Simulated Horizontal Mergers in Vertically Related Markets

by

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Declaration

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Abstract

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A global trend of increasing retail concentration and a heightened concern about buyer power demand more sophisticated and flexible merger screening tools. Parametrisable merger simulation models that suitably account for the effects of bargaining competition may pose a solution. Thus, this dissertation examines the predicted effects of retail consolidation in a vertically related market using the merger simulation tool developed by Tschantz and Froeb (2019). With the flat logit nested demand function for differentiated products of Boshoff *et al.* (2020), the predicted retail merger effects of five different bargaining and non-bargaining models for a 1×2 industry are evaluated.

The primary contribution of this study is its unique application of Nash-in-Shapley (NiS) bargains in the study of retail consolidation. It is novel in so far it compares the inherent implications of Nash-in-Nash (NiN) and NiS bargains for the appraisal of retail mergers. Pre-merger competitive outcomes with NiN predetermine a finding of an anticompetitive merger. Contrarily, predictions with NiS as its starting point do not indicate that a merger would cause consumer harm, and therefore, would not be prohibited. In addition, the results suggest that retail consolidation consistently poses a viable option through which retailers can improve their profitability and bargaining positions. However, merger incentives are moderated by the competitiveness of an outside market.

Uittreksel

Gesimuleerde Horisontale Samesmeltings in Vertikaal Verwante Markte

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’n Globale tendens van toenemende konsentrasie in die kleinhandelsektor en ’n verhoogde kommer oor koopkrag verg noodsaaklikerwys meer gesofistikeerde en aanpasbare samesmelting siftingsmetodes. Parameteriseerbare modelle van gesimuleerde samesmeltings wat op ’n geskikte wyse van die effekte van bedinging en mededinging rekening hou, mag ’n oplossing bied. Dus, bestudeer hierdie proefskrif die effek van konsolidasie in ’n vertikaal verwante kleinhandelsektor met die gebruik van die samesmelting-simulasiemetode van Tschantz en Froeb (2019). Met die gebruik van die “flat logit nested” vraagfunksie vir gedifferensieerde produkte van Boshoff *et al.* (2020) word die uitkomste van vyf verskillende bedinging en nie-bedinging modelle vir ’n 1×2 industrie evalueer.

Die primêre bydra van hierdie studie is sy unieke toepassing van Nash-in-Shapley (NiS) bedinging in die bestudering van konsolidasie in die kleinhandelsektor. Die studie is oorspronklik aangesien hierdie aanwending ’n kritiese vergelyking van die inherente implikasies van Nash-in-Nash (NiN) en NiS bedinging vir die beoordeling van samesmeltings toelaat. Pre-samesmelting NiN-modelle genereer toestande van oordrewe mededinging en sal daarom ’n bevinding van ’n anti-mededingende samesmelting vooraf bepaal. In teenstelling, sal ’n kleinhandel-samesmelting met NiS as sy beginpunt nie skade aan die verbruiker daarstel nie en sal daarom nie verbied word nie. Boonop, suggereer hierdie resultate dat kleinhandel-samesmeltings deurgaans ’n lewensvatbare opsie waardeur kleinhandelaars hul winsgewendheid en bedingingsposisie kan verbeter, bied. Daarbenewens, word die aansporings om saam te smelt deur die mededingendheid van ’n buite-mark gemodereer.

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Chapter 1

Introduction

Merger control remains a key function of competition agencies, as mergers—for all their efficiency-enhancing effects—can give rise to greater market power that yields adverse unilateral effects. For this reason, competition authorities are required to undertake a difficult balancing act when screening proposed mergers.[1] In particular, the Competition Commission of South Africa faces the responsibility of ensuring that mergers promote competition and economic transformation, especially in light of the high concentration of key sectors in the economy.[2] In many jurisdictions, however, only a small portion of reviewed mergers are ever revised or prohibited (Bonnet and Schain, 2020).

To complicate matters, economists often study these welfare trade-offs in highly complex and dynamic market environments. Industries are typically characterised by multi-tiered relationships between firms that give rise to various externalities, as decisions at any one level of a value chain can affect the entire chain (Shapiro, 2021). Such relationships also feature different forms of bargaining behaviour, each with its own welfare implications. However, the classical theories of oligopoly, on which much of international merger policy is based, often do not even distinguish between mergers in different divisions of the supply chain (O'Brien and Shaffer, 2005, p. 574).

Agencies utilise a range of widely-approved analytical tools to depict price-, quantity-, and bidding competition, and the elimination of such competition following a merger between competitors (Werden and Froeb, 2011). However,

[1]During the period 2000 to 2010, the Federal Trade Commission (FTC) and the Department of Justice (DOJ) reviewed roughly 1700 prospective US mergers with the total value of mergers exceeding one trillion US dollars per annum (Farrell and Shapiro, 2010).

[2]The objectives and legal capacities of the Competition Commission of South Africa are enshrined in the Competition Amendment Act 18 of 2018.

there is little to no policy or scholarly consensus on the treatment of vertical relationships (Salop and Culley, 2016, p. 4). Analysts are also constrained by the often ambiguous predictions of different theoretical models, as well as the empirical assessments thereof (Slade, 2020). This especially true in the context of bargaining in the presence of externalities created by product market competition, or *bargaining competition* (Froeb *et al.*, 2019).

In sum, contending merger screening techniques may predict conflicting welfare outcomes of horizontal mergers in vertically related industries. Therefore, the naive application of a particular screening tool may bias the adjudication of proposed mergers. A rigorous evaluation—and, where feasible, improvement—of alternative horizontal merger screening tools is required. Persistent increases in the concentration of retail markets observed globally (Dobson, 2002; Clarke *et al.*, 2002) will demand the increasing use of sophisticated techniques to appraise retail mergers in vertically related markets. Such methods may also be required to shed light on the potential contending effects associated with countervailing buyer power.

Therefore, this study contributes to the rich history of merger simulation modelling initiated by Werden and Froeb (1994), and coincides with the increasing use of flexible and parametrisable structural models to answer difficult questions in the field of competition economics. Specifically, a well-established nested logit demand model from Boshoff *et al.* (2020) is used to examine the effects of retail consolidation in a vertically related market, in terms of consumer welfare, vertical contracting, and the division of surpluses within the industry. Data generated from the merger simulation application developed by Tschantz and Froeb (2019), permits a study of the predicted effects of a retail merger between duopolist downstream firms that are supplied by an upstream monopolist under two-part pricing. Moreover, merger simulations are performed using three different bargaining models, and two non-bargaining benchmark models.

Notably, this study is the first to apply the Nash-in-Shapley bargaining protocol of Froeb *et al.* (2019) in the examination of retail consolidation in such a setting. In addition, significant insights regarding the degree to which the fundamental assumptions of Nash-in-Nash and Nash-in-Shapley bargaining models differentially predetermine predicted retail merger effects are garnered. These objectives are informed by an extensive review of the relevant theoretical and empirical literature in Chapter 2. In this review, different horizontal merger screening approaches and tools are critically compared. A survey of bargaining competition, and the various types of supply contracting, in vertically related markets is also performed. Importantly, the review examines the nature, strengths, and weaknesses of one common and one novel bargaining protocol employed in merger simulations, namely Nash-in-Nash and Nash-in-Shapley bargaining. In addition, the relevant literature on retail mergers and the adjudication of buyer power is summarised.

The rest of this dissertation is organised as follows: Chapter 3 describes the methodological procedure and assumptions employed. In particular, it provides a comprehensive exposition of the industry structure, type of contracting, demand system, and calibrations used to generate merger simulation data for different bargaining models. Chapter 4 presents the predicted outcomes of the simulations for a range of different model configurations, and evaluates the respective models in terms of their consumer welfare implications, effects on vertical contracting, and division of industry surpluses. Finally, Chapter 5 concludes the study with a brief summary and contextualisation of its findings.

Chapter 2

Literature review

2.1 Horizontal merger screening

The elimination of competition, as a result of a horizontal merger, can give rise to unilateral effects, such as increases in prices, and reductions in output (Werden and Froeb, 2011, p. 156). In short, horizontal merger screening entails a consideration of a merger's effect on firms' behaviour. This appraisal is informed by analyses of mergers' impacts on market structure (or market shares and concentration levels), market power in relation to consumers and competitors, the strategic responses of consumers and competitors, and the ease of market entry and exit (Ezrachi and Thanassoulis, 2013, p.397).

Given the infeasibility of the *ex post* separation of a merged entity, merger control is performed prospectively. Thus, competition authorities face the predicament of evaluating proposed mergers using only pre-merger data (Slade, 2020, p. 493). As such, model-based merger screening techniques require sound and simplifying assumptions to emulate complex market structure, and to simulate pre- and post-merger firm and consumer behaviour using imperfect data.

One such approach is to appraise mergers solely in terms of the merged entity's pricing power. The direct analytical link between market power and pricing power is a feature of the "linear pricing approach" (Ezrachi and Thanassoulis, 2013, p. 396). According to this approach, a merged entity's incentive to increase retail prices is often assumed given a sufficient level of market power. Moreover, this assumption is often uniformly applied in appraisals of upstream and downstream mergers, with the added consideration of countervailing buyer power in certain cases. In sum, this approach dictates that when an upstream merger gives rise to market power—absent countervailing buyer power restricting such power—a presumption is made in favour of a subsequent retail price increase.[1]

Merger adjudicators are, however, required to reconcile two contending price forces, namely the upward pressure resulting from increased market concentration, and the downward pressure resulting from a merger's synergy benefits (Bonnet and Schain, 2020). At equilibrium, increases in concentration can also induce non-merging firms to increase their prices, thereby raising the aggregate price level. On the other hand, a merged entity's lower marginal cost may intensify price competition in the market. In simple cases, the lack of such efficiencies have been shown to lead to higher market prices. Farrell and Shapiro (1990), for instance, indicate that a horizontal merger in concentrated markets will raise prices absent cost efficiencies and market entry.

Given the complexity of these analyses, numerous jurisdictions have adopted policies that guide horizontal merger control, such as the US (2010) and EC (2004) horizontal merger guidelines. However, it has been shown that governmental and merging parties tend to argue their respective cases predominantly in terms of the merging parties' alleged (lack of) compliance with these guidelines, as in US merger review (Shapiro and Shelanski, 2021, p. 51). Undoubtedly, merger guidelines have had a marked impact on the adjudication of horizontal mergers.

Furthermore, competition authorities have a host of model-based analytical tools at their disposal. Werden and Froeb (2011) perform a rigorous assessment of these tools. They note that the appropriateness of each tool varies with respect to the relevant stage of the merger assessment during which it is applied, namely initial screening, final decision, or courtroom presentation (2011, p. 155). In addition, it is argued that the efficacy of each tool will critically depend on the information that is available for the merger concerned, as well as the nature of the competition between merging parties (p. 167-177).

Merger simulation models (MSMs) are often used as complements to traditional screening tools that are based on market concentration. They were first introduced as a method for merger control by, among others, Werden and Froeb (1994). MSMs rely on various types of structural descriptions of consumers'

[1] Thus, the linear pricing approach necessarily entails an assumption of partial (or full) cost pass-through from the retailer to the consumer (Ezrachi and Thanassoulis, 2013, p. 399).

product substituting behaviour, and the strategic behaviour of merging and non-merging firms, to garner insights into a variety of competition-related issues. One difficulty in this line of research is the issue of isolating the sources of differences between alternative types of MSMs with different functional forms (Björnerstedt and Verboven, 2016, p. 127).

MSMs enable a precise quantitative demonstration of mergers' welfare- and anticompetitive effects in specific contexts, as well as the factors that give rise to such effects (Werden and Froeb, 2011, p. 157). So far, they have proved to be a valuable addition to the set of merger appraisal tools, however their "technical potential" has not yet been fully realised (Budzinski and Ruhmer, 2009, p. 277). Their use has coincided with an increasing emphasis on structural modelling in the empirical industrial organisation, and merger control (Sheu and Taragin, 2017, p. 1). In addition, MSMs are likely to grow in popularity, as computational power and data availability will continue to improve (Bonnet and Schain, 2020, p. 2).

Hereafter follows a critical and comparative evaluation of horizontal merger simulations and other categories of merger screening methods. This analysis is performed with a particular focus on each tool's ability to screen for the potential unilateral effects of mergers. Section 2.1.4 entails a discussion of the most salient strengths and shortcomings of these methods.

2.1.1 Concentration indexes (HHIs)

Competition agencies typically rely on market concentration indexes, such as the Herfindahl-Hirschman Index (HHI), as an initial screen for prospective mergers (Bonnet and Schain, 2020, p. 1). Its objective is to ascertain whether a proposed merger would result in a large enough merged entity to adversely impact total welfare. The HHI is calculated according to Equation (2.1.1), using the market shares (S_i) for the N number of firms in the markets. The pre- and post-merger HHI is computed to determine the expected change in concentration owing to the merger in question.

$$HHI = \sum_{i=1}^{N} {S_i}^2 \quad \forall \quad i \in [1,\ N] \tag{2.1.1}$$

In sum, the HHI provides a measure of the asymmetry in the market. Higher levels of asymmetry, in terms of market shares, result in higher HHI.

The popularity of the HHI partly stems from its simplicity, coupled with the accessibility of pre-merger data on market shares (Bonnet and Schain, 2020, p. 1). Consequently, pre-merger HHI, and its predicted change, is easily evaluated in relation to thresholds determined by the relevant regulatory authority. In practice, a corresponding assumption is made regarding the competitive nature of a proposed merger. This, in turn, determines the course of an agency's future action, if any. For example, the US Horizontal Merger Guidelines (2010) state that a proposed merger will not be presumed harmful if the pre-merger HHI is less than 1500, or if the predicted change in the HHI is less than 100. Contrarily, a rebuttable assumption that the proposed merger is harmful is made if the pre-merger HHI is larger than 2500, and the predicted change is more than 200.

Concentration indexes only serve as rough approximations of the market structure. Therefore, indexes are no more than a first step towards merger control, and are employed with the aim to economise agencies' resources. Various modified versions of the HHI have been developed to account for the intricacies associated with, amongst others, partial ownership (Theron and Boshoff, 2009; Brito *et al.*, 2018), cross-ownership of direct and indirect financial rights (Dietzenbacher *et al.*, 2000), geo-economic concentration (Le and Ieda, 2010), and common-ownership of direct financial and corporate control rights (O'Brien and Salop, 2000).

2.1.2 Horizontal upward pricing pressure (UPP) indexes

The horizontal UPP index is intended to predict the direction of price movements following a horizontal merger. As derived and employed in Werden (1997) and Farrell and Shapiro (2010), the UPP measure is not intended as a calculation of post-merger price levels, but is an approximation of the post-merger incentives to alter prices. Slade (2020, p. 501) describes this measure as the the value of sales that have been diverted following a horizontal merger. In short, UPP does not predict the magnitude of a merger's price effects, but only predicts the sign of such price effects (Farrell and Shapiro, 2010, p. 17).

In the context of Bertrand competition, if two differentiated single-good producing firms (firm 1 and 2) merge, the the net upward pricing pressure on product 1 for firm 1 is calculated according to:

$$UPP_1 = price : cost_2 \times diversion\ ratio_{1\ \rightarrow\ 2}\ - \Delta mc_1, \quad (2.1.2)$$

where $price : cost_2$ represents the price-cost margin of product 2, Δmc_1 is the reduction in marginal cost of firm 1, and $diversion\ ratio_{1\ \rightarrow\ 2}$ is the diversion ratio from firm 1 to firm 2. Diversion ratios measure the portion of lost sales following a price increase by one firm that is captured by a competing firm. Therefore, net UPP is increasing in the substitutability between products, and the profit margin of firm 2.

As a prediction of a firm's post-merger pricing incentives, it sheds light on the competitive outcomes of merger. Its use as a horizontal merger screening tool in the US has been formalised in the FTC and DOJ's merger guidelines (2010, Section 6.1). In sum, it recognises that mergers between competitors can create opportunity costs that induce merging firms to increase prices (Miller *et al.*, 2017, p. 217). The *gross UPP index* is also utilized in practice given its relative computational ease. The gross measure does not account for the marginal cost parameter, and therefore, cannot consider a merger's efficiency gains.

2.1.3 Horizontal merger simulation models (MSMs)

MSMs are structural econometric models applied with the aim to predict counterfactual outcomes in merger control (Björnerstedt and Verboven, 2016, p. 125). They were first introduced as a tool for competition authorities by Werden and Froeb (1994). According to Froeb and Werden (2000, p. 134), a standard merger simulation "uses a standard oligopoly model calibrated to observed prices and quantities to predict the effects of a merger on the prices and quantities of the merging firms and rivals." Whinston (2007, p. 2415) provides an extensive review of the use of MSMs in horizontal merger control.

Where UPPs only predict an incremental shift from initial conditions, i.e. pre-merger prices, MSMs predict an entirely different set of post-merger conditions (Slade, 2020, p. 503). To this end, MSMs first describe the type of game that firms are playing, such as Bertrand price competition or Cournot quantity competition (Budzinski and Ruhmer, 2009, p. 278). In these games, firms optimally choose the prices or quantities of the products within their control to maximise their respective profit functions.

The firms' pre- and post-merger profit maximisation problems can be decomposed into each product's demand function, and the corresponding marginal cost function. A merger between two firms renders a unit decrease in the number of profit maximisers. For each of the products in the market, simulations reveal a corresponding first-order condition with which post-merger equilibrium prices or quantities are solved for. Consequently, screening occurs where these predicted prices are compared to forecasts or actual pre-merger prices.

What are the simulated changes in conditions following a merger? In horizontal MSMs with Bertrand competition and differentiated products, firms initially neglect to account for the impact of the externality of their own pricing decisions on other firms' profits. Two firms that integrate horizontally will then proceed to incorporate the pricing externalities exerted between themselves. By construction, the prices of the merging firms will increase given sufficient substitutability between their products. Plainly interpreted, the role of MSMs as screens is to compute the size of the predicted price increase in the post-merger equilibrium (Slade, 2020, p. 503).

A common shortcoming of MSMs is that they assume a constant cost structure, or zero merger efficiencies. Absent such efficiencies, horizontal mergers have been shown to lead to higher market prices and lower consumer welfare, as in Farrell and Shapiro (1990). Thus, a lack of consideration for these efficiencies may neglect its downward pressure on prices. Budzinski and Ruhmer (2009, p. 314) hold that simulations that only account for the price pressures associated with increased market concentration may be interpreted as the maximal case. On the other hand, when simulations do account for synergy benefits, they are often given exogenously. The results of such an *ad hoc* efficiency rule have been to shown to produce misleading results (Bonnet and Schain, 2020, p. 4). Nonetheless, MSMs provide a sound structural framework for merger control that recognises the potential pro-competitive effects of mergers (Budzinski and Ruhmer, 2009, p. 278).

2.1.4 Discussion

A common theme among screening tools is that they are all highly approximate in nature. HHI and UPP measures do not account for a host of non-negligible factors, including a merger's possible second-round effects on non-merging firms' pricing response (Slade, 2020, p. 504; Bonnet and Schain, 2020, p. 2). HHI measures, for instance, have been shown to adequately capture the extent of market concentration under perfect competition or perfect collusion, yet fail under intermediate levels of competition (Bos *et al.*, 2017), or in markets with differentiated products (Farrell and Shapiro, 2010).[2] Notably, both measures can be modified to account for some of these shortcomings.[3]

MSMs are able to incorporate these and other factors at the cost of increased sensitivity to model specification. This is true, for example, with the specification of demand elasticity (2006, p. 4). Similarly, the screening accuracy of simulations may be diminished if the assumed pricing game does not closely correspond to the actual game played by firms. According to Miller and Weinberg (2017), this was the case in the *MillerCoors* joint venture in which the beer market became more collusive post-merger, and therefore, was not accurately depicted in the simulated game.

Furthermore, screening tools necessarily entail a trade-off between parsimony, or computational ease, and accuracy. UPP indexes are useful in part because they do not require a prediction of the complete equilibrium market adjustment after a merger (Farrell and Shapiro, 2010, p. 2). UPP measures also do not necessitate any information about the non-merging firms, and therefore, any form of market definition (Slade, 2020, p. 501). Consequently, the magnitude of pricing pressures can easily be quantified. However, this simplicity gives rise to other notable omissions, such as the neglect of the higher order properties of demand, and the extent of cost pass-through after a merger (Miller *et al.*, 2017, p. 217).

Concentration indexes are popular as an initial merger screening tool for comparable reasons, yet are widely-acknowledged to be imperfect predictors of merger outcomes. Moreover, concentration indexes raise concerns with respect to the accuracy of the market definitions it employs (Farrell and Shapiro, 2010, p. 3).[4]

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[2]Concentration indexes can be misleading in markets for differentiated goods, especially when the goal is to evaluate a merger's potential unilateral effects (Farrell and Shapiro, 2010).

[3]For instance, Brito *et al.* (2018) endogenously derives HHI and gross UPP measures through a probabilistic voting model in order to generalise these tools to partial acquisition settings.

[4]The contention about market definition is aptly described by Baker (2007, p. 129): "Throughout the history of US antitrust litigation, the outcome of more cases has surely turned on market definition than on any other substantive issue."

MSMs entail more complicated and cumbersome computations. For instance, model complexity increases when costs are assumed to vary from pre- to post-merger. This permits screening that accounts for merger efficiencies, yet may require additional computation and stylised assumptions if costs are not given exogenously. For example, Grieco *et al.* (2018) consider endogenous cost changes following a merger by jointly estimating merging firms' returns to scale, technological change, factor productivity, and cost markups. However, MSMs need to be sufficiently tractable so that it can be easily understood and applied during formal adjudication.

From empirical evaluations, such as Garmon (2017) and Miller *et al.* (2017), first-order measures of pricing incentive, like UPP indexes, seemingly outperform other screening techniques in terms of its mere ability to identify potentially anticompetitive horizontal mergers. This alludes to UPP's relative success in *ex ante* forecasting of potential merger effects using pre-merger data. However, these findings are not robust to all samples and specifications. For instance, the result pointing to UPP indexes' primacy only holds for mergers without variable cost structures (Garmon, 2017, p. 1097). Analogously, Miller *et al.* (2017) show that UPP measures can underestimate price effects if the specified demand system exhibits greater convexity than standard specifications of log-concave demand.

Regarding concentration indexes, Foncel *et al.* (2013) uses Monte Carlo simulations to illustrate that traditional HHI measures are subject to high probabilities of Type I error, yet low probabilities of Type II error. Miller *et al.* also employ Monte Carlo experiments to empirically assess the accuracy of HHIs as merger screens. They find that the relative change in HHI following a merger is a strong predictor of merger price effects, yet the absolute level of HHI is less useful to this end (2017, p. 219). Moreover, it is apparent that different types of HHIs suffer from highly variable accuracy, and success, as a result of different market definition protocols, such as weighted service area market definitions as opposed to other geographic market definitions (Garmon, 2017, p. 1093).

Garmon (2017, p. 1097) suggests that MSMs' relatively poor performance is due to the unavailability of detailed data for their appropriate calibration at the time of screening. Retrospective empirical analysis by Björnerstedt and Verboven (2016) appears to show that simulations that employ structural industry modelling can predict price changes quite well, yet perform poorly in data-scarce settings. On the other hand, Miller *et al.* (2017) find that UPP measures' prediction accuracy is not dissimilar to that of misspecified MSMs, or those simulations that utilise incorrect demand elasticities.

In sum, correctly specified MSMs may still prove useful in predicting post-merger outcomes, or the full equilibrium adjustment, when model assumptions and calibrations are consistent with the market under investigation (Slade, 2020, p. 505). Moreover, there is a variety of methods by which functional-form misspecification and standard errors in structural estimation can be limited in the application of MSMs, thereby improving its robustness and accuracy (Miller *et al.*, 2017, p. 241). In addition, the structural parameters of MSMs can be suitably calibrated to simulate a merger within a specific context using real-world data (Björnerstedt and Verboven, 2016, p. 125; Budzinski and Ruhmer, 2009, 278). These calibrations can be refined with the use of the insights from retrospective merger analysis (Angrist and Pischke, 2010, p. 20, Nevo and Whinston (2010), p. 77).

Importantly, many of the proposed horizontal mergers that require screening occur in vertically related industries (Milliou and Petrakis, 2007, p. 964). These industries are characterised by complex and dynamic vertical relationships, and bargaining between firms.[5] As such, it is crucial that merger screening methods sufficiently account for the externalities engendered by these relationships, especially those that determine bargaining competition. Given its flexibility and potential parametrisation, MSMs are arguably the best suited class of methods by which to appraise mergers' welfare and competitive outcomes, in lieu of the externalities that pervade vertically related industries (Horn and Wolinsky, 1988, p. 408).

However, MSMs with different functional forms have been shown to produce contrasting predictions, as in Slade (2006). In addition, the majority of MSMs have limited their attention to a single division of a vertically related industry (Sheu and Taragin, 2017, p. 1). A global trend of increasing concentration in the retail division of many industries starting as early as 1992 (Dobson and Waterson, 1999, p. 135; 2002; Clarke *et al.*, 2002) will demand the increasing use of MSMs as screening tools. This warrants a further examination and refinement of MSMs, particularly those applied in complex settings characterised by bargaining. Sheu and Taragin (2017, p. 10) offer a first blush of the capabilities of horizontal MSMs in the context of vertical supply chain

[5]See Section 2.2.

bargaining.

2.2 Bargaining

2.2.1 Bargaining competition

Bilateral bargaining between pairs of agents is ubiquitous in various economic settings, such as the negotiations between manufacturers and retailers over wholesale prices (Collard-Wexler *et al.*, 2019, p. 164). Bargaining competition refers specifically to the manner in which parties negotiate in the presence of the externalities engendered by competition amongst parties. In other words, competition between downstream retailers, or upstream suppliers, creates externalities that affect the bilateral bargaining between vertically related parties. For instance, Ho and Lee (2017) illustrate how competition between health insurance providers can affect the terms they negotiate with hospitals upstream. Ultimately, such externalities contribute to the exceeding complexity of modelling mergers in vertically related markets (Boshoff *et al.*, 2020).

Alternatively, horizontal mergers—or the elimination of competition between competitors—create externalities that affect the bargaining positions of vertically related parties. The relative changes in bargaining leverage will inevitably alter the terms of trade between these negotiating parties. Given that merger screening entails the prospective investigation of proposed mergers, competition agencies will likely favour this interpretation of bargaining competition when appraising mergers.

Previous works related to the study of bargaining competition, such as the seminal study by Horn and Wolinsky (1988), clearly indicate how the incorporation of bargaining may render significantly different findings to the standard duopoly models on which many traditional screening methods are based. The "bargaining effects" that give rise to these differences are a result of the externalities originating from bargaining competition. For example, the "commitment problem" is one manifestation of such bargaining effects. It entails that a single upstream supplier facing more than one downstream retailer may oversupply the market, because it cannot credibly commit to resist imposing negative externalities on one buyer by selling large quantities to the other buyer (de Fontenay and Gans, 2005, p. 545).[6]

[6]Here, the commitment problem is evident when bargaining between the supplier and

Milliou and Petrakis (2007) provide two examples of the bargaining competition externalities that may be internalised as a result of mergers between competitors. Supposing that two suppliers merge, they internalise the externality that is exerted as a result of the competition amongst themselves. Should each firm supply exclusively to a single downstream firm pre-merger, the so-called "output externality" is internalised. Before the merger, the output externality entailed that an increase in the wholesale price of one downstream firm will ultimately result in an increase in the rival downstream firm's output (Milliou and Petrakis, 2007, p. 964). In addition, the merged entity upstream now obtains an improved bargaining position in relation to each of the downstream retailers. By merging, suppliers have effectively created a new outside option that undergirds a threat of non-supply during negotiations.

In merger screening, economists are required to adopt assumptions that best approximate the competitive features of a merger given the prevailing market conditions (Werden *et al.*, 2004). However, in most of the applications of MSMs to date, comparatively few of them have accounted for the possible interactions between the upstream and downstream divisions of industries (Sheu and Taragin, 2017, p. 1). The added consideration of bargaining competition complicates the construction of MSMs for two reasons. First, it is difficult to define the appropriate type of bargaining at play (Boshoff *et al.*, 2020, p. 2). Secondly, the terms of trade are not predetermined or easily identifiable. The alternatives to the prospective agreement—or outside options—that determine the exact terms of trade are often unobserved (Nash, 1950, p .159). The contractual terms of supply are not known *ex ante*, given that they are frequently an emergent outcome of the bargaining between parties (Milliou and Petrakis, 2007, p. 964).

The availability of outside options are a measure of the degree to which a party may terminate its current negotiations in favour of bargaining with other trading partners (Ezrachi and Thanassoulis, 2013, p. 415).[7] Understandably, the prevailing industry structure will determine the value of buyers' and suppliers' outside options. The value of a buyer's outside option depends on the buyer's size and market power in relation to its current supplier (Inderst and Wey, 2003), coupled with the level of competition upstream (de Fontenay

different buyers is non-cooperative and performed sequentially (de Fontenay and Gans, 2005, p. 545).

[7]For obvious reasons, the availability of outside options is mitigated by the presence of switching costs for the negotiating party.

and Gans, 2005). The value of a seller's outside option represents the extent to which it can distribute its product through alternative means. Bargaining strength is closely related to the value of the relevant party's outside option, as it lends more credibility to threats of non-purchase, or non-supply (Ezrachi and Thanassoulis, 2013, p. 415).

Boshoff *et al.* (2020) provide a cogent exposition of the manner in which the bargaining assumptions can predetermine the predicted outcomes of mergers. Specifically, it is shown how certain fundamental assumptions of different bargaining models can give rise to conflicting predictions about the welfare outcomes of vertical mergers. Therefore, it is argued that bargaining models that best capture the characteristic features of pre-merger and post-merger competition in the relevant market ought to be used in merger screening. If merger control is taken to be a positive science, certain fundamental assumptions—whilst descriptively unrealistic—may yield better approximations of these features, and therefore, a prospective merger in a particular industry (Friedman, 1953, p. 15). Thus, the modeller should take care at the outset to make deliberate assumptions with respect to the outside options to the agreement, the type of bargaining, and the resulting contract.

2.2.2 Vertical contracting

The predicted effects of a merger depend on the specification of the relationship between retailers and manufacturers in the industry, i.e. integrated, separated, or exclusive. This is owing to the fact that the merger effects exacted in the same or opposite division is partly determined by the nature of the vertical relationships being modelled. For instance, Froeb *et al.* (2007) show that the downstream outcomes of an upstream merger between manufacturers of differentiated goods may be exactly the same outcomes as the case in which manufacturers were selling directly to consumers.[8] Other types of vertical relationships may entail subtle differences, like the relatively lower retail prices of vertically separated downstream firms (2007, p. 369). Consequently, the specification of vertical relationships may prove decisive during merger screening.

Vertical trade is conducted according to the terms of trade set out in supply contracts. In practice, these contracts can and do take various forms,

[8] This equivalence depends on the assumptions of perfect information—or transparent contracting—and non-cooperative bargaining with a monopoly retailer.

such as two-part tariff contracts, or linear pricing contracts (Bonnet *et al.*, 2006). Classical theories of mergers in oligopolistic competition also assume that firms set take-it-or-leave-it prices to all customers, regardless of where in the supply chain the firm is located. Therefore, past models of vertically related markets have often assumed retailers to be passive, thereby merely accepting or rejecting the offers made by manufacturers (Dobson and Waterson, 1997, p. 418).

However, this view of negotiation and price-setting cannot be squared with what actually occurs in numerous intermediate goods markets (O'Brien and Shaffer, 2005, p. 573). Supply terms are most often the outcome of bargaining between vertically related parties, and ultimately determine the supply chain's overall profitability (Draganska *et al.*, 2010, p. 57). Such terms will also determine how margins are split along the supply chain, hence are a function of the firms' respective bargaining powers. Moreover, O'Brien and Shaffer (2005) argues that negotiations are typically crystallised in non-linear contracts. Aggregate rebates, minimum quantity thresholds, and slotting allowances are but a few possible non-linear features of supply contracts that render the linear price-setting assumed in classical theories—and the linear pricing approach to merger control—insufficient.

Ezrachi and Thanassoulis (2013) provide another explanation as to why firms may opt for non-linear supply contracts. It is posited that upstream firms with sufficient market power may choose to maximise its profits through non-standard means like *efficient contracts*. These contracts have the effect of constraining the final good's retail price. With a superior bargaining position *vis-à-vis* downstream firms, the supplier may wish to maximise the profits within its own distribution channel when competing with other distribution channels. This is achieved by directly or indirectly policing the final consumer price.

Milliou and Petrakis (2007) innovatively treat vertical contracts as the outcome of the strategic decisions of firms. In the second stage of their four-stage game, firms decide between standard linear wholesale price contracts or non-linear two-part tariff contracts (2007, p. 964). The endogenous selection of contract type as a strategic decision has been used before, for instance in Rey and Stiglitz (1995) and Irmen (1998). They show that market structure plays a considerable role in the selection of contract types, and that the chosen contract type can ultimately determine the post-merger equilibrium market structure.

Moreover, compelling evidence by Horn and Wolinsky (1988) suggests that the order in which contracts are negotiated is of significant import. For instance, it is shown that staggered, or sequenced, negotiations with independent retailers of substitute goods enable a single supplier to negotiate higher input prices and obtain higher profits, as opposed to the case where negotiations are simultaneous (1988, p. 409). Another critical feature of vertical contracting during the appraisal of mergers is its observability, or transparency, to outside bargaining pairs. The transparency of pre-merger contracting, or lack thereof, has been shown to be a determining factor in the welfare outcomes of mergers in vertically related markets. Unobservable, or opaque, vertical contracting appears to favour powerful upstream firms at the expense of downstream firms, and consumers.

For example, Pinopoulos' (2020) results show that an upstream horizontal merger necessarily results in consumer harm when pre-merger contracting is unobserved by competitors. Conversely, with observable pre-merger contracting, upstream mergers may lead to lower input prices and higher consumer surpluses. This is true even in the absence of *ad hoc* merger-induced cost efficiencies.[9] Analogously, Froeb *et al.* (2007) show that the transparency of pre-merger contracting is associated with the profit margins of the manufacturers. For instance, if vertical contracting in their model is completely observable to Bertrand retailers, wholesale margins are negative. If contracting is opaque, wholesale margins become zero.

From a merger policy perspective, certain contracts, especially *existing contracts*, may prove to be problematic during the appraisal of prospective mergers in vertically related markets. Adjudicators may be inclined to overlook the loss of competition and consumer harm resulting from a merger if these effects only occur after an existing contract expires. Merging firms may strategically undertake multi-year customer contracts in order to undermine potential judicial challenges.

According to Shapiro (2021, p. 17), the consequences of such contracts are two-fold. Firstly, it removes the possibility of customers acting as witnesses in merger screening cases in certain jurisdictions. Secondly, it complicates the government's task of demonstrating and quantifying potential harm to

[9]Notably, these results are hinged on the assumption that the downstream competitor is more cost-efficient than a downstream vertically integrated retailer.

customers as longer-term contracts shift the prospective harm to a time beyond the court's ambit.[10] Coupled with the prevalence of *efficient* contracts, the issue of multi-year *existing* contracts appear to suggest that firms preside over extra-profit considerations when bargaining.

2.2.3 Nash-in-Nash and Nash-in-Shapley bargaining

The terms of trade in vertically related markets are rarely determined by perfect competition, or by take-it-or-leave-it offers (Collard-Wexler *et al.*, 2019, p. 164). It is well-established that such unilateral bargaining in, for instance, a *derived demand* bargaining model give rise to prices above monopoly levels (Lu *et al.*, 2007; Motta, 2004). As pointed out in Boshoff *et al.* (2020, p. 5), take-it-or-leave-it models of bargaining also necessitate the assumption of linear pricing, otherwise the price-setting upstream firm would also demand fees from downstream firms such that it captures all of the profits.

Under linear pricing, the instance of *double marginalisation* will always be observed (Church, 2008, p. 1467), hence predetermining relatively anti-competitive outcomes. This is because price-taking buyers and price-giving manufacturers both add their margin before selling the final good. Under such conditions, a horizontal merger between duopolist retailers would maximise double marginalisation, given that the merger eliminates the former partial competition downstream (Tschantz and Froeb, 2019). Consequently, the combination of assumptions of unilateral bargaining and linear pricing may skew towards anticompetitive outcomes pre- and post-merger, and will result in a joint profit outcome below the joint profit maximising outcome (O'Brien and Shaffer, 1992, p. 300).

Conversely, terms of vertical trade are most often determined by bilateral bargaining between parties (Horn and Wolinsky, 1988, p. 409). Such negotiations are often characterised by the alignment of the respective parties' incentives that is—by construction—overlooked in models of unilateral bargaining. The alignment of incentives has been observed, for example, in the bargaining between hospitals and managed care organisations over premium

[10] Shapiro (2021, p. 17-18) proposes to circumvent the the strategic misuse of contracts by prohibiting mergers that may "substantially lessen competition" regardless of whether customers are temporarily protected from its consequences in the short-run. It is argued that the application of a *protecting competition standard* would have advanced the aims of effective competition enforcement better than a strong *consumer welfare standard* in the AT&T-Time Warner (2018) case.

offers (Gowrisankaran *et al.*, 2015, p. 175). Such alignment may result in less of a trade-off between the capture of surpluses within the distribution channel, and the creation of surpluses downstream. Consequently, bargaining models that account for bilateral negotiations indicate a more equitable split of the gains from trade between vertically related parties (Froeb *et al.*, 2019, p. 13).

An applied literature that studies the division of surpluses in bilateral oligopoly settings has also emerged. For instance, Gowrisankaran *et al.* (2015) considers the pricing impact of upstream horizontal mergers between hospitals on managed care organisations, using the Horn and Wolinsky (1988) bargaining model for the Nash bargaining problem. On the other hand, Chipty and Snyder (1999) considers the welfare and efficiency effects of downstream horizontal mergers between cable operators in lieu of vertical bargaining with program providers, also using the Nash bargaining concept.

In this literature, bargaining models are typically characterised by two stages, or games. First, firms bargain over terms of trade. Second, downstream firms compete in the product market, given the agreed terms of trade (Horn and Wolinsky, 1988, p. 410). However, much of the related literature has narrowed its focus to settings in which only a single agent is implicated in all of the negotiations (Collard-Wexler *et al.*, 2019, p. 164), or in which the interactions between are restricted (Sheu and Taragin, 2017, p. 2).

Nonetheless, it is quite apparent that bargaining in vertically related markets is fundamentally affected by the externalities that arise from competition amongst parties, coupled with the interdependencies across firms and various bilateral agreements (Collard-Wexler *et al.*, 2019, p.164). In other words, the value of a bilateral agreement of one bargaining pair is influenced by the (non-) existence of other bilateral agreements in the network of potential bargaining pairs. Models that do not account for such interdependencies may provide an insufficient depiction of bargaining in vertical settings, and therefore, will be problematic in the appraisal of prospective mergers. It follows that the predicted welfare effects of a merger is contingent on this initial characterisation of bargaining, and its change after a merger.

In an effort to incorporate these interdependencies, the applied literature has extended the solution concept pioneered by Horn and Wolinsky (1988). The *Nash-in-Nash* bargaining solution, or "Nash equilibrium in Nash bargains" considers separate bilateral Nash bargaining problems for different bargaining pairs (Nash, 1950), within a Nash equilibrium of a non-cooperative game played in the downstream product market (Collard-Wexler *et al.*, 2019, p. 165). These models rely on Binmore *et al.*'s (1986) finding that the outcomes of non-cooperative and dynamic bilateral bargaining games, posited by Rubinstein (1982), converge to the outcomes of cooperative Nash (1950) bargains.

In short, the bargaining solution consists of a set of transfer prices between upstream and downstream firms in which the negotiated price between a given pair of firms is the Nash bargaining solution for that pair—given that all other pairs have reached an agreement. Importantly, this solution assumes that each bargaining pair will negotiate terms as if all other agreements will remain fixed in response to a breakdown or disagreement in their negotiations, thereby fixing each party's potential disagreement payoff. This bargaining protocol between manufacturers and retailers has been suitably applied to simulate horizontal merger effects in vertically related markets by Sheu and Taragin (2017).

Popular Nash-in-Nash bargains have the advantage of providing a relatively tractable framework according to which outcomes in complex bargaining environments can be calculated (Froeb *et al.*, 2019, p. 2). Its fundamental assumptions can considerably simplify the specification of structural models, and therefore, their corresponding calibration and simulation (Sheu and Taragin, 2017, p. 2). Coupled with its compatibility with classical price theory, it has become the "workhorse" for empirical work in bilateral oligopoly settings (Collard-Wexler *et al.*, 2019, p.163-165).

However, criticism has been levelled against the solution's use of a cooperative Nash bargaining solution within a non-cooperative Nash equilibrium. Previous efforts to incorporate non-cooperative microfoundations into the Nash-in-Nash solution, such as Crawford and Yurukoglu (2012), have employed Binmore *et al.*'s (1986) "delegated agent" model in which firms that are involved in multiple bilateral negotiations rely on separate agents to undertake each negotiation. More recently, Collard-Wexler *et al.* (2019) proposed a different non-cooperative microfoundation by extending Rubinstein's (1982) model of alternating-offers between two parties to the case where multiple firms are vertically related.[11] Notwithstanding, the use of delegated agent models in the empirical industrial organisation literature is far more pervasive.

By construction, firms cannot make use of all the available information,

[11] A similar microfoundation is employed in de Fontenay and Gans (2005) in the context of bargaining with vertical integration.

as their delegated agents act independently and do not communicate with one another. Therefore, the mainstream non-cooperative microfoundation in Nash-in-Nash bargaining solutions require that agents act "schizophrenically" (Collard-Wexler *et al.*, 2019, p. 165). Nash-in-Nash bargains are bilaterally efficient, but are not "socially" efficient for that coalition (de Fontenay and Gans, 2014, p. 758). This is the consequence of agents not fully recognising the presence of externalities between agreements. When delegated agents do not act in concert on behalf of their firm, they may independently secure agreements that do not maximise the total gains from trade from all the negotiations in which that firm is involved.

Froeb *et al.* (2019) suggest that when firms in Nash-in-Nash bargains act schizophrenically, it may appear as if they are bargaining against themselves. In addition, Rey and Vergé (2020) show that when all other bargains are viewed as constant according to the Nash bargaining assumption, parties will agree to low wholesale prices to allow downstream parties to price aggressively without recognising how their agreements may effect outside agreements. For these reasons, pre-merger Nash-in-Nash equilibrium outcomes may appear very competitive, and therefore, may artificially exaggerate predicted merger effects (Boshoff *et al.*, 2020).

In addition, Nash-in-Nash bargains are by construction unable to capture the implications of *contingent contracts*, and renegotiations on off-equilibrium paths (Yu and Waehrer, 2018, p. 1). Coupled with the schizophrenia highlighted above, standard Nash-in-Nash bargaining may produce highly counter-intuitive results. Froeb *et al.* (2019, p. 11) also show that Nash-in-Nash outcomes crucially depend on which parties earn the operating profit, and therefore, constitute a violation of the Coase Theorem (Coase, 1960). In other words, Nash-in-Nash bargains do not reflect the efficient allocation of surpluses in the presence of externalities by way of bargaining.

Consequently, Froeb *et al.* (2019) and Boshoff *et al.* (2020) propose an alternative class of bargaining models that is based on the work of Shapley (1953), Myerson (1997), and Navarro (2007). In *Nash-in-Shapley* bargaining models, total profits are also determined by the terms of trade resulting from independent bilateral bargaining. As in Nash-in-Nash bargaining, the surpluses of these profits relative to the profits associated with disagreement, i.e. threat points, determine how profits are divided between negotiating parties (Boshoff *et al.*, 2020, p. 2). However, the important distinction between these classes of bargaining models lies in their respective treatment of the threat point, or disagreement payoff.

Nash-in-Shapley bargaining abandons the Nash assumption that other agreements are fixed, or remain passive, in response to changing conditions in the bargain of interest. Instead, disagreement payoffs are computed recursively, given that all other negotiations will contemporaneously respond in the event of disagreement. These other agreements need also satisfy the Nash bargaining solution, whilst their corresponding threat points are also similarly determined from now fewer agreements (Froeb *et al.*, 2019, p. 7). For this reason, Nash-in-Shapley has been dubbed *Nash-in-Nash with recursive threat points* (Yu and Waehrer, 2018, p. 1). In sum, threat points are determined by the profits of all other agreements that have themselves responded to new sets of agreements (Froeb *et al.*, 2019, p. 5).

Bargaining is, therefore, performed with the recognition that present negotiations can impose bargaining externalities on other responsive negotiations. As such, bargaining may entail renegotiation on off-equilibrium paths, and contingent contracts (Boshoff *et al.*, 2020, p. 3; Yu and Waehrer, 2018, p. 5). In such models, it has been shown that profits are split according to the Shapley value, or the "equal-gains-principle" in cooperative games (Inderst and Wey, 2003, p. 5; Navarro, 2007, p. 759).[12] This entails that parties negotiate over terms in anticipation of how the subsequent non-cooperative game may determine profits (Boshoff *et al.*, 2020, p. 3). Therefore, Nash-in-Shapley bargains allow parties to bargain in recognition of how their negotiations can effect their final imputations, or net profits after payments, as well as the final imputations of all others.

In sum, profits are determined from a non-cooperative game ("Nash") in the product market. Player imputations are in turn calculated as the Shapley value (Shapley, 1953) for a connected coalition ("Shapley"), and the Myerson value (Myerson, 1997) for a disjoint coalition (Froeb *et al.*, 2019, p. 2). Using reasonable assumptions, the equivalence between the solution of Nash-in-Nash bargains with recursive threat points, and the Shapley value, is shown by Yu and Waehrer (2018). Yu and Waehrer also provide a similar proof of equivalence for the more general Myerson value for the corresponding cooperative game in partition function form (2018, p. 4).

[12] See Winter's (2002) survey of bargaining games between vertically related parties in which players' equilibrium imputations are determined according to the Shapley value.

Similarly, Froeb *et al.* (2019) show the equivalence between the outcomes of independent and bilateral Nash-in-Shapley bargaining, and the familiar outcomes of cooperative bargaining (Nash, 1950), if parties are connected by a chain of bilateral agreements. Furthermore, Froeb *et al.* (2019) argue that the Nash-in-Shapley bargaining model provides a framework according to which bargaining is efficient [p. 4] and optimal [p. 5] in a complete information setting. In other words, all operating profits are efficiently distributed to members of a coalition, and total coalition profits are maximised, respectively.

To the best of the author's knowledge, no theoretical works have applied Nash-in-Shapley bargaining models to the study of simulated retail consolidation in vertically related markets. Moreover, none have attempted to compare the degree to which the fundamental assumptions that underlie Nash-in-Nash and Nash-in-Shapley bargaining models have a bearing on the assessment of downstream retail mergers.

2.3 Retail mergers

Given the recent trend of increasing concentration in the retail markets of many industrialised countries, competition agencies have heightened their scrutiny of downstream mergers between competitors (Inderst and Shaffer, 2007; Inderst and Wey, 2007). Absent merger efficiencies that are passed through to consumers, and fierce downstream competition, a direct and positive relationship between downstream mergers' creation of market power, and subsequent retail price increases and consumer harm is well-established (Ezrachi and Thanassoulis, 2013, p. 396; von Ungern-Sternberg, 1996, p. 507).[13] In addition, concerns have been raised over retailers' exceeding buyer power in relation to suppliers.[14] However, only a relatively small number of structural MSMs have been applied in the study of retail consolidation in vertically related markets (Sheu and Taragin, 2017, p. 1).

In the past, it has been observed that consolidated retailers do in fact obtain more favourable terms of trade as a result of their increased buyer power, and even tend to reduce their supplier base (Inderst and Shaffer, 2007, p. 46). By consolidating downstream, the expected share of surplus flowing

[13]The same conditional link does not necessarily hold in all cases of upstream mergers, as shown by Milliou and Petrakis (2007), Milliou and Pavlou (2013), and Pinopoulos (2020).

[14]See Section 2.4.

upstream will decrease. The reduction in producer surpluses is a result of the relative changes in bargaining power in favour of the now integrated retailer.

In short, the more a party has to lose during bargaining—a lower threat point—the weaker that party's bargaining position becomes (Draganska *et al.*, 2010, p. 57). Downstream mergers have been shown to amplify buyer power by undermining the value of a supplier's outside option, or threat of selling to a competing retailer (von Ungern-Sternberg, 1996). For example, the horizontal integration of duopolist retailers effectively eliminates a supplier's outside option, thereby shifting bargaining power to the consolidated retailer. Increased retailer bargaining power is associated with an increase in *hold-up* (Montez, 2007, p. 949). This refers to the extent to which downstream firms are able to leverage their bargaining power to hold-up the producer.

In anticipation of the lower producer surplus, upstream producers may lower their capacity in response to downstream horizontal integration. Correspondingly, the appraisal of downstream mergers now includes an examination of the adverse investment incentives it engenders in upstream markets. Formerly, MSMs often assumed producers' investment decisions to be independent of downstream horizontal integration, like in Hart and Moore (1990). Nonetheless, the negative relationship between downstream mergers and upstream investment in productive capabilities has been suggested in studies, such as Inderst and Shaffer (2007). However, conflicting theoretical evidence indicate that this negative relationship may need to be qualified.

Using a two-stage game with bargaining over input supply, Montez finds a non-monotonic relationship between downstream integration and producer capacity in the long-run (2007, pp. 954 - 957). Using the Shapley solution concept, their results suggest that the integration of retailers may prompt producers to increase their capacity if the cost of capacity is low, and lower capacity if this cost is high. This non-monotonicity is explained by the contending impacts of an increase in hold-up, and a decrease in the rate of *bargaining erosion*.

Bargaining erosion refers to the decrease in a producer's bargaining power that is associated with an increase in the producer's capacity. In short, an increase in the relative abundance of the input good diminishes the competition for that good, thereby reducing the supplier's bargaining power. It is suggested that when downstream retailers integrate—and if the cost of producer capacity is low—the decrease in the rate of bargaining erosion outweighs the increase in hold-up (Montez, 2007, p. 949).

Analogously, Inderst and Wey (2007) make the finding that increased buyer power downstream—possibly as a result of horizontal integration—may lead to product and/or process innovation. To hedge itself against threats of non-purchase by large buyers, a supplier may be induced to invest more in product innovation, as to increase sales to other buyers. Suppliers that are facing fewer but larger buyers, and strictly convex costs, will also want to invest more in process innovation, thereby increasing total output and reducing deadweight loss. Process innovation also enables suppliers to negotiate with large buyers over a range of production where average incremental costs are higher than before. In sum, suppliers facing material buyer power will undertake incremental product and process innovations to "flatten" its cost function and to "flatten" large buyers' revenue functions, respectively (2007, p. 648). Such buyer power, however, may still hamper more substantial or non-incremental investments, such as market entry and the development of new products.

2.4 Buyer power

Screening of horizontal mergers in vertically related industries also includes a consideration of countervailing buyer power in addition to the traditional considerations of upstream market power. Buyer power can be described as the bargaining strength of the buyer in relation to the other parties during supply negotiations. According to the US guidelines (2010, Section 8), powerful buyers are able to negotiate favourable terms with their suppliers such that it may result in lower input prices and desirable conditions of delivery. In the EC's guidelines (2004, Note 65), buyer power is described as the "extent (to which) customers will be in a position to counter the increase in market power" upstream.

The consideration of (countervailing) buyer power is apt for a host of reasons. The DOJ contends that powerful buyers are able to limit the ability of upstream firms to raise prices. Similarly, the EC cites that "even firms with very high market shares" may not be able to induce anticompetitive outcomes by effectively acting independently of their buyers, if these buyers possess considerable countervailing power (2004, Note 64). Upstream market power may enable the supplier to increase the price of the good, decrease its quality, or adversely alter the conditions of its delivery. In response, a powerful buyer is one that could credibly threaten to obtain alternative sources of supply within a reasonable period of time (2004, Note 65). In both US and EC guidelines, powerful buyers can credibly threaten to sponsor an upstream entrant, vertically integrate or "integrate backwards" (Katz, 1987), or undermine coordinated effects upstream (Snyder, 1996). Additional examples of such expressions of countervailing buyer power include the refusal to buy the the supplier's other products, or the delay of purchase of the supplier's durable goods.

For a determination of effective buyer power to be made, the EC considers factors such as the buyer's size, its commercial significance to the seller, and the degree of the input substitutability available to buyers (2004, Note 64). The DOJ does not presume that the presence of large buyers alone is sufficient to counteract the anticompetitive pressures flowing from upstream, as even powerful buyers can be harmed by upstream market power. Furthermore, countervailing power cannot be found to sufficiently off-set upstream market power if it only safeguards a limited category of buyers. Another requirement is that countervailing buyer power must be shown to survive post-merger despite the proposed elimination of an alternative supplier (2004, Note 67).

The common treatment of buyer power by competition agencies can be distilled into an evaluation of the pre- and post-merger choices available to buyers. In the context of mergers between suppliers, the question of whether downstream firms have reasonable input alternatives is duly raised. Notably, Shapiro (2021) warns against the over-reliance on choice availability as a measure of buyer power. Specifically, it is argued that upstream market definitions and the resulting market shares itself may not be an appropriate tool with which to determine the *importance* of the relevant input to the buyer. Therefore, it is necessary to also examine the incentives of buyers to determine whether they will actually utilise their buyer power, or in fact exercise the choices available to them (European Commission, 2004, Note 66).

Inderst and Wey (2007) identify two sources of buyer power. Demand- and supply side channels for buyer power are present whenever suppliers preside over strictly convex costs, or have bindings constraints on their capacity. First, it is shown that a supplier's loss from foregone sales as a result of failed negotiations disproportionately increases relative to the size of the relevant buyer. In other words, larger buyers are able to make more substantial threats of non-purchase than smaller buyers. When large buyers refuse to purchase from a supplier, it frees up relatively more of that supplier's capacity. In turn, the extant capacity can only be diverted to other smaller buyers that negotiate prices "on the margin" at higher average unit costs to the supplier (Inderst and Shaffer, 2007, p. 47).

With respect to the supply side channel, Inderst and Wey (2007) illustrate that large buyers negotiate over a section of a supplier's production that entails lower marginal costs. Larger buyers, therefore, are able to gain larger discounts on their purchases. Under similar assumptions about supplier costs, Chipty and Snyder (1999) also show that larger retailers can negotiate lower input prices. For these reasons, among others, it is sensible that competition agencies take account of buyers' size, and commercial significance to suppliers, when evaluating countervailing buyer power.

Buyer power, particularly in the retail sector, is a significant concern for public policy given its adverse consequences for technology adoption (Inderst and Wey, 2003), product quality (Dobson and Waterson, 1999), and variety (Inderst and Shaffer, 2007). The work by Inderst and Shaffer (2007) depicts how buyer power can be leveraged to increase retailer profits, at the expense of consumer welfare. They show that increases in buyer power, as a result of horizontal integration, may lead to retailers no longer finding it profitable to resell all of the products of their former suppliers. Conversely, retailers increase upstream competition by reducing their demand for different inputs, thereby lowering total industry profits. Retailers may then decide to opt for a single-sourcing approach, thereby capturing a larger share of the lower industry profits, and lowering final product variety.

Chapter 3

Methods

The aim of this study is to better understand the implications of retail consolidation in vertically related markets. In particular, it considers the pre- and post-merger division of surpluses, and consumer welfare outcomes, in the event of a horizontal merger between duopolist retailers that are supplied by a monopolist manufacturer. It is, therefore, crucially important to account for the externalities and feedback effects associated with bargaining competition.

Contributing to the tradition of structural modelling in competition economics, this study employs a merger simulation model using a familiar nested logit consumer demand.[1] The parameters of this model can flexibly be calibrated in order to approximate market conditions in a variety of economic settings with vertical contracting. Furthermore, simulations incorporate two distinct types of bargaining protocols in complete information settings, namely *Nash-in-Nash* and *Nash-in-Shapley* bargaining. Thus, the degree to which these bargaining models' fundamental assumptions have a bearing on the appraisal of retail mergers, and buyer power, can be critically compared.[2]

As such, this study significantly relies on the methodology and derivations utilised in Boshoff *et al.* (2020). However, this analysis is distinct in so far it only attends to a 1×2 industry structure with two-part vertical contracting, and extends its focus to the setting of horizontal mergers. In addition, this study considers pre- and post-merger outcomes for a range of different calibrations by allowing the inside-to-outside-good quantity ratio, and aggregate

[1]For example, see the recent application of nested logit demand functions in MSMs by Björnerstedt and Verboven (2016) and Bonnet and Schain (2020).

[2]Whilst only considered implicitly here, it is also possible to explicitly account for the varying bargaining strengths of negotiating parties, as in Crawford *et al.* (2018, p. 913).

elasticity in the market, to vary. With the aid of one well-established, and one novel, bargaining protocol, this permits a more informed examination of retail merger incentives, industry division of surpluses, and consumer harm. The results from both bargaining- and benchmark models—for all calibrations—are rendered using the merger simulation application created by Tschantz and Froeb (2019).

3.1 Industry structure

This dissertation considers a 1×2 vertically related industry in which one upstream manufacturer, U, supplies a single homogeneous input to two equally-sized independent retailers, A and B, that are competing for final consumers. As in Dobson and Waterson (1997), these retailers can be considered to be differentiated by their retail service.[3] For convenience, downstream firms are assumed to be symmetric and single-good producing. This test case, as illustrated in Figure 3.1, follows the tradition of Horn and Wolinsky (1988).

It is assumed that U agrees to transfer the inputs to the downstream retailers at wholesale prices, W_A and W_B, respectively. For simplicity, it is assumed that U produces the input at zero marginal cost. Retailers sell their respective final goods to consumers at P_A and P_B, and face an additional and identical retailing cost. Before the simulated merger, downstream firms act independently to maximise their own final imputations, or net profits after payments.

In addition, this study considers the implications of a retail consolidation downstream. As illustrated in Figure 3.2, the horizontal integration of A and B, a new merged entity, HI, is formed. Given A and B's former symmetry, U subsequently supplies inputs to HI at a single wholesale price, W_{HI}. HI sells its final good at the same additional retailing cost directly to the consumer at the retail price, P_{HI}. Following the merger, the merged entity acts to jointly maximise the imputations previously associated with A and B.

Pre- and post-merger, consumers also have the option to purchase from an alternative, unobserved, retailer, O—the outside option. The outside option is not observable to the inside firms A, B, and HI. By exogenously increasing

[3] This differentiation can be the result of a host of factors, such as location, service quality, convenience, and so on (Dobson and Waterson, 1997, p. 420).

the quantity of the outside good, the total market size, M, is increased.[4] According to the literature described in Sections 2.2.1, 2.3 and 2.4, such an increase would appear to diminish the inside firms' market- and bargaining power.

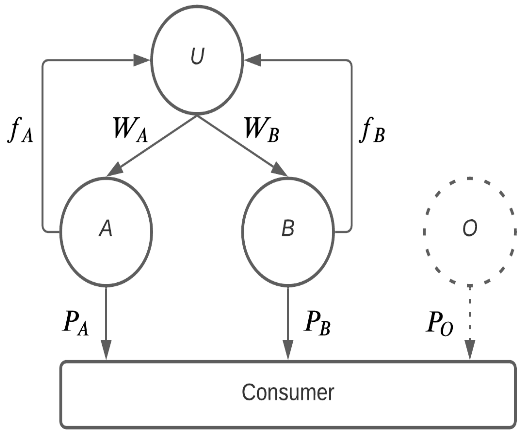

Figure 3.1: Pre-merger 1×2 market structure

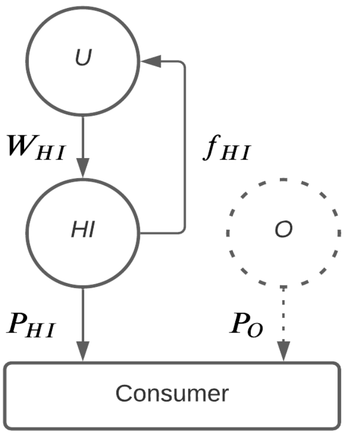

Figure 3.2: Post-merger 1×1 market structure

[4]Alternatively interpreted, the total amount of options available to consumers is increased by raising the quantity of the outside good in an *ad hoc* manner.

3.2 Form of contracting

Vertical contracting takes the form of two-part pricing. That is, bargaining pairs (U, A) and (U, B), or (U, HI), negotiate over a marginal wholesale price (W_A, W_B, or W_{HI}) and fixed fee (f_A, f_B, or f_{HI}). The assumption of two-part pricing is held to be reasonable, given the compelling evidence that an upstream monopolist would exclusively favour two-part tariff contracts when its bargaining power is sufficiently high, and final goods are somewhat differentiated (Milliou and Petrakis, 2007, p. 965).

The terms of supply of different bargaining pairs are negotiated concurrently, and in accordance with the relevant bargaining protocol. Moreover, contracting is transparent, and agreements are observable to all bargaining pairs. Wholesale prices and retail costs are assumed to determine equilibrium retail prices, and therefore, consumer demand. It is assumed that downstream firms set retail prices simultaneously in a so-called "Bertrand-logit" product market Nash equilibrium, as described in Sheu and Taragin (2017, p. 6).[5] Therefore, this MSM constitutes a two-stage complete information game. Both stages, vertical contracting and product market competition, are performed according to one of the subsequent bargaining models.

3.3 Bargaining models

Two bargaining models from Boshoff *et al.* (2020) are considered, namely the Nash-in-Nash and Nash-in-Shapley. The validity of the former model's solutions is well-documented (Horn and Wolinsky, 1988). Furthermore, Froeb *et al.* (2019) and Yu and Waehrer (2018) provide sufficient conditions for the existence and uniqueness of the latter model's solutions. As summarised in Section 2.2.3, each of these solution concepts converge to the familiar outcomes of cooperative bargaining games under certain reasonable assumptions. In addition, the results from two single-tier, non-bargaining benchmark cases are given for the sake of comparison. The two benchmarks, *monopoly* and *competition*, take the form provided in Boshoff *et al.* (2020).

In the competition model, goods are sold by independent downstream retailers. The upstream firm is assumed to supply inputs at marginal cost, and

[5]This assumption is relatively common in studies of retail power with vertical bargaining, for example Draganska *et al.* (2010) and Ho and Lee (2017).

downstream firms collect all of the profits. Perfect competition in the product market result in Nash equilibrium pricing. On the other hand, the monopoly model assumes that downstream firms are transparent,[6] hence it is equivalent to a model in which goods are sold by a single firm. Wholesale prices are set above cost to induce monopoly level pricing. In sum, monopoly prices are set to maximise the total profit of all firms. Fees are taken from the transparent downstream firms to return all profits upstream.

The Nash-in-Nash bargaining model over two-part prices (NiN2) considers simultaneous bargaining between U and A, and U and B, over wholesale prices for inputs, and fixed fees. Supply terms are determined according to the two-person Nash bargaining solution in relation to each negotiating party's respective threat point (Nash, 1950). As such, equilibrium wholesale prices are set to maximise the Nash product corresponding to a single agreement:

$$(\pi_i - \pi_i^0)(\pi_U - \pi_U^0) \quad \forall \quad i = A, B \tag{3.3.1}$$

where π_i and π_i^0 is the i-th retailer's agreement payoff and threat point, respectively. Similarly, π_U and π_U^0 is the upstream firm's agreement payoff and threat point (Boshoff *et al.*, 2020, p. 5). Notably, these negotiations are made under the assumption that the "other agreement" is invariable. Therefore, π_i^0 and π_U^0 are assumed to remain fixed, as in e.g. Sheu and Taragin (2017, p. 6).

Once the bargains are secured, retailers will simultaneously set their retail prices according to a Bertrand-Nash equilibrium in the final product market. In the study of retail consolidation within a duopoly, this particular two-stage procedure has been evoked in Horn and Wolinsky (1988). Analogously, Dobson and Waterson (1997), Chipty and Snyder (1999), and Sheu and Taragin (2017) apply this framework in the extended case of $N > 2$ retailers.

In sum, NiN2 implies that equilibrium wholesale prices are taken to maximise the surpluses—over the relevant threat point—from a **single** agreement. Fees are taken such that the profits over threat points for each negotiating party are equal (Tschantz and Froeb, 2019). This model is distinct in so far each agreement's surplus is maximised **independently**, whilst assuming that the "other agreement" is secured and remains **fixed**. Therefore, the respective threat points for each negotiation is assumed to be the continuation of the "other agreement" at the **same** wholesale price and fee.

[6] This implies that retailers are merely conduits for the upstream monopolist.

The Nash-in-Shapley bargaining model over two-part pricing (NiS2) also considers bargaining between U and A, and U and B, over wholesale prices for inputs, and fixed fees. As before, retailers simultaneously set final prices in Bertrand-Nash equilibrium after a bargain has been reached. Again, agreements are secured on the basis of a two-person Nash bargaining solution in relation to the each parties' threat points. Therefore, equilibrium wholesale prices are also set to maximise the product in Equation (3.3.1).

Importantly, threat points (π_i^0 and π_U^0) are determined recursively in NiS2. When negotiating terms, the parties do not consider the "other agreement" to be fixed. Instead, the "other agreement" is assumed to respond contemporaneously to the terms—and even breakdown—of the bargain of interest, whilst also satisfying the Nash bargaining solution itself. Consequently, threat points are recursively updated according to the now updated potential profit from the "other agreement." Needless to say, the threat points of the "other agreement" are also determined recursively, now from a set of fewer agreements (Froeb *et al.*, 2019, p. 7; Yu and Waehrer, 2018, p. 3).

As with NiN2, wholesale prices in NiS2 are taken to maximise surpluses from agreements, and fees are set such that each party's profits over threat points are equal. However, NiS2 is distinguishable in so far the total surpluses from **both** agreements within U's coalition are maximised, whilst assuming that its **recursive, and interdependent, effects on threat points** are accounted for. In sum, the threat points for each agreement are assumed to be the profits from the "other agreement"—now at a **new** wholesale price that also satisfies the Nash bargaining solution, and a **new** fee that guarantees the division of surpluses according to the Myerson-Shapley value (Tschantz and Froeb, 2019).

These assumptions are intended to circumvent the "schizophrenia" of delegated agents in Nash-in-Nash bargaining models (Collard-Wexler *et al.*, 2019, p. 165; Froeb *et al.*, 2019, p. 2). Specifically, Nash-in-Shapley bargaining enables parties that are involved in more than one bilateral bargain (in this case U) to make use of all the available information to undertake bargaining strategies that maximise their total surpluses across multiple agreements. This is achieved by enabling agents to recognise the dynamic feedback effects between different agreements, within the well-known framework of Nash bargains. An alternative view is that Nash-in-Shapley bargains are able to more realistically capture the implications of *contingent contracts*, and renegotiations on off-equilibrium paths (Yu and Waehrer, 2018, p. 1).

The simulated horizontal merger model with bargaining over two-part prices (HM2) entails a merger between A and B. The merged entity, HI, negotiates with U over a wholesale price and a fixed fee. Subsequent to the bargain being reached, HI sets its optimal retail price in order to maximise its total profit. As before, U and HI set wholesale price W_{HI} as to maximise combined total surpluses in Equation (3.3.1), and negotiate a fixed fee such that parties' surpluses over their respective threat points are equal.

Given the the elimination of one independent entity downstream, only a single agreement can potentially be secured. Consequently, the differences between the bargaining protocols of NiN2 and NiS2 that were contingent on "the other agreement" have now been removed. In other words, NiN2 and NiS2 models in the case of one manufacturer and one retailer following horizontal integration downstream, as illustrated in Figure 3.2, are identical (Tschantz and Froeb, 2019). In other words, the threat points in NiN2 and NiS2 are identical in HM2. The horizontal merger does not imply any changes other than changes in ownership. This enables a study of the "loss of competition effect" downstream (Björnerstedt and Verboven, 2016, p. 126), and its associated implications for bargaining.

For each bargaining model, it is necessary to account for the possibility of non-agreement, or a breakdown of negotiations, between bargaining pairs. If a bargaining pair fails to reach an agreement, the corresponding retail good will not be made available to consumers. Moderated by the extent of substitutability between inside goods, consumers may then choose to substitute towards the other retailer's product if possible. As in Dobson and Waterson (1997, p. 421), retailers do not have other trading options apart from U, hence their disagreement payoffs (π_A^0 and π_B^0) are assumed to be zero.

For the monopolist supplier, its disagreement payoff is computed according to the amount of profit it can obtain from an agreement with the remaining retailer (Dobson and Waterson, 1997, p. 421). However, no retail goods are sold if no agreements have been secured. In this event, zero profits are made by each of the firms (Boshoff *et al.*, 2020, p. 5). Whilst not shown here, the upstream firm will always find it most profitable to supply to both retailers in NiN2 and NiS2 (Tschantz and Froeb, 2019; Froeb *et al.*, 2019, p. 10). Coupled with the implications of retailers' zero-valued threat point, this study does not consider the results of NiN2 and NiS2 in the event that only one supply agreement has been secured.

3.4 Downstream demand

Assuming that two agreements have been reached, downstream retailers face a nested logit consumer demand in accordance with that of Boshoff *et al.* (2020). The use of discrete choice models the study of retail consolidation in vertically markets is not entirely novel, yet constitutes a considerable departure from the linear demand functions utilised in older works, such as Dobson and Waterson (1997).[7] This study continues the tradition of nested logit demand models originated by Berry (1994), who showed that such demand models can be estimated using aggregated sales data. With respect to competition issues, Werden and Froeb (1994) provide a tractable logit framework for downstream competition over differentiated products.

The same justifications for the use of a nested logit demand function as in Boshoff *et al.* (2020, p. 5) is given. This demand system can accommodate various configurations of agreements, and therefore, threat points, and allows for consistency in alternatives to the agreement (Tschantz and Froeb, 2019). Logit demand also provides a simple framework according to which the change from pre- to post-merger consumer surpluses can be computed. Moreover, the nesting of inside goods allows for easy deliberation over the degree of substitutability between goods. Such models are also able to incorporate unobserved consumer heterogeneity in their valuations of different goods (Björnerstedt and Verboven, 2016, p. 137).

Furthermore, this demand system enables a relatively simple study of the manner in which the profits from a single agreement are influenced by the concurrent availability of other agreements. This effect is equivalent to the bargaining competition externalities imposed on negotiations. For example, Boshoff *et al.* (2020) presents the case where competing downstream products, facing nested logit consumer demand, depend on two corresponding vertical agreements. The profits resulting from one such agreement are negatively affected by the existence of the competing agreement. This is because the nested logit demand function implies that all final goods are (imperfect) sub-

[7] Björnerstedt and Verboven (2016) apply both nested logit and random coefficient demand models in their *ex post* study of a horizontal merger between oligopolistic manufacturers of differentiated goods in a single-tiered market, also using a MSM.

stitutes (2020, p. 5-6). Consequently, product market competition engenders a negative externality on each of the vertical agreements.

Each of the retailers' final goods, or the *inside goods*, constitute a separate choice in a single nest of the demand function. The function also includes an outside option for the *outside good*.[8] The demand function is given in terms of Kendall's τ, or rank-order correlation, as opposed to a nest strength parameter $\theta = \frac{1}{1-\tau}$. $\tau \in [0, 1)$ represents a non-parametric measure of the nest strength, or preference correlation, between n inside goods, where 0 implies a zero nest strength, and 1 implies a perfect nest strength. In this case, n will be at most 2, and fixed at 0 if no agreements are reached, i.e. the outside option is chosen (O). P_i is taken to be the retail price of the i-th inside good, for each $i = A, B$. In the limiting case where no agreements are reached, $P_O = 0$.

The demand for inside good i is initially expressed as:

$$Q_i = M \ \Pr(X_i > X_j, \ \text{all } j \neq i), \tag{3.4.1}$$

where X_i is the *net value* of inside good i, after P_i, for a random consumer.[9] In short, the quantity demanded for the inside good i is given by the product of the total number of choices available to consumers (M) for a given period, and the probability that the net value of good i exceeds the net value of each of the other inside goods for a random consumer. X_i follows an extreme-value (logit) marginal distribution, such that its cumulative distribution function is given by:

$$F_i(t) = \Pr(X_i \leq t) = \exp\left(- \exp\left(- \frac{t - (\eta_i - P_i)}{\lambda} \right) \right) \tag{3.4.2}$$

where λ is the logit scale parameter for both inside goods, and η_i is the logit location parameter for the i-th inside good's *gross value*.[10] Thus, the logit location parameter for the i-th inside good's net value is given by $(\eta_i - P_i)$.

Subsequently, Equation (3.4.2) is appropriately transformed to represent $F_{\max}(t)$. Following the further derivations in Boshoff *et al.* (2020, p. 6-9), the

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[8]Because the limiting case of a complete breakdown of bargaining is not considered, this demand system does not ever need to be adjusted, or reduced to a single option. In addition, this study does not incur the problem of restrictive hierarchical substitution with nests and sub-nests, as it only considers a single nest (Björnerstedt and Verboven, 2016, p. 137).

[9]X_i is nominated in the same units as retail prices.

[10]For convenience, the logit location parameter for the outside good is assumed to be $\eta_O = 0$ (Boshoff *et al.*, 2020, p. 9).

solutions for the the quantities demanded for the retailers' respective inside goods are given by Q_i for each $i = A, B$, such that:

$$Q_i = M \frac{\exp\left(\frac{\eta_i - P_i}{\lambda(1-\tau)}\right)}{S + S^{\tau}} \quad \forall \quad i = A, B \tag{3.4.3}$$

In other words, the i-th choice probability of a random consumer, under the extreme-value assumption, is scaled by λ.[11] It is apparent that retail prices enter the demand function logarithmically, as opposed to linearly in Berry (1994). Consequently, it circumvents the issue of quasi-linearly increasing price elasticities in price (Björnerstedt and Verboven, 2016, p. 138). S represents the quantity share of the inside goods, and is given by:

$$S = \sum_{i=A}^{B} \exp\left(\frac{\eta_i - P_i}{\lambda(1-\tau)}\right). \tag{3.4.4}$$

The quantity demanded for the outside good reflects the demand of consumers whom are not choosing any of the inside goods. Q_O is taken as a multiple of the total quantity of the inside goods, and is given by:

$$Q_O = M \frac{S^{\tau}}{S + S^{\tau}}. \tag{3.4.5}$$

The total market size, or total amount of options available to consumers, M, can be increased by exogenously increasing the quantity demanded for the outside good. Ultimately, consumer surplus, CS, is given by:

$$CS = M\lambda \log(1 + S^{1-\tau}). \tag{3.4.6}$$

For convenience, X_i is taken to be independent of the net value of the other inside good, as well as the net value of the outside good (X_O). Consequently, the demand system becomes a flat logit nested demand, which implies that $\tau = 0$. In short, random consumer preferences are not correlated across inside goods. This study does not require a consideration of a more general—and more complex—logit demand function with Gumbel distributed consumer valuations (Boshoff *et al.*, 2020, p. 7).

[11] The unobserved differences in the variances of random consumers' valuations are scaled by λ.

3.5 Calibration

Before bargaining mergers can be simulated, the appropriate calibration of certain key variables is necessitated. As Draganska *et al.* (2010, p. 57) illustrates, the relative bargaining powers of retailers and manufacturers are a function of these exogenous firm characteristics, as well as the estimated (in this case calibrated) patterns of endogenous demand substitution. This study's main concern is the comparative efficacy of different bargaining models in light of retail consolidation downstream. Specifically, it is necessary to consider the bearing that the fundamental assumptions of the NiN2 and NiS2 bargaining models have in predetermining predicted merger effects.

Therefore, this study follows the same calibration procedure as in Boshoff *et al.* (2020). In particular, the logit scaling parameter (λ),[12] initial prices (P_A and P_B) and quantities (Q_A and Q_B) of the inside goods, and the nest strength parameter (Kendall's τ) are taken to be fixed. In contrast, by exogenously increasing the quantity of the outside good (Q_O) it enables a review of how bargaining models' predicted effects change in lieu of the increased substitutability of the inside goods in relation to the outside good. Given a higher quantity of the outside good, the aggregate elasticity in the industry (ε_{agg}) increases as a result of the increase in the total market size (M).

On the basis of these variable and fixed parameters, the location parameters (η_i) for the *gross* valuations of each inside good ($i = A, B$) can be calculated. It is computed in accordance with Boshoff *et al.* (2020, p. 10-11) such that:

$$\log\left(\frac{Q_i}{\sum_{j=1}^{n} Q_j}\right) = \frac{\eta_i - P_i}{\lambda(1-\tau)} - \log(S) \tag{3.5.1}$$

$$\eta_i = P_i + \lambda(1-\tau)\left(\log\left(\frac{Q_i}{\sum_{j=A}^{B} Q_j}\right) + \log(S)\right), \tag{3.5.2}$$

where

$$S = \left(\frac{Q_O}{\sum_{i=A}^{B} Q_i}\right)^{\frac{1}{(\tau-1)}}. \tag{3.5.3}$$

Subsequently, the demand system's initial conditions are calibrated such that it reflects the prices and elasticities of a hypothetical monopolist (Boshoff

[12]The arbitrary fixing of the scale parameter is common practice for extreme-value distributions (Swait and Louviere, 1993). This rules out any confounds that may result from variance differences in consumers' valuations.

et al., 2020, p. 11). First, it is assumed that the upstream firm supplies the input at zero marginal cost such that $mc_U = 0$. In turn, the marginal costs of the downstream firms (mc_A and mc_B) are deduced from initial monopolist prices and quantities. The hypothetical monopolist chooses prices to maximise the following profit function, π_M:

$$\pi_M = (P_A - mc_A)Q_A + (P_B - mc_B)Q_B. \tag{3.5.4}$$

Hence, profit-maximising initial prices satisfy the following first-order conditions:

$$0 = Q_A + (P_A - mc_A)\frac{\partial Q_A}{\partial P_A} + (P_B - mc_B)\frac{\partial Q_B}{\partial P_A} \tag{3.5.5}$$

$$0 = Q_B + (P_A - mc_A)\frac{\partial Q_A}{\partial P_B} + (P_B - mc_B)\frac{\partial Q_B}{\partial P_B}. \tag{3.5.6}$$

By decomposing Equation (3.4.3) into separate elements, taking the partial derivative of the demand function for inside goods becomes much simpler. Where $s_i = \exp\left(\frac{\eta_i - P_i}{\lambda(1-\tau)}\right)$ and $f(x) = \frac{1}{x+x^\tau}$, the demand for the i-th inside good becomes:

$$Q_i = M\frac{\exp\left(\frac{\eta_i - P_i}{\lambda(1-\tau)}\right)}{S + S^\tau} \tag{3.4.3}$$

$$Q_i = M s_i f(S) \tag{3.5.7}$$

Thereby, the first-order conditions for the hypothetical monopolist in Equations (3.5.5) and (3.5.6) become:

$$0 = Q_A + (P_A - mc_A)\left(Q_A + Q_A s_A \frac{f'(S)}{f(S)}\right) + (P_B - mc_B)\left(Q_A s_B \frac{f'(S)}{f(S)}\right)$$

$$0 = Q_B + (P_A - mc_A)\left(Q_B s_A \frac{f'(S)}{f(S)}\right) + (P_B - mc_B)\left(Q_B + Q_B s_B \frac{f'(S)}{f(S)}\right).$$

From the resulting first-order conditions, retailers' marginal costs, and own- and cross-price elasticities, ε_{ii} and ε_{ij} where $i \neq j$, can be derived. After equating these conditions, and dividing by each of the quantities demanded (Boshoff *et al.*, 2020, p. 11), it is shown that:

$$P_A - mc_A = P_B - mc_B \tag{3.5.8}$$

which implies that any difference in the hypothetical monopolist's initial prices is as a consequence of differences in downstream marginal costs. In sum,

mc_A and mc_B are calibrated such that initial prices, P_A and P_B, reflect the equilibrium prices for a monopolist.

Furthermore, symmetric retailers are assumed to preside over the same initial retail prices and quantities demanded. Initial quantities of the inside goods are normalised to a total of 100, and are chosen so that $Q_A + Q_B = 100$ and $Q_A = Q_B = \overline{Q} = 50$. Initial retail prices are normalised to a quantity-weighted average of 10, so that $P_A = P_B = \overline{P} = 10$ (Tschantz and Froeb, 2019). Given that the predicted outcomes will vary according to the exogenously chosen Q_O and ε_{agg}, arbitrarily chosen initial prices and quantities will not affect the comparative outcomes of bargaining models (Boshoff *et al.*, 2020, p. 11). However, initial conditions will be reflected in retailers' marginal costs.

Consequently, all the necessary parameters are given or derived in order to calibrate demand, and to compute the outcomes of bargaining models. Notably, given the assumption of symmetric retailers, the demand for A and B's inside goods are determined by the same location parameter, own- and cross price elasticities, and marginal costs, such that:

$$\eta_A = \eta_B = \overline{\eta} \tag{3.5.9}$$

$$\varepsilon_{AA} = \varepsilon_{BB} = \varepsilon_{\text{own}} \tag{3.5.10}$$

$$\varepsilon_{AB} = \varepsilon_{BA} = \varepsilon_{\text{cross}} \tag{3.5.11}$$

$$mc_A = mc_B = \overline{mc}. \tag{3.5.12}$$

Finally, this study follows Boshoff *et al.* (2020) and Tschantz and Froeb (2019) in so far it adopts a *flat* logit demand function.[13] This implies a nest strength parameter of zero, so that $\tau = o$. Hence, the effect of an exogenous increase in Q_O on the other variable parameters can be discerned. By exogenously altering Q_O and M, it necessarily also increases ε_{agg}, as λ remains fixed. The logit scale parameter is chosen such that $\lambda = 1.6667$. This permits easily interpreted increases in the outside quantity in increments of 50. Correspondingly, $\overline{\eta}$, ε_{own} and $\varepsilon_{\text{cross}}$, and $\overline{mc}$ will also vary to reflect increases in aggregate elasticity. This chain of changes is a consequence of determining the initial equilibrium of a hypothetical monopolist after each exogenous increase in the outside quantity demanded (Boshoff *et al.*, 2020, p.11-12).

As such, this analysis considers four different calibrations at the initial equilibrium for a hypothetical monopolist by varying Q_O to reflect a quantity

[13]See Section 3.4.

Table 3.1: Calibrations associated with varying Q_O

Q_O	%	M	ε_{agg}	ε_{own}	$\varepsilon_{\text{cross}}$	$\overline{mc}$	$\overline{\eta}$	λ
50	33.33%	150	-2	-4	2	5	10	1.6667
100	50.00%	200	-3	-4.5	1.5	6.67	8.845	1.6667
150	60.00%	250	-3.6	-4.8	1.2	7.22	8.169	1.6667
200	66.67%	300	-4	-5	1	7.5	7.69	1.6667

$P_A = P_B = 10$; $Q_A = Q_B = 50$; $\tau = 0$. % is proportion of M.

share of between 33.33% and 66.67% of the initial total industry output.[14] These exogenous incremental increases of the outside good are associated with changes in a host of calibration parameters, as summarised in Table 3.1. First, the total amount of initial choices available to consumers (M) vary from 150 to 300 in the same increments as Q_O. Second, the aggregate elasticity of demand (ε_{agg}) in the entire industry increases in magnitude from 2 to 4.[15]

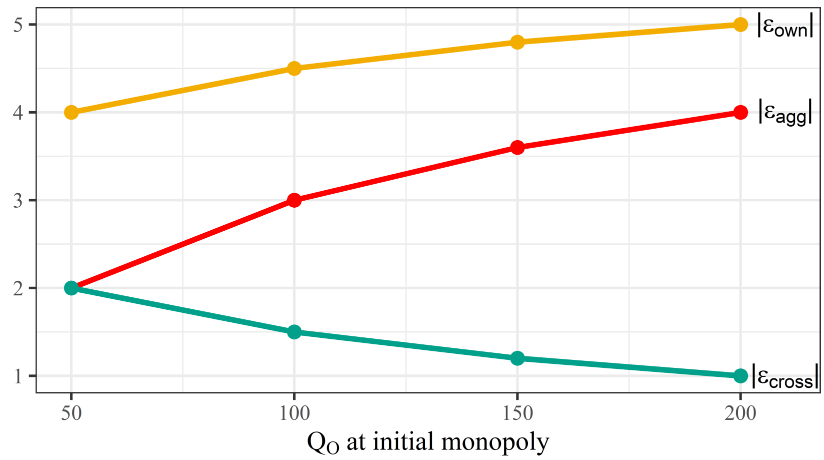

Figure 3.3: Inside goods' price elasticities by Q_O

The increase in aggregate elasticity at the initial monopoly equilibrium corresponds to proportionate and contrasting changes in the magnitude of the inside goods' own- and cross-price elasticities, as illustrated in Figure 3.3. Specifically, the magnitude of inside goods' own-price elasticities ($|\varepsilon_{\text{own}}|$) in-

[14]Recall that initial industry conditions for a hypothetical monopolist maintain that initial retail prices and quantities are equal to 10 and 50, respectively.

[15]Whilst outside the ambit of this study, exogenously varying Q_O in this manner would increase the logit scale parameter (λ) from 1.67 to 3.33, and decrease the logit location parameter ($\overline{\eta}$) from 10.00 to 5.38, if ε_{agg} remained fixed at -2. Increasing the quantity ratio of outside-to-inside-goods implies a vastly more dispersed, and much lower, distribution of random consumer *gross* valuations for the inside goods.

creases from 4 to 5, and cross-price elasticities ($|\varepsilon_{\text{cross}}|$) decreases from 2 to 1. This divergence is explained by the increased substitutability of the inside goods with respect to the outside good, and concurrently, the inside goods becoming less substitutable with one another. Therefore, the demand for any one inside good becomes more sensitive to its own price, yet less sensitive to the price of the other inside good (Boshoff *et al.*, 2020, p. 12).

In addition, marginal costs respond to an exogenous increase in the quantity of the outside good, as illustrated in Figure 3.4. Because initial prices are fixed in a hypothetical monopoly equilibrium, an increase in the substitutability of the inside goods with the outside good will be associated with a decrease in the inside firms' initial profit margins. Given the current setup, a reduction in margins can only be achieved by a corresponding increase in marginal costs (Boshoff *et al.*, 2020, p. 12). The relative increase in $\overline{mc}$ with respect to fixed initial retail prices ($\overline{P}$) is apparent. Notably, the increase in the substitutability of inside goods in relation to the outside good is coincident with a decrease in the location parameter of random consumers' gross valuations of inside goods ($\overline{\eta}$). This also implies that the median random consumer's net valuation of inside goods ($\overline{\eta} - \overline{P}$) is decreasing in $|\varepsilon_{\text{agg}}|$.

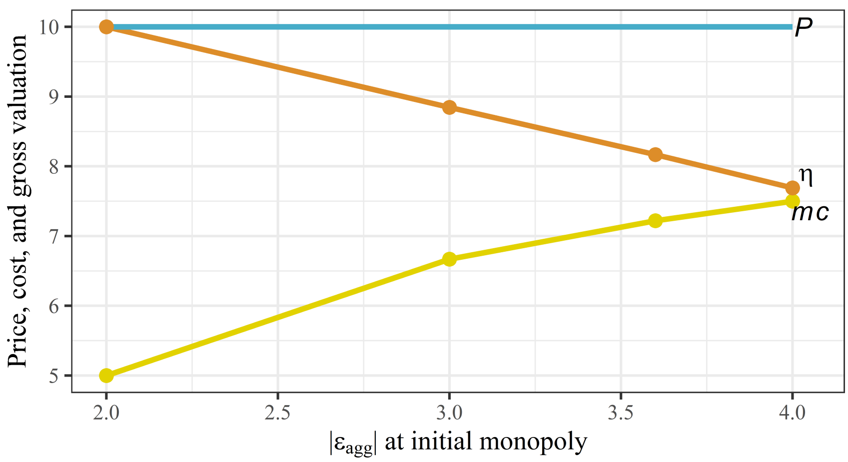

Figure 3.4: Gross valuation and marginal costs by varying ε_{agg}

Chapter 4

Results

The key outcomes of interest for all benchmark- and bargaining models are graphically illustrated in Figures 4.1 to 4.6. These figures are derived from the corresponding numeric predictions that are tabulated in Tables A.1 to A.6 in Appendix A. As set out in Section 3.3, the two benchmark cases, competition (Comp) and monopoly (Mon), do not entail any bargaining and are idiosyncratic with respect to their division of surpluses. The primary concern of this study is the extent to which the underlying assumptions of Nash-in-Nash (NiN2) and Nash-in-Shapley (NiS2) bargaining models predetermine the appraisal of retail mergers under two-part pricing. Therefore, the predictions of NiN2 and NiS2 are compared in conjunction with the predictions of the horizontal retail merger model (HM2) for different configurations of the aggregate industry size and composition.[1]

Given the assumed structure of the inside industry illustrated in Figures 3.1 and 3.2, the differences between the bargaining protocols of NiN2 and NiS2 are eliminated in the event of a downstream merger. As such, the fundamental assumptions of NiN2 and NiS2 will entirely determine the magnitude and direction of their predicted merger effects in relation to the outcomes predicted in HM2. These predicted merger effects—with NiN2 and NiS2 as starting points—are evaluated in terms of the merger's impact on industry competitiveness, consumer welfare, contracting, and the division of surpluses between inside firms. The latter consideration is of particular importance, given this study's interest in the effects of buyer power in vertically related markets.

[1]See Table 3.1.

4.1 Competition and welfare

Figure 4.1 provides a representation of the equilibrium retail prices and total quantities of inside goods, A and B. First, it is apparent that none of the bargaining models under two-part pricing predict retail prices above and quantities below monopoly levels. Therefore, bargaining models that account for the interdependencies between concurrent bilateral negotiations avoid the issue of the exceeding double marginalisation observed in models of unilateral bargaining.[2] Second, firms are able to avoid retail prices above monopoly levels, because two-part pricing permits inside firms to act on the incentive to maximise profits of their entire distribution channel, and in turn, split the gains from trade over threat points fairly. In contrast, linear pricing prohibits inside firms from acting to the benefit of the entire distribution channel, hence resulting in prices above monopoly levels (Boshoff *et al.*, 2020, p. 14).

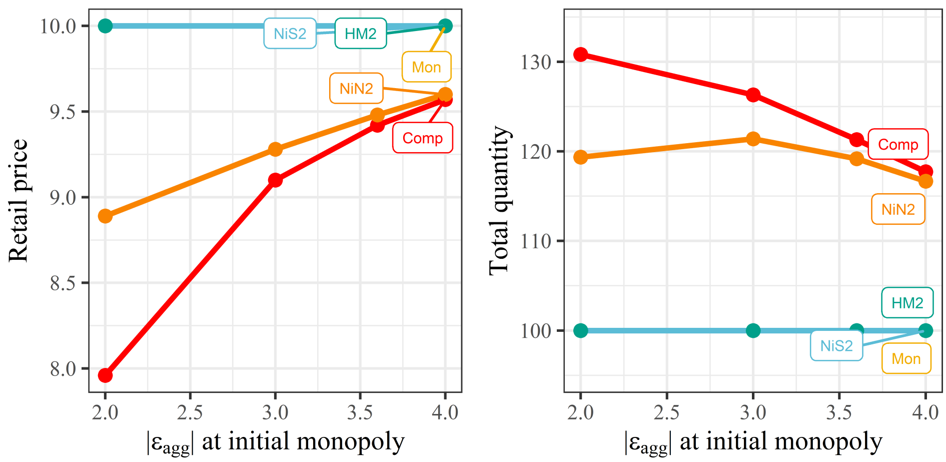

Figure 4.1: Inside good retail prices and quantities

Third, NiN2 presents the symptoms of the "schizophrenia" observed in delegated agent models (Collard-Wexler *et al.*, 2019, p. 165). By not allowing threat points to be determined recursively, firm U secures two bilaterally efficient agreements with A and B which do not maximise its total gains from both trades. By effectively bargaining against itself (Froeb *et al.*, 2019), U cannot secure the "socially efficient" outcome for its coalition (de Fontenay and Gans, 2014, p. 758). Hence, NiN2 predicts relatively more competitive outcomes than NiS2 for any given level of aggregate elasticity in the market, as discussed in Rey and Vergé (2020). In fact, the market outcomes of NiN2

[2]See Section 2.2.3.

and Comp begin to converge as the substitutability of inside- with outside goods increase.

Finally, it is noteworthy that NiS2 and HM2 produce retail prices and quantities equivalent to that of Mon.[3] In contrast to NiN2, NiS2 reflects bargaining that allows the gains from trade for the entire coalition to be maximised. In HM2, U and HI's threat points are zero and the total coalition surpluses are also maximised. Therefore, HM2 is only distinct from NiS2 in so far surpluses are divided differently.[4] In sum, the effective elimination of a competing retailer from NiS2 to HM2 did not give rise to the unilateral effects described in Werden and Froeb (2011, p. 156).

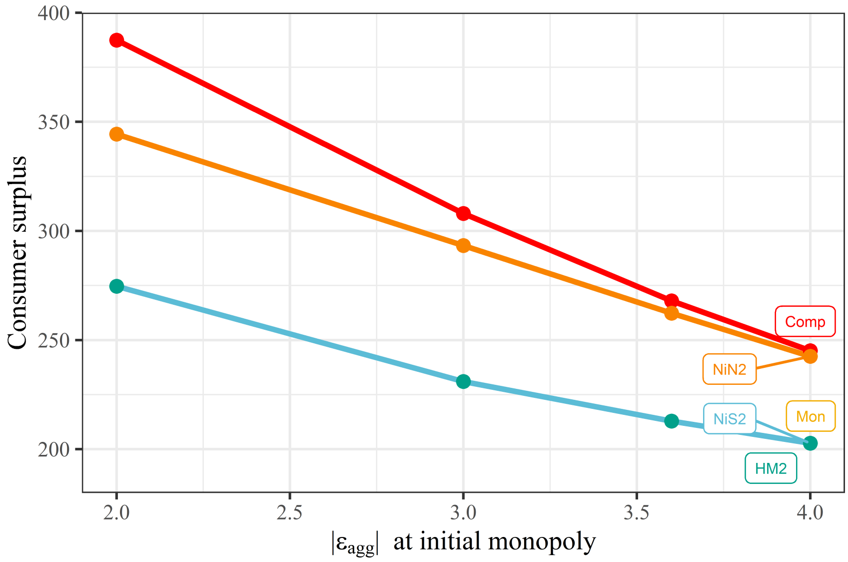

Figure 4.2: Consumer surplus

Figure 4.2 illustrates the models' retail outcomes in terms of consumer surpluses. In relative terms, the respective models' consumer surpluses perfectly correspond to the predicted outcomes in the retail market, as in Figure 4.1. For the reasons highlighted above, the predicted adverse effects of downstream consolidation (HM2) for consumers are exaggerated when considering the change from the artificially competitive outcomes of NiN2. The predicted decline in consumer surpluses from NiN2 to HM2 is between 20.2% and 16.4% as $|\varepsilon_{agg}|$ increases from 2 to 4. In contrast, consumer surpluses for NiS2 and HM2 are

[3]Mon retail prices and quantities are constant, as $|\varepsilon_{agg}|$ reflects calibration according to initial equilibriums for a hypothetical monopolist.

[4]See Section 4.3.

identical. Therefore, a strict application of the *consumer welfare standard* during the appraisal of a retail merger in this setting will prohibit the merger on the grounds of NiN2, and conversely, may permit the merger on the grounds of NiS2.

4.2 Contracting

Figures 4.3 and 4.4 illustrate the changing nature of negotiated vertical contracts for different equilibriums according to the varying substitutability of inside- with outside goods. The benchmark model, Comp, is excluded from this part of the analysis as it does not entail any vertical contracting. By construction, the marginal costs of downstream firms are increasing in $|\varepsilon_{agg}|$ for the different calibrations according to the initial equilibrium of hypothetical monopolist.[5]

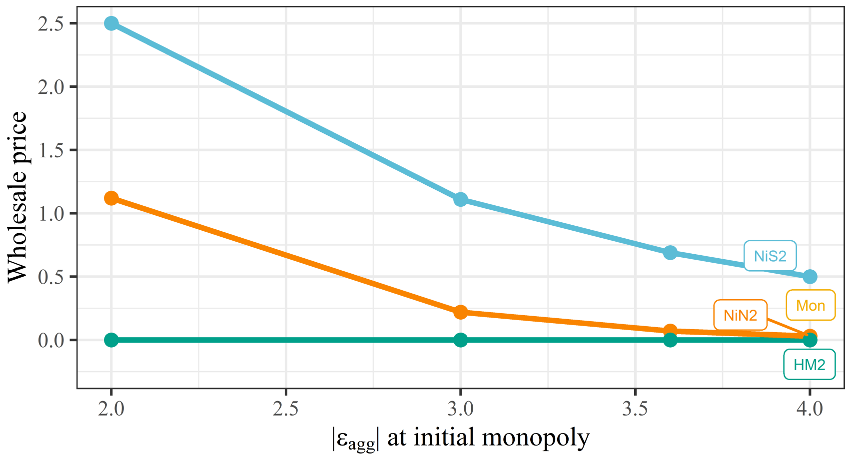

Figure 4.3: Wholesale prices

Excluding HM2, it is observed in Figure 4.3 that negotiated marginal wholesale prices are decreasing in the substitutability of inside- to outside goods. It implies that inside firms negotiate lower wholesale prices in response to the increasing competitiveness of the outside market. This is the outcome of inside firms' attempt to balance two objectives. First, wholesale prices are negotiated to allow A and B, or HI, to remain as competitive as possible in the retail market. Second, wholesale prices are used in conjunction with fixed

[5]See Figure 3.4 and Section 3.5.

fees to return the gains from the downstream product market to the upstream firm.

From Figure 4.3, it is apparent that the wholesale prices of the respective models corroborate the findings highlighted in Section 4.1. $\overline{W}$ is identical in NiS2 and Mon, which implies that inside firms negotiate wholesale prices in order to maximise surpluses through monopoly prices in the downstream product market. NiS2 and Mon wholesale prices are the largest of all the models, yet A and B are fairly compensated in NiS2 as their fixed fees are the lowest of all the models in Figure 4.4. This reflects the "equal-gains-principle" highlighted by Inderst and Wey (2003, p. 5) and Navarro (2007, p. 759).

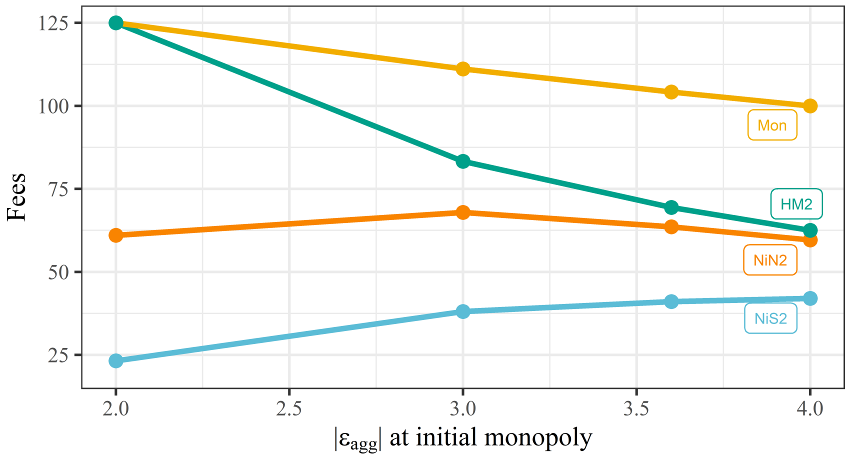

Figure 4.4: Fixed fees

On the other hand, NiN2 produces negotiated wholesale prices that are consistently lower than NiS2 and Mon. As apparent in Figure 4.4, relatively lower wholesale prices in NiN2 are not proportionately recouped by U through fixed fees. Despite relatively larger levels of $\overline{f}$, the lower $\overline{W}$ in NiN2 corresponds to the near perfectly competitive retail outcomes in Figure 4.2, thereby benefiting consumers at the expense of of U.[6]

Wholesale prices in HM2 (W_{HI}) are consistently zero. In terms of this metric, it can seemingly be concluded that relatively more powerful buyers are able to negotiate more favourable terms with their suppliers (Inderst and Shaffer, 2007, p. 46), as has been shown in Chipty and Snyder (1999). In accordance with the US horizontal merger guidelines (2010, Section 8), this instance may be flagged by competition authorities as a manifestation of adverse buyer

[6]The latter point is made evident in Figure B.3.

power during the appraisal of the retail merger concerned. The proposed retail merger will also constitute a merged entity of much greater commercial significance to U, thereby eliciting another factor that competition agencies may consider during an evaluation of adverse buyer power. However, the fact that f_{HI} in HM2 is consistently higher than $\overline{f}$ in NiN2 and NiS2 may render such a finding incomplete.

As will be made clear in Figure 4.6, the terms of trade in HM2 enable HI and U to maximise profits in the retail market, and have the effect of distributing surpluses over zero threat points equally. Notably, marginal wholesale prices and fixed fees for NiN2 and HM2 begin to converge as inside goods become more substitutable with outside goods. This suggests that vertical contracts in NiN2 become more equitable as the relative competitiveness of the outside market begins to increase. However, this once again exposes NiN2's inherent flaw of precluding U from making use of all of the information at its disposal.[7] The assumption of invariable threat points in Nash-in-Nash bargains determines that vertical contracts in NiN2 approach the equity observed in that of HM2, despite the greater value of U's outside option in the former.[8] In sum, the negotiated terms in NiN2 do not sufficiently reflect the externalities imposed by the existence of U's threat points.[9]

In contrast, NiS2 enables U to consistently leverage the existence of its outside option, thereby resulting in NiS2's consistently larger total wholesale costs (total input costs and fixed fees) in relation to HM2, as illustrated in Figure B.1 in Appendix B. This outcome is achieved through comparatively higher wholesale prices in NiS2 *vis-à-vis* HM2 that are moderated by relatively lower fees.

4.3 Division of surpluses

Figures 4.5 and 4.6 aids the interpretation of total inside industry profits and the division of surpluses within said industry. As expected, the profitability of the entire inside industry decreases as the substitutability of inside- with outside goods increases in Fig. 4.5. Similarly, the total level of profits that

[7] See Froeb *et al.* (2019) and Rey and Vergé (2020) in Section 2.2.3.

[8] When retailers integrate horizontally in HM2, U effectively loses the disagreement option of supplying to the "other" retailer, or threat of non-supply. As such, U's threat point becomes zero in HM2.

[9] See von Ungern-Sternberg (1996) in Section 2.3.

accrue to the downstream division of the inside industry also declines.[10] As a consequence of the respective models' predicted outcomes in the retail market, as highlighted in Section 4.1, total inside industry profits for NiS2, HM2, and Mon are identical. In relative terms, total industry profits in NiN2 are consistently lower than the monopoly benchmark, and are somewhat larger than the competition benchmark. As before, NiN2 converges to Comp given the increasing competitiveness of the outside industry.

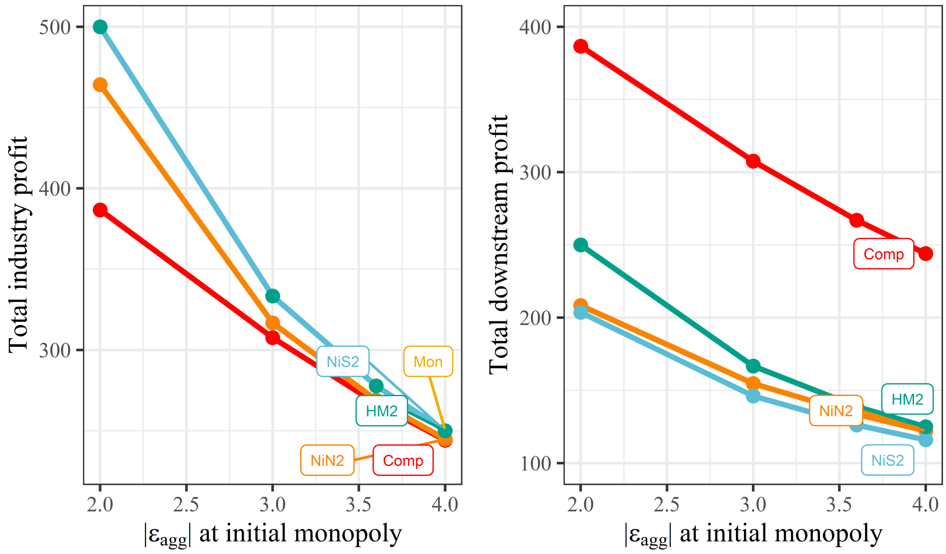

Figure 4.5: Inside industry profits

From the right-hand panel in Figure 4.5, it is apparent that the levels of downstream profits in Comp are considerably larger than those observed in all other models. As Comp does not entail any bargaining, or input costs, this difference alludes to the "bargaining effects" described by Horn and Wolinsky (1988). As such, this finding reaffirms the necessity of emphasising the externalities associated with bargaining competition during the application of MSMs.

Moreover, it is observed that retailers A and B will always find it profitable to consolidate in all configurations of the inside-to-outside-good quantity ratio. Specifically, the finding of merger incentives holds using both NiN2 and NiS2 models as starting points, as the level of total downstream profits in HM2

[10]The total profits of the downstream industry for Mon are excluded from the relevant figure, as downstream firms are taken to be transparent.

(π_{HI}) is consistently higher than that of both duopoly cases (π_{A+B}).[11] Higher levels of π_{A+B} are predicted in NiN2 in comparison to NiS2. This is a result of the comparatively favourable terms of supply granted to downstream firms by a myopic U in NiN2.[12]

Moreover, A and B's scope for increased profits by consolidating is inversely related to the substitutability of inside- to outside goods. This phenomenon can be explained by the associated increases in the magnitude of own-price elasticities and decreases in the magnitude of cross-price elasticities of the inside goods.[13] Particularly, retail merger incentives are amplified when the magnitude of cross-price elasticities are large, or when the downstream competition externality exerted between retailers is more substantial. In other words, the larger the competition externality that can be internalised, the greater the expected increase in profits as a result of consolidation. Specifically, the expected increases in downstream profits as a result of merging are between 22.84% and 7.78% in the case of NiS2, and between 20% and 2.4% in the case of NiN2.

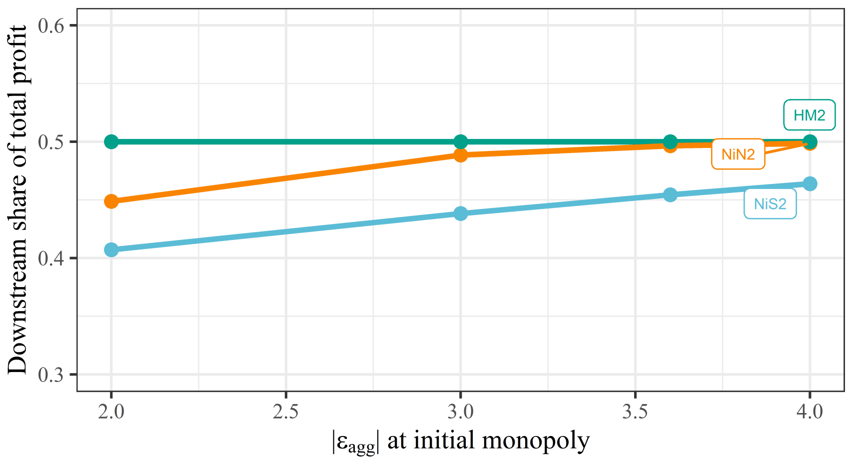

Figure 4.6: Downstream share of total industry profit

Finally, Figure 4.6 permits an analysis of how changes in the relative bargaining positions of upstream and downstream parties can affect profit-sharing across vertical relationships, irrespective of industry profits in absolute terms. As noted in Section 4.2, perfectly equitable profit-sharing between U and HI is consistently observed in HM2, i.e. 50% each. The terms of supply are set so

[11]Given the assumption of symmetry between A and B, retailers are assumed to share downstream profits equally in NiN2, NiS2, and HM2.

[12]See Section 4.2.

[13]See Section 3.5.

that downstream profits are maximised, and fees are taken to equally distribute surpluses over both parties' zero threat points.

In both NiN2 and NiS2, the downstream share of total inside industry profits are consistently lower than that observed in HM2. For the reasons highlighted in Section 4.2, however, the downstream profit share in NiN2 converges markedly to that of HM2, as aggregate elasticity in the entire industry increases. Specifically, A and B's share of total inside industry profits increases from 44.88% to 49.87%. In contrast, the downstream profit share in NiS2 remains somewhat lower than that of HM2, even for the maximum level of aggregate elasticity in the entire industry. In short, the downstream profit share in NiS2 ranges between 40.72% to 46.39% of total inside industry profits.

Increasing aggregate elasticity in the entire market seemingly induces the downstream and upstream divisions of the inside industry display more reciprocity. When downstream profits margins are lower in NiN2 and NiS2 as a result of the increased own-price elasticity of inside goods, it undermines the value of U's threat of selling to a competing retailer as the cross-price elasticities of inside goods exhibit a corresponding decrease. In other words, the bargaining power of A and B improves in relation to that of U, given that the downstream firms' threat points remain zero and U's disagreement payoff decreases. Provided these changes in price elasticities, U's ability to credibly threaten non-supply diminishes, as an increasing number of consumers will substitute toward outside goods as opposed to the alternative inside good. Hence, wholesale prices tend to decrease and fees tend to stabilise in response to a more elastic total industry in Figures 4.3 and 4.4, thereby guaranteeing more equitable contracting in NiN2 and NiS2.

Chapter 5

Conclusion

The primary aim of this dissertation was to shed light on the predicted effects of retail consolidation, and adverse buyer power, in vertically related markets. A survey of the relevant literature yielded a few key—yet troubling—observations that served as justifications for this study. During the appraisal of retail mergers in vertically related markets, competition authorities are required to balance the objectives of efficiency and consumer welfare in complex environments often characterised by the externalities associated with bargaining competition. These assessments are typically performed using only pre-merger data, overly-presumptions approaches, and different screening tools that sometimes produce incomplete, counterintuitive or conflicting predictions. The persistent trend of increasing concentration in retail markets across the world in recent decades will necessitate more flexible and sophisticated merger screening tools.

Parametrisable structural models are posited to be a possible solution to this impending problem. As such, merger simulation models (MSMs) that account for different vertical bargaining patterns are well-situated to generate more quantitatively informed predictions of a merger's potential effects. In addition, MSMs can be calibrated to approximate the conditions in a variety of market settings, and its specifications can be further refined through retrospective merger analysis. Future increases in data availability and computational power will likely overcome its current shortcomings associated with ease of calculation, misspecification, and data-poor environments.

Nonetheless, MSMs are yet to reach their full technical potential. MSMs have mostly been applied to only a single division of vertically related industries, and analysts struggle to isolate the degree to which predictions are merely a result of models' functional forms. Moreover, the magnitude and direction of Horn and Wolinsky's (1988) "bargaining effects"—that render standard, non-bargaining duopoly models obsolete—may also be biased by the fundamental assumptions of the bargaining protocol being modelled. It has also proven to be quite hard to identify the appropriate type of bargaining at play for any given vertical relationship. In addition, commonly-used bargaining protocols have tended not to appropriately account for the dynamic feedback effects between different existing or potential agreements.

Therefore, this study examines the different predicted effects of a retail merger between duopolist downstream firms, that are supplied by a single upstream firm, using two benchmark non-bargaining models and three other bargaining models under two-part pricing. Predictions are generated using the merger simulation application of Tschantz and Froeb (2019) for various specifications of the inside- and outside industry composition. Simplifying assumptions are made with respect to costs, retailer symmetry, consumer valuations of retailers' inside goods. A flat logit nested demand function that allows for product differentiation from Boshoff *et al.* (2020) is calibrated to simulate the initial equilibrium outcomes for a hypothetical monopolist. Hence, the different predictions of the various models can be purely ascribed to the differences in the fundamental assumptions of bargaining protocols.

Notably, this dissertation constitutes the first application of Nash-in-Shapley (NiS2) bargaining in the study of retail consolidation in a vertically related market. Moreover, it is also distinguishable in its novel consideration of how the underlying assumptions of Nash-in-Nash (NiN2) and NiS2 can predetermine the prediction of the magnitude and direction of a retail merger's effects. Given that the inherent differences between NiS2 and NiN2—as a result of how threat points, or disagreement payoffs, are determined—are eliminated in the case of a horizontal merger (HM2), it allows for an intuitive comparison of the two bargaining models of interest.

In sum, the findings suggest that retail consolidation poses a viable course of action through which downstream retailers are able to improve their combined profitability and bargaining positions in relation to their upstream supplier. Seemingly, this corroborate the assertion that increased buyer power can be leveraged to increase retailer profits (e.g. Inderst and Shaffer, 2007). Consolidation gives rise to improved retailer profitability as a result of the internalisation of the competition externality formerly exerted between retailers.

A retail merger improves the downstream firms' bargaining power, primarily by undermining the upstream firm's former threat of supplying to a competing retailer (von Ungern-Sternberg, 1996). In addition, the resulting merged entity is of much greater commercial significance to the monopolist supplier. As Draganska *et al.* (2010, p. 57) point out, this necessarily leads to a shift in bargaining power in favour of the downstream firm, which can manifest as increased supplier *hold-up* (Montez, 2007, p. 949).

However, the scope for improvement on both fronts is mitigated by the degree of aggregate elasticity in the entire industry. Given the surprising increase in the equality of vertical contracts observed in NiN2, the mitigating impact of aggregate elasticity on merger incentives is stronger in NiN2 than in NiS2. However, it is remarkable that the assumptions that underlie NiN2 and NiS2 bargaining models predetermine the predicted effects of a retail merger in terms of retail market outcomes, consumer harm, and common measures of buyer power. A myopic upstream supplier in NiN2, with delegated agents, produces highly competitive pre-merger outcomes that may bias competition agencies' adjudication of a retail merger in favour of prohibition (Boshoff *et al.*, 2020). In contrast, when negotiating parties' threat points are allowed to vary intelligently, NiS2 predicts retail outcomes commensurate with the predictions of the merger- and benchmark monopoly case. Consequently, retail consolidation with NiS2 as its starting point would improve downstream firms' profitability, bargaining position, and profit share, without leading to consumer harm.

Given the immense versatility of the merger simulation application of Tschantz and Froeb (2019), it provides a rich source for future avenues of research in the empirical industrial organisation literature. Admittedly, this dissertation offers only an initial gloss of the potential of MSMs that incorporate superior bargaining protocols. The obvious next steps in this line of research would entail the alteration or relaxation of some of the simplifying assumptions with respect to symmetry, costs, industry structure, and consumer valuations.

Appendices

Appendix A

Merger simulation data

Table A.1: Competetiton model

$\varepsilon_{\mathbf{agg}}$	$\overline{P}$	$\overline{Q}$	wc	$\overline{W}$	$\overline{f}$	$\overline{\pi}$	π_{A+B}	π_U	$\pi_{\mathbf{tot}}$
-2.00	7.96	65.41	0.00	0.00	0.00	193.31	386.62	0.00	386.62
-3.00	9.10	63.15	0.00	0.00	0.00	153.81	307.62	0.00	307.62
-3.60	9.42	60.65	0.00	0.00	0.00	133.47	266.94	0.00	266.94
-4.00	9.57	58.86	0.00	0.00	0.00	122.05	244.09	0.00	244.09

Results are computed from Tschantz and Froeb (2019).

Table A.2: Monopoly model

$\varepsilon_{\mathbf{agg}}$	$\overline{P}$	$\overline{Q}$	wc	$\overline{W}$	$\overline{f}$	$\overline{\pi}$	π_{A+B}	π_U	$\pi_{\mathbf{tot}}$
-2.00	10.00	50.00	250.00	2.50	125.00	0.00	0.00	500.00	500.00
-3.00	10.00	50.00	166.67	1.11	111.11	0.00	0.00	333.33	333.33
-3.60	10.00	50.00	138.89	0.69	104.17	0.00	0.00	277.78	277.78
-4.00	10.00	50.00	125.00	0.50	100.00	0.00	0.00	250.00	250.00

Results are computed from Tschantz and Froeb (2019).

Table A.3: Nash-in-Nash model (NiS2)

$\varepsilon_{\mathbf{agg}}$	$\overline{P}$	$\overline{Q}$	wc	$\overline{W}$	$\overline{f}$	$\overline{\pi}$	π_{A+B}	π_U	$\pi_{\mathbf{tot}}$
-2.00	8.89	59.68	127.94	1.12	61.01	104.16	208.32	255.88	464.21
-3.00	9.28	60.70	81.00	0.22	67.90	77.36	154.72	162.00	316.71
-3.60	9.48	59.59	67.72	0.07	63.60	66.79	133.58	135.44	269.03
-4.00	9.60	58.33	61.36	0.03	59.64	61.03	122.06	122.71	244.78

Results are computed from Tschantz and Froeb (2019).

Table A.4: Nash-in-Shapley model (NiS2)

$\varepsilon_{\mathbf{agg}}$	$\overline{P}$	$\overline{Q}$	wc	$\overline{W}$	$\overline{f}$	$\overline{\pi}$	π_{A+B}	π_U	$\pi_{\mathbf{tot}}$
-2.00	10.00	50.00	148.21	2.50	23.21	101.79	203.58	296.43	500.00
-3.00	10.00	50.00	93.62	1.11	38.06	73.05	146.10	187.23	333.33
-3.60	10.00	50.00	75.78	0.69	41.06	63.11	126.22	151.57	277.78
-4.00	10.00	50.00	67.01	0.50	42.01	57.99	115.98	134.02	250.00

Results are computed from Tschantz and Froeb (2019).

Table A.5: Horizontal merger model (HM2)

ε_{agg}	$\overline{P}$	$\overline{Q}$	wc	$\overline{W}$	$\overline{f}$	$\overline{\pi}$	π_{HI}	π_U	$\pi_{\mathbf{tot}}$
-2.00	10.00	50.00	125.00	0.00	125.00	125.00	250.00	250.00	500.00
-3.00	10.00	50.00	83.33	0.00	83.33	83.33	166.67	166.67	333.33
-3.60	10.00	50.00	69.44	0.00	69.44	69.44	138.89	138.89	277.78
-4.00	10.00	50.00	62.50	0.00	62.50	62.50	125.00	125.00	250.00

Results are computed from Tschantz and Froeb (2019).

Table A.6: Consumer surpluses by model

$\varepsilon_{\mathbf{agg}}$	**Competition**	**Monopoly**	**NiN2**	**NiS2**	**HM2**
-2.00	387.41	274.66	344.37	274.66	274.66
-3.00	308.03	231.05	293.29	231.05	231.05
-3.60	267.95	212.85	262.34	212.85	212.85
-4.00	245.10	202.74	242.52	202.74	202.74

Results of own calculations using Equations (3.4.4) to (3.4.6).

Appendix B

Additional figures

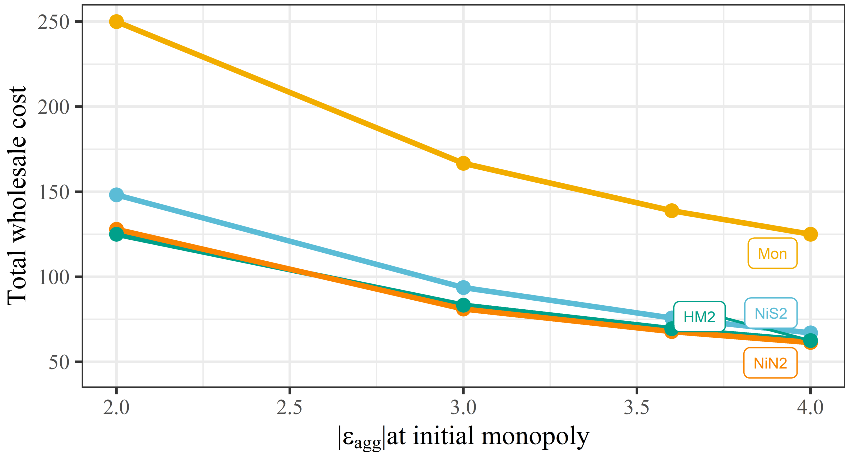

Figure B.1: Total wholesale costs

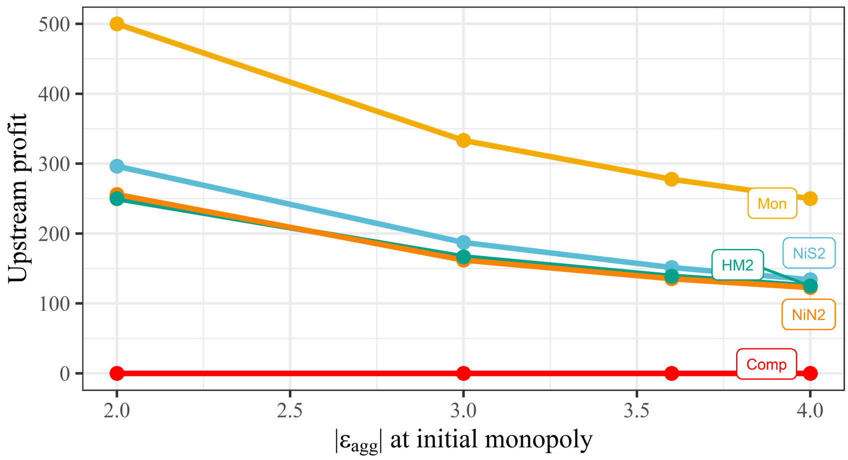

Figure B.2: Upstream profits

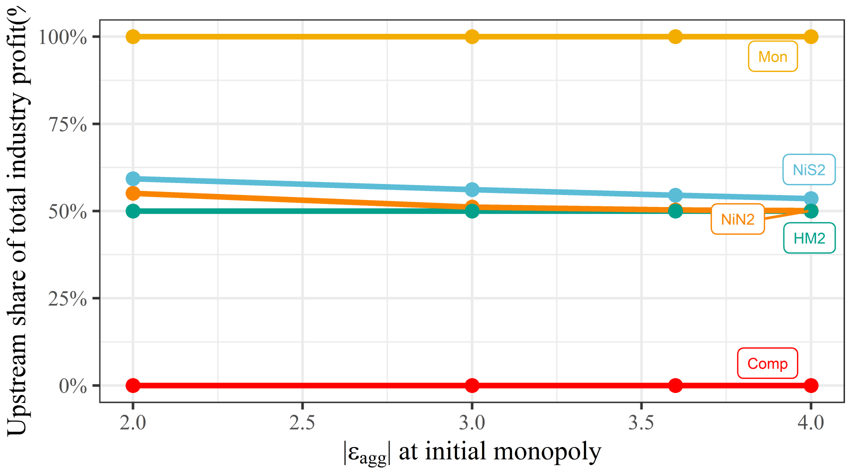

Figure B.3: Upstream share of total profit

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