

Agenda

Advancing economics in business

Empirical analysis of buyer power

Assessing buyer power has long been essential in analysing supplier mergers. However, it is often qualitative and does not isolate the marginal effect of buyer power on final prices from the effect of other factors such as the size of the transaction and supplier heterogeneity. Dr Walter Beckert, Oxera Associate and Senior Lecturer at Birkbeck, University of London, discusses an empirical methodology to differentiate these effects, and hence estimate the impact of buyer power on final prices charged by suppliers

Since the early work of Galbraith (1952, 1954),¹ buyer power has been considered a key factor that can constrain upstream market power, in addition to constraints from competitors and any regulation. The notion of countervailing buyer power—i.e. buyer power that is sufficient to constrain upstream market power and therefore lead to lower wholesale prices—was developed theoretically in a dynamic setting by Snyder (1996).² This line of inquiry is now an integral part of most competition investigations involving business-to-business (B2B) dealings. A quintessential example is the relationship between supermarkets and their suppliers, which has been assessed in mergers and market investigations across Europe. Some recent cases involving supermarkets include *ABF/Dorset*, *Diageo/United Spirits* and *Barr/Britvic* investigated by the UK authorities; and *Arla Foods/Milk Link* investigated by the European Commission. Examples from other sectors are *EMI/Universal* and *Anglo American/Lafarge*.³

Whatever the sector, in most B2B relationships the pricing schemes have two main features:

1. complex non-linear pricing structures (for example, due to franchise fees, volume discounts and other incentive payments);
2. bilateral bargaining between the buyer and seller over the division of the available margin.

One of the primary difficulties in assessing buyer power using transaction prices is therefore isolating the impact of non-linear pricing (as well as other influencing factors) from the outcome of the bargaining.⁴

In this article I briefly set out an empirical methodology for analysing buyer power, given transaction prices across buyers and sellers over time and geographies. In doing so, I discuss the theoretical considerations arising from the

existing literature, followed by an illustration using data from the UK brick industry.

The conceptual framework

The conceptual framework for the empirical analysis considers buyer power in the context of non-linear pricing schemes, while incorporating bargaining over rents. It builds on a model of bargaining in bilateral oligopolies by Inderst and Wey (2003), employing the cooperative bargaining theoretic concepts of Stole and Zwiebel (1996) to characterise equilibrium bargaining payoffs.⁵ The theoretical literature highlights features of B2B settings that together determine the observed transaction prices in a market:

- in the presence of upstream market power, equilibrium prices are non-linear, and average prices typically decline with volumes purchased (Wilson, 1993);⁶
- enhanced outside options on the part of a specific supplier induce uniformly higher price schedules (implied by Inderst and Wey, 2003);
- in any specific buyer–supplier transaction, greater switching possibilities to alternative suppliers for a buyer lead to uniformly lower price schedules;
- in many B2B settings, suppliers may have capacity constraints, and large volume increases that lead to a binding constraint on the supplier may cause an increase in the price schedules. This in turn implies that, in the face of suppliers' capacity constraints, the larger size of a buyer may, in fact, diminish its buyer power.⁷

The conceptual framework therefore captures the impact that outside options have on outcomes from the bargaining process. These outside options are likely to be unobserved and constitute idiosyncratic supplier- and buyer-level

heterogeneity. Other factors, such as unobserved capacity constraints of suppliers and geographic locations of buyers and suppliers (which will influence transport costs and hence prices), also constitute supplier- and buyer-level heterogeneity. This insight is particularly pertinent to the B2B context, where traditional explanations for variations in bargaining outcomes, in terms of imperfect information, often seem implausible as the two parties are likely to be well informed about each other.⁸ In this regard, the analysis is similar to the empirical auction literature, which offers outside options as an explanation of dispersion in valuations,⁹ as well as to the empirical bargaining literature.¹⁰

The empirical approach I propose below captures these theoretical predictions and is easy to implement, and hence should be beneficial to applied competition analysis.¹¹ Existing work on empirical analysis of buyer power focuses on reduced-form analysis of prices and other explanatory factors, such as upstream market concentration and transaction volumes. For example, in the UK grocery market investigation, the Competition Commission conducted a fixed-effects regression of transaction prices on volumes and costs.¹²

However, it is critical to note that, in many B2B settings, the bargaining includes both prices and quantities (e.g. as part of framework agreements). As such, the transaction counterparties and transaction volume are potentially endogenous, in that the prices may affect the buyer's decision on which suppliers to consider and the volume to be purchased. The empirical application below using data on the UK brick industry takes this into account.

Analysing buyer power in the UK brick industry: an illustration

To briefly illustrate the proposed methodology, I use data from a UK merger inquiry in the brick manufacturing industry.¹³ While it is a unique dataset for academic research, it is the type of data that competition authorities typically have legal powers to request. The dataset comprises approximately 1.6m transactions between four brick manufacturers and their customers over the period 2001–06. A specific transaction record is identified by a unique combination of the date, manufacturer, buyer, brick type and delivery site; a contract is an aggregation of identical transactions.¹⁴ For each transaction, the data includes prices paid, quantities delivered, characteristics of the respective buyer and brick type, manufacturing plant, and some cost and logistic information. The rich variation in the data of actual (and potential) transactional relationships over time and across locations permits the identification of unobserved heterogeneity across buyers and manufacturers, and therefore the delineation of the impact of buyers' outside options on prices from the impact of transaction and business size.

The econometric model reflecting the pricing relationship is specified as follows:

$$p_{ikj} = f(q_{ikj}; s_{ik}, x_{ijk}) + \lambda_{jk} + v_{ij} + \epsilon_{ikj}$$

where p_{ikj} is the transaction price paid by buyer i to supplier j for bricks delivered to site k ; q_{ikj} is the corresponding quantity of the transaction; s_{ik} is the number of suppliers that buyer i used (in the past and elsewhere) with manufacturing plants in the area around delivery site k ; and x_{ijk} is the vector of product characteristics such as type of brick.

The central relationship of interest is how prices vary with transaction volumes and with the number of outside options the buyer has. The above model also recognises that prices are affected by buyer-specific, supplier-specific or buyer-supplier-pair-specific factors. This is represented by λ_{jk} (which reflects the shadow value of supplier j 's plant capacity in the area around site k); v_{ij} (which represents the effects of buyer i 's relative bargaining weight in negotiations with manufacturer j); and ϵ_{ikj} (which represents other idiosyncratic factors such as specific loyalty rebates).

As noted above, one key element of B2B bargaining is that the transaction quantity (q_{ikj}) and the number of options a buyer has (s_{ik}) may be endogenous. For example, loyalty rebates to a specific buyer lead to lower prices and therefore to a smaller number of suppliers that the buyer actively considers as part of the choice set. Similarly, a higher bargaining power of the buyer leads to lower prices, which would in turn induce higher quantities. Hence, an empirical analysis that treats quantities and the number of suppliers as exogenous may lead to biased estimates. In this case, it is necessary to use exogenous firm characteristics as instruments for the endogenous variables. In the case of the brick industry, I use as instruments three exogenous buyer-specific characteristics: the size of the buyer's downstream business, the structure of the logistics of delivery that a buyer uses with specific suppliers, and the type of the buyer's business model (in particular, whether it is a builder or a merchant). Given the characteristics of the industry, these are likely to correlate with quantities purchased and the number of suppliers used, but not with loyalty rebates and the buyer's relative bargaining strength.

Estimation results

Initial estimation results, which treat quantity and supplier numbers as exogenous, show statistically significant evidence of non-linear pricing. Specifically, prices for 1,000 bricks fall with transaction/contract volume. The results also provide some evidence of countervailing buyer power, in that prices fall when more suppliers are available within a 50km radius around the buyer's delivery site, although this impact is small. (The detailed regression results are set out in Table A2 of Beckert, 2013.)

However, as discussed above, in light of the potential endogeneity of transaction volume and the number of competing suppliers, there might be concern about bias in these estimates. For example, buyers with stronger bargaining power in a particular transaction would be expected to obtain lower prices, all else being equal. Such buyers can stick to fewer suppliers and hence may not feel a need to play off competitors. As a consequence,

this would imply that the coefficient estimate on the number of suppliers in the above regression—i.e. the buyer power effect—is likely to be underestimated. Similarly, buyers with stronger bargaining power are more valuable to the supplier because, all else being equal, they place larger orders and generally buy more. Therefore, one might expect the impact of transaction volume itself to be overestimated.

Regression analysis that takes account of this endogeneity confirms these biases.¹⁵ The results show that the degree of buyer power is actually significantly more pronounced than suggested by the initial regression estimates, while the non-linear pricing effect is less significant. Overall, the results suggest that buyers in this market enjoy buyer power arising from local competition in supply and their ability to switch, and that this leads to uniformly lower price schedules that exhibit a relatively moderate degree of non-linearity. The preferred estimates imply that the marginal effect of buyer power on price is in the order of 33–40%.

Conclusions

This analysis provides a comprehensive framework that derives testable predictions in an empirical analysis of buyer power that is useful for practitioners, such as competition economists in antitrust cases, and highlights the

importance of disentangling the effect of non-linear pricing and bargaining over rents in a B2B setting. The empirical methodology presented above emphasises the importance of controlling for endogeneity of volumes and competing supply chains, and for heterogeneity across buyers and suppliers.

This methodology is, in principle, adaptable to other industries of interest and implementable on the basis of transaction data, which is routinely requested by antitrust authorities at the outset of their inquiries. The primary challenge for using this type of analysis elsewhere will be to adapt the empirical approach to the respective industry details. (For example, while brick transaction quantities in the construction industry may plausibly be regarded as exogenous demand dictated by building designs, transaction quantities in grocery wholesaling between supermarkets and their suppliers are likely to be endogenous, derived from downstream retail demand.) While industry-specific detail may pose some barriers to immediate generalisations to other industries, it is hoped that this study can guide future work on the analysis of buyer power in the area of B2B bargaining, going beyond the present application.

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This article is based on Beckert, W. (2013), 'Empirical analysis of countervailing power in business-to-business bargaining', 1 July, which is available from the author on request.

¹ Galbraith, J.K. (1952), *American Capitalism. The Concept of Countervailing Power*, Boston: Houghton Mifflin. Galbraith, J.K. (1954), 'Countervailing Power', *The American Economic Review*, 44:2, Papers and Proceedings of the Sixth Annual Meeting of the American Economic Association, pp. 1–6.

² Snyder, C.M. (1996), 'A dynamic theory of countervailing power', *RAND Journal of Economics*, 27:4, pp. 747–69.

³ Competition & Markets Authority (2014), 'Anticipated acquisition by Associated British Foods plc of Dorset Cereals Limited', ME/6452/14, 28 October. Competition & Markets Authority (2014), 'The Competition and Markets Authority (CMA) has today approved Diageo's sale of the Whyte & Mackay business to Emperador', news story, 31 October. Competition Commission (2013), 'AG BARR p.l.c./Britvic plc: A report on the anticipated acquisition by AG BARR p.l.c. of Britvic plc by means of an all-share merger', 9 July. European Commission (2012), 'Mergers: Commission clears acquisition of UK dairy cooperative Milk Link by rival Arla, subject to conditions', press release, 28 September. European Commission (2012), 'Commission Decision of 21/09/2012 addressed to Universal Music Holdings Limited declaring a concentration to be compatible with the internal market and the EEA agreement (Case No COMP/M.6458 - Universal Music Group / EMI Music)', C(2012) 6459 final, 21 September. Competition Commission (2012), 'Anglo American PLC and Lafarge S.A.: A report on the anticipated construction materials joint venture between Anglo American PLC and Lafarge S.A.', 1 May. See also the European Commission's Decisions in *Rewe/Meinl*: European Commission (1999), 'Buyer power and its impact on competition in the food retail distribution sector of the European Union', GD IV, Brussels; and the UK Competition Commission's inquiry into UK grocery retailing: Competition Commission (2008), 'The supply of groceries in the UK market investigation', Final Report.

⁴ See also O'Brien, D.P. and Shaffer, G. (2005), 'Bargaining, Bundling, and Clout: The Portfolio Effects of Horizontal Mergers', *RAND Journal of Economics*, 36:3, pp. 573–95; Froeb, L., Tschantz, S. and Werden, G.J. (2006), 'Vertical Restraints and the Effects of Upstream Horizontal Mergers', Vanderbilt University Law School, Law and Economics Working Paper Nr. 06-13; Bonnet, C., Dubois, P. and Simioni, M. (2010), 'Inference on Vertical Contracts between Manufacturers and Retailers Allowing for Nonlinear Pricing and Resale Price Maintenance', *RAND Journal of Economics*, 41:1, pp. 139–164, who investigate manufacturer–retailer relationships involving non-linear pricing. They present empirical tests of two-part tariffs with and without retail price maintenance embedded in a structural model of competition in differentiated product markets using market-level data.

⁵ Inderst, R. and Wey, C. (2003), 'Bargaining, mergers, and the technology choice in bilaterally oligopolistic industries', *RAND Journal of Economics*, 34:1, pp. 1–19. Stole, L.A. and Zwiebel, J. (1996), 'Intra-Firm Bargaining under Non-Binding Contracts', *Review of Economics Studies*, 63:3, pp. 375–410.

⁶ Wilson, R.B. (1993), *Nonlinear Pricing*, Oxford University Press.

⁷ The relationship between Chinese steel mills and Australian and Brazilian iron ore miners is another topical example and a case in point; see *Financial Times* (2008), 'Freight expectations', 9 July. In spite of shipping costs per tonne (which are paid by the Chinese mills) from Brazil being twice those from Australia, Brazilian and Australian miners receive the same freight-on-board price. This is interpreted as a reflection of the superior negotiating power of Brazilian miners when bargaining with Chinese mills, as Chinese demand for iron ore is so great that it outstrips the supply capacity of the (cheaper) Australian miners. In other words, the Chinese mills lack an outside option, so the bargaining position with Brazil is weakened.

⁸ The traditional view relates to consumer retail prices and is articulated in Salop, S. and Stiglitz, J. (1977), 'Bargains and Ripoffs: A Model of Monopolistically Competitive Price Dispersion', *American Economic Review*, **44**:3, pp. 493–510; Salop, S. and Stiglitz, J. (1982), 'The Theory of Sales: A Simple Model of Equilibrium Price Dispersion with Identical Agents', *American Economic Review*, **72**:5, pp. 1121–30; Reinganum, J.F. (1979), 'A Simple Model of Equilibrium Price Dispersion', *Journal of Political Economy*, **87**:4, pp. 851–58; Burdett, K. and Judd, K.L. (1983), 'Equilibrium Price Dispersion', *Econometrica*, **51**:4, pp. 955–69; Carlson, J.A. and McAfee, R.P. (1983), 'Discrete Equilibrium Price Dispersion', *Journal of Political Economy*, **91**:3, pp. 480–84; Hallagan, W. and Joerding, W. (1985), 'Equilibrium Price Dispersion', *American Economic Review*, **75**:5, pp. 1191–4; Sorensen, A.T. (2000), 'Equilibrium Price Dispersion in Retail Markets for Prescription Drugs', *Journal of Political Economy*, **108**:4, pp. 833–50. See also the ensuing literature on equilibrium price dispersion.

⁹ See, for example, Bajari, P. (1997), 'The First Price Auction with Asymmetric Bidders: Theory and Applications', PhD dissertation, University of Minnesota.

¹⁰ See Draganska, M., Klapper, D. and Villas-Boas, S.B. (2010), 'A Larger Slice or a Larger Pie? An Empirical Investigation of Bargaining Power in the Distribution Channel', *Marketing Science*, **29**:1, pp. 57–74; Ho, K. (2009), 'Insurer-Provider Networks in the Medical Care Market', *American Economic Review*, **99**:1, pp. 393–430; Crawford, G.S. and Yurukoglu, A. (2011), 'The Welfare Effects of Bundling in Multi-Channel Television', CEPR Discussion Paper No. DP8370; and Grennan, M. (2009), 'Bargaining Ability as a Source of Competitive Advantage: Empirical Evidence from Medical Devices', NYU Working Paper.

¹¹ See Reiss, P.C. and Wolak, F. (2007), 'Structural Econometric Modeling: Rationales and Examples from Industrial Organization', in J.J. Heckman and E.E. Leamer (eds), *Handbook of Econometrics*, 6A, pp. 4277–415. It is notable that many of these considerations are included in the guidelines for assessment of buyer power by various competition authorities. For example, the UK Competition Commission Guidelines consider the relevant factors to include the buyer's ability to find alternative suppliers, ease of switching, the potential for backward integration or sponsoring entry, and the possibility of delisting a supplier.

¹² Competition Commission (2008), 'Final Report of the Grocery Market Investigation', Appendix 5.3.

¹³ The author is grateful to executives of the UK brick industry for granting permission to use their data. For the details of the merger, see Competition Commission (2007), 'Wienerberger Finance Service BV and Baggeridge Plc', Final Report.

¹⁴ The data contains approximately 600,000 contracts with complete information on all relevant variables. The econometric analysis is carried out using both the transaction- and contract-level data, with results that are robust to the choice of (dis-)aggregation.

¹⁵ Detailed results of the instrumental variable regressions IV(1)–(3) and the generalised-method-of-moments (GMM) estimators are included in Tables 3 and 4 of Beckert (2013). The instrumental variables were the number of competing suppliers by delivery and builder dummies, which were used as instruments for the buyer's exogenous organisational structure, and log transaction volume by buyer size. The Sargan–Hansen *J*-statistic is consistent with the validity of these overidentifying restrictions imposed by the instruments in the GMM estimations.