, Huang & Tian (2019) proved that accessibility was a determinant for non-farmers to improve their dietary consumption. In some cases, converging with what the nutritional authority recommended by increasing the consumption of oils and decreasing that of cereals, some grains, tubercles, etc.

This shift, specifically for Chinese grain imports, led to recent research contributions to stability, sustainability, and policies. Specifically, price volatility is widely studied by its financial derivatives (Xiao et al., 2019), direct and

indirect relations to the energy market (Zhang et al., 2021), its price support policy (Lyu & Li, 2019), and land use policy (Liu & Zhou, 2021). Meanwhile, sustainability focuses on water distribution and footprint on grain production, such as water stress (Sun et al., 2019), water footprint (Ye et al., 2019), nitrogen-carbon footprints of dairy farm systems (Ledgard et al., 2019), and the established national policies on those matters (Qu et al., 2020).

Other global trends affect the production of food and food-related products. For instance, Li et al. (2021) surveyed college students and found that several factors, including green publicity and green atmosphere, influenced their perception and purchase intention of greener products. The international demand for products labeled as organic caused a more intensive use of land for their production in China (Xie et al., 2011), fighting for resources with the same goods without such distinction, and therefore, with lesser value increasing the level of intra-industry commerce. For further reference regarding shifting patterns, see Shao (2019).

It is noteworthy that China's import and export patterns are influenced by the classic Ricardian production decisions and the government's objectives. A clear example is that at the beginning of the century, a biofuel program was launched to meet the increasing demand for fuels and to dispose of the large amounts of accumulated grains that were no longer suitable even for feed (Qiu et al., 2011). The program later extended to other regions until all the stock was used up, and input demand forced imports to increase. The Chinese government tried to further regulate production towards more intensive use of specific cereals of lower qualities—to free up the rest for human consumption—; however, this affected the poorer portion of the population in China who could not afford higher-quality cereals (Koizumi, 2013).

The program impacted many areas, one of them being the use of land, which shifted from agriculture for human consumption to biofuel (Weng et al., 2019). When it was realized that biofuel production was competing for grains with livestock and humans, instead of reallocating investment, diversification of production inputs was urged, modifying trade patterns towards a higher import of maize, sugarcane, sweet potato, and sorghum (Qiu et al., 2011).

The case of potatoes is a good example. Previously used for feed, an increase in its price made it more expensive for that specific purpose, which might help explain first, potential shifts in its use towards human consumption and, second, other products' imports during those years (Scott & Suarez, 2012).

Some publications regarding trade patterns have found that China had a dynamic comparative advantage throughout time (Hanson, 2012). This

is expected due to shifting conditions for all implicated in international commerce. Other papers focused on the comparative advantages of specific countries. Such is the case of the China-Korea relationship, for which the signed Free-Trade Agreement (FTA) is expected to cause even further shifts in Trade (Kim & Shikher, 2015). China has a comparative advantage only in two of the analyzed sectors (Food and Wood), for which we expect an increase in trade of related products. Simulations in that study suggested that Korean exports to China would increase by a stunning 303%.

Several studies have been conducted on the relationship between China and other markets, for instance, China's Revealed Comparative Advantage (RCA) is oriented towards higher-end items, importing food products from India (Khan & Ahmad, 2017), and, in general, agricultural products from some African countries (Jun et al., 2013). This aggregation oversees the composition of the country; a province-level study conducted by Li (2012) suggests that China is exporting agricultural labor-intensive products while importing land-intensive ones —also mentioned by Gale et al. (2015)—. This is consistent with a previous text where it was stated that what China imports are natural-resources intensive, where the countries of origin hold their comparative advantage (Lu & Li, 2010).

As previously stated, the Chinese Government, like any other, must ensure food supply without compromising independence, which translates as a constant need to look for trade partners. For instance, in a context where the US accounted for 24% of agricultural products by value in 2012-2013, China signed a zero-tariff treaty with some African countries substituting or adding trade partners to lower dependence (Gale et al., 2015). The goal of diversification becomes clear when analyzing the low complementarity between such countries, in other words, what China exports to the world is not what Africa imports, and what Africa exports is not what China imports most (Jun et al., 2013).

Other authors have decided to study specific products, for instance, Villasante et al. (2013) studied fish production, consumption, and imports to China. Besides being considered a luxury good in that country, fish protein intake grew exponentially along with Chinese participation in the world market. In 2005, China was already the principal importer by volume and the principal exporter both by volume and value, thus supporting the hypothesis of the author that the growth strategy consisted in importing low-value products mainly as feed for higher-value species, a similar strategy explains the growth of imports of grains and cereals being for feed (Gale et al., 2015).

The United States Department of Agriculture (USDA) suggests that China will continue its growth of agricultural imports well into 2023, with soybean as the main product and an expected rise of corn and meats (Gale et al., 2015).

Our research utilized data compiled from the available tools on the Uncomtrade website. A file was created with the time series of the 22 categories of food and food-related imports from 1992 to 2020 (See Annex A for full reference on each category). First differences were computed from the weight of each category relative to the total imports, resulting in a general overview of the commodity stability and the number and direction of extreme events marked as outliers. Subsequently, stationary tests were performed to determine whether these shocks would be temporary or remain in the medium-long haul.

Then, normality tests were performed for two reasons, first, to establish a priory behavior. Secondly, to identify whether a Spearman or Pearson correlation analysis would be a better fit. Such an analysis allowed for the determination of the apparent substitution of some commodities with others. The same exercise was applied at the level of origin of the imports, which implies a change in the structure of trade partners.

A proxy for market dependency is proposed with the number of needed exporters to cover 60% of imports by commodity classification —such threshold was deliberately chosen since the number of required partners to achieve 80% presented a quasi-exponential increment due to the spurious contribution of subsequent partners.

Finally, the nine biggest economies —leaving out China— were analyzed to determine their role in the substitutions, presenting which nations are being substituted by them or vice versa.

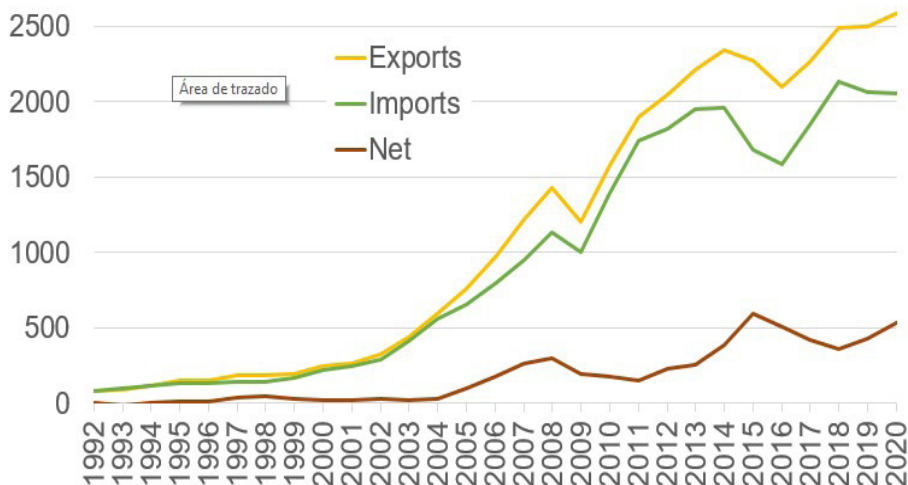
The rest of the paper is organized as follows: Section 2 includes Materials and Methods, while Results are detailed on section 3, Discussion on major findings can be consulted on section 4, concluding on section 5.

2. Materials and Methods

Throughout this part of the text, we analyze the trade of food and food-related items, classified into twenty-two categories by the Uncomtrade (2021). Though imports have not kept pace with exports, they behave as usual as most others, and both are closely correlated, showing a 0.9953 Pearson Correlation Coefficient for the studied period (1992-2020). In such a period, net exports

stayed positive in all years, except for 1993, when they reached a net import total of 12.2 billion dollars (see Graph 1). It is possible to assert that total trade had grown exponentially after accession to WTO in 2001.

Graph 1
China's food Trade Balance



Source: Own elaboration with data from Uncomtrade (2021), expressed on billions of dollars.

For the category level, transactions were expressed in their relative value compared to the total for each year to track the composition of the imports rather than the total change in value.

First differences were applied to resulting values, and outliers were determined for observations outside the interval $[Q1-1.5IQR, Q3+1.5IQR]$ (Q1: First Quartile, Q3: Third Quartile, IQR: InterQuartile Range).

When two consecutive outliers in opposite tails were found, we assumed that the second one was a consequence of the former and was considered a rebound. Stable, not rebounded outliers would imply a gradual return or no return at all to previous stages. These results are shown along with normality and unit root tests in Table 1.

Table 1
Commodity import stability

Commodity	Superior Outliers	Inferior Outliers	Rebound	Stable not rebounded Outliers	Normality						Unit root	
					Shaphiro - Wilk 5%		Kolmogorov -Smirnov 5%		Anderson - Darling 5%		Augmented Dickey - Fuller 5%	
					P-Value	Can't reject normality	P-Value	Can't reject normality	P-Value	Can't reject normality	P-Value	Can't reject unit root
01	0	0	0	0	0.589	x	1.000	x	0.534	x	0.000	--
02	3	0	0	3	0.005	--	0.406	x	0.002	--	0.012	--
03	0	0	0	0	0.184	x	0.303	x	0.078	x	0.000	--
04	1	1	0	2	0.001	--	0.338	x	0.003	--	0.000	--
05	2	1	0	3	0.034	--	0.364	x	0.022	--	0.015	--
06	1	1	1	0	0.006	--	0.501	x	0.014	--	0.000	--
07	2	1	1	1	0.685	x	0.765	x	0.387	x	0.000	--
08	0	0	0	0	0.033	--	0.433	x	0.012	--	0.322	x
09	1	2	1	1	0.353	x	0.620	x	0.155	x	0.854	x
10	2	3	1	3	0.001	--	0.171	x	0.000	--	0.174	x
11	0	2	0	2	0.047	--	0.484	x	0.089	x	0.781	x
12	0	0	0	0	0.082	x	0.303	x	0.034	--	0.001	--
13	1	1	1	0	0.000	--	0.066	x	0.000	--	0.000	--
14	0	1	0	1	0.297	x	0.672	x	0.147	x	0.000	--
15	1	0	0	1	0.010	--	0.186	x	0.034	--	0.001	--
16	0	0	0	0	0.204	x	0.788	x	0.206	x	0.000	--
17	1	1	0	2	0.212	x	0.715	x	0.139	x	0.055	x
18	2	1	1	1	0.409	x	0.794	x	0.259	x	0.186	x
19	0	0	0	0	0.869	x	0.858	x	0.651	x	0.006	--
20	1	1	1	0	0.100	x	0.648	x	0.071	x	0.000	--
21	0	2	0	2	0.176	x	0.563	x	0.119	x	0.000	--
22	0	0	0	0	0.306	x	0.969	x	0.269	x	0.004	--
Total	18	18	7	22	13		22		13		6	

Source: Own elaboration and computation, based on data from Uncomtrade (2021).

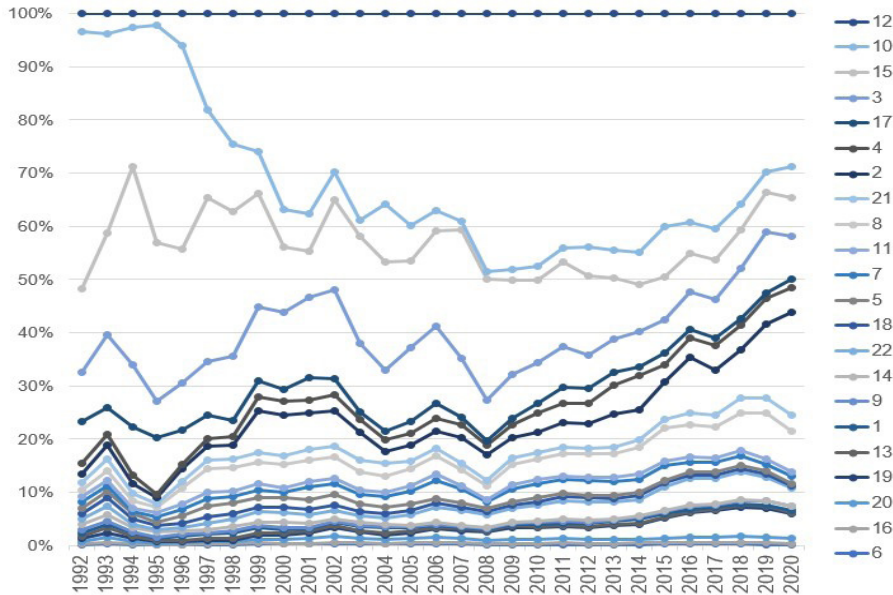
As previously mentioned, the presence of superior outliers implies that at that moment imports increased abruptly; and conversely, inferior outliers suggest a drop in imports of a given commodity. However, it is expected that at an extreme temporary event, the return to its trend could have been collected as an opposite outlier. A short description of the findings from table 1 is presented below.

The combination of the identification of outliers and the Augmented Dickey-Fuller test for unit root yields impressive results. Let us take commodities 1 through 7 as examples (See Annex A for full reference on each category), they possess no unit root -thus, stationary processes are accepted. Extreme events in some time series did not impact the long-term mean reversion and are, therefore, interpreted as temporary. In the cases of commodities 8 and 12, although no extreme events were present, the existence of a unit root on commodity 8 implies minor structural changes that took place in a smoother manner, while for commodity 12, no structural changes were perceived.

Commodity 10 is one of the most variables, presenting five shocks, out of which, three were permanent and changed the long-term mean, confirmed by the presence of a unit root. Finally, commodity 17 presents one permanent outlier in each tail and is considered non-stationary.

It is easily appreciated that at this general level, a few anomalies are collected. It is also clear that some commodities present only lower-than-usual anomalies (cases of categories 11, 14, and 21). Some others show only higher-than-usual imports (categories 2 and 15), while categories 1, 3, 8, 12, 16, 19, and 22 present no meaningful distortions. The rest of them vary in both directions.

Graph 2
Commodities' relative weight distribution



Source: Own elaboration with data from Uncomtrade (2021).

From the graphic, several things are noteworthy; for instance, 12 *Oil seeds and oleaginous fruits* are one with the highest participation in imports growing from less than 5% in 1995 to almost 50% in 2008, decreasing slowly to represent about 30% in 2020. Commodity 10 *Cereals* were substituted, decreasing from about 50% in 1992 to less than 10% in 1998, reaching its minimum in 2008. At the same time, those are two of the most variable categories in relative terms, allowing all observations on 12 *Oil seeds and oleaginous fruits* to fall into the *typical* behavior and consider no outliers. Commodity 10 *Cereals* presents several not rebounded outliers.

There are other groups with stable behavior and usually low participation in imports, such as 1 *Live animals*, 6 *live trees, plants, bulbs, roots, cut flowers, etc.*, 9 *Coffee, tea, mate, and spices*, 13 *Lac, gums, resins, vegetable saps, and extras nes*, and the groups that include 16 *Meat and seafood food preparations*, 18 *Cocoa and cocoa preparations*, 20 *Preparations of vegetables, fruit or nuts*, and 21 *Miscellaneous edible preparations*.

We first identified the relative importance of each category, then we accepted normality on those series where the Kolmogorov-Smirnov, Shapiro-Wilk, and Anderson-Darling's normality tests could not be rejected (table 1). The following step was to create a simplified mixed Pearson (asterisk) and Spearman correlation coefficient matrix where the 22 categories were cross-correlated, giving a total of 231 different results. Only a hundred observations are statistically significant (p-value < 5%) as shown in table 2. With it, we propose potential changes in consumption patterns, identifying which categories increase together, and which are being substituted. No causality is determined up to this point.

Table 2.
Correlation coefficients

	03*	04	05	06	08	11	13	17*	20*	21*	22*
01*								-0.47*		0.40*	
03*		0.46	0.59	0.72	0.67		0.70		0.82*	0.43*	0.49*
04	0.46		0.46	0.55		0.50	0.50		0.39		
05	0.59	0.46		0.52	0.62	0.41	0.42		0.53	0.44	
06	0.72	0.55	0.52		0.45	0.39	0.66		0.74		0.53
07*						0.57					
08	0.67		0.62	0.45		0.38	0.61		0.41		0.48
10	-0.50			-0.47			-0.48		-0.43		
11		0.50	0.41	0.39	0.38		0.44		0.52	0.46	
12								-0.53			
13	0.70	0.50	0.42	0.66	0.61	0.44			0.59		0.46
16*		0.40				0.47			0.39*		0.43*
18*	0.50*		0.50		0.62			-0.39*	0.44*		
19*	0.57*	0.42	0.43	0.67	0.41	0.43	0.55		0.63*		0.64*
20*	0.82*	0.39	0.53	0.74	0.41	0.52	0.59			0.50*	0.59*
21*	0.43*		0.44			0.46		-0.57*	0.50*		0.38*
22*	0.49*			0.53	0.48		0.46		0.59*	0.38*	

Notation: * stands for Pearson correlation, all others are determined using Spearman correlation due to normality conditions.

Source: Own elaboration and computation, based on data from Uncomtrade (2021).

Although all those correlations are statistically different from zero, the ones important for this text are the highest, both positive and negative. In the case of the negative correlations (where China is relatively substituting one commodity with the other), commodity 17 *Sugars and sugar confectionery* is quite relevant versus 21 *Miscellaneous edible preparations* (-0.567), 12 *Oil seeds and oleaginous fruits* (-0.529), and 1 *Live animal; animal products* (-0.468); Also, commodity 10 *Cereals* versus categories 1 *Live animals; animal products* (-0.501), 13 *Lac, gums, resins, vegetable saps and extracts* (-0.484) and 6 *Trees and other plants, live* (-0.47).

3. Results

In the case of the positive observations, category 3 *Fish and crustaceans, mollusks, and other aquatic invertebrates* typically moves in the same direction as categories 20 *Cereal, flour, starch, milk preparations*, 6 *Trees and other plants, live*, and 13 *Lac, gums, resins, vegetable saps and extracts*; presenting correlations of (0.817), (0.719), and (0.701), respectively, while categories 6 and 20 (0.736) are also strongly related.

Out of the 100 valid correlations, nine are negative, confirming that only specific categories are systematically replaced with others. Although further research must be done, it could help demonstrate a shift in consumption preferences or the level of specialization of the country.

Table 3 shows the number of trade partners needed to cover 60% of total imports per commodity. A lower figure indicates a high concentration of imports resulting in a higher dependence and a weaker position from China's perspective.

Table 3
Imports dependence to 60%

Year	Commodity																					Total countries	
	Concentrating					No trend											Diversifying						
	4	11	6	1	9	7	14	12	15	16	8	10	17	5	22	20	19	3	2	18	13		21
1992	7	3	4	2	3	3	4	4	4	1	6	2	1	3	2	3	3	5	2	1	5	3	24
1993	7	4	3	2	8	2	3	2	2	2	3	2	2	5	3	3	2	6	1	1	3	3	24
1994	6	5	3	3	7	2	6	2	3	4	3	2	2	5	3	4	2	6	1	1	3	2	23
1995	5	4	4	4	6	2	4	3	3	2	4	2	2	5	1	6	3	5	1	2	4	2	29
1996	5	5	4	4	3	3	4	1	2	4	2	2	2	4	4	5	4	5	1	2	4	1	26
1997	4	5	4	5	7	3	4	1	3	4	2	2	2	4	3	6	6	4	2	2	4	2	27
1998	4	5	3	5	4	3	4	3	4	1	3	2	2	4	3	4	5	3	2	3	3	2	30
1999	3	5	2	3	5	3	4	3	3	2	4	3	4	6	3	3	3	4	2	3	3	2	26
2000	3	6	2	5	4	4	5	3	3	3	4	3	4	6	3	2	3	6	1	3	3	2	27
2001	3	5	2	4	4	2	5	2	2	4	4	2	3	5	4	2	3	5	1	5	5	2	29
2002	2	3	2	3	4	2	3	2	3	4	4	2	3	3	3	2	5	4	1	5	5	2	28
2003	2	3	2	2	5	1	5	2	2	4	4	3	3	3	3	2	5	4	1	6	4	2	30
2004	2	3	2	2	6	1	5	2	3	7	4	2	3	4	3	2	4	4	3	6	7	2	30
2005	2	3	2	2	6	1	4	2	2	7	4	2	4	5	2	2	5	4	2	5	7	4	32
2006	2	2	2	3	4	1	4	2	2	6	4	2	3	5	2	2	4	4	2	5	7	3	29
2007	3	2	2	3	4	2	4	2	2	7	4	2	4	5	2	2	4	4	2	5	7	4	33
2008	3	1	2	2	4	2	3	2	3	4	4	2	3	5	2	2	4	5	2	4	6	5	30
2009	2	2	2	3	5	2	4	2	2	4	3	3	3	4	2	3	3	4	2	5	6	6	27
2010	1	1	2	2	5	1	5	2	2	2	4	2	2	4	2	2	4	4	4	5	7	6	29
2011	1	2	2	3	4	2	4	2	2	1	4	2	2	6	2	3	5	4	3	5	7	7	29
2012	1	2	2	3	3	2	4	2	2	1	4	2	2	5	2	4	6	5	4	5	6	7	29
2013	1	1	2	2	4	2	3	2	3	2	3	2	1	6	3	5	6	6	5	6	6	7	28
2014	1	1	2	2	5	1	3	2	2	1	4	2	2	6	4	6	7	6	5	7	8	7	32
2015	2	1	2	2	5	1	3	2	2	2	4	3	3	5	5	5	6	7	6	7	9	8	33
2016	2	1	2	2	2	1	4	2	3	4	4	3	2	6	4	5	6	7	6	7	8	7	31
2017	2	2	2	3	7	2	3	2	2	3	5	3	4	6	4	6	5	7	6	7	9	6	35
2018	2	1	2	2	5	2	3	1	3	4	4	4	7	6	5	6	4	8	5	6	8	6	34
2019	2	2	2	2	4	2	3	2	3	4	4	4	4	6	5	6	4	8	5	6	8	6	35

Source: Own elaboration and computation, based on data from Uncomtrade (2021).

We computed the number of partners needed to cover 60% of imports for each of the 22 categories as a quick reference for dependency concentration; diversification of strategic commodities' origins might be an element of food security. When analyzing the indicator, the positive trend suggests that there might be a proclivity towards lowering dependence - interpreted as diluting the imports amongst more exporters. The year China's imports were more concentrated was 1994, needing 23 partners to cover 60% of all food imports, while the lowest concentration came in 2017 and 2019, with a total of 35 partners.

The categories in table 3 are classified according to their slope in linear regression. The ones at the left (categories 4, 11, 6, 1, and 9) present a tendency to concentrate dependence on fewer countries with a maximum of three partners at the end of the period; on the other hand, categories 2, 18, 13, and 21 have a clear path towards diversification of suppliers contributing to a healthier dependence by doubling the number of partners needed in 1992.

Table 4
Major economies and their relations to other exporters

Country	Commodity	Related Country	Country	Commodity	Related Country
USA	↓↑	2, 18, 19	Japan	2*	Australia
		2*, 5*, 12*		2,7	Canada
		8, 9, 13, 17, 20		7	Chile
		2*		13	China, Hong Kong SAR
		16*		2	Denmark
		13*		2	France
		6, 7, 12		8	Free Zones
		17		14*	India
		4*		1	Israel
		11*		2*, 7*	New Zealand
		19, 22		3	SACU
		11		7*	United Kingdom
		13		2*	Uruguay
		11		2	USA

United Kingdom	↓↑	22	Free Zones	Canada	↓↑	12	Brazil	
		11	Germany			12, 22	Czechia	
		7	Japan			12	Italy	
		13*	Other Asia, nes			12	Thailand	
		6	Singapore			5	China, Hong Kong SAR	
		22	SACU			9, 17	Free Zones	
		11	Thailand			1	Israel	
France	↓↑	2	Chile	Canada	↓↑	2*, 7*	Japan	
		9	Poland			15	Nepal	
		9	Sri Lanka			16	Netherlands	
		21	Belgium-Luxembourg			12	Singapore	
		2, 5	China, Hong Kong SAR			4*	Thailand	
Germany	↓↑	2*	Japan	Italy	↓↑	22	Italy	
		16*	Myanmar			21	New Zealand	
		22	SACU			3	Philippines	
		4*	Viet Nam			18	Belgium-Luxembourg	
		18	Belgium			15	Nepal	
		20	India			9	Brazil	
		4	Netherlands			22	Canada	
Germany	↓↑	20	Other Asia, nes	Italy	↓↑	22	Chile	
		20	Thailand			18	Germany	
		11*	China, Macao SAR			22	Hungary	
		8	Free Zones			12	Japan	
		1	Israel			2	Mexico	
	Germany	↓↑	8	Singapore	Italy	↓↑	22	New Zealand
			11*	United Kingdom			9	Poland
			4	Australia			19	Rep. of Korea
			10	China, Macao SAR			19	Spain
			10	Ireland			9	Sri Lanka
Germany	↓↑	18	Italy	Italy	↓↑	2	Switzerland	
		17	Malaysia			21	Thailand	
		4, 10	Netherlands			18, 19, 21	Belgium-Luxembourg	
		21	Thailand			20, 21	Free Zones	
		21	Belgium-Luxembourg			20	SACU	
Germany	↓↑	5, 6	China, Hong Kong SAR	Italy	↓↑	4*	Viet Nam	
		14	Japan			16	Côte d'Ivoire	

India	↓↑	14*	Myanmar	Brazil	↓↑	9	Colombia
		15	Nepal			7	Costa Rica
		3	Ecuador			12	Czechia
		20	France			9	Ethiopia
		15	Indonesia			12	Indonesia
		15	Norway			9	Italy
		15	Spain			12	Japan
				1	Nepal		

Notation: \Rightarrow , stands for same direction relation, \Leftarrow stands for opposite direction relation and * stands for share lose by the country by the related country on the specified commodity.

Source: Own elaboration and computation, based on data from Uncomtrade (2021).

4. Discussion

The pinnacle of this research is the identification of nations from which the Asian country has systematically acquired less in favor of others. Within the American block, we find that the USA has been losing sales to Hong Kong in 2 *Meat and edible meat offal*; 5 *Products of animal origin, nes*; and 12 *Oil seeds and oleaginous fruits*. At the same time, it is losing ground to Japan in 2 *Meat and edible meat offal*, to Myanmar in 16 *Meat and seafood food preparations*, and to Others, in Asia in 13 *Lac, gums, resins, vegetable saps, and extracts*. Japan is taking the place of Canada as a supplier in 2 *Meat and edible meat offal*, and 7 *Edible vegetables, roots, and tubers*; at the same time, to Thailand in 4 *Dairy products, eggs, and honey*. Vietnam is keeping some of Brazil's share in the latter category.

In Europe, France's sales have fallen in the categories of 2 *Meat and edible meat offal* to Japan, 16 *Meat and seafood food preparations* to Myanmar, and 4 *Dairy products, eggs, and honey* to Vietnam.

The United Kingdom has granted exports to Belgium and other countries from Asia in classifications of 11 *Milling products* and 13 *Lac, gums, resins, vegetable saps, and extracts*, respectively. Germany is losing sales of 11 *Milling products* in favor of Macao and the U. K. The Italian case is not statistically relevant.

Finally, in the Asian block, Japan is losing ground to Australia in 2 *Meat and edible meat offal*, to India in 14 *Vegetable plaiting materials*, to New Zealand in 2 *Meat and edible meat offal*; Japan is losing sales of 7 *Edible vegetables, roots,*

and tubers to both New Zealand and the United Kingdom; and to Uruguay in 2 *Meat and edible meat offal*. India is giving space to Myanmar in 14 *Vegetable planting materials*.

It is interesting to note that some countries are increasing sales of some commodities while decreasing sales in other categories, which could imply that the country is specializing in some products. In such situations, we find Brazil losing in 4 *Dairy products, eggs, and honey* while gaining ground in 18 *Cocoa and cocoa preparations*; 19 *Cereal, flour, starch, milk preparations and products*; 20 *Preparations of vegetables, fruit, or nuts*; and 21 *Miscellaneous edible preparations*.

On the same path, we find that Canada is specializing in 1 *Live animal; animal products*; 5 *Products of animal origin, nes*; 9 *Coffee, tea, mate and spices*; 17 *Sugars and sugar confectionery*; 12 *Oil seeds and oleaginous fruits; miscellaneous grains, seeds, and fruit; industrial or medicinal plants; straw and fodder*; 15 *Animal or vegetable fats and oils and their cleavage products*; and 16 *Meat, fish and seafood food preparations nes*. At the same time, Canadian exports are slowing pace in categories: 2 *Meat and edible meat offal*; 4 *Dairy products, eggs, honey, edible animal product nes*; and 7 *Edible vegetables and certain roots and tubers*.

Germany is specializing in 1 *Live animal; animal products* and 8 *Edible fruit, nuts, peel of citrus fruit*; while losing ground in 11 *Milling products*.

The rest of the analyzed economies have some commodities in which they gain ground against one partner but lose to another in the same commodities, this might mean that there is a dynamic comparative advantage in those products.

5. Concluding remarks

Globalization has impacted many aspects of life, trade is one of them. Neoliberalism policies favored the segmentation of the production chain into many smaller, more fragmented value-adding steps. This, along with a deepening of the commerce partnerships and the need to balance out internal and external consumption and production shifts, results in shocks to national accounts via imports and exports.

Some of these shocks result in temporary movements that fade out one period later. Some others maintain their effects over subsequent periods; those were the cases of 8 *Edible fruit, nuts, peel of citrus fruit*, 9 *Coffee, tea, mate*

and spices, 10 Cereals, 11 Milling products, 17 Sugars, and sugar confectionery, and 18 Cocoa and cocoa preparations.

Over the studied period, China has decreased the import of products from category 17 Sugars and sugar confectionery mainly in favor of 21 Miscellaneous edible preparations, 12 Oil seeds and oleaginous fruits, and 1 Live animal; animal product. In the same sense, 10 Cereals decreased in favor of products from categories 1 Live animals; animal products, 13 Lac, gums, resins, vegetable saps, and extracts, and 6 Trees and other plants, live.

In general, the number of partners needed to cover 60% of the total imports of each category has been increasing over the years, starting with approximately 24 trade partners and adding ten more to end up with 34. Specific cases that are worth mentioning are, on the one hand, categories 4 Dairy products, eggs, honey, 11 Milling products, 6 Trees and other plants, live, 1 Live animals; animal products, and 9 Coffee, tea, mate and spices, tend to concentrate dependence on fewer countries ending in a maximum of three partners; on the other hand, categories 21 Miscellaneous edible preparations, 2 Meat, and edible meat offal, 13 Lac, gums, resins, vegetable saps and extracts, and 18 Cocoa and cocoa preparations, have a clear path towards diversification of suppliers contributing to a healthier dependence by doubling the number of partners needed in 1992.

The identification of instances in which the Asian nation has systematically acquired less in favor of others is the research's crowning achievement. Within the American block, we observe that the *United States* has lost business to *Hong Kong* (commodities 2, 5, 12), *Japan* (2), *Myanmar* (16), *Vietnam* (4), and *others, Asia* (13); whereas *Canada* has been losing sales to *Thailand* and *Japan* (commodities 2 and 7). *Vietnam's* relevance to *Brazil's* exports of commodity 4 is diminishing.

France's sales of commodities 2, 16, and 4 have decreased in Europe (to *Japan*, *Myanmar*, and *Vietnam*, respectively); while the *United Kingdom* has conceded products to *Belgium* and *others, Asia* in commodities 11 and 13, separately. The *Italian* case is not statistically significant. While *Germany* loses sales of commodity 11 to *Macao* and the *United Kingdom*.

Lastly, in the Asian block, *Japan* is falling behind *Australia* in commodity 2, *India* in commodity 14, *New Zealand* in commodities 2 and 7, the *United Kingdom* in commodity 7, and *Uruguay* in commodity 2. While *Myanmar* is given space in commodity 14 by *India*.

The existence of statistically significant substitutions does not necessarily mean that there is an explicit policy of the Chinese Government being carried out and should be interpreted carefully, for they could respond to many different factors, including further specialization of the involved nations, foreign direct investment, cooperation between countries, to mention a few.

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Annexes

Annex A. Commodity code relation

Code	Complete description	Simplified description
1	Live animals; animal products	Live animals; animal products
2	Meat and edible meat offal	Meat and edible meat offal
3	Fish and crustaceans, molluscs and other aquatic invertebrates	Fish, molluscs and crustaceans
4	Dairy products, eggs, honey, edible animal products	Dairy products, eggs, honey
5	Products of animal origin, nes	Products of animal origin, nes
6	Trees and other plants, live	Trees and other plants, live
7	Edible vegetables and certain roots and tubers	Edible vegetables, roots and tubers
8	Edible fruit, nuts, peel of citrus fruit, melons	Edible fruit, nuts, peel of citrus fruit
9	Coffee, tea, mate and spices	Coffee, tea, mate and spices
10	Cereals	Cereals
11	Milling products, malt, starches, inulin, wheat gluten	Milling products
12	Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medicinal plants; straw and fodder	Oil seeds and oleaginous fruits
13	Lac, gums, resins, vegetable saps and extracts	Lac, gums, resins, vegetable saps and extracts
14	Vegetable plaiting materials, vegetable products	Vegetable plaiting materials
15	Animal or vegetable fats and oils and their cleavage products	Animal or vegetable fats and oils
16	Meat, fish and seafood food preparations	Meat and seafood food preparations
17	Sugars and sugar confectionery	Sugars and sugar confectionery

18	Cocoa and cocoa preparations	Cocoa and cocoa preparations
19	Cereal, flour, starch, milk preparations and products	Cereal, flour, starch, milk preparations
20	Preparations of vegetables, fruit or nuts	Preparations of vegetables, fruit or nuts
21	Miscellaneous edible preparations	Miscellaneous edible preparations
22	Beverages, spirits and vinegar	Beverages, spirits and vinegar

Abbreviation:

nes. Not elsewhere specified or included.

Annex B. Trade partners considered

#	Country	#	Country	#	Country	#	Country
1	Afghanistan	57	Dem. Rep. of the Congo	113	Latvia	169	Russian Federation
2	Albania	58	Denmark	114	Lebanon	170	Rwanda
3	Algeria	59	Djibouti	115	Lesotho	171	Saint Kitts and Nevis
4	Andorra	60	Dominica	116	Liberia	172	Saint Lucia
5	Angola	61	Dominican Rep.	117	Libya	173	Saint Pierre and Miquelon
6	Antigua and Barbuda	62	Ecuador	118	Lithuania	174	Saint Vincent and the Grenadines
7	Areas, nes	63	Egypt	119	Luxembourg	175	Samoa
8	Argentina	64	El Salvador	120	Madagascar	176	San Marino
9	Armenia	65	Equatorial Guinea	121	Malawi	177	Sao Tome and Principe
10	Aruba	66	Eritrea	122	Malaysia	178	Saudi Arabia
11	Australia	67	Estonia	123	Maldives	179	Senegal
12	Austria	68	Eswatini	124	Mali	180	Serbia
13	Azerbaijan	69	Ethiopia	125	Malta	181	Serbia and Montenegro
14	Bahamas	70	Faeroe Isds	126	Marshall Isds	182	Seychelles

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15	Bahrain	71	Fiji	127	Mauritania	183	Sierra Leone
16	Bangladesh	72	Finland	128	Mauritius	184	Singapore
17	Barbados	73	Fmr Sudan	129	Mexico	185	Slovakia
18	Belarus	74	France	130	Mongolia	186	Slovenia
19	Belgium	75	Free Zones	131	Montenegro	187	So. African Customs Union
20	Belgium- Luxembourg	76	French Guiana	132	Montserrat	188	Solomon Isds
21	Belize	77	French Polynesia	133	Morocco	189	Somalia
22	Benin	78	FS Micronesia	134	Mozambique	190	South Africa
23	Bermuda	79	Gabon	135	Myanmar	191	South Sudan
24	Bhutan	80	Gambia	136	Namibia	192	Spain
25	Bolivia (Plurinational State of)	81	Georgia	137	Nauru	193	Sri Lanka
26	Bosnia Herzegovina	82	Germany	138	Nepal	194	State of Palestine
27	Botswana	83	Ghana	139	Neth. Antilles	195	Sudan
28	Br. Virgin Isds	84	Greece	140	Netherlands	196	Suriname
29	Brazil	85	Greenland	141	New Caledonia	197	Sweden
30	Brunei Darussalam	86	Grenada	142	New Zealand	198	Switzerland
31	Bulgaria	87	Guatemala	143	Nicaragua	199	Syria
32	Burkina Faso	88	Guinea	144	Niger	200	Tajikistan
33	Burundi	89	Guinea-Bissau	145	Nigeria	201	Thailand
34	Côte d'Ivoire	90	Guyana	146	Norfolk Isds	202	Timor-Leste
35	Cabo Verde	91	Haiti	147	North America and Central America, nes	203	Togo

36	Cambodia	92	Holy See (Vatican City State)	148	North Macedonia	204	Tonga
37	Cameroon	93	Honduras	149	Norway	205	Trinidad and Tobago
38	Canada	94	Hungary	150	Oceania, nes	206	Tunisia
39	Cayman Isds	95	Iceland	151	Oman	207	Turkey
40	Central African Rep.	96	India	152	Other Africa, nes	208	Turkmenistan
41	Chad	97	Indonesia	153	Other Asia, nes	209	Tuvalu
42	Chile	98	Iran	154	Other Europe, nes	210	Uganda
43	China	99	Iraq	155	Pakistan	211	Ukraine
44	China, Hong Kong SAR	100	Ireland	156	Palau	212	United Arab Emirates
45	China, Macao SAR	101	Israel	157	Panama	213	United Kingdom
46	Colombia	102	Italy	158	Papua New Guinea	214	United Rep. of Tanzania
47	Comoros	103	Jamaica	159	Paraguay	215	Uruguay
48	Congo	104	Japan	160	Peru	216	USA
49	Cook Isds	105	Jordan	161	Philippines	217	Uzbekistan
50	Costa Rica	106	Kazakhstan	162	Poland	218	Vanuatu
51	Croatia	107	Kenya	163	Portugal	219	Venezuela
52	Cuba	108	Kiribati	164	Qatar	220	Viet Nam
53	Curaçao	109	Kuwait	165	Rep. of Korea	221	Wallis and Futuna Isds
54	Cyprus	110	Kyrgyzstan	166	Rep. of Moldova	222	Yemen
55	Czechia	111	LAIA, nes	167	Rest of America, nes	223	Zambia
56	Dem. People's Rep. of Korea	112	Lao People's Dem. Rep.	168	Romania	224	Zimbabwe