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ANALYSIS OF SHOCK PERSISTENCE IN BRAZILIAN ORANGE JUICE EXPORT

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ABSTRACT

Brazil is one of the world leaders in the production and export of orange juice, a position that reflects the quality and competitive capacity of the country's citrus chain. Considering this, the present work aims to analyze the behavior of orange juice exports, in volume and monetary value, considering its main destinations, aiming to understand how these series behaved in the face of market shocks between 1997 and 2019. For that, the methodology used was based on the method proposed by Robinson et al. (1995a), which tests the presence of long memory across time series data, and on the structural break test proposed by Andrews and Ploberger (1994). According to the results, all analyzed series show no long memory. This result indicates that shocks that occurred in the period had a temporary effect on the flow of Brazilian orange juice exports, with no long-term effect on the trajectory of the series. These results allow us to conclude that the destinations analyzed here are solid markets for Brazilian orange juice export, and that short-term variations in export flows indicate a search for bargain prices among agents who purchase the Brazilian drink.

Keywords: Orange Juice; Export; Shocks; Long Memory

RESUMO

O Brasil configura-se como um dos líderes mundiais na produção e exportação do suco de laranja, posição que reflete a qualidade e a capacidade competitiva da cadeia citrícola. Diante de tal importância, o objetivo do presente trabalho é analisar o comportamento das exportações de suco de laranja, em volume e valor monetário, para seus principais destinos, visando compreender como tais séries se comportam perante choques de mercado, entre os anos de 1997 e 2019. Para tanto, a metodologia empregada baseou-se no método proposto por Robinson et. al (1995a), que testou a presença de memória longa em séries de tempo. Também foi conduzido teste de quebra estrutural. Conforme os resultados, todas as séries analisadas apresentam ausência de memória longa. Tal resultado indica que choques ocorridos no período se refletiram de forma temporária no fluxo das exportações brasileiras do suco de laranja, não tendo efeitos na trajetória de longo prazo das séries. Tais resultados permitem concluir que os destinos, aqui analisados, configuram-se em sólidos mercados do suco de laranja brasileiro, e que variações de curto prazo nos fluxos de exportação indicam atuações visando barganha de preços entre os agentes que adquirem a bebida brasileira.

Palavras-chave: Suco de laranja; Exportações; Choques; Memória longa

Código JEL: Q02; Q17

INTRODUCTION

Brazil is one of the main players in agribusiness today. The country has competitive farming, thriving agribusiness, and solid institutions. Orange juice is one of the main commodities exported by Brazil. In 2018 alone, the export of this beverage grew 14.5%, totalling a volume of 1.14 million tons., and generating the equivalent of USD 2.13 billion. According to analyses by Cepea – Centro de Estudos Avançados em Economia Aplicada (CEPEA, 2018), this result was one of the most relevant for the growth of Brazilian agribusiness exports in 2018, with the soybean (grains and meal) and ethanol complexes as the only ones to surpass the growth of orange juice regarding external sales. Compared to 2017, shipments of soybeans grew 23%, in parallel to an expansion of 19% for soybean meal, and 19.7% for ethanol.

These results have kept Brazil at the forefront of the world's orange juice production and exports. A leadership that has endured since the 1980s, when the Brazilian production of the beverage started to cover a large part of the world's demand. CitrusBR (2019) shows that currently the country is responsible for 53% of the world orange juice supply, exporting 98% of its production, which corresponds to an annual average of 1.2 billion tons in the last decade. Brazil does not hold such an isolated leadership position in any other sector.

Exports and the search for a better understanding of the international dynamics of the orange juice trade market have been the object of several studies in the literature. Allegra et al. (2019) presented a new pattern in food consumption, with orange juice as the protagonist. They emphasize that the long-term survival of this sector depends on adapting to this new standard and to consumer demands. Dhamodharan et al. (2016) and Neves (2010) show that taxes directly affect the competitiveness of the markets of the main exporting and importing agents. In particular, the study by Dhamodharan et al. (2016) reveals that the processing industry in Florida (USA) is strongly favored by customs tariffs when compared to those in São Paulo (Brazil). Heng and House (2018) point out that the bilateral agreement between the United States and South Korea benefited American suppliers of orange juice to the detriment of Brazilian ones, which generated a positive effect in terms of commercial value for the American industry on the world stage.

Given the importance of the Brazilian citrus chain and the worldwide discussion about the subject, the objective of the present work is to analyze the behavior of orange juice exports, according to value (USD) and volume, for its main destinations, between the years of 1997 and 2019, to understand how these series behaved in the face of market shocks, such as exchange rate variations, fluctuation in international juice prices, excess or shortage in production, trade, tariff and/or phytosanitary barriers, etc. Specifically, it seeks to test the presence of long memory in the series, verify the existence of structural breaks in the data, and identify the presence of heterogeneity in the behavior of the series.

The study assumed of shock persistence, that is, medium and long-term sales flows are maintained, even if subject to short-term inversions. This hypothesis is supported by the consolidation of Brazilian juice in its main destinations, considering that Brazil exports quality products at competitive prices and, therefore, it tends not to suffer sudden and persistent variations in sales due to problems considered to be exogenous. In other words, what can happen are discussions about prices, but the exported volumes remain, in general, following the expected trend. It is, therefore, a consolidated market.

The contribution of this article is based on two pillars: 1) the applied methodology, based on the analysis of fractional integration, as well as testing long memory or shock persistence; this methodology helps to understand the degree of persistence in a time series, and has not yet been used in series of orange juice exports; 2) it contributes to understanding the Brazilian orange juice export market dynamics.

Regarding fractional integration, this tool has become an alternative and viable modeling method to be used with many time series. Since the idea behind this specification is that the dependence between observations, which are increasingly distant in time, can be better captured in terms of hyperbolic decay rates instead of exponential rates associated with autoregressive structures (GIL-ALANA, 2008). That is, the presence of long memory is related to the persistence of autocorrelation in each series (APERGIS & TSOUMAS, 2011, 2012) and its memory in relation to shocks. A shock is an event that occurs at a specific point in a series and is not limited to that point. It is known to have a temporary or short-term effect if, after several periods, the series returns to its previous performance level. On the other hand, the shock has a persistent or long-term effect if the short-term impact leads and sets a new trend in the behavior of the series (BARROS et al., 2016).

The recent literature on time series in the farming sector is represented only by the works by Silva Neto and Ribeiro (2020) and Silva Neto and Wander (2020) regarding Brazilian beef export and the rice market, respectively. However, in other fields of study on economics, the method is more widespread, as briefly described below. In energy economics, for example, it is notorious that series can present trends, seasonality, absence of linearity, fractal structures, among other characteristics; works by Chen and Lee (2007), Narayan and Smyth (2007, 2008), Hsu et al. (2008), Maslyuk and Smyth (2009), and Mishra et al. (2009), for example, use a variety of unit root tests procedures based on the dichotomy I(0)/I(1), that is, stationary/stationary for the first differences, to study energy consumption and production. Other works, like those conducted by Narayan et al. (2010), Apergis and Payne (2010), Aslan (2011), Aslan and Kum (2011), Hasanov and Telatar (2011), Ozturk and Aslan (2011), and Kula et al. (2012) use conventional unit root and stationarity tests to analyze the integration properties of various types of energy consumption. However, conventional unit root tests have low power when analyzing long-memory processes (FAVA & ALVES, 1998), as they cannot distinguish I(1) processes from fractional integration processes, I(d). Therefore, it is necessary to apply

proper methods to evaluate fractionally integrated series when there is suspicion of long memory.

Several methodologies can be used to assess long memory in a series (SOUZA et al., 2006), among them stand out the classic R/S analysis, by Hurst (1951) and Mandelbrot (1972); the modified R/S analysis, by Lo (1991) (see TABAK & CAJUEIRO, 2007); the method for estimation of the fractional integration parameter proposed by Geweke and Porter-Hudak (1983); the semiparametric estimator by log-periodogram, by Robinson et al. (1995a); the Gaussian semiparametric estimator, by Robinson et al. (1995b); and the V/S analysis developed by Giraitis et al. (2003) and Cajueiro and Tabak (2005). The present work is similar to the studies carried out by Lean and Smyth (2009), Gil-Alana et al. (2010), Apergis and Tsoumas (2011, 2012) and Barros et al. (2011, 2012, 2016), because it employs the fractional integration methodology to identify the degree of persistence of the series, especially that of Barros et al. (2012), which uses the method proposed by Robinson et al. (1995a) to estimate the fractional parameter.

In addition to this introduction, the article also brings the methodology and data in its second section, followed by the analysis of results and discussions, with the final considerations in the last section.

METHODOLOGY AND DATA

Method

Time Series Econometrics is the proposed method for identifying the presence of shock persistence. The test itself is based on identifying, within the properties of a time series, whether it has elements that make it possible to say whether there is persistence to a certain exogenous shock. Therefore, other methods such as econometrics in Data Panel, Cross Section or linear estimations in Ordinary Least Squares or in Different Generalized Stages do not apply in this case.

To achieve the objectives proposed by the present work, each of the orange juice export series is represented by y_t and its behavior will be described using the following model:

$$y_t = \beta^T Z_t + x_t, \qquad t = 1, 2, \ldots \tag{1}$$

in which β is a vector of unknown coefficients (k x 1), Z_t is a set of deterministic terms that can include an intercept ($Z_t = 1$), an intercept with a linear time trend ($Z_t = (1, t)^T$), or any other type of deterministic processes, and x_t are the regression errors.

According to Barros et al. (2012), the time series x_t ($t = 1, 2, \ldots$) is fractionally integrated of the d order and follows a model $I(d)$ represented by:

$$(1 - L)^d x_t = u_t, \qquad t = 1, 2, \ldots \tag{2}$$

in which $(1 - L)^d$ is the fractional difference operator, L is the *lag* operator (that is, $Lx_t = x_{t-1}$), d is the order of integration of the process, which can

be any real number, and u_t is a stationary process $I(0)$, with zero mean and spectrum$f_u(\lambda)$.

The polynomial $(1-L)^d$ on the left side of Equation (2) can be expressed in terms of binomial expansion, for any real number d:

$$(1-L)^d = \sum_{j=0}^{\infty} \psi_j L^j = \sum_{j=0}^{\infty} \binom{d}{j} (-1)^j L^j = 1 - dL + \frac{d(d-1)}{2} L^2 - \cdots,$$

That is,

$$(1-L)^d x_t = x_t - dx_{t-1} + \frac{d(d-1)}{2} x_{t-2} - \cdots$$

Barros et al. (2011, 2016) point out that parameter d, represented by Equation (2), plays a crucial role in data analysis, because it is an indicator of the degree of dependence of the series. The higher the value of d, the higher is the level of association between observations that are increasingly distant in time.

In the case of $d = 0$ in (2), the stochastic process x_t has a stationary covariance. If the fractional parameter assumes a value of $d = 1$, x_t is a non-stationary process with a unit root, that is, the model contains a stochastic trend. Thus, fractional integration arises when d assumes positive, non-integer values, $0 < d < 1$. If the value of d is restricted to the interval $0 < d < 0.5$, x_t reverts to the mean and remains a process of stationary covariance, but with the decay of the autocovariance function being slower than in the stationary case, $I(0)$. If $0.5 \leq d < 1$, x_t is non-stationary but reverts to the mean and its autocovariance function exhibits greater persistence (APERGIS & TSOUMAS, 2011, 2012). However, if $d \geq 1$, x_t is non-stationary and does not revert to the mean (GIL-ALANA, 2008).

Processes with $d > 0$ in Equation (2) exhibit the "long memory" property, so called due to the strong degree of association between observations that are very distant in time (BARROS et al., 2016). Impulse responses are also affected by the magnitude of d, according to Barros et al. (2011), the higher the value of d, the higher the responses. In case of $d < 1$, the series reverts to the mean, and the shocks have temporary effects and disappear in the long term. However, if $d \geq 1$, the shock will have permanent effects unless strong political measures are taken.

In the context of fractional processes, Gil-Alana (2008) stresses that occasionally neglecting structural breaks can lead to the spurious discovery of long memory. Therefore, this article examines the possibility of fractional integration in the presence of a single structural break at an unknown point within the sample. So, each of the series y_t that presents a break is represented according to the following model:

$$y_t = \beta_1^T + x_t; \qquad (1-L)^{d_1} x_t = u_t, \qquad t = 1, 2, \ldots, T_b \tag{3}$$

$$y_t = \beta_2^T + x_t \qquad (1-L)^{d_2} x_t = u_t, \qquad t = T_b + 1, \ldots, T \tag{4}$$

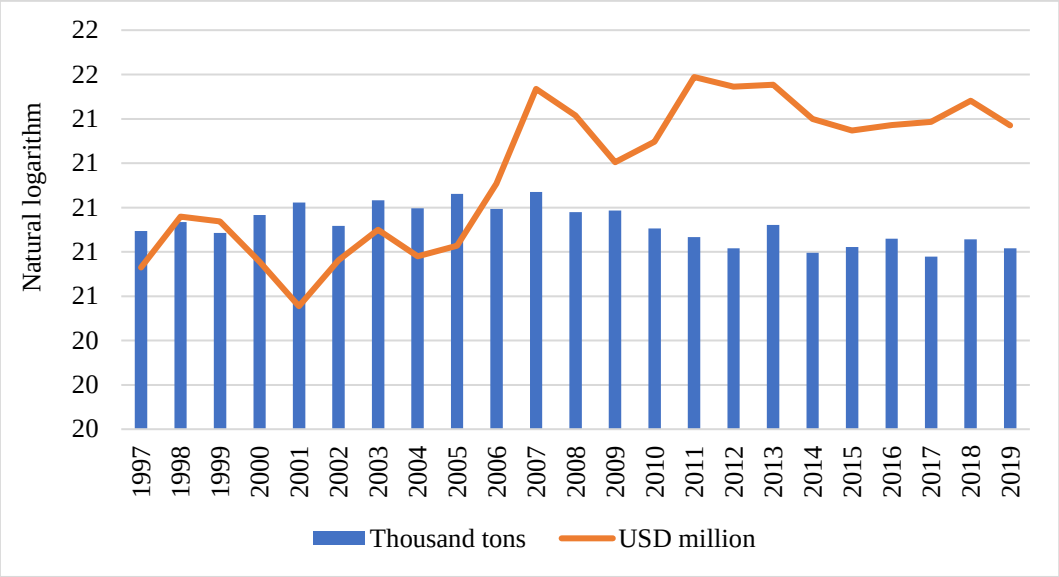
in which β's are the coefficients corresponding to the deterministic terms, d_1 and d_2 are real numbers, u_t is a stationary process $I(0)$, with zero mean and spectrum $f_u(\lambda)$, and T_b is the unknown breaking point. Each of the orange juice export series is denoted by y_t, and x_t are the regression errors.
The methodology employed in the present study to estimate the fractional differentiation parameter is the method proposed by Robinson et al. (1995a), the Gaussian Semiparametric Estimator (GSE) based on the Whittle Likelihood in the frequency domain. The test proposed by Andrews and Ploberger (1994) was also applied, using Hansen's (1997) approximations for the p-value, which is recommended to test a single structural break at an unknown point within the sample and to identify the date of the break, T_b. Afterwards, new estimates of the parameter *d* are made in the presence of the break[1].

Data

Data were collected from ComexStat, the monthly series of Brazilian orange juice exports, in total and per main destination: European Union, United States, Japan, and China, between 1997 and 2019. Together, these destinations were responsible for 92% of annual Brazilian juice purchases abroad in the last decade.
The price series, which refer to export values, are in dollars (USD) and following the methodology of Tabak and Cajueiro (2007), Gil-Alana *et. al* (2010), Ribeiro and Silva Neto (2020) and Haque (2021), the series was also not deflated. Still, the natural logarithm was applied in all series used in the work.
Graphic 1, which the total exports of orange juice in the period under study, shows that the annual variations in volume remain relatively stable when compared to the performance of the series in value (USD million), but without sudden behaviors and long reversal. For the analyzed period, while the annual volumes vary 0.1% on average, in USD this variation reaches 5.3% annually. For the period accumulated, the exported volume decreased by -3.7%, while the value increased by 112.2%.
As pointed out by Silva Neto and Ribeiro (2020), a similar behavior between the series in USD and in volume may mean acceptance of the hypothesis of the possibility of minimal difference between the series of volumes and traded values, in which the existing noises in the market may simply indicate the search for price bargaining opportunities. However, this hypothesis has yet to be proven by testing the memory of the orange juice series.

[1] The econometric software used to perform the statistical procedures of this work is the Regression Analysis of Time Series (RATS 9.2).

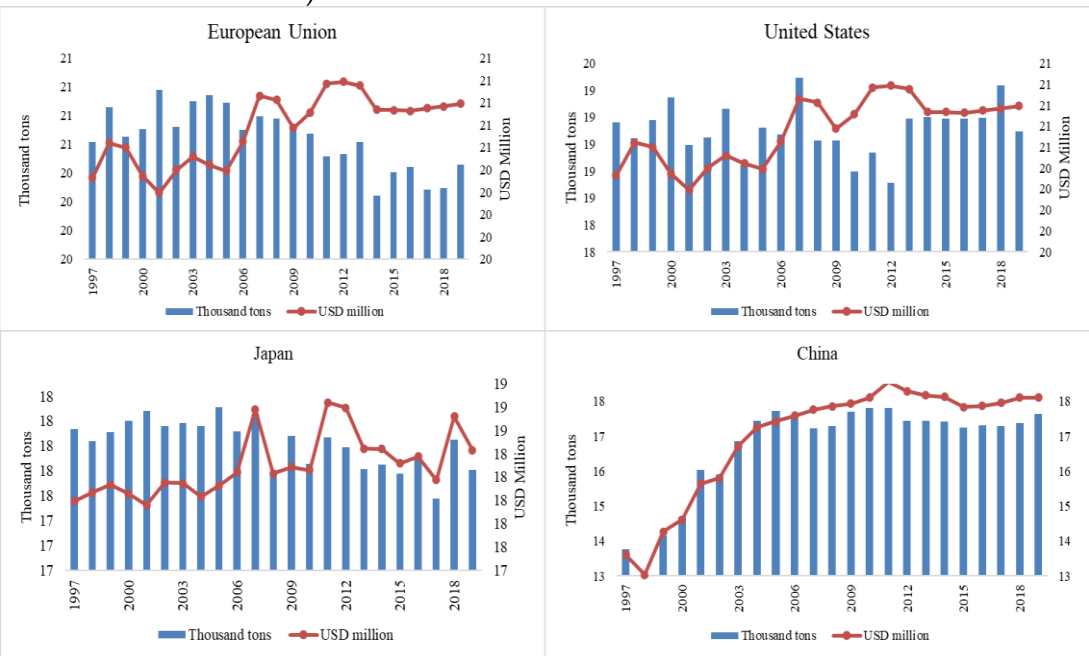
Graphic 1: Brazilian orange juice export (thousand tons and USD million) 1997 from 2019



Source: Prepared by the authors with data from ComexStat.

A similar scenario is observed when considering the export series for the main destinations (Graphic 2), that is, considering different units of measurement. There are no major differences in behavior between the series in volume and in USD, even though the latter presents greater volatility visually.

Graphic 2: Brazilian orange juice export, selected destinations (thousand tons and USD million)



Source: Prepared by the authors with data from ComexStat
Note: series in natural logarithm were used.

The rapid growth in Brazilian juice exports to China in the first decade of the 2000s is noteworthy. This behavior reflected the country's income

growth, and the greater concern of the Chinese with consuming natural and healthy products, since tropical fruit juices are considered of better quality. More recently, orange juice consumption has faced competition from other beverages of lower caloric and monetary value, such as carbonated water, soft drinks, isotonic drinks, teas, and other fruit juice flavors. The consumption of such beverages instead of orange juice has been consecutively jeopardizing Brazilian exports of the drink, especially to the main markets of the product, such as the European Union and the United States. Add to that the fact that these countries make recurrent and timely use of protectionist practices that aim to hinder, or even prevent, the entry of the more competitive Brazilian products in local markets.

RESULTS AND DISCUSSION

The results of the estimation of the fractional parameter, initially disregarding the possibility of any structural break, are presented in Table 1. The first column contains the main destinations for orange juice exports. The second column presents the parameter *d* estimates by Robinson et al. (1995a) for the series, whose values demonstrate that the series in USD and Kg produce estimates in the interval (0.1).

Of the five series of orange juice exports in USD, four show less persistence ($d < 0.5$), with more expressive oscillations than the series of the destination *China*, which has a greater degree of persistence ($0.5 \leq d < 1$). In the first case, there is a greater probability of low orange juice export values in the period t being preceded by higher values in period $t + 1$, and vice-versa. The less persistent the series, the greater the probability. The same behavior is presented in the series in volume, that is, a value in the interval $0.5 \leq d < 1$ was only found in the series of destination *China.* Therefore, all series in USD and Kg show a value of d lower than 1, indicating that they revert to the mean, and the shocks have temporary effects and disappear in the long term.

Table 1: Estimation of the fractional parameter of the orange juice export series (USD and Kg) – selected destinations

	Entire sample – USD		Entire sample – Kg	
	d	Standard error	*d*	Standard error
EU	0.2165	0.053	0.1305	0.053
EUA	0.2359	0.053	0.0538	0.053
Japan	0.1236	0.053	0.0455	0.053
China	0.7036	0.053	0.7210	0.053
World	0.3131	0.053	0.0648	0.053

Source: Prepared by the authors.

Note: d = fractional parameter of the entire sample; d_1 = fractional parameter before the break; t_1 = observations before the break; d_2 = fractional parameter after the break; t_2 = observations after the break.

These coefficients are consistent with the Brazilian orange juice export flow, traditionally to the United States and the European Union, the main

consumers of the drink in the world. Therefore the fractional parameter for these series had a value below 0.5. China, on the other hand, is a relatively new destination, given its rise in consumption only from the 2000s, as shown in Figure 2. However, although more recent, this already demonstrates to be a consistent destination for Brazilian exports of orange juice, as shown by the parameter that was found: above 0.5, but below 1.

According to these results, citrus market shocks did not have permanent effects on sales behavior to selected countries, although there were short-term effects, especially for China. In other words, the hypothesis of this article is accepted: the Brazilian orange juice export sector is consolidated internationally, with a consistent volume, and market fluctuations do not persistently affect the trade flow.

In general, this result is similar to that presented by Neves and Trombin (2011), regarding the high volatility in orange juice prices (a recurrent standard in agricultural commodities), in contrast to less volatile demand, and even constant demand in some periods. They believe that the high volatility in orange juice prices is due to significant fluctuations in fruit prices. These variations, when they occur in short periods of time, added to production expectations and their consequent speculation, make the prices of concentrated orange juice (FCOJ) highly volatile, causing a significant economic disturbance in the segments of the production chain, even though there is stable volume demanded.

In view of the possibility of inconsistent estimates of the fractional parameter due to a possible structural break (LIMA et al., 2015), the Andrews and Ploberger (1994) test was carried out, the results of which are shown in Table 2. The break points (T_b) are shown in the second column, the parameter values prior to the break (d_1) are on the third column, and the sixth column presents the post-break values (d_2).

The series that showed a break were divided into two samples. The first contains parameter d_1 with size $t_1 = 1, 2, \dots, T_b$, and the second contains d_2 with size $t_2 = T_b + 1, \dots, T$. The total observations of samples t_1 e t_2 are shown on the fifth and eighth column of Table 2. The series with values of $0 > d_1, d_2 > 2$ are not fractionally integrated.

The coefficient analysis indicated that of the ten series analyzed, only two showed no structural change, namely: exports to Japan in USD, and exports to the USA in Kg. Although these series show significant fluctuations in some years, the test estimate did not find any trend over the period under analysis.

Regarding exports to the USA, the sharpest fluctuation in the series occurred between the years 2008 and 2012, a period in which the exported volume followed a downward trend, reflecting a set of factors, among which the financial crisis of 2008/09, added to the drop in prices received by Brazilian citrus growers and the appreciation of the exchange rate between 2008 and 2009. In 2012, the scenario was aggravated by the discovery of traces of the fungicide carbendazim in Brazilian orange juice by the United States Food and Drug Administration (FDA), as this product is prohibited in that country. This discovery resulted in a blockage of shipments of Brazilian juice, affecting the volumes sent to the US over several months.

Table 2: Estimation of the fractional parameter, with structural break, of the orange juice export series – selected destinations

Results for the series in USD							
	Structural break	Before the Break			After the Break		
		d_1	Standard error	t_1	d_2	Standard error	t_2
EU	Sep./06	0.2736	0.0745	117	0.2436	0.0662	159
USA	Mar./02	0.1106	0.0962	63	0.185	0.0589	213
Japan	-	-	-	-	-	-	-
China	Aug./02	0.5439	0.0928	68	0.7313	0.0593	208
World	Sep./06	0.2786	0.0745	117	0.3434	0.0662	159
Results for the series in Kg							
	Structural break	Before the Break			After the Break		
		d_1	Standard error	t_1	d_2	Standard error	t_2
EU	Jan./11	0.4355	0.0645	169	0.2276	0.0772	107
USA	-	-	-	-	-	-	-
Japan	Dec./07	0.2826	0.0714	132	-0.0465	0.0687	144
China	Aug./02	0.5588	0.0928	68	0.7511	0.0593	208
World	Jan./11	0.3267	0.0645	169	0.2724	0.0772	107

Source: Prepared by the authors.

Note: d = fractional parameter of the entire sample; d_1 = fractional parameter before the break; t_1 = observations before the break; d_2 = fractional parameter after the break; t_2 = observations after the break.

The series of orange juice exports to China (USD and Kg) have a break date in August 2002, a period after which foreign sales to this destination started to grow more significantly, following the country's growth.

The *World* series, which represents the sum of all Brazilian orange juice exports, has the same breaking points as its main destination, the EU: USD (September 2006) and Kg (January 2011). These breaks are related to the complex scenario faced by the citrus sector between the years 2004 and 2010, whose reflexes lasted until recently.

Since the mid-2000s, world orange production has been hampered by the incidence of hurricanes in the North American citrus belt (2004 and 2005) and by the spread of greening disease, which significantly compromised the productivity of American and Brazilian orchards between 2008/09 and 2009/10, resulting in declines in world orange juice stocks since then. Add to that the global financial crisis that hindered negotiations with already consolidated markets and emerging markets. According to Neves and Trombin (2011), after a period of decelerating prices between 2007 and 2009, the international prices of the drink only returned to significant growth in 2010, which is justified by the low stocks accumulated in previous years.

The d_1 parameters show the non-persistence of the behavior of the series (in USD and Kg) for the *EU*, the *USA*, *Japan*, and the *World*, $0 < d < 0.5$, with stationary behavior and reversion to the mean. These results corroborate the hypothesis of the present work, which considers Brazilian orange juice as a product with a strong presence in the international market, although subject to short-term dynamics influenced by several factors, such as climatic variability, price volatility, political interference, high market concentration and market power of retailers.

On the other hand, the d_2 values for the post-break period, evidence the persistence of the series (in USD and Kg) for *China*, $0.5 \leq d < 1$, showing non-stationary behavior, but with reversion to the mean. This result indicates that the series of exports to China was the only one with long memory, which correlates with the fact that this is a relatively recent destination for exports of the Brazilian product.

FINAL CONSIDERATIONS

The present work analyzed the shock persistence of series of exports of orange juice, according to currency (USD) and volume sold (Kg), to its main destinations – EU, USA, Japan, and China –, with the objective of testing the presence of long memory, verifying the presence of structural breaks in the data, and identifying heterogeneity in the behavior of the series.

Regarding the issue of heterogeneity, the results indicate that the degree of persistence differs from one series to another, depending on the measure (in USD or Kg) and the destination of orange juice exports. However, in most series, the fractional differentiation parameter for the same destination, in USD and Kg, presents approximate values.

All the series analyzed in this study have an integration order below the unit, showing that in no case will a shock in the series itself have permanent effects, only temporary effects that will disappear in the long run. This result highlights the importance of Brazilian orange juice in the world market, although subject to dynamics influenced by several factors. The fractional parameter estimates confirm the stationary behavior and reversion to the series mean in USD and Kg for the destinations EU, USA, and Japan. While the estimates for the series in USD and Kg for China confirm the presence of long memory, with non-stationary behavior, but with reversion to the mean.

These results indicate that the markets analyzed by the present study can be considered solid destinations for Brazilian orange juice, which gives Brazil an advantage in selling to these destinations, and that short-term variations in export flows indicate actions aimed at price bargaining among agents who purchase the Brazilian drink.

In addition, it should be noted that this advantage could be expanded with measures that reduce barriers to the entry of the Brazilian drink in foreign markets. Currently, Brazilian exports of orange juice are taxed in several markets, which makes the product more expensive for the end consumer, reducing competitiveness and resulting in substitution for other more affordable drinks.

This scenario has been resulting in a drop in consumption of orange juice in consolidated destinations, which could be reversed through measures such as the one employed by the Chinese government at the end of 2019, when it reduced the import tax from for juices 30% to 15%. Since this is a market that shows a preference for orange juice (considering it to be a healthier product), the expectation is that this measure will increase exports to China, contributing to this country becoming a destination of greater relevance for Brazilian orange juice.

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