



Contents lists available at ScienceDirect

The Journal of Economic Asymmetries

journal homepage: www.elsevier.com/locate/jeca

Vertical price relationships between different cuts and quality grades in the U.S. beef marketing channel: A wholesale-retail analysis

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ARTICLE INFO

JEL classification:

C14

Q13

L66

ABSTRACT

The present article offers an empirical assessment of the degree and the structure of price dependence between wholesale and retail market levels in the U.S. beef industry, while accounting for product differentiation. This is pursued using the statistical tool of copulas and monthly rates of price changes for different cuts and quality grades of the beef product for the time period 2002–2016. Six wholesale–retail pairs were formed based on different cuts and quality grades. The empirical results suggest that prices at retail level respond differently to extreme negative and positive wholesale price shocks. More specifically, extreme price increases at the wholesale level are transmitted to the retail level in five out of six pairs whereas extreme price decreases are not passed from the wholesale to the retail market level in five out of six pairs. Based on these findings, there is evidence of asymmetric price relationships between wholesale–retail market levels in the U.S. beef marketing channel, when quality differences in cuts and grades are considered.

1. Introduction

Asymmetric price relationships is an increasingly disputed issue in agricultural and food economics. Increases in farm prices are believed to be transmitted faster at the retail level, whereas negative price shocks at the farm level take more time to be passed on to consumers (Gervais, 2011). Downward price stickiness in agri–food supply chains can be considered as one of the reasons that explain imperfect price transmission (Vavra & Goodwin, 2005). As Emmanouilides and Fousekis (2015) mention, inertia and incomplete pass-through may be indicators of market inefficiency. For these reasons it attracts the attention of researchers and policy makers.

There exists a widespread belief that price transmission in the U.S. beef industry is asymmetric. These concerns have been validated to some extent in the literature. Recent evidence by Kuhns and Volpe (2014) for the United States Department of Agriculture-Economic Research Service reveals that retail beef prices rise rapidly, but fall slowly in response to price changes in upstream markets. Emmanouilides and Fousekis (2015) assessed the degree and the structure of price dependence along the U.S. beef supply chain with the use of the statistical tool of copulas. Their findings reveal the existence of asymmetric price dependence between wholesale–retail levels. Goodwin and Holt (1999), estimated a threshold vector error correction model (T-VECM) of beef price relationships at the farm, wholesale and retail levels. The authors found evidence that the adjustment path towards the equilibrium is asymmetric. On the other hand, Pozo, Schroeder, and Bachmeier (2013) with the use of a threshold asymmetric error-correction model (TAECM) found no evidence of asymmetric price transmissions (APT) in the response of retail beef prices to changes in upstream prices.

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<http://dx.doi.org/10.1016/j.jeca.2017.06.002>

Received 4 January 2017; Received in revised form 7 June 2017; Accepted 12 June 2017

Available online xxxx

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In the majority of the studies, increased concentration in downstream markets and input manufacturing has been often pointed out to explain why decreases in upstream prices are not accompanied by proportional decreases in downstream markets. Concentration in the beef packing industry has generated a lot of concern over the years since firms started to concentrate market power due to mergers and acquisitions (Cai, Stiegert, & Koontz, 2009; Love, Capps, Williams, & et al, 2009).¹ At wholesale level, the four-firm concentration ratio (CR4) reached the level of 85 percent in 2010, dropped to 84 percent in 2011, and raised again to 85 percent in 2012.² In general, the four-firm concentration ratio has remained around 80 percent in the last ten years (USDA, Packers and Stockyards program 2013 Annual Report). At the same time, there are high levels of concentration at the retail level of the beef industry. At this last stage of the beef supply chain we find retail grocers, food service providers and restaurants with significant name recognition and potentially high degree of market power as well (e.g. McDonald's, Kroger, Safeway, Costco, Compass Group PLG, etc.).

However, there are other possible explanations for asymmetric price dependence besides market power. Asymmetries might arise within a perfectly competitive environment as well, as Gardner (1975) pointed out. According to the author, increases (decreases) in the farm supply will work towards smaller (larger) margins. Furthermore, if the elasticity of supply of marketing inputs is less than the supply elasticity of farm products then an increase in the demand for food will increase the retail-to-farm price ratio. Convexity/concavity of consumer demand (Azzam, 1999; Fousekis, 2008) and/or convexity of farm supply (Xia, 2009) might also be responsible for asymmetries in the magnitude of farm-to-retail price transmission. Adjustment costs, inventory management, increasing returns to scale, exchange rates, transportation costs, menu costs of changing prices and product differentiation are also identified in the literature as some of the sources responsible for the existence of asymmetries in price transmission (Conforti, 2004; Meyer & Cramon-Taubadel, 2004).

This work investigates if product differentiation could be a source of asymmetric price relationships between wholesale–retail market levels in the US beef industry. Beef is sold to consumers as cuts. Different beef cuts exhibit different prices. Cuts from the middle part of the animal are priced higher than cuts from the ends. Cuts like ribs, loin, and sirloin are usually priced higher than cuts like round or briskets. Different cuts do not constitute the only beef attribute to determine consumers' willingness to pay. Physical intrinsic qualities like tenderness, texture, juiciness, fat composition, appear to influence consumers' decisions when purchasing beef (Leick, Behrends, Schmidt, & Schilling, 2012).

Beef is being inspected and graded before it reaches the retail market. The U.S. Department of Agriculture (USDA) offers this service since the day the system was established.³ Until today, no system has proven more reliable operating without bias under actual commercial conditions (Morris, 1999). There are eight types of quality grades, but the ones commonly available at the retail level are: i) Prime (highest in quality and intramuscular fat, amazing tenderness, juiciness, flavor and fine texture, limited supply, featured at the most exclusive upscale steakhouse restaurants), ii) Choice (high quality, widely available in food service industry and retail), and iii) Select (acceptable quality, commonly sold at supermarkets, less juicy and less tender due to leanness).⁴ About 3% of carcasses grade as Prime, more than 50% grade as Choice, and 40% grade as Select. Most of the graded beef sold in supermarkets is USDA Choice or USDA Select.

In the light of the preceding, there is plenty of evidence suggesting that consumers perceive beef as a differentiated product. At the same time, the U.S. beef industry vertically differentiates its product through the USDA grading system. Despite this fact, the majority of studies on price transmission along the US beef supply chain have been carried out considering aggregate commodity prices. This means that the literature treats beef as an aggregate product when overwhelming evidence suggests otherwise. As a consequence, potential differences in price adjustments between different beef cuts and beef quality grades are averaged out when using aggregate data.

The objective of this study is to empirically examine if the existence of product differentiation could be a source of asymmetric price dependence between the wholesale and the retail levels of the U.S. beef industry, for certain cuts and quality grades of the beef product. The statistical tool utilized in this study is that of copulas. Copulas can be used for modeling the joint distribution of random variables. Hence, in the case of market upswings and/or downswings, copulas make it possible to assess whether prices move with the same intensity or not. Panagiotou and Stavrakoudis (2015) used copulas in order to assess the degree and the structure of price dependence between different cuts and quality grades at of the U.S. beef industry at retail level. Results indicated that, depending on the cuts and the grades, there was evidence of asymmetric and non-asymmetric price co-movements. Fousekis and Grigoriadis (2016) used non-parametric copulas in order to examine the intensity and the mode of price linkages for quality differentiated coffee beans. The empirical findings suggested that there is symmetric price co-movement under positive and negative price shocks; that means, shocks of the same absolute magnitude but of different sign are transmitted from one coffee market to another with the same intensity. The transmission of shocks, however, of the same sign but of different magnitude is asymmetric. Fousekis, Emmanouilides, and Grigoriadis (2016) assessed the degree of integration of the international skim milk powder between the three the EU, the U.S. and Oceania markets (principal producing regions), with the employment of nonparametric kernel-based time-varying copulas. Their empirical results indicate a strong and increasing degree of overall price co-movement along with statistically significant probabilities for joint price crashes and booms.

Copulas have a wide range of applications in the area of economics. Aloui and Aïssa (2016) employed a vine copula approach to

¹ On the other hand, Ward, (2010) reviewed a large number of studies and concluded that there is insufficient evidence to strongly argue that the US beef packing industry is not competitive. Furthermore, as Emmanouilides and Fousekis (2015) point out, even though the empirical results of their study raise concerns regarding the efficiency of the US beef supply chain and point to the market power as the possible source, one should be careful with their interpretation. The authors also mention other sources that might be responsible for asymmetries in price transmission along the beef marketing channel besides market power.

² The top four beef packing operations are: Tyson Foods Inc., Cargill Meat Solutions Corp., JBS USA, National Beef Packing Co.,LLC.

³ Organized grading of beef dates back to 1923.

⁴ Lower grades are U.S. Standard (lower quality, yet economical, lacking marbling), U.S. Commercial (low quality, lacking tenderness, produced from older animals), U.S. Utility, U.S. Cutter and U.S. Canner.

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