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Annual Review of Resource Economics

A Line in Space: Pricing, Location, and Market Power in Agricultural Product Markets

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JEL codes: L13, Q13, R32



Keywords

agricultural markets, spatial competition, buyer market power, spatial price discrimination, spatial differentiation

Abstract

Agricultural economists have a long history of emphasizing and analyzing the spatial dimension of agricultural and food markets. Despite a rich body of literature and important contributions to agricultural and spatial economics, one aspect is frequently disregarded: the oligopsonistic nature of agricultural markets due to spatial competition of neighboring buyers of farm products. This review presents the theoretical foundations of spatial pricing, competition, and location in terms of buyer power and discusses concepts that are relevant for agricultural markets. By providing a comprehensive overview of prior work, we highlight the multifaceted areas of applications to agricultural markets. Additionally, we discuss future research avenues for and challenges of the analysis of spatial competition in agricultural economics.

Spatial economics: brings location, transportation, and land into economics and identifies the microeconomic underpinnings of the location of economic activities

1. INTRODUCTION

The spatial distribution of farming is an essential feature of agricultural production and, ever since the pioneering work of von Thünen (1826), a topic at the core of agricultural economics. Agriculture is rather continuously distributed across geographical space, while buyers of agricultural products, e.g., food processors, are located at discrete points in space. Because agricultural raw products are often bulky and/or perishable, transportation is costly relative to the value of the final product. This limits farmers' access to alternative buyers for selling their products (Rogers & Sexton 1994). These features impact land use decisions by farmers, location choice of downstream firms (e.g., warehouses, mills, meat packing facilities, food processors, ethanol plants, and retailers), and the market structure of the whole food supply chain. Although there is a rich body of literature in agricultural economics that considers the spatial dimension of agricultural markets, one important implication of the features described above remains underexamined: Agricultural markets are often oligopsonistic markets because buyers of farm products compete with only a few close neighbors (Faminow & Benson 1990).

Spatial economics provides the theoretical framework to analyze pricing, competition, and location decisions of firms in such a setting, but most studies and reviews in the spatial economics literature to date refer to seller market power, i.e., monopoly and/or oligopoly markets (Beckmann & Thisse 1986, Greenhut et al. 1987, Biscaia & Mota 2013). The latter is particularly relevant in food retailing, where space is important because a concentrated retail sector sells (a variety of products) to spatially dispersed consumers. We provide a discussion of spatial issues in retail food markets in **Supplemental Appendix A**.¹ The focus of this review, however, is on buyer market power because downstream industries, such as food manufacturing and distribution, are frequently more concentrated than agricultural production (Sexton 2000, Dobson et al. 2003). This focus also reflects the current and increasing interest in buyer market power in developed and developing countries alike (OECD 2014). For instance, weak bargaining positions of farmers and their exposure to market power are major concerns both in the United States and Europe (US DOJ 2012, AMTF 2016). These issues are exacerbated in the context of developing countries due to poor infrastructure and access to transportation (Omamo 1998). Just recently, Bergquist & Dinerstein (2020) provide experimental evidence that traders of agricultural raw products exhibit a high degree of market power and capture almost all of the market surplus.

Against this background, the first aim of this review is to present and promote spatial economics concepts and models that are relevant for applications to agricultural markets. The second aim is to take stock of the literature in the field, highlight the many facets where space plays a crucial role in agricultural markets, and emphasize the importance of considering it adequately in the analysis of these markets.

Because spatial economics models vary greatly regarding their underlying assumptions, the review begins by presenting a unified picture of these approaches. Most important in this respect are the price strategy, i.e., how transportation costs are reflected in the spatial price schedule; the nature of competition, e.g., cooperative versus noncooperative spatial competition; and whether firms' locations are fixed or endogenous. Section 3 presents applications of spatial price and competition models for agricultural markets, while Section 4 discusses research gaps and avenues for future work. We conclude in Section 5.

¹For a recent general review on pricing strategies in food retailing, see that by Hamilton et al. (2020).

2. SPATIAL ECONOMICS: CONCEPTS AND MODELS

Any economic activity takes place in and is (unevenly) distributed over geographical space. Unfortunately, the consideration of space in economic models creates a number of difficulties (including imperfect competition). Proost & Thisse (2019, p. 575) therefore state that “[s]patial economics is both at the core and periphery of economics.” In the context of this review, two theories from spatial economics are the most important: spatial price theory and location theory. In this respect, we focus on the microeconomic concepts that follow Hotelling’s (1929) pioneering work of spatial competition. Prior literature develops the theoretical framework mostly in the context of seller market power, yet our focus is on buyer power. Therefore, when necessary we mirror relevant results to the input market perspective but still cite the original reference.

2.1. Spatial Price Theory

A spatial economics framework is typically required if three conditions are fulfilled (Capozza & Van Order 1978): (a) There are costs associated with the transportation of goods between locations and these costs are considerable relative to the value of the good, (b) fixed costs or economies of scale cause concentration of economic activity at discrete locations, and (c) buyers (e.g., processors or traders) and sellers (e.g., farmers) of a raw product are distributed over geographical space. If these three conditions are fulfilled, a buyer is able to spatially separate sellers into submarkets. The basis of this separation is geographical distance and the associated transportation costs. Because buyers exhibit transportation cost advantages over neighboring competitors in some proximity to their own location, buyers have local market power and sellers will have only access to a few buyers (Rogers & Sexton 1994).

Models investigating pricing (and eventually competition) from a spatial perspective usually make use of a set of standard assumptions (see, e.g., Löfgren 1986, Zhang & Sexton 2001). It is convenient to make these assumptions explicit here:

1. Sellers of a homogeneous good are dispersed along a one-dimensional market according to an exogenously given density function;²
2. Sellers have identical supply functions;
3. Given a defined production technology, a buyer produces a final or intermediate product that can be sold in the output market at a constant output price net of other constant production/processing costs;³
4. The transportation of one unit of input causes constant transportation costs per unit of distance; and
5. The buyer’s procurement area is limited only by the buyer’s (spatial) price strategy and potentially by strategies of competitors.

Variations or specifications in assumptions 1–5 have resulted in a multitude of spatial competition models. For instance, the representation of space (assumption 1) in terms of a linear or circular market or the nature of supply functions (assumption 2) has considerable effects on theoretical predictions. One central criterion to categorize the literature is the price strategy employed. A general representation of spatial price strategies is the following linear price distance function (Norman 1981):

$$w(r) = m - \alpha tr, \quad 1.$$

²The fact that most spatial models reduce space to a one-dimensional line motivated the title of this review.

³Typically, it is assumed that the buyer uses a fixed proportions production technology, so that one unit of (agricultural raw) input is transformed into one unit of (processed) output.

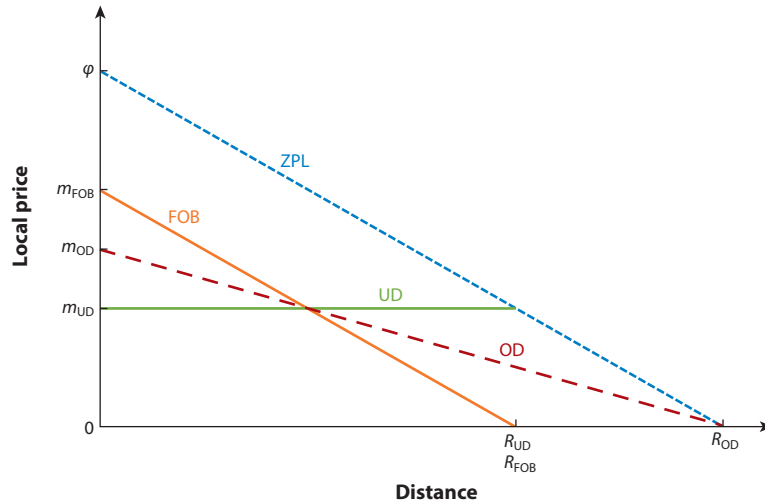


Figure 1

Standard price strategies of the spatial monopsony (adapted from Graubner 2010). Due to transportation costs, the zero profit line (ZPL), starting at the net output price φ , decreases with increasing distance to the buyer's location. At each location, the difference between the free-on-board (FOB) pricing curve and the ZPL is the local per unit profit. This profit decreases under both uniform delivered (UD) and optimal discriminatory (OD) pricing. The latter realizes the largest market radius R and the overall buyer's profit. The intercept represents the mill price m of each price strategy. The figure shows optimal FOB, UD, and OD price schedules of the monopsony under the assumption of linear supply functions, and sellers are uniformly distributed along the line market. In general, the profit maximizing mill price m of any price strategy and the slope of the OD price schedule depend on the price elasticity of supply (Cheung & Wang 1996, Graubner et al. 2011a). Under a perfectly price-inelastic supply, for instance, UD pricing coincides with OD pricing.

where $w(r)$ is the price at location r , m is the price at the buyer's location, t is the transportation rate per unit of product and distance, and $\alpha = [0, 1]$ is the share of transportation costs reflected in local prices. The maximum local price a buyer can offer without taking a loss at this location is defined by $\varphi - tr$, and φ is the net output price (or the net marginal revenue) received by the buyer (see assumption 3 above). Due to transportation costs, this maximum local price decreases with the distance to the buyer's location which constitutes a zero profit line (ZPL), as shown in **Figure 1**. Also depicted in this figure are three classic spatial price regimes that differ by the value assigned to α : free-on-board (FOB), uniform delivered (UD), and optimal discriminatory (OD) pricing. In the case of FOB pricing, the buyer announces a common "mill" price at its own location.⁴ Sellers bear transportation costs by delivering to the site of the buyer or the buyer picks up the commodity and thus accounts for these costs in the local price (e.g., at the farm gate). In either case, local prices differ exactly by transportation cost differences; i.e., $\alpha = 1$. Because the slope of both the FOB price schedule and the zero profit line is $-t$, local per-unit profits are constant over the market area if the buyer uses FOB pricing. In this case, the market area is restricted by the price a seller is willing to accept. In **Figure 1**, this price is assumed to be zero. FOB pricing is common, e.g., in grain markets (McNew & Griffith 2005) or in the context of developing countries where farmers

Free-on-board (FOB) pricing: local prices reflect transportation cost differences

Uniform delivered (UD) pricing: local prices are equal over the market area of the buyer

Optimal discriminatory (OD) pricing: the buyer sets profit maximizing prices at each location

⁴FOB pricing is also called mill pricing in the literature. Throughout this review, we use the term FOB pricing, whereas the term mill price refers to the price at the location of the buyer under any price strategy, i.e., m in Equation 1.

often have to carry their crop to the nearest market (Fafchamps & Hill 2005). Moreover, in the case of food retailing, consumers face FOB pricing if they travel to the store (Bliss 1988).

An alternative to FOB is UD pricing. As illustrated in **Figure 1**, under UD pricing, sellers receive the same local prices independent of their distance to the buyer; i.e., $\alpha = 0$. This typically requires that the buyer is responsible for or commissions the collection of the agricultural product from sellers' locations. In fact, UD pricing is very common in agricultural markets. Some specific examples include markets for raw milk (Alvarez et al. 2000, Tribl et al. 2017), tomatoes (Durham et al. 1996), and sugar beets (Graubner et al. 2011a).

Although differences in transportation costs are not reflected in local prices under UD pricing, i.e., the buyer fully absorbs transportation costs, they reduce the buyer's local per unit profit with increasing distance. Hence, buyers need to restrict their market areas to avoid negative local profits. This is illustrated in **Figure 1** at distance R_{UD} , where the UD price schedule intersects with the zero profit line. Under linear supply functions, FOB and UD pricing yield identical monopsony profits and market areas (Beckmann & Ingene 1976, Löfgren 1986). On average, however, sellers are better off under FOB pricing compared to UD pricing because they receive higher average prices overall in the case of FOB pricing (Beckmann 1976).

The third linear pricing option is OD pricing. Under this price policy, the buyer maximizes profits at each single location which, under the given assumptions, yields a linear price distance function where half of the transportation costs are reflected in local prices (Beckmann 1976). Hence, the buyer engages in spatial price discrimination by partially absorbing transportation costs. By its very nature, from the buyer's perspective, OD pricing is superior to other pricing options as it maximizes profits, but it can also be beneficial for sellers (Holahan 1975) because OD pricing maximizes the market area, R_{OD} , and thus more sellers can participate in the market (see **Figure 1**). In general, the ranking of the three price strategies with respect to profit, seller surplus, and social welfare depends on the shape of the sellers' supply functions (Cheung & Wang 1996), whether the market area is endogenously determined (Hsu 2006), and whether the buyer operates under increasing returns to scale (Graubner 2020).

Although FOB, UD, and OD pricing are available to the buyer under monopsony and competition, other options only emerge under spatial competition. One option is basing point pricing in which one location "is accepted by common consent as the basing point" (Scherer & Ross 1990, p. 504), and all other local prices are derived from the base price minus transportation costs. Basing point systems are typically considered as an indicator of collusive behavior because they exploit locational rents (Benson et al. 1990) and are often targeted in antitrust cases (Scherer & Ross 1990, Hovenkamp 2007).

Instead of linear price distance functions, alternative options are characterized by a discontinuous spatial price schedule. For instance, under zone pricing, a uniform price is set in a predefined geographical area while different prices apply in neighboring regions (Hansen et al. 1997). Adams & Williams (2019) show that zone pricing can increase consumer surplus compared to finer price discrimination. Another example is unrestricted spatial price discrimination in the sense that a firm can set local prices at each location independently (see Section 2.2). In any case, it is important to note that all price strategies, except FOB pricing, feature spatial price discrimination (Greenhut et al. 1987) because sellers receive a price that does not fully reflect the costs associated with the trade, i.e., the transportation costs in a spatial setting.⁵ Any strategy different from FOB pricing

⁵If multiple buyers are located at a given procurement point, arbitrage will undermine discriminatory price regimes under noncooperative competition.

Normalized transportation costs:

measure of the intensity of competition determined by tD/φ , i.e., transportation cost (per distance unit) times the market length relative to the net output price

is therefore an indicator of (local) market power because this is a precondition to employ spatial price discrimination (Hoover 1937). The extent to which local market power can be exploited under any spatial price policy depends on the intensity and nature of spatial competition. Both concepts are introduced in the next section.

2.2. Spatial Competition Under Fixed Locations

When there are no transportation costs or all buyers reside at the same location, there is perfect or Bertrand price competition. If distances between buyers or transportation costs are sufficiently high, buyers can act as spatially separated monopsonies. Between these two polar cases, buyers engage in spatial competition. **Figure 2** illustrates this for a simple duopsony setting.

Because of decreasing potential market areas, the intensity of competition (from Bertrand price competition to spatial monopsonies) decreases from panel *a* to panel *d* in **Figure 2**. The intensity of competition can be measured by normalized transportation costs, i.e., the relation between the economic distance (or importance of space) tD between buyers and the (net) marginal revenue product φ (Zhang & Sexton 2001). This ratio is $tD/\varphi = 0$ in **Figure 2a** and increases from panel *a* to panel *d* in **Figure 2**. In location models, the importance of space tD is endogenous.

The intensity of spatial competition relates to potential market areas. In contrast, actual market areas, input, and profit allocation are determined by buyers' price strategies and market behavior. The market behavior of buyers concerns not only price competition (Bertrand) or quantity competition (Cournot), but also whether competition is cooperative or noncooperative. In regard to price competition under FOB pricing, the literature distinguishes between Hotelling–Smithies, Löschian, and Greenhut–Ohta competition (Capozza & Van Order 1978). Hotelling–Smithies competition implies noncooperative behavior and is an analog to nonspatial Bertrand–Nash competition (Sexton 1990). In this case, buyers conjecture that competitors' prices are fixed, which constitutes a noncooperative game. In contrast, under Löschian competition, each buyer assumes that its market area is fixed and acts as the monopsonist within that area (Benson 1980). This represents a form of cooperative or collusive behavior because it implies that prices rise or fall in unison, so as to maintain fixed market areas (Capozza & Van Order 1978). Under Greenhut–Ohta competition, buyers consider both the market area and the rival's price as variable but consider the price at the market boundary as fixed (Greenhut et al. 1975).

Capozza & Van Order (1978) investigate these three scenarios under FOB pricing and point out that theoretical predictions can be quite different and, under certain conditions, opposite to economic intuition. For instance, we would commonly assume that increasing fixed, marginal, or transportation costs would increase consumer FOB prices, but this is not always the case under Löschian (Capozza & Van Order 1978) or Hotelling–Smithies competition (Mével & Sexton 2010).⁶ Furthermore, the nature of competition depends on the price strategy employed in the market. For instance, Greenhut–Ohta competition under FOB pricing implies that the buyer would react to a price increase by a competitor by lowering its own FOB price, effectively ceding some market share. This option clearly disappears under UD pricing because prices at each location are equal. In fact, Gronberg & Meyer (1981) highlight that under UD pricing, the condition of fixed market areas requires higher cooperation (collusion) compared to FOB pricing, where the negatively sloped price schedules determine the market border at the location of the indifferent seller, i.e., where the local prices of both buyers are equal. This is illustrated in

⁶Fixed costs of production can affect consumer prices in the case of free entry. If fixed costs decrease, more firms enter the market, market areas decrease, and the (average) consumer price increases (Capozza & Van Order 1978).

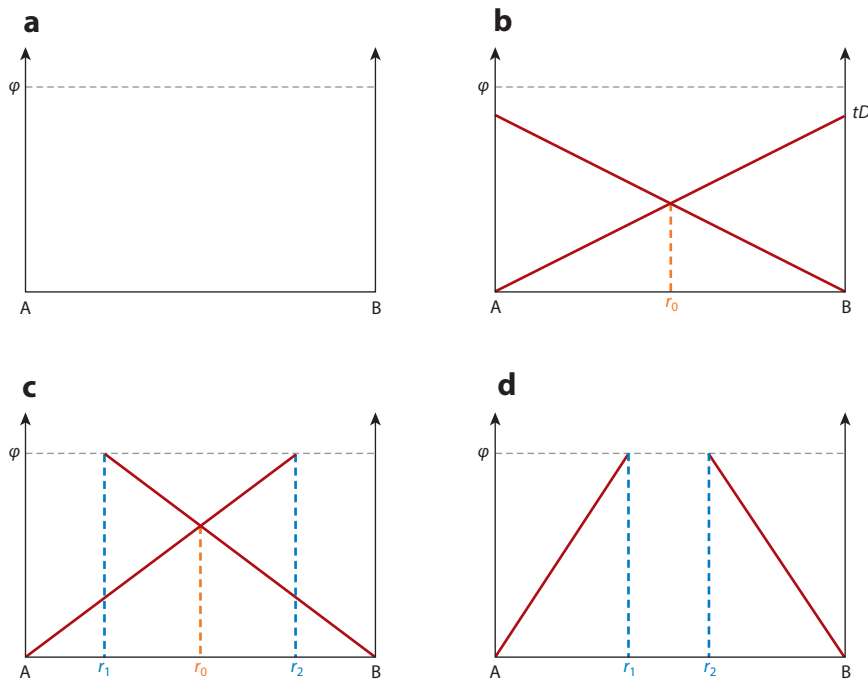


Figure 2

The intensity of competition depending on the level of transportation costs. Two otherwise identical buyers (A, B) are located at the end points of a line market of size D . In panel *a*, transportation costs are zero, which is reflected in a horizontal zero profit line (*dashed grey line*). Buyers engage in Bertrand price competition and set a price equal to the net output price φ and yield zero profits. If transportation costs are sufficiently low, as shown in panel *b*, buyer A is able to offer a positive price at the location of buyer B because transportation costs (*red line* starting at A) do not consume the full net output price. Any price higher than the difference $\varphi - tD$ will earn negative local profits for buyer A at the location of B. The same can be mirrored for buyer B. Hence, potential market areas fully overlap and any location between A and B can be served by either buyer, but buyer A (B) has a cost advantage over buyer B (A) at all locations left (right) of r_0 . Panel *c* depicts the case of moderate transportation costs where neither buyer can profitably purchase at the competitor's location and locations close to it. Instead, the marginal location at which buyer A (B) would purchase is given by r_2 (r_1), where transportation costs are equal to the net output price ($tr = \varphi$). Because only locations between r_1 and r_2 are exposed to competition while A (B) exhibits a local monopsonistic position left of r_1 (right of r_2), potential market areas partially overlap. When transportation costs are (sufficiently) high, as in panel *d*, market areas do not overlap and both buyers can operate as monopsonists. In this case, neither buyer can profitably set a positive price at locations between r_1 and r_2 , sellers in this region have no buyer, and only subsistence production can occur.

Figure 3.⁷ Suppose that both buyers use the same FOB pricing regime with mill price m_{FOB} . In this case, the market is shared equally with A (B) purchasing left (right) of r_0 .

Assuming that both buyers set the UD price m_{UD} , sellers right of r_2 can only sell to B because A cannot profitably purchase at any point beyond r_2 . The same is true for B left of r_1 . In the contested market region between r_1 and r_2 , sellers are indifferent between A and B because both offer the same price. To determine market allocation, additional assumptions in terms of market

⁷Note that the figure does not necessarily display equilibrium solutions but rather possible market allocations for illustrative purposes.

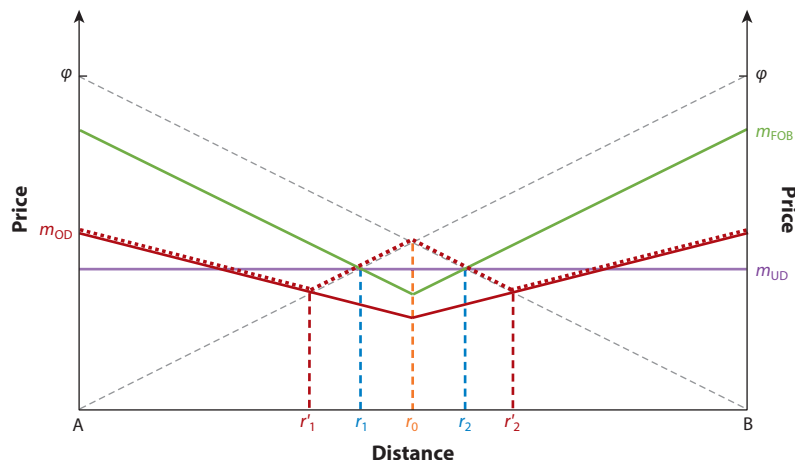


Figure 3

Potential price schedules and market allocation. Buyers A and B are spatially separated by some distance. Both buyers use the same free-on-board (FOB; *green line*), uniform delivered (UD; *purple line*), optimal discriminatory (OD; *solid red line*), or unrestricted spatially discriminatory (*dotted red line*) pricing strategy with the corresponding mill price m . The zero profit lines (*dasbed grey lines*) decrease with the distance to the buyer's location due to transportation costs. φ is the net output price, and r indicates a location where a given price schedule intersects with either the buyer's own or the competitor's zero profit line, which determines either the border between the market areas of both buyers (in the case of r_0) or the border between a monopsonistic region and a region where both buyers can profitably operate (e.g., r_1 and r'_1).

sharing rules are required (Gronberg & Meyer 1981, Iozzi 2004). For instance, sellers might select randomly among buyers if prices are equal (random tie-breaking rule or price-matching competition) or sellers may prefer the nearest buyer (efficient tie-breaking rule or Löschian competition). Market areas will overlap in the first case, but not in the second.

Under noncooperative (Hotelling–Smithies) competition, a price equilibrium in pure strategies does not exist with UD pricing (Beckmann 1973) because either buyer would have an incentive to overbid the competitor to capture most or all of the market (e.g., increasing the price marginally above m_{UD}) or set a monopsonistic low price in the residual market area (Zhang & Sexton 2001) (e.g., left of r_1 if B uses m_{UD}).

OD pricing, in turn, is inconsistent with Hotelling–Smithies and Greenhut–Ohta competition, as the very definition of this price strategy is that buyers set optimal prices at each location. However, OD pricing can be employed under monopsonistic competition in which the free entry of buyers in the presence of fixed costs, e.g., to set up a facility, drives profits to zero (Norman 1981). The OD pricing schedule is also depicted in **Figure 3** (decreasing from m_{OD} until r_0 and then increasing from r_0 to the location of B), where A's (B's) market area is the region left (right) of r_0 .

If buyers can set prices at each location individually, they employ unrestricted spatial price discrimination. As shown in **Figure 3**, buyer A will use OD pricing up to r'_1 , i.e., the location where the OD pricing schedule intersects with the competitor's zero profit line. From r'_1 to the market center r_0 , buyer A will price at (or marginally above) the local net marginal revenue, i.e., the zero profit line, of the competitor. This secures these locations for A because B has no profitable option to conquer A at any location left of r_0 . In fact, this is the only equilibrium outcome of the noncooperative game if firms do not commit to or are not restricted to use linear pricing (Lederer & Hurter 1986, Thisse & Vives 1988).

Unrestricted spatial price discrimination necessitates rich information and yields a rather complex spatial pricing schedule. Based on survey data concerning the selling side of the market,

Greenhut (1981) reports that over half of the polled firms in the United States, West Germany, and Japan use either FOB or UD pricing. Because of this and because linear pricing is easy to administer (Espinosa 1992), some studies investigate the endogenous choice of linear price policies. Kats & Thisse (1989) use a two-stage game where firms first decide whether to use FOB or UD pricing and thereafter compete in prices given the choice in the first stage of the game. Espinosa (1992) extends this setting by modeling a dynamic game with an infinite time horizon and allowing for a general linear price distance function. In either case, spatial price discrimination in terms of UD pricing yields higher profits compared to FOB pricing. An important aspect of the dynamic setting studied by Espinosa (1992) is that collusion can be facilitated under spatial price competition. A couple of contributions are devoted to this issue and question, for example, the sustainability of cartel behavior depending on the underlying spatial game (Häckner 1996, Miklos-Thal 2008).

The previous discussion highlights the diversity of spatial competition models in terms of alternative price strategies and competition settings. It also highlights that most of the literature considers price as the strategic variable. One notable exception is Hobbs (1986), who provides a comparison between FOB and UD pricing under Hotelling–Smithies and spatial Cournot competition. He shows that UD pricing yields higher welfare compared to FOB pricing under price competition, while the opposite is true under quantity competition.

2.3. Location Models of Spatial Competition

Starting with the canonical Main Street framework by Hotelling (1929), a central question of location models concerns the degree of spatial differentiation, i.e., whether firms will choose to locate at the same or different locations.⁸ Hotelling (1929) concludes that firms operating in a finite line market under FOB pricing and linear transportation costs would agglomerate at the market center. This result is known as Hotelling’s principle of minimum differentiation. Eaton & Lipsey (1975) point out that this finding only holds under specific conditions. d’Aspremont et al. (1979) show that there is no price equilibrium in the original Hotelling model and that the principle of minimum differentiation is therefore erroneous. To restore equilibrium, d’Aspremont et al. modify the model by assuming strictly convex transportation costs, which yields maximum differentiation in equilibrium; i.e., each buyer would locate at one end point of the line market. Introducing a second dimension of product heterogeneity besides space, De Palma et al. (1985) show that the principle of minimum differentiation can be restored.⁹

Neither maximum nor minimum differentiation emerges if (normalized) transportation costs are sufficiently high (Hinloopen & van Marrewijk 1999) or if FOB pricing is replaced by unrestricted spatial price discrimination (Lederer & Hurter 1986). Instead, buyers locate opposite to each other at some distance from the market center and market borders (e.g., at the market’s quartiles). This establishes a region of intense competition between the locations of buyers and a region that is shielded from spatial competition between a buyer’s location and the market border. The latter region is commonly termed the hinterland. In a location game of more than two buyers, the existence of hinterlands can create benefits (Economides 1993, Brenner 2005) such that buyers there can enforce lower prices or gain a larger market share compared to buyers located in the interior of the line market who face competition in both directions.

⁸Biscaia & Mota (2013) provide a detailed review of location models in the tradition of Hotelling.

⁹In fact, in two-dimensional space or under multidimensional product differentiation, minimum differentiation holds for all but one dimension (Tabuchi 1994, Irmen & Thisse 1998).

Because these border effects drive results in the line market, a number of studies use the circular model proposed by Salop (1979) to impose symmetry. Initially, the specification of equidistant locations around a circle was assumed by Salop (1979) but was later confirmed as an equilibrium solution of the location game (Kats 1995). Subsequent extensions include an arbitrary large number of heterogeneous competitors that differ in productivity (Syverson 2004) and, additionally, the option for spatial price discrimination (Vogel 2011). In either case, more efficient firms feature higher market shares (i.e., the distance to the next competitor is larger), and increasing competition also increases average productivity.

Given that quantity is the strategic variable, a number of studies investigate location decisions under spatial Cournot competition. In a linear market, Cournot competition yields minimum differentiation and different equilibrium price levels compared to price competition (Hamilton et al. 1989, Anderson & Neven 1991). In a circular market setting, Pal (1998) shows that the location equilibrium does not differ between spatial price or quantity competition, but Gupta et al. (2004) demonstrate that this result is just a special case and, in fact, a wide variety of location equilibria exists.

3. APPLICATIONS TO AGRICULTURAL MARKETS

As the previous section shows, space allows for a multitude of alternative price and competition strategies. This variety is also reflected in the heterogeneity of applications in agricultural markets. While we aim to provide a comprehensive overview of spatial competition analysis within agricultural economics in this section, we do not aspire to completeness. With the focus on approaches introduced in the previous section, we also briefly refer to related concepts if relevant (e.g., see sidebar titled Related Literature). **Supplemental Appendix B** provides a selective overview of the reviewed contributions.

Following the structure of the previous section, we first present work that investigates spatial pricing options theoretically, including the endogenous choice of the price policy, and/or empirically, i.e., studies that aim to reveal the price schedule of buyers. In Section 3.2, we then discuss contributions that focus on the nature of spatial competition and that make ad hoc assumptions concerning the underlying price regime. Because of its relevance, Section 3.3 is devoted to spatial competition in mixed markets, i.e., where one (or several) buyers are organized as cooperatives. Finally, we discuss location-related work in Section 3.4.

Supplemental Material >

RELATED LITERATURE

Agricultural economics research has contributed important concepts and results to regional science and general economics. One example is the famous Thünen Rings: zones of different land use activities due to land rent functions that decrease with the distance to a central market because of transportation costs (von Thünen 1826). The Thünen model is still a cornerstone of a wide range of agricultural economics applications, e.g., following the seminal approach by Chomitz & Gray (1996). Subsequently, spatial dependencies and spatial heterogeneity became more explicitly researched, and spatial econometric approaches (Anselin 1988) gained increasing traction beyond land use change (recent examples include those of Baldoni & Esposti 2021, Vroege et al. 2020). Another important spatial framework of agricultural economists over the last six decades belongs to the domain of spatial equilibrium modeling (Fackler & Goodwin 2001) in which discrete points of supply and demand are separated by geographical distance. Based on the principles that if trade occurs between two locations, prices at these locations will differ by transportation costs (Takayama & Judge 1964) and that a price change in one location will be passed on to the other location (Ravallion 1986), these point-location models have been extensively used to test for market integration.

3.1. Spatial Pricing in Agricultural Markets

Löfgren (1986) provides a comprehensive discussion of the spatial monopsony comparing FOB, OD, and UD pricing. One important result is that the welfare implications, similar to the monopoly case, crucially depend on the shape of the supply functions. For instance, if local supply curves are linear and the procurement area can be freely determined, input demand by the monopsony is equal under FOB and UD pricing but is lower compared to OD pricing. Whereas the monopolist's profits are maximized by OD pricing, supplier surplus is highest under FOB pricing. The ranking of the price policies with respect to social welfare (i.e., the sum of profit and supplier surplus), however, depends on the distribution of suppliers over the market area.

In investigating the buyer's choice between FOB and UD pricing, Zhang & Sexton (2001) deviate from previous work in consumer markets by not only focusing on an input market, but, more importantly, also allowing the supply functions of sellers to be price elastic. The study shows that FOB pricing emerges as an equilibrium strategy of the duopsony if competition is fierce (i.e., normalized transportation costs are low), whereas UD pricing is the equilibrium strategy under high transportation costs. If normalized transportation costs are moderate, a mixed FOB-UD pricing equilibrium is derived. Graubner et al. (2011a) extend this analysis toward a linear price distance function defined in Equation 1. This flexibility of potential price policies has important consequences because price discrimination, either in the form of UD pricing or the partial absorption of transportation costs ($0 < \alpha < 1$), emerges as an equilibrium strategy despite price-elastic supply responses by sellers. These results theoretically confirm the importance of price discrimination in agricultural markets, which is supported by empirical evidence (see Section 3.2).

In a developing-economy context, transportation costs and distances to potential markets are especially important for farm income (Omamo 1998, Fafchamps & Hill 2005). Moreover, sellers often have to pay transportation costs. Using an FOB pricing framework, Mérel et al. (2009) investigate the effect of infrastructure investments in developing countries on transportation costs, competition, product price, and farmers' income. The study shows that, e.g., the initial level of spatial competition influences the profitability of such investments. In a related setting, Courtois & Subervie (2015) link the remoteness of farms and transportation costs to information deficits that will be exploited by traders purchasing from farmers who do not opt to deliver products themselves to the nearest market. The study shows that improving market transparency improves farm income.

Based on spatial price theory, Löfgren (1985) derives hypotheses about the effect of changing transportation rates on mill prices and tests these for the Swedish pulpwood market. The study finds empirical evidence of limited price discrimination, which seems to be consistent with the monopsonistic market structure at hand. Bailey et al. (1995) use data of cattle video auctions to determine relevant market areas and test for price effects of buyer concentration. They show that cattle buyers absorb transportation costs, i.e., engage in spatial price discrimination, such that prices at distant locations are higher than expected while those at proximate locations are lower than expected due to the estimated transportation costs. The study also emphasizes that market areas overlap substantially.

A couple of studies investigate the price effects in (corn) input markets for biofuel production. Whereas Gallagher et al. (2005) explicitly distinguish and identify FOB pricing and price discrimination (based on individually negotiated local prices at the farm gate), other studies assume FOB pricing (McNew & Griffith 2005, Sesmero et al. 2015, Motamed et al. 2016) and test for price differentials depending on the distance to ethanol plants. The results are mixed, indicating that buyers employ different spatial price strategies.

In their investigation of the corn procurement market in Indiana, Jung et al. (2020) take advantage of recent developments to estimate structural models that can account for spatial differentiation and price discrimination (see Miller & Osborne 2014). The authors do not find evidence of spatial price discrimination, which supports the FOB pricing assumption of prior work. The utilized empirical approach appears to be especially promising because it allows the recovery of firm-specific structural parameter estimates, including transportation costs, based on (regional) aggregated data.

3.2. The Nature of Spatial Competition

One prominent contribution is a study by Faminow & Benson (1990), which identifies basing point pricing in the Canadian hog market over a period of time. More importantly, however, the study highlights the significant consequences of accounting for spatial competition in the analysis and interpretation of market integration. Spatially dispersed buyers and sellers and the presence of intraregional transportation costs allow farms or firms to differentiate between market partners based on their location. This not only contradicts assumptions commonly used in spatial equilibrium models but can also reverse the interpretation of derived results. For example, estimating highly correlated movements of prices in two geographically separated markets can be interpreted as a high level of market integration, strong competition, and market efficiency. In contrast, Faminow & Benson (1990) show that this result can also be caused by collusive basing point pricing, which in fact features market inefficiency.

Benson et al. (1992) further examine this example. The authors derive hypotheses based on three specific spatial competition scenarios: noncooperative FOB pricing, noncooperative spatial price discrimination, and cooperative (organized) spatial price discrimination in terms of price leadership or basing point pricing. The study points out that price dynamics will be very different under these different settings. For instance, under noncooperative (FOB price) competition, potential price adjustments can be expected to be lagged and will spread over space, while collusive pricing might cause almost instantaneous price responses. In contrast, noncooperative price discrimination may cause (seemingly) isolated markets where prices do not respond. Based on the theoretical considerations and the empirical results, Benson et al. conclude that there are limited organized (discriminatory) pricing and price leadership in terms of a basing point price system.

Based on a UD pricing model, Durham & Sexton (1992) derive the hypothesis that firms (collectively) have the potential to exercise local market power. They test this hypothesis for California's tomato processing market by estimating residual supplies for different regions (groups of processors). They find that the market power potential is limited because the price flexibility (elasticity) of the residual supply is rather low (high). In a subsequent study, Durham et al. (1996) focus on the feature of UD pricing that allows for market overlap and thus transportation cost inefficiency because of cross-hauling. The study explicitly models the profit maximizing allocation of tomatoes in the main tomato producing counties of California. Based on a comparison of data from the actual allocation, they conclude that inefficient product allocation only amounts to modest losses, despite the industry using UD pricing. In fact, Durham et al. (1996) attribute this result to fierce spatial price competition among processors.

Graubner (2018) also uses a UD pricing model to show that farm direct payments have a minor impact (incidence) on land (rental) prices under alternative scenarios of spatial price competition. This result is in line with empirical findings, which frequently report levels of subsidy incidence that are lower than expected by nonspatial theoretical models. Graubner et al. (2021) apply a spatial price leadership model to Ukrainian land markets with agroholdings, i.e., large, horizontally and/or vertically integrated farm enterprises. Based on theoretical and empirical findings,

the authors conclude that the pricing behavior and relative farm sizes of these agroholdings are consistent with spatial price leadership under UD pricing.

Alvarez et al. (2000) and Graubner et al. (2011b) investigate UD pricing in raw milk markets in Spain and Germany, respectively. Alvarez et al. (2000) allow for hinterlands in their spatial model, which yields nonmonotonic farm-wholesale price relations, whereas Graubner et al. (2011b) consider milk marketing cooperatives, which cause spatial competition over the whole region because the milk processor cannot select suppliers only from profitable locations. Empirical results from both studies confirm price-matching competition.

3.3. Mixed Markets

In the presence of buyer power, a common strategy of farmers is to organize themselves into cooperatives (coops; see sidebar titled Agricultural Cooperatives) and compete with investor-owned firms (IOFs) in a mixed market, as opposed to the pure (IOF) markets discussed thus far.¹⁰ In their excellent review on cooperative theory, Fulton & Giannakas (2013) provide a framework to study horizontal and vertical product differentiation in mixed markets. Because spatial competition represents horizontal product differentiation, studies in this section contribute an important building block to cooperative theory. For instance, Sexton (1990) was the first to investigate the yardstick of competition hypothesis (e.g., Cotterill 1987) in a spatial FOB pricing model. He determines the relative farm-processor price spread of an IOF under Löschian, Hotelling–Smithies, and Cournot competition in a pure IOF market of processors and compares these results to a mixed market. In addition, he derives results under different coop objective functions and under an open and closed membership policy. Under certain conditions, Sexton (1990) confirms a competitive yardstick effect of the coop, as the IOF's relative farm-processor price spread is lower in the mixed market compared to the pure IOF market. He also identifies conducive conditions for this effect (including an open instead of a closed membership policy). After Sexton (1990), a number of studies investigated mixed markets in nonspatial settings (e.g., Tennbakk 1995, Albæk & Schultz 1998, Liang & Hendrikse 2016), but in general, the literature on mixed markets focuses on either the existence of a coop-IOF market equilibrium and its conditions or the competitive yardstick effect of coops (see Azzam & Andersson 2008).

Yardstick of competition hypothesis:

cooperatives may improve competition by mitigating the oligopsonistic power of investor-owned firms

AGRICULTURAL COOPERATIVES

Cooperatives (coops) play an important role in agricultural markets worldwide (Grashuis & Su 2019). In general, coops are businesses owned and controlled by the users of their services that distribute benefits based on use or patronage (Barton 1989, cited by Ortman & King 2007). Though different forms of coops exist, agricultural coops either provide production factors to their members (backward integration) or, e.g., process and sell their members' production (forward integration) (see Cotterill 1987). By adhering to coop principles (LeVay 1983, Cotterill 1987), coops differ from investor-owned firms (IOFs), particularly regarding their objective function and principle of open membership. However, property rights problems (see, e.g., Cook 1995) may be addressed by closed-membership policies (see Fulton & Giannakas 2013). Unlike profit-maximizing IOFs, coops might aim, e.g., to maximize member welfare or to maximize the (raw product) price subject to a break-even constraint (e.g., Staatz 1987, Sexton et al. 1989). Coops can be an option for farmers to countervail market power exercised by downstream/upstream firms and may induce a competition-improving effect on IOF competitors (Sexton 1990, Sexton & Lavoie 2001).

¹⁰Fousekis (2011b) and Tribl (2012) are examples of theoretical studies on spatial competition in a pure coop market.

For the case of FOB pricing, Rogers & Sexton (1994) conduct numerical simulations of the relative farm-retail price spreads of IOFs to compare different scenarios of oligopsonistic competition between processors. The authors show that a coop has a significant competitive impact if it replaces a Löschian IOF and if transportation costs are relatively low. Fousekis (2011a) replaces one player in the price policy game studied by Zhang & Sexton (2001) with a coop, which almost reverses their results: UD (FOB) pricing emerges as the equilibrium strategy for both the IOF and the coop if transportation costs are low (high), but UD pricing is also an equilibrium strategy for the IOF for any level of normalized transportation costs. Additionally, the author finds a (positive) competitive yardstick effect of the coop for most parameter and price policy settings. In a theoretical framework, Tribl (2012) analyzes a mixed market under UD pricing and an open membership coop, e.g., by assuming no rationing by the coop and applying the efficient tie-breaking rule similar to Iozzi (2004), yielding nonoverlapping market areas between processors. Depending on the IOF's information about the pricing schedule offered by the coop to farmers, Tribl (2012) shows the following results: The competitive yardstick effect (as the difference between the UD price in the mixed market and in the pure IOF market) is highest if the coop replaces a Löschian IOF competitor (rather than an IOF under price matching) and if the IOF has no information about the coop's pricing schedule and takes the UD price as given. This competitive yardstick effect can be confirmed if normalized transportation costs are relatively low. These results indicate that farmers need not necessarily benefit from a high transparency of raw product prices paid by processors (Tribl et al. 2017). Other theoretical studies on spatial mixed markets include one by Fousekis (2015) on location choices and another by Fousekis (2016) on cooperative spatial entry deterrence.

Empirical applications on spatial mixed markets are rare. Wann & Sexton (1992) analyze the California pear processing industry and empirically test for the competitive yardstick effect. Their finding that growth in coops' market position did not increase competition among processors is in line with theoretical results of Sexton (1990) concerning closed membership coops. Tribl et al. (2017) investigate the raw milk market in Southern Germany. They estimate a spatial error model and a spatial Durbin model.¹¹ The results show that the price paid by a processor to farmers is influenced by the price paid by neighboring milk processors and that the presence of coops in the market increases the average price. However, the results indicate that coops need a certain size (in terms of quantity processed) to have a positive price impact. Grashuis (2020) provides empirical evidence of the competitive yardstick effect of (grain handling) coops on nearby corporations in the Iowa corn market by estimating an ordinary least squares model and a spatial Durbin model. Regarding spatial pricing strategies, Gallagher et al. (2005) estimate price-distance functions for corn in the vicinity of ethanol plants in Iowa. According to their results, most coops have no statistically significant effect on nearby prices.

3.4. Location Decisions and Related Issues

The investigation of location decisions in an agricultural context has a long tradition dating back to the work of von Thünen (1826). A considerable body of work has been devoted to optimal locations with respect to a transportation cost minimization problem of one or a number of processing facilities relative to input and output markets (Lucas & Chhajer 2004). Hsu (1997) investigates a von Thünen model with a central city (where demand and labor supply are

¹¹A spatial error model assumes spatial dependence in the disturbance term, whereas a spatial Durbin model explicitly models spatial dependence of the dependent variable and some other covariates (LeSage & Pace 2009).

concentrated) and spatially distributed suppliers of an agricultural raw product. The optimal location of the buyer, who processes the agricultural product and sells in the city, generally depends on input and output market conditions; however, in contrast to nonagricultural manufacturing, the optimal location does not necessarily involve minimizing total transportation costs. Differences between agribusiness and nonagricultural manufacturing are obviously not only of theoretical nature as survey data show. Infrastructure and access to agricultural inputs are relatively more important as determinants for location or relocation decisions among agribusiness firms (Lopez & Henderson 1989, Leistritz 1992).

One aspect that is typically not tackled in this literature is strategic interactions in determining optimal locations. For example, a buyer's access to inputs in a region may be hampered by nearby competitors (Lambert et al. 2008). Although the literature presented in Section 2.3 provides the theoretical underpinning for this, there is also some anecdotal and empirical support. For instance, food manufacturers can exploit cost-saving potentials in areas with a high input and demand density, but incentives to locate in such areas eventually increase the intensity of spatial competition, which may also cause higher input prices in these regions (Cohen & Paul 2005).

With the expansion of biofuel production over the last few decades, location decisions of ethanol plants became a contemporary object of research, especially in the United States. Again, the proximity to input (grain) production and the location of competitors are important determinants behind the decision of where to locate a plant. Entry into a local market is less likely if there is already a competing plant, but this effect decreases with distance (Sarmiento et al. 2012). Sesmero et al. (2015) compare competition for biofuel inputs under FOB pricing and alternative spatial market structures. The authors show that entry, which is assumed to be ad hoc at the central location while incumbent (monopsonistic) plants locate at the region's periphery, increases (local) input prices and decreases buyers' profits. They illustrate the quantitative effects by an empirical example of biomass production in Indiana. Recently, Wang et al. (2020) use an FOB pricing model and construct a competition intensity index that captures not only the spatial (oligopsonistic) structure of the market (the number of and distance between competitors) but also production capacities. The authors show that the expansion of ethanol production induces corn production intensification. This effect, if caused by entry relative to production expansion of incumbent plants, is strongest in regions of higher spatial competition for corn.

Further examples of research that emphasize the importance of spatial competition investigate it rather indirectly through neighborhood effects using spatial econometric methods. Roe et al. (2002) argue that intense spatial competition of packing plants for hogs will positively affect a farmer's choice to establish or intensify hog production. Sarmiento & Wilson (2005) highlight that technology adoption by grain handlers at a given location is driven by competitors' decisions to adopt and that the positive effect on the adoption probability depends on distance. Storm et al. (2015) and Saint-Cyr et al. (2019) show that farm exit decisions and farm survival depend on the farm size and sum of subsidies received by neighboring farms.

4. KNOWLEDGE GAPS, PROMISING APPROACHES, AND CHALLENGES

It is well established that the spatial dimension is a fundamental economic characteristic of agricultural markets. However, its potential implications in regard to imperfect competition and market power have attracted less attention and, therefore, spatially imperfect competition appears to be underexamined in the agricultural economics literature. One reason for this neglect results from issues concerning the empirical validation of the theoretical results of spatial competition. Krugman (1998, p. 172) states: "The new industrial organization has been notoriously better at creating interesting models than at generating empirical predictions [...]." In fact, spatial

competition models are often kept simple (e.g., assuming perfectly inelastic or unity supply/demand elasticity, fixed proportion technology, linear transportation costs, two competitors, one dimensional space) to remain solvable, whereas empirical verification/falsification of theoretically derived hypotheses has to consider the complexity of reality. This challenge is certainly not unique to spatial competition models but is particularly distinctive for the literature in this field of study. Moreover, the problem is reinforced by data availability because data often do not feature sufficiently low spatial resolution and are often not publicly available. For example, the terms of a contract (e.g., price, quantity, quality, shipping fees) are typically determined in private negotiations between buyers and sellers.

So far, most of the existing contributions in this literature rely on estimating reduced form equations of the spatial competition game, rather than modeling interactions between buyers. For example, these studies do not directly estimate price interactions between competitors, but rather explain prices by some measure of distance between firms or by local firm density (e.g., Alvarez et al. 2000, Graubner et al. 2011b). A recent exception is the study by Grashuis (2020), who applies a spatial Durbin model in a rather ad hoc way. Although such a spatial lag model appears to be a natural representation of, e.g., price competition between buyers, it suffers from the problem that the weighting matrix, i.e., the form of spatial dependence, has to be chosen a priori and subjectively by the researcher. However, the form of spatial dependence might be exactly what we are attempting to deduce. The challenge therefore persists to better align theoretical and empirical models, such as in terms of structural estimations.

In their seminal work on the wholesale gasoline market in the United States, Pinkse et al. (2002) develop a semiparametric approach in the context of differentiated products, which also allows for the estimation of the weighting matrix, i.e., the nature of the spatial dependence of prices. Moreover, they provide a theoretical underpinning that firms' reaction (best response) functions in pricing competition can be represented by a spatial lag model. Pinkse & Slade (2004) follow a similar approach to investigate competition among suppliers of a differentiated product (beer), including the estimation of firms' demand curves. In general, there is a rich literature estimating demand functions for differentiated products and deriving firms' price reaction functions and/or measures of market power (e.g., price-cost margin) based on the estimated demand parameters (see Berry et al. 1995, Nevo 2001, Houde 2012). Although many empirical applications along this line exist, as well as for the food supply chain (Bonanno et al. 2018), applications to oligopsonistic markets, in general, and agricultural markets, in particular, in the spirit of Pinkse & Slade (2004) are lacking.

There is another way to investigate how prices of spatially dispersed buyers are related. Obviously, this task is not very different from what is done in the rich literature on spatial market integration and efficiency (Ravallion 1986, Fackler & Goodwin 2001). However, as Faminow & Benson (1990) point out, empirical studies on market integration models are based on different assumptions, which can lead to a different interpretation of results and thus conclusions. Spatial market integration studies are based on point-location models. Economic activities are seen as a network of nodes connected by links. In point-location models, the nodes are markets, and the links reflect the distance and therefore the transportation costs between markets (Fackler & Goodwin 2001). To put it differently, there are different markets where buyers and sellers are concentrated in one specific point. Distribution within a market is ignored. However, spatial competition models are agents-on-links models with individual agents producing (consuming) along the links. Nevertheless, following Faminow & Benson (1990) and Sexton et al. (1991), the same time series methods commonly used in market integration studies (e.g., tests on the order of integration and cointegration, error correction models, causality tests, and impulse response functions) could be applied to test for different price strategies and conjectures in a market based on hypotheses

derived in spatial competition models. To the best of our knowledge, however, this has not yet been undertaken.

Another issue is the high variability of spatial competition models with respect to the underlying assumptions and the implied plurality of theoretical results. As discussed in the previous sections, characteristics explicitly related to the spatial dimension of the market (including the spatial price strategy, the representation of the region as a circle or line market with or without hinterland, and the transportation costs function) inherently affect theoretical predictions under spatial competition. For instance, knowledge of the spatial price strategies used by market participants is crucial. Beyond anecdotal evidence or instances identified by single contributions (Bailey et al. 1995, Gallagher et al. 2005), our knowledge is limited. For instance, a systematic analysis of the use of spatial price strategies for different agricultural markets and/or regions, e.g., comparable to that by Greenhut (1981), is not available. This certainly represents a field for future research.

In addition, our knowledge of the welfare implications of different price and competition strategies (beyond those of a monopoly/monopsony) is rather limited. One reason is that the introduction of space into competition models most often yields severe analytical difficulties and requires, for the sake of analytical tractability, restrictive assumptions regarding other important features of the market. While the task is indeed to identify and apply a spatial model that adequately represents the market at hand, theoretical and/or empirical investigations will often be limited by the issues discussed above. In this case, alternative approaches, such as simulation techniques, are required (Kuenne 1992, Irwin et al. 2011).

Fostered by the tremendous progress in computing power, economists have become increasingly interested in computationally intensive methods over the last three decades. Judd (1994) promotes the complementary nature and potential of deductive theory and computational approaches to derive and test hypotheses. Developments in agent-based modeling and artificial intelligence are especially noteworthy. Agent-based modeling explicitly allows one to model economic interaction over geographical space (Tsfatsion 2006), whereas artificial intelligence methods can handle (decision) problems of great complexity. Prominent applications of computational models within agricultural economics include those by Balmann (1997), Berger (2001), Happe et al. (2006), and Schreinemachers & Berger (2011). Although some of the simulation models consider transportation costs, e.g., to determine land prices (Happe et al. 2006), spatial competition issues are typically neglected. Some agent-based approaches, e.g., those used by van Leeuwen & Lijesen (2016) and Graubner et al. (2011a), however, go in this direction and show promising results. We believe that the potential of computational models to incorporate rich detail and handle complex decision problems permits fruitful insights into spatial competition problems.

5. CONCLUSIONS

Agricultural markets are often characterized by the spatial distribution of supply and demand of bulky and/or perishable goods, which causes costly transportation relative to the value of the good. Because of these features, agricultural and food markets are characterized by spatially imperfect competition of neighboring firms. For instance, only a few dairy processors or ethanol plants in a region compete for the local farm supply (raw milk, grain), consumers mostly have few options to buy food products at retail, and farms compete with neighbors for land to rent or buy.

Spatial economics provides the framework to analyze price determination, competition, location choice, and policy impacts under such settings. The assumption of perfectly competitive markets in agricultural economics neglects the crucial effect of space. For instance, most results derived under perfect competition do not hold in a spatial framework where local market power,

for example, facilitates spatial price discrimination. Moreover, the impacts of agricultural market policies (including subsidies as direct payments or price reporting systems) can be significantly different in the presence of spatial market power compared to nonspatial settings. Indeed, based on reviewed applications, we highlighted that spatial economics concepts can provide (additional) explanations for observed outcomes that are inconsistent with or not predicted by nonspatial models.

The introduction of space into competition models, however, leads to vastly increased complexity. Spatial economics typically focused on analytically tractable cases, which forced simple and frequently restrictive assumptions. The required simplicity has two effects. First, depending on alternative model specifications, it yields varying and sometimes even contradictory results. Second, it hampers empirical validation. We not only discussed these limitations and challenges but also highlighted promising concepts and approaches for future research.

By providing a unified framework of spatial competition in buyer markets and presenting the wide variety of prior applications within the domain of spatial competition models toward agricultural economics problems, we aimed to promote this approach and enhance the awareness of spatial issues, in general, and spatially imperfect competition, in particular, in the analysis of agricultural markets. We believe that prior work, especially over the last 30 years, offers valuable and interesting points of departure to continue the quest for the “exploration of space” and its effects on agricultural markets. To once again quote Krugman (1998, p. 173), “[agriculture] exists in and occupies space on the map; it is good that we have finally begun to acknowledge this in our models.”

DISCLOSURE STATEMENT

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