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UNITED STATES, EUROPEAN UNION, CHINA, AND JAPAN: DEMAND FOR BRAZILIAN AGRICULTURAL EXPORTS

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ABSTRACT

This study evaluates the concentration of demand for Brazilian agricultural exports by the US, EU, China and Japan. It employs the agricultural definitions used by the World Trade Organization and the available data comprise 1989 to 2015 period, for long-term analysis. It calculates locational quotient (LQ) and locational Gini coefficient (LGC) and, complementarily, the modified Hirschman-Herfindahl Index. The results demonstrate that Brazilian agricultural exports are more attracted to Japan and China, while the EU and US are less important market destinations for these exports, especially in comparison with levels in the early 1990s. The study also highlights the groups of products comprising most of each trading partner's demand and specific market access problems. Supplementary studies are suggested to understand potential competition from third countries or to focus on value-added strategies to sustain Brazil's shares in international markets.

Keywords: Agriculture; Exports; Gini; Brazil.

RESUMO

O estudo avalia a concentração das exportações agropecuárias brasileiras com destino Estados Unidos (EUA), Japão, China e União Europeia (UE). Utilizou-se a categorização de agropecuária da Organização Mundial do Comércio e os dados contemplam o período 1989-2015, uma série de longo prazo. Empregaram-se o Quociente Locacional (QL) e o Coeficiente de Gini Locacional (CGL) e, complementarmente, o índice de Hirschman-Herfindahl modificado (HHm). Os resultados mostram uma relativa atração dos produtos agropecuários brasileiros ao redor de China e Japão, ao mesmo tempo em que a concentração em torno dos mercados de EUA e UE reduziu-se, sobretudo em face dos resultados no início dos anos 1990. Ademais, o trabalho identifica grupos de produtos com demanda líquida em cada um dos destinos analisados e problemas de acesso em cada um daqueles mercados. Futuras análises são sugeridas, de modo a conhecer melhor a potencial concorrência de terceiros países e estratégias de agregação de valor aos produtos brasileiros.

Palavras-chave: Agricultura; Exportações; Gini; Brasil.

JEL Code: F13; Q17.

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INTRODUCTION

Several studies (GIAMBIAGI, 2003; BONELLI AND FONTES, 2013) have identified structural restrictions on continuous growth of the Brazilian economy, particularly those related to gains in productivity. Today, conjunctural forces and new specific limitations can also be added to these structural restrictions.

In such a scenario, Brazilian agriculture (which aggregates farming, livestock breeding and food processing) was able to transform the country from a net food importer in the 1980s to a central figure in world agricultural exports. Agricultural products were responsible for 30% of Brazilian export revenues between 1989 and 2015 (FREITAS, 2016). The capacity to generate US dollars through exports is as important as the capacity to save US dollars by replacing imported items with domestic items.

As a secondary effect, the agricultural sector has supplied the increasing domestic demand for food, which contributed to positive sectorial trade balances throughout the entire 1989-2015 period. These positive net trade balances continue to be crucial for Brazil's macroeconomic stability, especially in years of poor domestic economic performance, because they counterbalance the negative net balance from Brazil's non-agricultural trade.

Indeed, Brazil is now one of the largest sources of food exports to international markets, and forecasts from the OECD (2014) indicate that Brazil will supply increasing shares of meat and sugar in international trade in the near future. At the same time, other analysts (FREITAS AND MENDONÇA, 2016) have shown that Brazil is one of the few countries able to expand its agricultural areas.

Some countries, such as the United States (US), China, Japan, and those of the European Union (EU), have historically been major importers of agricultural goods in the international market. EU, for example, represented 37.4% of global imports of food in 2017 while US (9.3%), China (7.6%) and Japan (4.5%) had impressive shares too (WTO, 2018a). They constitute the top four agricultural importers and represented 59% of global imports of food in 2017.

Moreover, these trading partners have made crucial efforts to establish bilateral agreements, including for agricultural products (FERREIRA AND CAPITANI, 2017). The US has a wide range of such agreements; the EU focuses on Africa and Middle East countries, and China and Japan concentrate negotiations in Pacific and Asian surroundings. Such bilateral agreements normally result in increasing trade flows with third countries and can substitute Brazilian supply over time.

Therefore, it is crucial to better understand the demand profile of those four big partners for Brazilian agricultural goods; first, to interpret the demand profiles in the medium and long terms; and second, to map possible opportunities and risks for Brazil and provide useful information for the corresponding public and private policies.

Accordingly, the goal of this article is to measure the concentration of imports from the US, China, Japan, and the EU within Brazilian agricultural exports. An additional objective is to determine, based on Brazil's profile as an agricultural exporter, which products these trading partners demand the most.

For that purpose, the study employs the locational quotient and locational Gini coefficient, and the modified Hirschman-Herfindahl Index. These tools will permit measuring the importance of US, China, Japan, and the EU markets in terms of Brazilian agricultural exports during the 1989-2015 period.

THE US, CHINA, JAPAN AND EU: RELEVANCE IN WORLD MARKETS AND AGRICULTURAL IMPORTS

Several factors affect Brazilian capacity for exporting agricultural products. These factors include Brazilian comparative advantages (SOUZA *et al.*, 2012), domestic infrastructure restrictions (DA MATA AND FREITAS, 2008), external trade restrictions (ANDERSON, VAN DER MENSBRUGGHE AND MARTIN, 2006), and macroeconomic factors (HOMEM DE MELO, 2005).

Other variables such as distance to the final markets, partner´s GDP and partner´s geographical location are also highlighted by classical studies about exports determinant factors (BERGSTRAND; 1985, 1989; FEENSTRA, MARKUSEN AND ROSE; 2001). The study does not try to measure these factors, but there is no doubt that they are relevant for Brazilian agricultural exports.

Specifically the US, China, EU and Japan represent large markets in terms of aggregate income as well as number of actual or potential consumers. This profile makes them important markets for top agricultural exporters (SANTO, LIMA AND SOUZA, 2012; WTO, 2018a).

The GDP of the United States has experienced average real growth of 2.5% since 1990 (THE ECONOMIST, 2016, *apud* IPEADATA, 2016), an impressive long-term growth rate. According to Santo, Lima and Souza (2012), although the country experienced some negative growth after 2008, it is still a strong source of demand in global markets, including for agricultural products.

In agricultural aspects, Luz (2014), highlights that the US has less unused arable land than Brazil. Even though country is a leading importer of agricultural products, it is a fierce competitor with Brazilian products worldwide, especially by means several preferential trade agreements with third countries, and it imposes high tariffs on dairy products (SANTO, 2010).

At the same time, growth levels in Japan decreased, particularly after the global economic crisis in 2008 (THE ECONOMIST, 2016, *apud* IPEADATA, 2016). Nonetheless, several studies have highlighted Japan's importance for Brazilian exports. Nojosa and Souza (2011) focused on the country's shortage of agricultural area and potential opportunities for Brazilian exports of meat, meat preparations and fruits.

Santo, Lima and Souza (2012) detected space in the Japanese market for a variety of agricultural goods because of its high level of import dependence. Brazil has no preferential tariff measures for Japanese market access (NOJOSA AND SOUZA, 2011), which makes it harder to increase exports to the country.

Meanwhile, the World Bank (2016) highlighted that Chinese GDP growth in recent years has outpaced that of other relevant countries (Australia, Canada, Japan, Mexico, Singapore and US) in the Asia-Pacific area. According to Sanguinet *et al.* (2017), China also represents singular opportunities for Brazilian production because of its huge population and increasing *per capita* income. Furthermore, although some authors (FUKASE AND MARTIN, 2016) have argued that local production can supply China's domestic demand for food, a high level of agricultural imports will persist during the next decade.

In counterpart, there are high Chinese tariffs on specific items, like dairy products (SANTO, 2010), and sanitary and phytosanitary barriers are equally important regarding access to that market (MENDONÇA, CARVALHO AND REIS, 2018).

Concurrently, despite its slow economic growth since 2000, the EU is the world's largest importer of agricultural products according to the WTO (2013a), and as such is a top importer of Brazilian agricultural products (SANTO, LIMA AND SOUZA, 2012). According to Florindo *et al.* (2014) and Sbarai and Miranda (2014), in the EU the market for meat and meat preparations is affected by sanitary concerns and non-tariff measures, preventing better access by Brazilian exporters.

Simultaneously, external and internal factors may diminish the EU's level of support for its agricultural producers, which could mean new opportunities for Brazilian exports of meat, meat preparations, and sugar (SÁ, MARINO AND MIZUMOTO, 2012).

All of these countries are major food importers. They already constitute significant sources of demand for specific products, and are expected to maintain or increase their status as global importers of foodstuffs in the near future (SANTO, LIMA AND SOUZA, 2012; OECD-FAO; 2014, 2016).

METHODOLOGY AND DATABASE

This study employed Brazilian export data from the MDIC (2016) spanning 1989 to 2015. The agricultural product definitions used are taken from the Agricultural Agreement (WTO, 2011) and the respective Harmonized System codes used are presented in Table 1.

Table 1. Harmonized System Codes from the Agricultural Agreement

Product group (HS)	Item
1 and 2	All
4 to 24	All (except fish and their preparations)
29	2905.43 and 2905.44
33	33.01
35	35.01 to 35.05
38	3809.10 and 3823.60
41	41.01 to 41.03
43	43.01
50	50.01 to 50.03
51	51.01 to 51.03
52	52.01 to 52.03
53	53.01 and 53.02

Source: The author, based on WTO (2011).

Methodological harmonization was performed as established in MDIC (2012) to use the codes from the Brazilian Product Classification (1989-1996) and the Mercosur Common Nomenclature (1996-2015). The methodology utilized three different tools: the locational quotient (LQ); locational Gini coefficient (LGC); and modified Hirschman-Herfindahl index, as detailed in the following subsections.

Locational quotient and locational Gini coefficient

The first stage of the approach utilized LQ and LGC. LGC was employed by Krugman (1991) to analyze location dynamics, and other authors have highlighted its benefits, related to ease of implementation and data requirements (VAN DEN HEUVEL, DE LANGEN AND FRANSOO, 2013). This tool has also been used in studies other than agriculture, for example in studies of regional specialization in China (LU, FLEGGB AND DENGE, 2011), identifying industrial reallocations (RUAN AND ZHANG, 2014), and identifying high-tech concentrations (DEVEREUX, GRIFFITH AND SIMPSON, 2004). Reveiu and Dardala (2011) also applied LQ to investigate employment statistics in Romanian counties, while Piet *et al.* (2012) employed LGC to measure inequalities in French farm sizes over time.

This study employed both LQ and LGC to measure the attraction of Brazilian agricultural exports by the US, China, Japan and the EU, and to identify whether these exports were relatively concentrated in one or more of these commercial partners.

LQ is useful for assessing whether a group of products is specific in certain regions in terms of exports; in other words, if a particular partner is relatively more important for agricultural exports than for all exports. According to Haddad (1989), LQ is defined by the following equation, for each $group_i$ of Brazilian agricultural exports:

$$LQ_{ij} = \left(X_{ij} / X_{i*}\right) / \left(X_{*j} / X_{**}\right) \quad (1)$$

Where:

X_{ij} = Brazilian agricultural exports of group$_i$ to country *j* (*j*: US, China, Japan or EU);

X_{i*} = Brazilian agricultural exports of group$_i$ worldwide;

X_{*j} = Brazilian exports to country *j* (*j*: US, China, Japan or EU);

X_{**} = Brazilian exports worldwide;

- $\left(X_{ij} / X_{i*}\right)$ = relative importance of country$_j$ in Brazilian agricultural exports of group$_i$';

- $\left(X_{*j} / X_{**}\right)$ = relative importance of country$_j$ in Brazilian exports.

In dealing with major trading partners, the next step is to organize them in decreasing order of LQ for a chosen variable (share of group$_i$ in Brazilian agricultural exports, for example). A location curve is then constructed for each trading partner, with curve point generators as follows:

- Y coordinates are derived from the accumulated share of the chosen variable (group$_i$'s share in Brazilian exports) for each commercial partner assessed;

- X coordinates are derived from the accumulated share of the same variable (group$_i$'s share in Brazilian exports) for worldwide exports.

In both cases, the descending order of the LQ defines the order in which the data are calculated (KRUGMAN, 1991; SUZIGAN *et al.*, 2003) and the LGC measures the ratio between agricultural export share by partner destination (US, EU, Japan or China) and agricultural export share by total agricultural exports, among the groups of agricultural items.

Theoretically, the maximum value of LGC is 1. The closer the value is to 1, the more spatially concentrated the exports being analyzed is, and vice versa. In the context of a large international trade market, LGC will naturally tend to be relatively small.

Modified Hirschman-Herfindahl index

The second methodological tool is the modified Hirschman-Herfindahl index (mHHI), based on Crocco *et al.* (2006). This index identifies the net effect specifically resulting from the agricultural products in the context of total Brazilian exports to each partner considered.

Equation 2 calculates the mHHI.

$$mHHI_{ij} = \left(X_{ij} / X_{i*}\right) - \left(X_{*j} / X_{**}\right) \quad (2)$$

The relative importance of a country *j* for a group *i* of Brazilian agricultural exports is discounted by the relative importance of the same country *j* for all Brazilian (agricultural and non-agricultural) products exported.

This approach partially overcomes a typical LGC limitation, namely that it does not detail the level of economic diversity of the distinct Brazilian agricultural products exported to each partner. Therefore, the mHHI summarizes the net effects (associated with a surplus resulting from agricultural products) of the respective trade. It offers new data about whether a specific partner (EU, US, China, or Japan) has relatively strong demand for a group *i* of Brazilian agricultural exports.

So, the study employed the mHHI as a complementary tool based on Crocco *et al.* (2006). The authors used the mHHI for making a geographical analysis about the shoes industry in São Paulo State.

RESULTS AND DISCUSSION

It is important to note that the calculation of the LGC was based on the Brazilian profile of agricultural exports in terms of group share in average values from 1989 to 2015, as described in Table 2. This means that the results are associated with that profile.

Table 2. Group share in Brazilian agricultural exports, mean values, 1989–2015

Product group (HS)	%	Product group (HS)	%
Oil seeds and oleaginous fruits (12)	16.09	Essential oils and resinoids (33)	0.39
Meat and edible meat offal (02)	14.01	Dairy products (04)	0.35
Food industries and wastes thereof (23)	12.97	Live animals (01)	0.30
Sugars and sugar confectionery (17)	11.96	Preparations of cereals, flour, milk (19)	0.27
Coffee, tea, mate and spices (09)	11.04	Lac; gums, and plant resins (13)	0.16
Preparations of vegetables or fruit (20)	6.93	Edible vegetables and roots (07)	0.08
Tobacco and manufactured (24)	6.39	Products of the milling industry (11)	0.08
Animal or vegetable fats and oils (15)	4.58	Trees and other plants, live; bulbs (06)	0.08
Meat preparations thereof (16)	2.40	Wool, fine or coarse animal hair (51)	0.05
Cereals (10)	2.32	Silk (50)	0.04
Miscellaneous edible preparations (21)	2.25	Organic chemical products (29)	0.03
Fruits (08)	1.93	Vegetable plaiting materials (14)	0.02
Beverages, spirits and vinegar (22)	1.73	Raw hides, skins and leather (41)	0.02
Cocoa and cocoa preparations (18)	1.50	Other vegetable textile fibers (53)	0.001
Cotton (52)	0.99	Diverse chemical products (38)	0.0007
Other animal originated products (05)	0.55	Fur skins, manufactures thereof (43)	0.0005
Albuminoidal substances (35)	0.48	Pharmaceutical products (30)	0.000001

Source: The author, based on MDIC (2016).

In general, the five main groups accounted for 66% of Brazilian agricultural export revenues. Recently, meat products have experienced impressive growth in relation to coffee and sugar, traditional items of Brazilian agricultural exports.

Santo, Lima and Souza (2012) discussed the rising Chinese share in Brazilian agricultural exports, boosted by cereal and meat demand from China since the 2000s. In contrast, US imports from Brazil have been traditional in fruits (especially juice and other fruit juices) and coffee products. At the same time, the imports by the EU and Japan are more diversified (NOJOSA AND SOUZA, 2011; SANTO, LIMA AND SOUZA, 2012), but at different levels, since EU has long been a top destination for Brazilian agricultural exports.

Locational quotient and locational Gini coefficient for Brazilian agricultural exports

In terms of each partner's share in Brazilian agricultural exports, the results show a decreasing share for the EU, US, and Japan, as demonstrated in Figure 1.

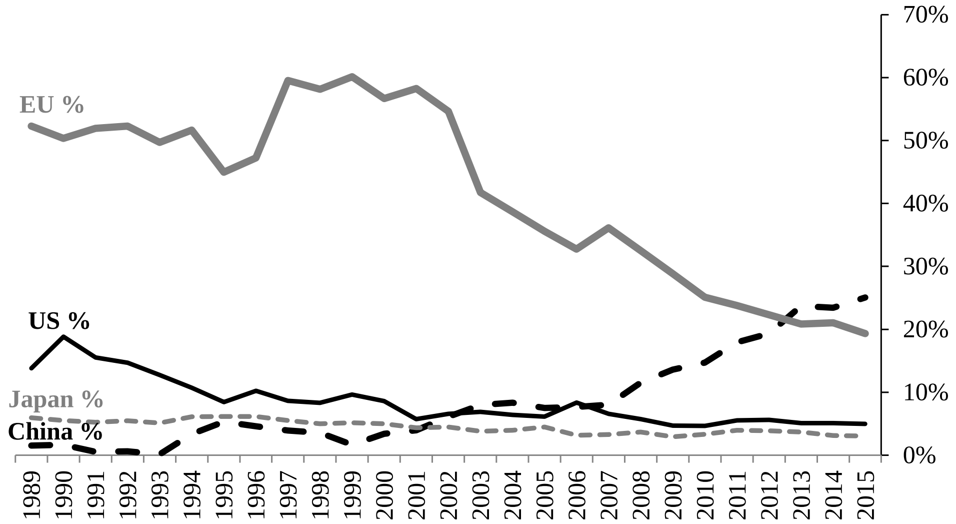

Figure 1. Shares in Brazilian agricultural exports by each destination, 1989–2015

Source: The author, based on MDIC (2016).

A more pronounced drop can be seen for the EU and US. The EU's share of Brazilian agricultural exports decreased sharply, particularly after 2001. At the same time, the US's share remained practically stable since 1994-1995 after a significant decline from 1989 to 1994. These results highlight the strength of the EU and US as global agricultural producers (OECD-FAO, 2016) and the possible effects of their attempts to find third-country suppliers for agricultural products.

Moreover, according to WTO (2018a), the EU and US are now the two main agricultural exporters. Therefore, they compete with Brazil in a range of agricultural products. This competition is stronger from the EU

(WTO, 2017a) since it has several domestic agricultural support policies (direct payments, intervention and private storage aid, and export subsidies) and a wide range of trade restrictions (specific tariffs, tariff-rate quotas, preferential tariffs, prohibitions or restrictions on imports, import licensing system and safeguards) in terms of agricultural market access.

Japan's share of Brazilian agricultural exports declined slightly in the period studied. In this case, the final bound tariff applied to countries such as Brazil for agricultural products is more than four times the simple average rate including all traded products (WTO; 2013b, 2017b). A second point exposed by WTO (2017b) is that Japan presents the highest producer support estimate (PSE) (48%)[1] among the four analyzed partners, which generates less market access to global agricultural exporters like Brazil.

In contrast, China dramatically increased its share of Brazilian agricultural exports, moving from a marginal share in 1989 to receiving almost a quarter of Brazil's total agricultural exports. However, this movement was concentrated in meat and soybean chains, which is a weakness in terms of Brazilian perspectives.

According to WTO (2018b), China bound 100% of its tariffs at *ad valorem* rates. In this context, the simple average rate for agricultural products is 15.1%, while for non-agricultural products it is 8.7%. Major variations happen within the bound tariff rates by sector, with higher ones applying to cereals, cereal preparations and beverages and spirits.

China also has several free trade agreements with Asian and Pacific countries, where other large agricultural producers and exporters are located, such as Canada, Indonesia, Thailand, Australia and India. Regarding Chinese tariff protection, Moretto *et al.* (2017) highlighted positive welfare effects from a simulated tariff-free area between China and Brazil and specific positive results for Brazilian agriculture.

Next, Table 3 highlights the LGC results. These show that Brazilian agricultural exports are attracted by Japan and China. In contrast, the results for the EU and US indicate that these markets relatively lost importance as destinations for Brazilian agricultural exports in the period analyzed.

The LGC results for the US highlight that the ratio between agricultural export share by US and agricultural export share by total agricultural exports, among the groups of agricultural items, fell steadily in the period.

The results for the US also suggest that it is becoming less attracting for Brazilian agricultural exports *vis-à-vis* worldwide demand. Santo, Lima and Souza (2012) already discussed this phenomenon. This can be attributed to the US strategy of establishing free trade agreements all over the world (WTO, 2016), respecting WTO rules under the Generalized System of Preferences, the African Growth and Opportunity Act and the

[1] PSE is the annual monetary value of gross transfers from consumers and taxpayers to agricultural producers, measured at the farm gate level, arising from policy measures that support agriculture (WTO, 2017b; 2018a).

Caribbean Basin Initiative, which reduces space for Brazilian products in the US market.

Table 3. LGC for each partner, Brazilian agricultural exports 1989–2015

	US LGC	China LGC	Japan LGC	EU LGC
1989	-0.094	0.014	-0.013	0.193
1990	-0.034	0.202	-0.041	0.177
1991	-0.032	-0.015	-0.070	0.179
1992	-0.036	-0.113	-0.014	0.214
1993	-0.074	-0.234	-0.014	0.247
1994	-0.116	0.366	0.049	0.275
1995	-0.144	0.457	0.018	0.218
1996	-0.117	0.450	0.033	0.256
1997	-0.133	0.424	0.021	0.389
1998	-0.148	0.424	0.095	0.328
1999	-0.144	0.115	0.076	0.342
2000	-0.138	0.239	0.048	0.268
2001	-0.201	0.130	0.119	0.377
2002	-0.195	0.217	0.125	0.360
2003	-0.185	0.163	0.103	0.222
2004	-0.183	0.227	0.168	0.189
2005	-0.166	0.146	0.194	0.188
2006	-0.117	0.138	0.076	0.156
2007	-0.139	0.126	0.110	0.156
2008	-0.146	0.197	0.110	0.157
2009	-0.151	0.084	0.085	0.176
2010	-0.127	0.054	0.028	0.109
2011	-0.103	0.082	0.079	0.100
2012	-0.122	0.136	0.140	0.101
2013	-0.131	0.191	0.120	0.084
2014	-0.171	0.220	0.085	0.124
2015	-0.188	0.247	0.177	0.117
Mean	**-0.131**	**0.174**	**0.071**	**0.211**

Source: The author, based on MDIC (2016).

The EU was a large export destination from 1989 to 2001. Nevertheless, this phenomenon changed thereafter and the latest LGC results for the EU were below the results for the beginning of the series. Florindo *et al.* (2014) supported this result and pointed out recent changes in the destination of Brazilian agricultural exports, moving from EU concentration to Asia and South America.

However, the mean EU value (0.211) is the highest among the four large markets measured; indicating that careful attention to groups of agricultural products is warranted (see section 4.2). In addition, simulations about a free trade area between Brazil and EU (VIEIRA AND

AZEVEDO, 2018) indicate positive effects on Brazilian agroindustry and greater Brazilian agricultural exports to the EU.

Japan's results were unexpected. The LGC series moved to increasing results from 2000 on. As reported previously, Japan faces a number of severe restrictions on supplying food from domestic sources.

Japan also presents opportunities for processed agricultural products, especially because the country is the world's fourth largest agricultural importer (WTO, 2018a), and there is no free trade agreement between Brazil and Japan yet. According to Santo, Lima and Souza (2012), Japan is a top import market for agricultural goods, with potential space for Brazilian products.

Lastly, China's LGC results show a marked change towards concentration of Brazilian agricultural exports during the 1990s. Other analysts (TAMIOSSO *et al.*, 2017) share this conclusion and emphasize that Chinese effects on international agricultural trade deserve further and deeper analyses.

Modified Hirschman-Herfindahl index

Table 4 shows the mean mHHI for each partner measured between 1989 and 2015. The results yield a number of notable results and discussion points.

First, no single product has a positive mHHI for all evaluated partners, which suggests the existence of a specialized geographical pattern of attraction of Brazilian agricultural exports among these four major markets. Competitive Brazilian agricultural products, like corn (FERREIRA AND CAPITANI, 2017), do not have positive mHHI for any analyzed market. This is understandable for large cereal producers like the EU and US, but it deserves further studies in the Chinese and Japanese cases.

Second, six products showed net demand in three markets: oil seeds and oleaginous fruits; coffee, tea, mate and spices; preparations of vegetables, fruits or nuts; albuminoidal substances; essential oils and resinoids; and vegetable plaiting materials. In the context of fruits, Silva, Ferreira and Lima (2016) highlighted growth of Brazilian agricultural exports based on destination profile, especially for mangoes from the São Francisco Valley. All six of these product groups could undergo sectorial evaluations in order to focus on strategies for adding value in these markets.

Coffee, tea, mate and spices; preparations of vegetables, fruits or nuts; albuminoidal substances; and essential oils and resinoids deserve additional attention to increase market penetration in the US, Japan and EU.

A third point for discussion is that some products presented a specific net demand by individual partners. In this context, EU markets attracted a wider variety of agricultural products. The EU showed a net effect for food industries, residues and waste thereof; tobacco and manufactured tobacco substitutes; meat and preparations thereof; other animal originated products; trees and other plants, live, bulbs, roots; raw hides, skins and leather; other vegetable textile fibers; and fur skins, artificial fur, manufactures thereof.

Table 4. Mean mHHI for trading partners, Brazilian agricultural exports, 1989–2015

HS Chapter	US	China	Japan	EU
Oil seeds and oleaginous fruits (12)	-0.178	0.219	0.007	0.270
Meat and edible meat offal (02)	-0.181	-0.058	0.056	-0.010
Food industries and wastes thereof (23)	-0.179	-0.056	-0.034	0.493
Sugars and sugar confectionery (17)	-0.108	-0.045	-0.043	-0.005
Coffee, tea, mate and spices (09)	0.014	-0.069	0.037	0.298
Preparations of vegetables or fruit (20)	0.032	-0.054	0.017	0.346
Tobacco and manufactured (24)	-0.034	-0.004	-0.020	0.187
Animal or vegetable fats and oils (15)	-0.147	0.161	-0.027	-0.133
Meat preparations thereof (16)	0.006	-0.069	-0.031	0.324
Cereals (10)	-0.151	-0.067	-0.014	-0.083
Miscellaneous edible preparations (21)	-0.050	-0.065	0.060	-0.080
Fruits (08)	0.148	-0.068	-0.043	0.257
Beverages, spirits and vinegar (22)	0.009	-0.066	0.107	-0.104
Cocoa and cocoa preparations (18)	0.122	-0.062	-0.017	-0.146
Cotton (52)	-0.161	0.025	-0.015	-0.144
Other animal originated products (05)	-0.126	-0.063	-0.030	0.199
Albuminoidal substances (35)	0.029	-0.068	0.002	0.043
Essential oils and resinoids (33)	0.203	-0.044	0.044	0.083
Dairy products (04)	-0.101	-0.066	0.077	-0.179
Live animals (01)	-0.129	-0.069	-0.044	-0.247
Preparations of cereals, flour, milk (19)	-0.068	-0.068	-0.017	-0.236
Lac; gums, and plant resins (13)	0.030	-0.038	0.000	0.078
Edible vegetables and roots and tubers (7)	-0.067	-0.066	0.045	0.003
Products of the milling industry; malt (11)	-0.115	-0.065	-0.034	-0.199
Trees and other plants, live; bulbs, roots (06)	-0.047	-0.068	-0.004	0.484
Wool, fine or coarse animal hair (51)	-0.165	-0.064	-0.044	-0.070
Silk (50)	-0.182	0.149	0.343	-0.194
Organic chemical products (29)	0.089	-0.067	0.279	-0.197
Vegetable plaiting materials (14)	-0.049	0.103	0.159	0.059
Raw hides, skins and leather (41)	-0.174	0.003	-0.044	0.039
Other vegetable textile fibers (53)	-0.182	-0.062	-0.045	0.357
Diverse chemical products (38)	-0.148	-0.068	-0.045	-0.205
Fur skins, manufactures thereof (43)	-0.071	-0.080	-0.040	0.376
Pharmaceutical products (30)	-0.210	-0.015	-0.070	-0.311

Source: The author, based on MDIC (2016).

In the EU, direct agricultural payments are concentrated in beef, milk, cereals, sugar beets and fruits and vegetables (WTO, 2017a). Moreover, the highest simple average tariffs are found for animal and products thereof (19.40%), dairy products (35.60%), cereals and preparations (14.90%), and sugars and confectionery (26.80%). Agricultural products also concentrate the incidence of *non-ad valorem* tariffs and are subject to import licensing (cereals and rice, sugar, olive oil and table oil, milk and milk products, beef and veal, pork, poultry, eggs and egg products, garlic, and preserved mushrooms).

At the same time, China exhibits net demand that is more restricted to fewer groups of products. Chinese markets also had a net effect for oil seeds and oleaginous fruits; animal or vegetable fats and oils; cotton; silk; and vegetable plaiting materials.

According to WTO (2018b), China charges high tariffs for competitive Brazilian products, such as sugar and confectionary (30.90%), cereals and preparations (23.30%), cotton (22%), and beverages and tobacco (21.8%). In addition, China has quotas on several agricultural products (wheat, corn, rice, sugar, wool and cotton) and an import licensing system that affects livestock and animal products, vegetable products, animal and vegetable oils and fats, and prepared food products.

The products highlighted in the US markets were coffee, tea, mate and spices; preparations of vegetables, fruits or nuts; fruits; cocoa and cocoa preparations; albuminoidal substances; essential oils and resinoids; lac, gums, and resins, and organic chemical products.

Three aspects should be mentioned regarding US markets. According to WTO (2016), in US markets the PSE level is around 9.40%, but it presents the highest levels for cotton (17.20%), milk (15%), and refined sugar (44.2%). Moreover, the country offers a range of support programs with effects on export flows to the US, including commodity programs, crop insurance, disaster assistance, export credit guarantees, and specific programs for sugar and dairy sectors. Third, average WTO tariffs are 9.1% for agricultural products and 4.0% for non-agricultural products.

In Japan, net demand was seen for meat and edible meat offal; coffee, tea, mate and spices; preparations of vegetables, fruits or nuts; miscellaneous edible preparations; beverages, spirits and vinegar; essential oils and resinoids; dairy products; edible vegetables and roots and tubers; silk; organic chemical products, and vegetable plaiting materials.

Not coincidently, Japan has a large PSE (43%), concentrated in rice, wheat, soybeans, beef, pork, poultry, and selected fruits and vegetables (WTO, 2017b), all of them current or potential Brazilian agricultural products in world markets.

Another kind of analysis involves measuring the positive time persistence of the mHHI by trading partner, as shown in Table 5. This indicates how long the mHHI remained positive (higher than 50%) throughout the period 1989-2015. For example, the 70% value for oilseeds and oleaginous fruits in China signals that China had a net demand for Brazilian exports of oilseeds and oleaginous fruits during 70% of the period 1989-2015. However, this figure must be considered carefully (AGUIAR AND MATSUOKA, 2016), since Brazil's Kandir Law in 1997 represented an incentive for unprocessed soybean exports.

Table 5. Positive mHHI persistence over time, Brazilian agricultural exports, 1989–2015

US		**China**	
Essential oils and resinoids (33)	100%	Animal or vegetable fats and oils (15)	93%
Fruits (08)	96%	Oil seeds and oleaginous fruits (12)	70%
Cocoa and cocoa preparations (18)	85%	Silk (50)	56%
Lac; gums, and plant resins (13)	74%		
Organic chemical products (29)	74%		
Meat preparations thereof (16)	70%		
Preparations of vegetables or fruit (20)	67%		
Albuminoidal substances (35)	67%		
Coffee, tea, mate and spices (09)	52%		
Japan		**EU**	
Meat and edible meat offal (02)	100%	Food industries and wastes thereof (23)	100%
Miscellaneous edible preparations (21)	100%	Coffee, tea, mate and spices (09)	100%
Beverages, spirits and vinegar (22)	100%	Preparations of vegetables or fruit (20)	100%
Silk (50)	100%	Tobacco and manufactured (24)	100%
Organic chemical products (29)	100%	Meat preparations thereof (16)	100%
Coffee, tea, mate and spices (09)	93%	Trees and other plants, live; bulbs (06)	100%
Essential oils and resinoids (33)	93%	Fruits (08)	93%
Preparations of vegetables or fruit (20)	81%	Essential oils and resinoids (33)	89%
Dairy products (04)	67%	Albuminoidal substances (35)	85%
Vegetable plaiting materials (14)	63%	Oil seeds and oleaginous fruits (12)	78%
Lac; gums, and plant resins (13)	56%	Lac; gums, and plant resins (13)	78%
Edible vegetables and roots (07)	52%	Other animal originated products (05)	67%
		Other vegetable textile fibers (53)	67%
		Fur skins, manufactures thereof (43)	63%
		Meat and edible meat offal (02)	56%

Source: The author, based on MDIC (2016).
Note: only products with positive mHHI for more than 50% of the 1989-2015 period.

Again, it is possible to note that the EU has a relevant net effect for several groups of Brazilian agricultural exports during most of the measured period. This indicates that although demand from the EU is relatively lower than it was in the 1990s, the EU still represents crucial demand for Brazilian agricultural products. Among the four major trading partners, the EU has the most diversified net demand for Brazilian agricultural exports, followed by Japan and the US. China exhibits net demand concentrated in animal or vegetable fats and oils, oil seeds and oleaginous fruits, and silk.

Specific products merit special attention because they have a relevant net effect for two or more of the four partners. These include meat and meat preparations and essential oils and resinoids in the US, EU, and Japan; fruits in the EU and US; and silk in Japan and China.

These groups of products could benefit from further investigations in order to promote the Brazilian position in these markets, in terms of Brazilian domestic policies, as well as to understand potential competition from third countries. According to Florindo *et al.* (2014), meat and meat preparations, for example, face several sanitary restrictions in the US, EU, Japan and China. Therefore, public policymakers should pay attention to this question (MENDONÇA, CARVALHO AND REIS, 2017) to improve Brazilian access in those markets.

FINAL REMARKS

This study investigated the attraction of the US, China, Japan, and the EU for Brazilian agricultural exports. In terms of share of Brazilian agricultural exports, the EU had a decrease, particularly from 2001 onward. On the other hand, the US's share remained practically stable from 1994-1995, after a decline from the late 1980s. Japan's share of Brazilian agricultural exports fell slightly, while China grew, accounting for almost a quarter of Brazilian agricultural exports.

These findings highlight the roles of the EU and US as major world agricultural producers. They also suggest that both partners may be very active in bilateral agreements, which may boost their efforts to find third-country suppliers for agricultural products. The US has also a range of support programs with meaningful effects, including specific programs for sugar and dairy sectors, and its agricultural tariffs are twice its non-agricultural tariffs.

The LGC levels show the attraction of Brazilian agricultural exports by Japan and China. At the same time, the results for the EU and US signal that these markets are less central as destinations for Brazilian agricultural exports *vis-à-vis* their levels in the early 1990s. Nonetheless, the mean EU value remains the highest among the four large markets measured and simulations about a free trade area between Brazil and EU indicate positive effects on Brazilian agroindustry and greater Brazilian agricultural exports to the EU.

In the EU, direct payments are made to the beef, milk, cereal, sugar beet, fruit and vegetable sectors. High simple average tariffs are found on livestock and animal products (meat, hides, and milk), cereals and preparations, and sugars and confectionery. Agricultural products also concentrate the incidence of *non-ad valorem* tariffs and are subject to import licensing. In terms of product groups, the EU markets attracted a greater variety of agricultural products. Moreover, the EU is strategic in multilateral agreements.

There is also some evidence that China's attraction level for Brazilian agricultural exports stabilized since 1997-1998. This result should be interpreted in terms of Brazilian agricultural exports as a whole, and does not exclude the greater Chinese relevance for some specific groups of Brazilian agricultural exports, especially animal or vegetable fats and oils, oil seeds and oleaginous fruits, and silk.

It must be remembered that this market charges high tariff levels for competitive Brazilian products, such as sugar and confectionary, cereals and preparations, cotton, beverages and tobacco. In addition, China imposes tariff-rate quotas on several agricultural products and has an active import licensing system that affects livestock and animal products, vegetable products, animal and vegetable oils and fats, and prepared food products.

As for Japan, although this country's share of Brazilian agricultural exports slightly diminished in the period, it became increasingly attractive for the profile of Brazil's agricultural exports as a whole. Results of this type reveal the importance of a better understanding of price effects. This is one limitation of the present study. Japan also has strong agricultural supports, concentrated in rice, wheat, soybeans, beef, pork, poultry, and selected fruits and vegetables, all of them current or potential Brazilian agricultural products in world markets.

Two main elements must be cited as limitations of the study. At first, it does not include macroeconomic variables. Price effects for example would be a topic for future studies. However, trade restrictions were approached in results section.

Secondly, bilateral and preferential agreements must also be incorporated in the methodological evaluation in further investigations, especially those one incorporating Brazilian competitors in agricultural goods, as US, Argentina, EU, Australia, Canada, and Russia, for example. About this point, another important aspect is that all the four partners made resolute efforts to establish free trade agreements to provide favorable market access conditions to third countries. Brazilian policymakers should consider this.

Finally, some products also need special attention because of their net demand among two or more of the four partners. These include meat and meat preparations; fruits; and silk. Supplementary studies should be conducted to promote the Brazilian position in these products/markets in terms of Brazilian domestic policies as well to understand potential competition from third countries.

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