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Domestic landings and imports of seafood in emerging economies: The Brazilian sardines market

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ABSTRACT

Seafood imports have increased strongly in emerging economies during the last decades. However, the impacts of increased imports on price determination process, local fishers' income and fish stocks have received limited attention. This paper presents a market integration and price transmission analysis for the Brazilian sardine market, comprising the fresh and canned sardines segments, to shed light on these issues. Imports currently supply about one-half the sardines in the Brazilian market, and even more when the domestic fishery landings are low. The results suggest not only a fully integrated market but also a complete price transmission in both sardine value chains. Hence, import competition with domestic fisheries limit price increases in the domestic fishery and reduce fishers' income and fishing effort. However, the canneries, consumers and fish stocks are better off.

1. Introduction

Seafood is one of the most traded food product categories, as more than 37% of the seafood produced is traded, and seafood trade is growing (Anderson, 2003; Asche et al., 2015). This development has fundamentally changed many seafood markets as domestic producers face stronger import competition, but also export opportunities. This development also affects emerging economies, such as Brazil, where imports of seafood have increased strongly in recent decades (FAO, 2015). Economic growth and increased incomes in Brazil have led to stronger demand for seafood that domestic fisheries and aquaculture producers have not been able to supply. The extent to which imported product substitute domestic product raises a number of interesting questions with respect to price determination (Asche et al., 2015; Xie and Zhang, 2017), food security (Béné et al., 2016; Smith et al., 2010), fishing effort and fish stock health status (Valderrama and Anderson, 2010) as well as opportunities for aquaculture producers (Pincinato and Asche, 2016a; Belton et al., 2018). In this paper, we will shed light on some of these issues for Brazil by investigating market integration and price transmission between imported and domestic sardine prices.

The sardine fishery is the largest Brazilian fishery and has traditionally been the main supplier of sardines to the domestic market. However, it is a volatile fishery due to natural stock variation, and high fishing effort has led to reduced landings and potential overexploitation (Cergole and Dias-Neto, 2011). Because of this, imports play an increasingly important role in the Brazilian market, supplying on average one-half of the total sardines quantity consumed, and a larger share when domestic landings are short. The majority of imports and between 40 and 80% of the domestic production goes to the cannery industry (IBGE, 2014). The reminder of the domestic production supplies the fresh sardine market, which is comprised of wholesale markets, fishmongers, fairs, restaurants, and other outlets. The Brazilian sardine is, in general, perceived as a higher quality product than imported ones. However, it is exposed to worse preservation conditions from fishing to processing than imported sardines (do Carmo et al., 2010).

With the two sources of sardines (domestic fishery and imports) and the two different final markets (canned and fresh), the degrees of substitution and price transmission are of substantial interest. It is well known that in a poorly managed fishery, fishing effort increase strongly when revenues increase (Homans and Wilen, 1997), and the potential revenue is influenced by which market is being served (Homans and Wilen, 2005; Smith, 2012). Hence, as there is a high fishing effort level, and no quota set for the Brazilian sardine stock, increased sardines prices due to limited supply from lower landings can reinforce the poor state of the stocks. Competition from alternative sources such as imports hold the potential to limit the price increase, and therefore to partly protect the fish stocks against higher fishing effort (Kristofersson and Anderson, 2006; Nielsen, 2006). However, this disincentive to increase fishing effort can also reduce fishers' income relatively to the

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situation with no import competition for local landings (Asche et al., 2015; Valderrama and Anderson, 2013, 2010). On the other hand, import competition will increase consumer surplus in Brazil as increased competition reduce retail prices (Nielsen, 2006). Also in seafood supply chains of specific product attributes have value (Ahmad and Anders, 2012; Bronnmann and Asche, 2017; Roheim et al., 2007; Uchida et al., 2014), and country-of-origin, as well as fresh, may segment the market for domestic sardines from import competition.

As the sardines make up a substantial part of the cost of the final product when sold fresh as well as canned, one would expect a high degree of price transmission from the import and wholesale markets to the retail markets (Asche et al., 2002a). Market integration at one stage of the supply chain is sufficient to make prices highly correlated through the supply chain if the degree of price transmission is relatively high (Asche et al., 2007a). Hence, price leadership is of substantial interest if it exists. In general, when price leadership exists for food commodities it tends to be shocks in production that drive price determination (Goodwin and Holt, 1999), but in supply chains with a global market, prices will often be determined at the trade level (Asche et al., 2007b). Market integration and price transmission analysis can be helpful to clarify the prices determination process both horizontally and vertically between the two sources of sardines and the two markets being served in Brazil. This has important consequences for both the sardine industry and the consumer welfare (Gordon and Maurice, 2015).

In developed countries there exist a number of studies of seafood market integration and price transmission (Ankamah-Yeboah and Bronnmann, 2018, 2017; Bjørndal and Guillen, 2017a, 2017b; Bronnmann et al., 2016; Lee and Kennedy, 2010; Regnier and Bayramoglu, 2017). Recent studies of market integration involving the processing seafood industry, focus mainly on tuna canning markets (Jiménez-Toribio et al., 2010), or different salmon products (Landazuri-Tveteraas et al., 2018). In emerging economies, seafood market integration and price transmission are relatively scarce (Gordon and Maurice, 2015; Pincinato and Asche, 2016b; Tveteraas, 2015; Yazdani et al., 2013).

The paper is organized as follows: the next section provides a background context on the Brazilian sardine market and the main sources of sardine. Data and the method used for the analysis are presented in the following sections. Next, the empirical results are shown, and its possible implications are discussed. Finally, some concluding remarks are provided.

2. Background

2.1. The Brazilian sardines production

Brazilian sardine (*Sardinella brasiliensis*) landings are based on one stock, which is found between Rio de Janeiro state and Santa Catarina state, along the southeastern coast. It is primarily a purse-seine fishery, although other types of gears may also be used, especially in the artisanal sector (Cergole and Dias-Neto, 2011). As shown in Fig. 1, the landings reached a maximum in 1973 (~228 k tonnes), and after that followed a downward trend until 1990. The fishery recovered somewhat during the early 1990s before they crashed around the turn of the century reaching a minimum for the whole period in 2000. Even though production has increased since then, it is still less than half of what it was at the peak in the 1970s.

Cergole and Dias-Neto (2011) suggest that a part of the production fluctuations (Fig. 1) are due to variable environmental conditions influencing recruitment. On the other hand, the industrial fishery has improved its technology, such as substitution for synthetics or nylon multifilament and larger nets, and use of power block and sonar, increasing fishing power. In addition, although the number of authorized fishing vessels has been reduced, it is still higher than what is recommended in the last management plan (Brazilian Ministry of Fisheries and Aquaculture, 2012; Cergole and Dias-Neto, 2011). Hence, the increase of fishing effort over time may also be responsible for the declining landings of this resource. Officially, this resource has been considered overexploited (Brazilian Ministry of the Environment, 2004), but no updated stock assessment is available.

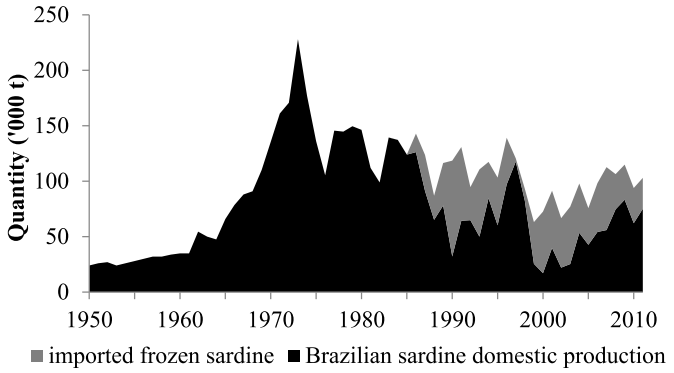

Fig. 1. Brazilian sardine production, frozen and canned imported sardine from 1950 to 2012. '000 tonnes. Source: (FAO, 2015).

2.2. Imported sardines

Imports of sardines and similar species (mainly *Sardina pilchardus*, *Sardinops* spp., *Sardinella* spp. and *Sprattus sprattus*) have been providing inputs for the canneries since 1986 (Fig. 1).[1] In the early 1990s imports reached a maximum of 86.5 k tonnes. Imports decreased in the 1990s as domestic landings increased, until a low of 11 k tonnes was reached in 1997. After the collapse in the domestic landings in 2000, imports have remained relatively stable at around 40 k tonnes per year. Several studies suggest that imports are negatively correlated with domestic production (Cergole and Dias-Neto, 2011). Using the data in Fig. 1, the correlation coefficient is −0.78.

Globally, Brazil is the seventh largest importer of frozen sardines (FAO, 2015). Traditionally, the main suppliers were Venezuela and Russia, but since 2006 Morocco has also become an important source.

3. Data and method

The analysis is based on monthly time-series data of prices from the wholesale market, imports and retail markets for fresh and canned sardines, for the period January 1994 to September 2010. The wholesale market prices for Brazilian sardines were provided by CEAGESP (São Paulo wholesale market). The price series for imported frozen sardines was compiled from Aliceweb, (2015), a database of the Ministry of Development, Industry and Foreign Trade, while the retail prices for canned and fresh sardine are taken from the São Paulo metropolitan region as collected by the Institute of Agricultural Economics in São Paulo. All prices were converted to real prices using the Consumer Price Index. The empirical analysis is conducted using the natural logarithms of the variables.

The prices are shown in the upper panel of Fig. 2. As expected given the higher degree of processing, the canned price is the highest followed by the retail price for fresh sardines. The wholesale price is mostly higher than the import price but also appears to be more volatile. To facilitate a visual inspection of the correlation of the upstream and downstream data series, they are shown in the lower panels of Fig. 2 with different price series at different axis. Although there are short-run deviations, the prices appear to follow a similar pattern at some extension for most of the period.

The empirical analysis of market integration or price transmission is

[1] Mercosur Common Nomenclature (MCN) 0303 5300.