Mergers and Horizontal Subcontracting

Jan Bouckaert\(^1\) and Geert Van Moer\(^2\)

December 2016

Preliminary version

When price-competing firms outsource production through horizontal subcontracting, the effects of a no-synergies merger can differ from the traditional analysis. When subcontractors compete à la Bertrand, the price goes up. Outsiders are less willing to compete because contracting costs from a more concentrated, less competitive subcontracting market, rise. However, when subcontracting market competition is weak, the post-merger price reduces and rivalry on the main market increases. Outsiders are reluctant to act as a subcontractor because the merged entity calls upon subcontractors less frequently. For both subcontracting market settings, the merger is profitable though decreases the outsiders’ profits.

Keywords: mergers; market structure; horizontal subcontracting.

JEL-code: D43, L13, L14, L41

Acknowledgments: Bouckaert thanks the University of Antwerp and FWO for financial support. Van Moer is grateful to FWO for funding. Both authors also thank Engie for support. We are grateful to Jacques Crémer, Elisabetta Iossa, Massimo Motta, José Louis Moraga, Jorge Padilla, Patrick Rey, and Alicia Van Cauwelaert for their most valuable comments and thank seminar participants at several occasions.

\(^1\) Department of Economics, University of Antwerp. jan.bouckaert@uantwerpen.be

\(^2\) Department of Economics, University of Antwerp. geert.vanmoer@uantwerpen.be
1. Introduction

When two competing firms merge, prices are typically expected to rise when insufficient cost synergies arise. This has been shown by Williamson (1968), by Deneckere and Davidson (1985) for price competition, and by Farrell and Shapiro (1990) when firms compete in quantities. Consumer welfare, the typical standard used by antitrust authorities to judge mergers, then goes up only if the merging entities enjoy sufficient synergies.

We investigate mergers in industries where firms can sign horizontal subcontracts after competing. Horizontal subcontracts are contracts between competing firms, where a firm (the contractor) outsources production of goods or services to its competitors (the subcontractors). Mergers without cost synergies increase the price when subcontractors compete à la Bertrand. However, we show that the effects of a merger can differ from the traditional analysis without synergies. In particular, if the subcontracting market is not sufficiently competitive to justify Bertrand competition, the merger without cost synergies can decrease the price. Though firms compete in prices, we find that the insiders profit from the merger, while the outsiders see their profits go down.

In general, if the subcontracting market is imperfectly competitive, downstream price setting does not depend exclusively on production costs. Firms then charge a higher equilibrium price for two reasons. First, the firm serving the market incurs higher subcontracting costs. Second, competing fiercely entails an opportunity cost. In particular, the possibility to profit from subcontracting is foregone by the firm that serves the market, as shown by Kamien, Li, and Samet (1989).³

We isolate merger effects that do not follow from cost synergies by assuming that the merger does not affect the production possibilities available in the market. Firms consolidate their production plants but do not enjoy learning or management synergies.⁴ Moreover, the subcontracting market settings that we study guarantee that firms allocate production efficiently, i.e. firms produce at the most efficient marginal costs, both before and after the merger. Our results are thus not driven by cost synergies, i.e., the merger does not affect the industry cost function.

³ Other contributions are Spiegel (1993) for horizontal subcontracting with quantity competition, Gale et al. (2000) who study the bidding effects from sequential procurements, and Haile (2003) who considers equilibrium bidding with option values to buy or sell in the secondary market.

⁴ Our “no synergies” assumption corresponds to the one used by Farrell and Shapiro (1990).
Merging is profitable for the following reason. Two merging firms consolidate their production plants without changing their joint pre-merger production possibilities. Merging provides insiders with the opportunity to produce cheaper in-house absent horizontal subcontracting. This opportunity reduces the merged firm’s demand for subcontracting services. If the subcontracting market is not perfectly competitive, the merger thereby reduces the contracting cost in equilibrium, which explains why the merger is profitable.

The price change following the merger comes from two opposing effects. On the one hand, if the outsider serves consumers, the merger can lead to higher contracting costs because the subcontracting market includes the merged firm and has therefore turned less competitive. If so, the outsiders have less incentives to compete fiercely, which explains that the equilibrium price can go up. On the other hand, if the insiders serve the market, the outsiders’ subcontracting profits from not serving consumers can decrease. If the subcontracting market is not competitive, the merged firm disciplines the contracting cost because it calls upon subcontractors less frequently. The outsiders’ profits from subcontracting can therefore go down, resulting in increased incentives to compete fiercely.

We show that, if there is fierce price competition among subcontractors, the second effect does not apply and the equilibrium price goes up. In contrast, in the extreme scenario of a monopolistic subcontracting market, the first effect does not apply and the equilibrium price goes down. Different from the traditional analysis, the merger results in lower profits for the outsider, both for Bertrand subcontracting and monopolistic subcontracting. If the first effect is important, the increase in the equilibrium price leads to less consumers served, and hence the outsiders are called upon to subcontract production for fewer consumers. If the second effect is important, the outsiders are called upon less frequently for a given consumer, notwithstanding the fact that the price decrease results in higher market demand.

Horizontal subcontracting is a widely observed practice across many industries. For example, successful procurement bidders in the construction industry frequently contract from competing bidders. Huff (2012) and Marion (2015) extensively report on this practice for highway construction procurements in California. Importantly, these construction companies often result from mergers between downstream rivals. A recent example is the cleared merger between L.A. based AECOM technology Corp. and URS Corp. in San Francisco in 2014. The new massive company employs 95,000 people in 150 countries.

---

5 Horizontal subcontracting should be distinguished from instances where the successful bidder contracts a part of the main contract from non-competing bidders. For example, affirmative action programs with subcontractor goals towards non-competing disadvantaged business enterprises may contain an important part of public procurement rules. Such vertical subcontractor goals are e.g. implemented by the US Department of Transportation and by the European Commission for the award of contracts in the fields of defense and security (Directive 2009/81/EC). We refer to Marion (2015) and Moretti and Valbonesi (2015) for empirical analyses.

Horizontal subcontracting also occurs frequently in the financial sector. Underwriting services offered by financial institutions guarantee issuing firms to raise sufficient capital. Potential underwriters compete with each other to guarantee the issuing firm an amount of money at a certain price. Winning underwriters (lead arrangers) typically contract part of their underwriting commitment from multiple sub-underwriters (co-arrangers), including non-winning underwriters, and form a syndicate to attract enough investors. This practice increases the prospects for successful funding and reduces the underwriting costs by moving the risks towards the banks that are more capable of taking it. Corwin and Schultz (2005) analyze in their detailed study the composition of these syndicates. They report that inclusion in the syndicate is explained by the probability of being selected as the winning underwriter. Their interpretation is that issuing firms suggest the winning underwriter to “include in the syndicate other underwriters who vied for the lead position”. This illustrates the practice of horizontal subcontracting in the market for underwriting services. Importantly, Corwin and Schultz (2005) also report a high degree of mergers between syndicate members in the underwriting services industry. This can be seen from major players like e.g. BankAmerica Merrill Lynch, JP Morgan and Citi, who together represent 25.3 % of the Americas 2015 mandated lead arrangers loans market (Thomson Reuters (2015)).

Horizontal mergers and bidding consortia in these industries that do not create synergies may raise competitive concerns by antitrust authorities. While these concerns are justified for competitive subcontracting markets, we show that for less competitive subcontracting markets increased concentration can reduce the profits from horizontal subcontracting, causing firms to compete more fiercely downstream.

Section 2 describes the model and offers the equilibrium analysis for symmetric firms. Section 3 studies the competitive and welfare effects from merging. Finally, section 4 presents and discusses our concluding remarks.

2. The model and equilibrium analysis

The model – There are \( N \geq 2 \) risk-neutral, symmetric price-竞争ing firms that produce homogeneous goods. Market demand \( Q(p) \) can originate from non-strategic final consumers, competitive retailers or a

---

7 This market comprises $ 2,622 billion in 2015 (Thomson Reuters, 2015). Syndicated loans e.g. are becoming increasingly important for non-financial businesses in the US and Europe and nowadays represent higher volumes than the public issuing of corporate debt and equity together (Drucker and Puri (2007) and Ferreira and Matos (2012)).

8 The assumption of homogeneous goods is intuitive because subcontracting requires that producers are substitutable.
procure and depends on $p$, the market price. We assume that $Q(p)$ is differentiable, cuts both axes, is strictly downward sloping and concave so that

\[(A1) \quad Q(p) < 0 \text{ and } Q'(p) \leq 0\]

We denote the price at which demand is zero by $\overline{p}$ such that $Q(\overline{p}) = 0$.\(^9\)

In stage one, firms choose prices. The lowest-price firm must serve demand $Q(p)$ where $p$ is the lowest price submitted. We examine two tie-breaking rules if several firms submit the lowest price. Under the winner-take-all assumption one of them is randomly selected, each with equal probability, to be the winner that serves the market. The other possibility is that each lowest-price firm serves an equal portion of market demand.\(^{10}\) After prices are chosen, stage-one outcomes are common knowledge.

An important empirical motivation for subcontracting is that firms are uncertain about their marginal costs. For example, Haile (2001) reports that contracts to harvest timber are typically executed at the end of the contract term, so that bidding firms are likely to be uncertain about their future costs at the moment of competing in the auction. In particular, firms can be uncertain about the technology they will use to execute the contract.

The $N$ firms are characterized by constant but uncertain marginal costs. After competing in stage one, firms each draw their marginal cost from the same probability distribution. In particular, we assume that firms independently draw a high marginal cost $0 < c_H < \overline{p}$ with probability $0 < k < 1$, and draw a zero marginal cost with the remaining probability $1 - k$. We can summarize that each firm $i$’s expected unit cost is identical and equals

\[(A2) \quad C_i = k c_H .\]

Without horizontal subcontracting, the firms serving the consumers are the ones that produce. Since all other firms earn zero, there is fierce competition to serve the market. The no-subcontracting equilibrium price, $p^{\text{w}}$, equals the expected unit cost

\[p^{\text{w}} = k c_H \]

and all firms earn zero profits in equilibrium.

---

\(^9\) Our main results also hold when demand is fixed.

\(^{10}\) As we will see, both tie-breaking rules lead to the same equilibrium price.
Of course, it is not cost-efficient to produce at a high cost if a zero-cost rival remains idle. If so, firms can reduce production costs by reallocating their production using horizontal subcontracts. In particular, horizontal subcontracts enable firms to shift production towards zero-cost production technologies.

In stage two, firms sign horizontal subcontracts. The expected minimal industry’s (sum of all firms) unit cost after subcontracting is

\[ C_{IND} = k^N c_H. \]

Indeed, with horizontal subcontracting, the industry only incurs a marginal cost of \( c_H \) when all \( N \) firms draw \( c_H \), with probability \( k^N \). If firm \( i \) serves a consumer, the unit surplus from subcontracting \( S_i \) equals the expected cost-reduction made possible from subcontracting

\[ S_i = C_i - C_{IND} = (k - k^N)c_H, \]

the difference between firm \( i \)’s in-house cost \( C_i \) and the minimal industry’s production costs \( C_{IND} \).\(^{11}\) Since each firm is symmetric, the unit subcontracting surplus is identical for each firm. In our framework with constant but uncertain marginal costs, the size of the subcontracting surplus is not affected by dividing the contract.\(^{12}\)

The remainder of the paper omits the clarification that costs, subcontracting surplus and profits are an expectation.

**Efficient subcontracting.** The micro foundations that we study guarantee that firms take advantage of all potential surplus from subcontracting. In other words, firms use subcontracts to allocate production cost-efficiently, so that they only incur the minimal industry production cost. The merger effects that we find therefore do not follow from efficiency changes on the subcontracting market.

\(^{11}\) The surplus from subcontracting is earlier modelled by e.g. Spiegel (1993) and Gale et al. (2000).

\(^{12}\) In an alternative analysis, following Kamien et al. (1989) and Spiegel (1993), we looked at convex variable costs in a winner-take-all framework. For instance, construction firms may lack the appropriate capacity or scale to manage very high workloads in a low-cost manner. As another example, power generating firms first dispatch their lowest marginal cost units. If more generation is required, they must turn to more expensive generation units or buy from less expensive competitors. Just as ex ante cost uncertainty, convex variable costs explain the practice of horizontal subcontracting and generate the same insights. However, with convex costs, the analysis of competition among subcontractors is unnecessarily complicated. Moreover, it raises issues of optimal design because, for convex costs, the importance of horizontal subcontracting depends, for example, on the extent to which the contract is divided into multiple smaller ones. Consumers or procurers may have a preference for mechanisms that minimize or eliminate the subcontracting surplus, e.g. by contracting from more than one firm, as happened for the Suez Canal projects in 2014-2015. As such, the design affects the equilibrium price. A winner-takes-all framework then applies well for settings where consumers or procurers rather coordinate with just one supplier so as to avoid asymmetric information issues among multiple contractors.
Stage two equilibrium analysis — There is a wide range of factors or institutions that determine the subcontractors’ bargaining or market power. The share $\sigma$ of realized surplus from subcontracting is appropriated by the selling firms (subcontractors). The remaining share $1 - \sigma$ goes to the buyers (contractors). We will find that $0 \leq \sigma \leq 1$. Indeed, in stage two, the contractors would never be willing to buy from the subcontractors if $\sigma > 1$. In-house production would then outperform subcontracting. Similarly, the subcontractors would not be willing to sell if $\sigma < 0$. For duopoly competition, Kamien et al. (1989) interpret the subcontractor as a Stackelberg leader if $\sigma = 1$. The symmetric two-player Nash-bargaining solution corresponds to $\sigma = 0.5$. Since our analysis involves more than two firms, share $\sigma$ results from a more complex market process.

The effects of a merger will depend on the subcontracting market institutions. First, these institutions differ with respect to how, in equilibrium, the surplus from subcontracting is divided between subcontractors and contractors. However, second and importantly, the share of surplus going to the subcontractors is not exogenous to the merger, as the merger also affects concentration in the subcontracting market.

We therefore present three subcontracting market institutions that, taken together, cover both of these aspects. They serve as benchmarks to analyze the consequences of subcontracting institutions. The first one is most natural and assumes that subcontractors compete à la Bertrand on the subcontracting market. Since in many industries the subcontracting market is not transparent with respect to the tariff, we second present a model that leads to the least competitive outcomes, denoted by monopolistic subcontracting, by assuming that subcontractors sequentially make their offers. Third, we provide a model that leads to the most competitive outcomes, labelled a monopsonistic subcontracting, by studying a subcontracting market where offers are made by the contractors.

1. Bertrand subcontracting. Subcontractors simultaneously offer a tariff. Let a firm’s cost draw, $c_i$, or zero, be common and verifiable knowledge.$^{13}$ Suppose that each firm simultaneously offers a unit tariff at which it wants to subcontract. Then, the unique equilibrium tariff is zero if there are two or more subcontractors with zero costs. If there is one subcontractor with zero costs, that subcontractor captures all subcontracting surplus by offering a unit tariff that undercuts $c_i$ by the smallest possible amount.

---

$^{13}$ The outcome of the analysis remains if competing subcontractors have private knowledge and receive the second-lowest offer, for example by an English auction.

$^{14}$ Subcontracting is often studied in a complete information setting (see Kamien et al., 1989 and Spiegel, 1993). The advantage is that firms can then easily identify the subcontracting opportunities. The merger effects we study therefore do not follow from asymmetric information. For an analysis of asymmetric information in auctions with resale, see Haile (2003). For incomplete contracts we refer to Miller (2014).
The resulting share of surplus going to the subcontractors is the probability that surplus is captured by subcontractors, conditional on there being surplus. The probability that any one of the \( N-1 \) subcontractors can capture surplus from subcontracting is \( (N-1)(1-k)k^{N-1} \), i.e., the probability that any one of the subcontractors is the only firm drawing a zero cost. In particular, it is the probability \( (1-k)k^{N-1} \) that a given firm is the only one of all \( N \) firms drawing a zero, times the number of subcontractors \( N-1 \). The probability that there is surplus equals \( k-k^N \), i.e., the probability that the firm serving the unit draws a high-cost minus the probability that all of the firms draw high costs. We can write that share \( \sigma \) equals \( \sigma = \frac{(N-1)(1-k)k^{N-1}}{k-k^N} \).

It can be shown that \( \frac{d\sigma}{dN} < 0 \), meaning that the larger the number of subcontractors, the more they compete and thereby the lower the share of surplus they capture.\(^\text{15}\) The contractors, in turn, can appropriate a larger share if subcontracting market competition gets more fierce.

Observe that \( \sigma \) is irrespective of how much demand is served by each of the firms.

2. Monopolistic subcontracting. Subcontractors obtain maximal subcontracting surplus, as if they were monopolists. It can follow from a setting where subcontractors sequentially offer a tariff. Let a firm’s cost draw, \( c_H \) or zero, be private knowledge. Suppose that each firm sequentially offers a (better) unit tariff at which it wants to subcontract, and that subsequent subcontractors observe the most favorable offer made so far. Each subcontractor makes only one offer, and the order at which the offers are made is random but common knowledge. Then, the last subcontractor, if zero-cost, always undercuts. Previous subcontractors anticipate this possibility and understand that they can only profit in case all subsequent subcontractors have drawn \( c_H \). They therefore have an incentive to make an offer that undercuts all previous offers, but remains as close as possible to \( c_H \). In equilibrium, all surplus from subcontracting goes to the subcontractors, so that \( \sigma = 1 \).

3. Monopsonistic subcontracting. The contractors obtain maximal subcontracting surplus, as if they were monopsonists. It can follow from a setting where the offers are made by the contractors. In particular, let

\(^\text{15}\) Indeed, the derivative \( \frac{d\sigma}{dN} = \frac{[ (1-k)k^{N-1} + (N-1)(1-k)k^{N-1}\ln(k) ](k-k^N) - (N-1)(1-k)k^{N-1}(k-k^N) \ln(k) }{(k-k^N)^2} < 0 \) if and only if the numerator is negative. We can rewrite this condition as \( 1-\kappa < -\ln(\kappa) \) for \( 0<\kappa = k^{N-1} < 1 \). This is always satisfied because at \( \kappa = 1 \), we have \( 1-\kappa = -\ln(\kappa) \) and \( \frac{d(-\ln(\kappa))}{d\kappa} < -1 \) for \( 0<\kappa < 1 \).
each firm simultaneously offer a unit tariff at which it wants to contract. Then, a contractor can do no better than submitting a positive tariff as close as possible to zero. Indeed, if there is a zero-cost subcontractor, that subcontractor has an incentive to accept the tariff. As such, the contractors capture all subcontracting surplus, so that $\sigma = 0$.

**Stage one equilibrium analysis** – The analysis starts by investigating at what prices firms prefer to win a unit or to lose a unit. The goal is to obtain, for each $\sigma$ and therefore each subcontracting market setting, the equilibrium price.

The profits of winning a unit equal

$$W_i(p) = p - C_i + (1 - \sigma)S_i.$$  

The first term, the price, represents the firm’s revenues from serving a unit. The second term reflects its costs without subcontracting. The last term represents the share $1 - \sigma$ of the surplus from subcontracting that is appropriated by the winning firm.

The profits of losing a unit to a rival are positive because a losing firm can extract surplus from subcontracting. Since all $N - 1$ subcontractors are symmetric, they all capture an equal portion $1/(N-1)$ of the surplus from subcontracting that goes to the subcontractors. Therefore, the profits of losing a unit equal

$$L_i = \frac{1}{N-1}\sigma S_i.$$  

We denote the price at which firms are indifferent between winning and losing a unit by $p_i^*(\sigma)$ such that

$$W_i(p_i^*(\sigma)) = L_i(p_i^*(\sigma)).$$

We will argue that price $p_i^*(\sigma)$ is the equilibrium price. By using that $S_i = C_i - C_{iD}$, we can write that price $p_i^*(\sigma)$ equals

$$p_i^*(\sigma) = C_{iD} + \sigma S_i + \frac{\sigma}{N-1}S_i.$$  

Price $p_i^*(\sigma)$ is the sum of three components. The first component is the industry unit production cost. The second is the per unit surplus paid to the subcontractors through the contracting cost. The third component

---

*16 It is useful to write the equilibrium analysis at the unit level. The analysis at the market level easily follows.*
is the unit opportunity cost, which captures the subcontracting profits the winner foregoes by winning. As a result, a firm wants to win a consumer only if the price is sufficiently high.

Importantly, note that the willingness to win an extra unit does not depend on how many units a firm already serves, nor does it depend on how many the rival firms already serve. It follows that price \( p^{*}_i(\sigma) \) is irrespective of the tie-breaking rule.

We make a further assumption to guarantee the existence of a unique and symmetric equilibrium price. In particular, we assume that firms prefer to sell at \( p^{*}_i(\sigma) \), rather than reducing the price to increase demand. The purpose is to restrict attention to situations where a symmetric equilibrium in pure strategies exists. Formally, we write

\[
(A3) \quad \frac{d[W(p)Q(p)]}{dp} > 0 \quad \text{for all } p \leq p^{*}_i(\sigma).
\]

To help interpret (A3), it is useful to rewrite it as \( W(p)Q(p) + W(p)Q(p) = (p - C_i + (1 - \sigma)S_i)Q(p) + Q(p) > 0 \) for all \( p \leq p^{*}_i(\sigma) \). A sufficient condition is obtained by plugging in \( p = p^{*}_i(\sigma) = C_{i\text{nd}} + \frac{N}{N-1} \sigma S_i \) in the first term.

By further using that \( S_i = C_i - C_{i\text{nd}} \), we can rewrite (A3) as

\[
\frac{1}{N-1} \sigma S_i < \frac{Q(p)}{Q(p)} \quad \text{for all } p \leq p^{*}_i(\sigma).
\]

The profits from losing a unit (left hand side) should thus be sufficiently small so that firms have sufficient incentives to win a unit rather than lose one. Alternatively, the price at which firms are indifferent between winning and losing a unit should be sufficiently below \( \overline{p} \).\(^{17}\) \(^{18}\)

Note that, since \( W(p)Q(p) \) is concave, assumption (A3) also guarantees \( p^{*}_i(\sigma) < \overline{p} \).

\[\text{For example, for linear demand } Q(p) = a(p - \overline{p}) \text{, we obtain } p + \frac{\sigma}{N-1} S_i < \overline{p} \text{ for all } p \leq p^{*}_i(\sigma) \text{, which we can write as } p^{*}_i + \frac{\sigma}{N-1} S_i < \overline{p} \text{.}\]

\[\text{If the parameters are such that (A3) does not hold, the winner has an incentive to reduce the price from } p^{*}_i(\sigma) \text{ to the price that maximizes the winner’s profits. The equilibrium is asymmetric. One winner charges the price that maximizes the winner’s profits, while the others charge a sufficiently high price so as to discourage the winner from losing.}\]
It follows that price \( p^i(\sigma) \) is the equilibrium. Indeed, at \( p^i(\sigma) < p \), firms are indifferent between winning and losing, so that neither undercutting nor charging a higher price raises a firm’s profits. Also, a firm cannot profitably charge any other lower price \( p < p^i(\sigma) \).

The equilibrium price for each subcontracting market setting is obtained by plugging in \( \sigma \). Proposition 1 summarizes these results.

**Proposition 1.**

*The downstream equilibrium price equals \( p^i(\sigma) \).*

If the contractors capture a large portion of the surplus, they can contract production at a tariff close to the rivals’ variable costs. These rivals, in turn, earn little profits from subcontracting. Since there is only a small opportunity cost from winning a unit, there is fierce competition downstream, resulting in an equilibrium price close to the industry average cost.

If instead subcontractors capture a large portion of the surplus, the cost of contracting production is close to in-house costs. Moreover, winning firms forego considerable profits from subcontracting, which act as an opportunity cost. Both effects together add a substantial markup to the downstream equilibrium price.

For Bertrand subcontracting, contractors obtain more surplus as the number of firms goes up. Monopolistic subcontracting is the most extreme example where subcontractors get all surplus from subcontracting. Monopsonistic subcontracting is the most extreme example where contractors capture all surplus from subcontracting.

**The effect of horizontal subcontracts on consumers** – We use the symmetric model to study under what circumstances subcontracts are good for consumers. The effect on consumers crucially depends on share \( \sigma \), the share of the surplus from subcontracting that goes to the subcontractors.

**Proposition 2.**

*Horizontal subcontracting*

- *benefits consumers if and only if the number of firms is sufficiently large for Bertrand subcontracting*
- *harms consumers for monopolistic subcontracting*
- *benefits consumers for monopsonistic subcontracting.*
The proof is in the appendix and shows that subcontracts reduce prices if and only if sufficient surplus from subcontracting goes to the contractor, or

\[ p_i(\sigma) < p_s \iff \sigma < \frac{N-1}{N}. \]

The cutoff value for \( \sigma \) is \( \frac{(N-1)}{N} \), which equals 0.5 for a duopoly and approaches 1 as the number of firms increases.\(^{\text{19}}\) The intuition behind proposition 2 is as follows. The first observation relates closely to Kamien et al. (1989) and is that consumers are more likely to benefit from subcontracts if the subcontractors have little bargaining or market power. The intuition is that, then, subcontractors earn little profits and are therefore willing to compete fiercely to serve consumers, which leads to lower prices. The second observation relates to Haile (2003) and is that the requirement on \( \sigma \) becomes less stringent as the number of firms goes up. Each subcontractor then captures only a smaller part of the surplus from subcontracting. A subcontractor’s profits decrease, so that he is more willing to compete for consumers by charging lower prices. The third observation is a contribution of our analysis and is that, if subcontractors compete à la Bertrand, horizontal subcontracting benefits consumers if and only if the number of firms is sufficiently large.

### 3. Merger analysis

This section takes the symmetric model from section 2 as a starting point and investigates (i) the effect of a merger on the equilibrium price and (ii) firms’ incentives to merge.

Before the merger, there are \( N \geq 3 \) symmetric firms in the market. We use the analysis and notation of the symmetric model in section 2. The unique equilibrium price equals \( p_i(\sigma) \) and each firm earns profits \( \pi_i(p_i(\sigma)) \).

\(^{\text{19}}\) The same cutoff value also applies in our alternative model with convex costs.
After two firms merge, there are only $N-1$ firms in the market, one merged firm $m$ and $N-2$ outside firms $o$. Hence, we need to relax the assumption of symmetry. The post-merger analysis uses the character “-” in order to distinguish the notation from the symmetric model that applies pre-merger.\(^\text{20}\)

We first investigate firms’ costs after the merger, after which we provide the equilibrium analysis.

**Cost conditions after two firms merge** – This subsection investigates the cost conditions of the merged firm, the outside firms, and the industry.

*No synergies.* We suppose that the merged firm’s marginal cost equals the marginal cost that both pre-merger entities can obtain without the merger by signing horizontal subcontracts bilaterally. This corresponds to Farrell and Shapiro’s (1990, p. 112) terminology “no synergies” from merging.\(^\text{21}\) By not considering possible synergies, e.g. originating from learning effects or more efficient management, we isolate the strategic effects of merging.

After the merger, the merged firm $m$ draws $c_{H}$ with probability $k^2$ only. The merged firm is therefore characterized by a unit cost of $\tilde{C}_m = k^2 c_{H}$. The subcontracting surplus per unit if firm $m$ serves consumers only equals $\tilde{S}_m = k^2 c_{H} - k^3 c_{H}$. The $N-2$ outside firms remain symmetric and have the same cost function as before the merger. The outsiders $o$ draw $c_{H}$ with probability $k$, as before, so that $\tilde{C}_o = C_o$. Their surplus from subcontracting per unit is $\tilde{S}_o = k c_{H} - k^3 c_{H}$.

The no synergies assumption guarantees that, for efficient subcontracting, the merger does not lead to cost savings at the industry level. The reasoning is that firms already produce at the lowest possible cost pre-merger by using horizontal subcontracts. Industry costs result exclusively from the production facilities that are in the market, not on the names of their owners. We therefore have that the merger does not affect the minimal industry cost per unit, so that $\tilde{C}_{\text{IND}} = C_{\text{IND}}$.

To summarize, cost conditions satisfy

$$C_{\text{IND}} = \tilde{C}_{\text{IND}} < \tilde{C}_o < \tilde{C}_o = C_o.$$ 

\(^{20}\) To be clear, the post-merger analysis is asymmetric. We write prices as $\tilde{p}$, profits as $\tilde{\pi}$, costs as $\tilde{C}(Q)$, the surplus from subcontracting as $\tilde{S}(Q)$, and the share of surplus going to the subcontractors as $\tilde{\sigma}$.

\(^{21}\) Farrell and Shapiro’s (1990, p. 112) description of a merger $M$ with no synergies is: “After the merger, the combined entity $M$ can perhaps better allocate outputs across facilities ("rationalization") but $M$'s production possibilities are no different from those of the insiders (jointly) before the merger. In this case we say that the merger "generates no synergies."\(^\text{m}\). This also corresponds to Perry and Porter (1985), who vary the industry structure while fixing the industry supply curve.
The subcontracting surplus if an outsider serves a unit equals $\bar{S}_i = S_i$. By merging, firms reduce the subcontracting surplus to $\bar{S}_n$ if the merged firm serves the unit. At the same time, the merger decreases the number of outsiders, causing an opposing and increasing effect on the surplus of subcontracting per outsider. The following lemma provides a helpful and intuitive insight that allows us to analyze the equilibrium.

**Lemma 1**: The unit subcontracting surplus per outsider decreases when the number of firms in the winning entity increases. When considering a merger between two firms, we can write

$$\frac{\bar{S}_n}{N-2} < \frac{\bar{S}_i}{N-1}.$$  

The proof is in the appendix.

Importantly, lemma 1 does not treat the *equilibrium* subcontracting surplus per outsider. Its main purpose is to show that for a given unit, the subcontracting surplus per outsider if the merged firm wins (left hand side) is smaller than the subcontracting surplus per outsider if an outsider wins (right hand side).

**Stage two equilibrium analysis when two firms merge** – This subsection analyses the share of surplus appropriated by each of the firms. To analyze the effects of a merger, we consistently apply the same subcontracting market setting before and after the merger. So, if subcontractors compete à la Bertrand before the merger, they continue to do so after the merger. The same consistency applies for monopsonistic subcontracting, and monopolistic subcontracting. As mentioned, the shares of surplus appropriated by each of the firms are not exogenous to the merger. In particular, the first setting where subcontractors compete à la Bertrand on the subcontracting market finds that more concentration in the subcontracting market leads to a substantial increase in the surplus going to the subcontractors. This need not be the case, however, if subcontracting market institutions are more, or less, competitive. Indeed, our least competitive setting, monopolistic subcontracting where subcontractors sequentially make their offers after the merger, cannot turn less competitive on the supply side because subcontractors already capture all surplus from subcontracting. Also, monopsonistic subcontracting, our most competitive setting where contractors can make the offers, leads to an invariant share of zero that is appropriated by the subcontractors.

To better understand how the share of surplus going to the subcontractors changes as a result of the merger, we write it as a function of the share that applies pre-merger ($\sigma$). We will limit notation by letting $B = \{0, 1\}$.

---

22 Lemma 1 also applies in an alternative analysis with convex costs.
indicate whether or not subcontractors compete à la Bertrand during stage two. The indicator equals one if and only if subcontractors compete à la Bertrand.

1. Bertrand subcontracting. Recall that, in this subcontracting market setting, the unique equilibrium tariff is zero if there are two or more subcontractors with zero costs, and \( c_\mu \) otherwise. We now distinguish between who wins the unit, the merged firm or an outsider.

Suppose that the merged firm wins the unit. The share of surplus going to the subcontracting outsiders is again a conditional probability. The probability that any one of the \( N - 2 \) subcontractors can capture surplus from subcontracting is \( (N-2)(1-k)k^{N-1} \), i.e., the probability that one of the \( N - 2 \) subcontractors is the only firm in the industry drawing zero cost. In particular, it is the probability \( (1-k)k^{N-1} \) that a given subcontractor draws the only favorable cost out of \( N \) draws in the industry, times the number of subcontractors \( N - 2 \). The probability that there is surplus equals \( k^2 - k^N \), i.e., the probability that the merged firm serving the unit draws a high-cost minus the probability that all of the firms draw high costs. We can write that \( \tilde{\sigma} \) equals

\[
\tilde{\sigma} = \frac{(N-2)(1-k)k^{N-1}}{k^2 - k^N} = \frac{N-2}{N-1} \frac{k - k^N}{k^2 - k^N} = \frac{N-2}{N-1} \frac{S_o}{S_m} \sigma .
\]

From Lemma 1, we know that \( \frac{N-2}{N-1} \frac{S_o}{S_m} > 1 \), so that the share of surplus going to the subcontractors is higher as compared to before the merger. Indeed, given that there is subcontracting surplus, chances are higher that it goes to the subcontractors because there are fewer subcontractors that compete against each other. As an extreme example, if there is a merger from three firms to two firms, any subcontracting surplus after the merger is always captured by the only subcontractor left.

Suppose that an outsider wins the unit. The subcontracting market has turned more concentrated as a result of the merger. Indeed, the subcontractors consist of the merged firm, and the \( N - 3 \) losing outsiders. The probability that any of the \( N - 3 \) losing outsiders captures surplus from subcontracting equals \( (N-3)(1-k)k^{N-1} \). However, the probability that the merged firm captures surplus from subcontracting equals \( 2(1-k)k^{N-1} + (1-k)^2 k^{N-2} \). The first term of the expression represents the probability that the merged firm is the only firm in the industry a drawing zero cost. The second term adds the probability that the merged firm has two favorable cost draws. If so, the merged firm still captures the surplus since the merging parties do not compete with each other to subcontract. The probability that there is surplus equals \( k - k^N \), as without the merger. We can write share \( \tilde{\sigma} \) as the sum of the surplus share going to the losing outsiders and the
surplus share going to the losing merged firm. We obtain
\[ \tilde{\sigma} = \frac{(N-3)(1-k)k^{N-1} + 2(1-k)k^{N-1} + (1-k)^2 k^{N-2}}{k - k^N}, \]
which we can rewrite as
\[ \tilde{\sigma} = \sigma + \frac{(1-k)^2 k^{N-2}}{k - k^N}. \]
So, each of the \( N-3 \) losing outsiders that subcontract get the same share as before the merger, \( \frac{\sigma}{N-1} \), and the merged firm gets \( \frac{2\sigma}{N-1} + \frac{(1-k)^2 k^{N-2}}{k - k^N} \). The final term represents the scenario where the merged firm has favorable cost draws, while the others draw high costs. A more concentrated subcontracting market leads to more favorable terms for the subcontractors.

2. Monopolistic subcontracting. Monopolistic subcontracting follows from a setting where subcontractors sequentially offer a tariff at which they want to subcontract. The equilibrium argument is the same as before the merger. Given that the last subcontractor always undercuts if it draws a zero cost, previous subcontractors drawing a zero cost have an incentive to make an offer that undercuts all previous offers, but remains as close as possible to \( c_H \). In equilibrium, all surplus from subcontracting goes to the subcontractors, so that \( \tilde{\sigma} = \sigma = 1 \).

3. Monopsonistic subcontracting. Offers are made by the contractors and the equilibrium argument is the same as before the merger. A contractor can do no better than submitting a positive tariff as close as possible to zero, thereby capturing all subcontracting surplus, so that \( \tilde{\sigma} = \sigma = 0 \).

**Stage one equilibrium analysis when two firms merge** – This subsection uses the same approach as in section 2. The equilibrium analysis starts by investigating at what prices firms \( o \) and \( m \) prefer to win or to lose a unit. The goal is to obtain, for each \( \tilde{\sigma} \) and therefore each subcontracting market setting, the equilibrium price. We assume that, in case of a tie that involves the merged firm, the merged firm wins the unit.

**Outsiders analysis (firms \( o \))**

If a firm \( o \) wins a unit, it earns
\[ \tilde{W}_o(\tilde{p}) = \tilde{p} - \tilde{C}_o + (1 - \sigma - B \frac{(1-k)^2 k^{N-2}}{k - k^N})\tilde{S}_o. \]
By winning the unit, firm $o$ earns $\hat{p}$ revenues. Without subcontracting, it would incur in-house costs $\check{C}_o$. As a contractor, firm $o$ captures share $1-\hat{\sigma}=1-\sigma-B\frac{(1-k)^2k^{N-2}}{k-k^N}$ of the subcontracting surplus. The last term captures that, for Bertrand subcontracting, the winning outsider incurs higher contracting costs because the merger has turned the subcontracting market less competitive.

Firm $o$’s profits from losing a unit depend on which firm wins the unit, firm $m$ or another firm $o$. If firm $o$ loses and firm $m$ wins the unit, firm $o$ earns

$$\hat{L}_{o\rightarrow m} = \frac{1}{N-2} \left( (1-B)\sigma + B \frac{N-2}{N-1} \frac{\hat{S}_o}{S_m} \right) \hat{S}_m.$$ 

If firm $m$ wins the unit, the surplus from subcontracting is $\hat{S}_m$. Each firm $o$ captures an equal portion of the surplus from subcontracting $\hat{\sigma}=(1-B)\sigma+B\frac{N-2}{N-1} \frac{\hat{S}_o}{S_m}$. Importantly, for Bertrand subcontracting ($B=1$), these profits can be written as $\hat{L}_{o\rightarrow m} = \frac{1}{N-1} \sigma \hat{S}_m$ and therefore exactly equal the corresponding expression before the merger. The reason is that, if subcontractors compete à la Bertrand, losing outsiders profit if and only if they are the only firm drawing a zero cost. Bertrand competing subcontractors can only capture an efficiency rent if they are alone to have a zero cost. That probability does not change as a result of the merger.

If another outsider wins and firm $o$ loses a unit, firm $o$ earns profits given by

$$\hat{L}_{o\rightarrow o} = \frac{1}{N-1} \sigma \hat{S}_m.$$ 

Given that the outsider loses a unit against another outsider, its profits are again no different as compared to before the merger. For Bertrand subcontracting, a losing outsider only gets efficiency rents if it is alone to draw a zero cost. The monopolistic and monopsonistic scenarios where $\hat{\sigma}=\sigma=1$ or $\hat{\sigma}=\sigma=0$, respectively, result in the same share of surplus going to the losing outsider as before the merger.

Define the price at which the outsider is indifferent between winning and losing a unit against $m$ by $\hat{\mathbf{p}}_{o\rightarrow m}^*$ such that $\hat{W}_o(\hat{\mathbf{p}}_{o\rightarrow m}^*(\sigma))=\hat{L}_{o\rightarrow m}(\hat{\mathbf{p}}_{o\rightarrow m}^*(\sigma))$. We obtain that

$$\hat{\mathbf{p}}_{o\rightarrow m}^*(\sigma)=\hat{\check{C}}_{oBD}+(\sigma_B+\frac{(1-k)^2k^{N-2}}{k-k^N})\hat{S}_o+\frac{1}{N-2}\left( (1-B)\sigma + B \frac{N-2}{N-1} \frac{\hat{S}_o}{S_m} \right) \hat{S}_m.$$ 

The first term captures the industry unit production cost. The second term represents the surplus paid to the subcontractors if the outsider wins a unit. The final term captures the foregone profits a firm could have earned by losing the unit.

Define the price at which the outsider is indifferent between winning and losing a unit against $o$ by $\hat{p}_{v,o}^*$ such that $\hat{W}_e(\hat{p}_{v,o}^*(\sigma)) = \tilde{L}_{v,o}(\hat{p}_{v,o}^*(\sigma))$. We obtain that

$$\hat{p}_{v,o}^*(\sigma) = \hat{C}_{ind} + (\sigma + B \frac{(1-k)^2 k^{N-2}}{k-k^N}) \hat{S}_o + \frac{\sigma}{N-1} \hat{S}_o,$$

which again represents production costs, surplus paid to subcontractors in the form of contracting costs, and the opportunity cost of winning the unit.

**Merged firm’s analysis (firm $m$)**

If firm $m$ wins a unit, it earns

$$\hat{W}_m(\hat{p}) = \hat{p} - \hat{C}_m + (1 - \left(1 - B\sigma + B \frac{N-2 \hat{S}_m}{N-1 \hat{S}_m}\right) \hat{S}_m).$$

Firm $m$ receives $\hat{p}$ by winning a unit. It enjoys lower in-house unit costs $\hat{C}_m < \hat{C}_o$ than firm $o$. As a contractor, firm $m$ captures share $1 - \sigma = 1 - \left(1 - B\sigma + B \frac{N-2 \hat{S}_m}{N-1 \hat{S}_m}\right)$ of the unit surplus from subcontracting.

By losing a unit, the merged firm obtains

$$\hat{L}_m(\hat{p}) = \frac{2\sigma}{N-1} \hat{S}_m + B \frac{(1-k)^2 k^{N-2}}{k-k^N} \hat{S}_m.$$

The last term captures that, for Bertrand subcontracting, the merged firm benefits from merging because it can earn efficiency rents if it has two favorable cost draws.

Define the price at which the merged firm is indifferent between winning and losing a unit by $\hat{p}_m^*(\sigma)$ such that $\hat{W}_e(\hat{p}_m^*(\sigma)) = \tilde{L}_m(\hat{p}_m^*(\sigma))$. We get

$$\hat{p}_m^*(\sigma) = \hat{C}_{ind} + \left(1 - B\sigma + B \frac{N-2 \hat{S}_m}{N-1 \hat{S}_m}\right) \hat{S}_m + \frac{2\sigma}{N-1} \hat{S}_m + B \frac{(1-k)^2 k^{N-2}}{k-k^N} \hat{S}_o.$$

We proceed by stating Lemma 2, which maps the prices $\hat{p}_o^*(\sigma)$, $\hat{p}_{v,o}^*(\sigma)$ and $\hat{p}_{v-o}^*(\sigma)$, above which firms prefer to win a unit rather than to lose one. As before the merger, these prices are irrespective of the tie-
Lemma 2. The merged firm has more incentives to compete for consumers than the outside firms. The prices above which firms want to win rather that to lose a unit can be ranked as \( p_m^*(\sigma) \leq p_{o-m}^*(\sigma) \leq p_{o-o}^*(\sigma) \).

Figure 1 visualizes Lemma 2.

![Diagram](image)

Figure 1. A visualization of lemma 2.

Again, analogous to assumption (A3), we restrict attention to situations where a symmetric equilibrium exists in pure strategies by assuming that

\[
(A4) \quad \frac{d[W_m(p)Q(p)]}{dp} > 0 \quad \text{for all} \quad p \leq p_m^*(\sigma) \quad \text{and} \quad \frac{d[W_c(p)Q(p)]}{dp} > 0 \quad \text{for all} \quad p \leq p_{o-m}^*(\sigma) \quad \text{and} \quad p \leq p_{o-o}^*(\sigma)
\]

Proposition 3. The downstream equilibrium price is \( p_{o-m}^*(\sigma) \).

The appendix provides the proof.

The intuition is as follows. First note that (i) a price above \( p_{o-m}^*(\sigma) \) cannot be an equilibrium because firms would want to profitably undercut, and that (ii) charging a price below \( p_{o-m}^*(\sigma) \) is a dominated strategy for an outsider, because an outsider always prefers to lose below that price.

It follows that, in equilibrium, the merged firm wins.\(^23\) The merged firm takes into account that the outsiders should not be willing to undercut. Therefore, the equilibrium price is crucially determined by the price the

\(^{23}\) This possibility may seem counterintuitive. However, also in Spiegel’s (1993) analysis, the lowest-cost firm acts as a subcontractor. Pagnozzi (2007) finds a similar effect where, with resale, the strong bidder drops out of the auction before the
outsider wants to charge. So, the merged firm can charge up to \( p_{e-m}^*(\sigma) \), the price at which the outsiders are indifferent between winning and losing. The merged firm wins by the tie-breaking rule.

The equilibrium price, \( p_{e-m}^*(\sigma) \), is the sum of actual production costs, the rents going to the subcontractors if the outsider wins, and the opportunity cost of winning in the form of foregone subcontracting profits. While we still have that more subcontracting surplus going to the subcontractors leads to a higher equilibrium price, the surplus going to each of the subcontractors can now depend on who wins, the merged firm or the outsiders.

**The effects of a merger on profits and prices** – Proposition 4 presents our main result by comparing the equilibrium price before and after the merger. Proposition 5 investigates firms’ incentives to merge.

**Proposition 4.** A merger without synergies

- strictly increases the equilibrium price for Bertrand subcontracting
- strictly decreases the equilibrium price for monopolistic subcontracting
- does not affect the equilibrium price for monopsonistic subcontracting

The appendix shows that the price effect of the merger equals

\[
\frac{1}{N-2} \bar{S}_m - \frac{1}{N-1} \bar{S}_m
\]

The price effect depends on the outsiders’ willingness to win a unit rather than to lose one. For Bertrand subcontracting, the merger reduces the outsiders’ profits from winning. In contrast, for monopolistic subcontracting, the merger reduces the outsiders’ profits from losing. We next explain the intuition.

For Bertrand subcontracting \((B=1)\), the merger raises the equilibrium price by \((1-k)^2c_m\). The reason is that a winning outsider contracts from a subcontracting market that is less competitive. Indeed, if the outsider wins, the merged firm benefits from merging because it can now also capture surplus from subcontracting if it is the only firm to have two favorable cost draws. The contracting costs of a winning outsider increase, thereby increasing the price it wants to offer. The merged firm, in equilibrium, can therefore charge a higher price. Remark that the price rise coincides with the increase in contracting cost if the outsider wins.

\[\text{weak bidder. Since having lower costs improves both the profits from winning and the profits from subcontracting, it is not obvious that the merged firm prefers to win in equilibrium.}\]
For monopolistic subcontracting ($B = 0$ and $\sigma = 1$), the merger reduces the price because 
\[
\frac{1}{N-2}\sigma \delta_n - \frac{1}{N-1}\sigma \delta_L < 0
\] from Lemma 1. The subcontracting surplus shared among the subcontracting outsiders decreases because the merged firm is characterized by lower in-house production costs. As a result, the merger reduces the outsiders’ opportunity cost of winning—by foregoing subcontracting profits—so that they want to compete more fiercely for the market by charging strictly lower prices.

For monopsonistic subcontracting ($B = 0$ and $\sigma = 0$), the price effect is zero. Subcontractors earn zero profits from subcontracting. Firms are therefore willing to compete equally fiercely for the market before as well as after the merger.

Given that firms reallocate production efficiently using subcontracts, a merger only affects social welfare, i.e., the sum of consumer and producers surplus, through its price-effect. Since marginal costs are constant, a merger that brings the equilibrium price closer to the industry marginal cost improves social welfare. It therefore follows from proposition 4 that a merger without synergies

- reduces social welfare for simultaneous offers by subcontractors
- increases social welfare for sequential offers by subcontractors
- is social welfare-neutral for offers by contractors.

We proceed with proposition 5 to study the profitability of mergers.

**Proposition 5.** A merger without synergies

- is strictly profitable for Bertrand subcontracting and monopolistic subcontracting.
- is profit-neutral for monopsonistic subcontracting.

The proof is in the appendix.

The merger does not achieve cost savings at the industry level; firms already implement cost-reducing reallocations by using efficient horizontal subcontracts. Profitability results from the following two other effects.

The first effect concerns the contracting costs. The possibility for the merged firm to reallocate production in-house lowers its in-house costs absent subcontracting. The merged firm thereby reduces the maximal amount paid to the rivals for subcontracting from $C_1(Q)$ to $\hat{C}_n(Q)$. This effect results in more favorable contracting terms, because the merged firm needs to call upon subcontractors with a lower probability.
We argue that this effect is smaller for Bertrand subcontracting than for monopolistic subcontracting. The intuition is that, if competition among subcontractors is fierce, contracting costs are already low before the merger. Consequently, the additional effect of acquiring another firm is small. In particular, for Bertrand subcontracting, acquiring a firm avoids paying subcontracting surplus in the event that firm is the only one with a favorable cost draw (with probability \((1-k)k^{k-1}\)). Otherwise, competition among subcontractors would have guaranteed favorable contracting terms before the merger as well. For monopolistic subcontracting, the reduction in contracting costs is larger. Indeed, before the merger, the subcontracting market is not competitive and always results in high contracting costs. The merger, by decreasing demand for contracting, disciplines contracting costs and as such substitutes for the lack of competition among subcontractors. As compared to before the merger, merging avoids paying subcontracting surplus if the acquired firm draws a favorable cost while the acquiring firm draws a high cost (with probability \((1-k)k\)).

The second effect concerns the equilibrium price. For Bertrand subcontracting, the equilibrium price goes up. Indeed, as it is more costly for the outsiders to contract from the merged firm, they have less incentives to compete fiercely. The merged firm benefits from the price increase. For monopolistic subcontracting, the equilibrium price goes down because the outsiders forego less subcontracting profits by winning a unit. The outsiders are therefore more willing to compete for consumers. The negative effect of the price decrease on the merged firm’s profits is, however, too small to offset the reduced contracting cost effect, which is large for monopolistic subcontracting. We thus find that, for monopolistic subcontracting, the interests of a “no-synergies” merger and consumers are aligned. Both benefit from a decrease in subcontracting surplus.

Figures 2 and 3 illustrate our merger insights. They show the effects of the merger on prices and profits for Bertrand subcontracting and monopolistic subcontracting. For both figures, the upper graph shows the effects for an outside firm. The lower graph shows the effects for the merged firm. The vertical axis shows profits and the horizontal axis shows the lowest price in the market. Before the merger, all firms are symmetric and indifferent between winning and losing at \(p^*\).
For Bertrand subcontracting, after the merger, the contracting costs of the winning outsider go up. Outsiders are therefore willing to lose at a price $p_{o-m} > p_i$. The merged firm benefits twice. First, its profits from winning increase, because it enjoys lower contracting costs. Second, the merged firm can sell at a higher equilibrium price. Remark that, while the merged firm wins in equilibrium, it would also have enjoyed higher subcontracting profits in case it loses. Interestingly, even though firms compete in prices, the merging firms increase their profits whereas the outsiders’ profits go down.

Figure 2: The effect of a merger on prices and profits for Bertrand subcontracting.
For monopolistic subcontracting, after the merger, the outside firms \( o \) are harmed because they can profit less if they lose. Their opportunity cost of winning goes down so that they are indifferent between winning and losing at a lower price \( p_{\text{o-m}} < p^*_i \). The reasoning is different for the merged firm. Merging improves stand-alone production possibilities. This is profitable only through more favorable contracting terms, i.e., if the merged firm wins the market. The merged firm maximizes revenues by charging a price equal to \( p^*_m \), the price at which an outside firm no longer wants to win. The outsiders’ profits go down, whereas the merging firms increase their profits.

**4. Conclusion and general discussion**

Our analysis finds that, in industries with horizontal subcontracting, the effects of a merger without synergies can differ from the traditional merger analysis in several respects.

To isolate the effects of a merger without synergies, we consider (i) horizontal subcontracts that efficiently reallocate production across firms and (ii) we rule out synergies like learning effects or management
efficiencies. While a merger does not reduce industry costs, the possibility for the merged firm to reallocate production improves its \textit{in-house} production possibilities. This has two important consequences.

First, merging can be profitable by reducing the amount of contracting from the rivals. As the merged firm needs to rely less on subcontractors to serve the market, merging avoids unfavorable contracting terms if the subcontracting market is not perfectly competitive. This effect is positive but small for Bertrand subcontracting, which still allows a single most efficient subcontractor to earn an efficiency rent. The reason is that, even without the merger, the contractor can benefit from competition among subcontractors to discipline the contracting cost if there are multiple subcontractors with a favorable cost draw. The reduction in contracting cost then only applies to situations where only one of the subcontractors has a favorable cost draw. In contrast, if the supply of subcontracting services is less competitive than Bertrand, the effect is positive and large. If so, a merger decreases the demand for subcontracting, and thereby substitutes for the lack of competition among subcontractors. These insights help explain consolidation in industries with horizontal subcontracting such as e.g. construction, dredging or syndicated lending.

Second, the merger without synergies can or cannot benefit consumers, depending on the outsider’s willingness to compete. There are two opposing effects. First, it can be more costly for the outsiders to win consumers because a more concentrated subcontracting market can lead to higher contracting costs. This effect is important for Bertrand subcontracting, which finds that the merger increases the equilibrium price. We expect a similar effect in a cooperative or bargaining rather than a competitive subcontracting setting. The merger is then likely to increase the surplus going to the subcontractors, making contracting more costly for an outsider. Second, the merger can also increase the incentive for the outsiders to win consumers. Indeed, if the merged firm’s improved contracting terms reduce the outsiders’ subcontractors’ profits, the outsiders forego less profits by competing fiercely. This effect is important for monopolistic subcontracting, which finds that the equilibrium price decreases after the merger. Interestingly, if instead of a merger we would consider a temporary joint venture that cooperates only to serve consumers on the main market but breaks apart in the event of acting as subcontractor, the first effect cannot not apply. Indeed, a winning outsider then contracts from a subcontracting market that is equally competitive as without the joint venture. A decrease in the outsider’s profits from subcontracting is then sufficient for the merger to reduce the equilibrium price. Finally, the no synergies assumption should be interpreted as a benchmark. As any learning effects or management synergies would be cost reducing, we expect that synergies would have a decreasing effect on the price.

These results have important implications for antitrust authorities that evaluate the effects of a merger. In particular, if industries are characterized by competitive subcontracting, the price effects of a merger are in line with the traditional literature. However, if subcontracting markets are less competitive, for example
because they are not sufficiently transparent to justify Bertrand competition, a merger does not need to involve synergies to reduce the equilibrium price. Increased concentration can then be pro-competitive without reference to an efficiency defense.\textsuperscript{24} Our analysis suggests that, for monopolistic subcontracting markets, the market structure favored by consumers could be a concentrated one with a few large firms, because then none of the firms can profit much from subcontracting. With many small firms, the winning firm would rely heavily on the subcontracting services of the losing firms, which discourages firms from conquering the market with low prices. Of course, some caution is appropriate since our analysis studies unilateral merger effects without considering potential coordinated merger effects that follow from increased market concentration.

The effect of the merger on the outsiders’ profits differs from the traditional merger analysis. In particular, the outsiders can be worse off after the merger because they earn less subcontracting profits. For Bertrand subcontracting, a merger does not affect an outsider’s subcontracting profits per consumer served because the probability that it is the only firm with a favorable cost draw remains unchanged. However, the equilibrium price increase leads to less consumers served, and hence a reduction in subcontracting profits. For monopsonistic subcontracting, an outsider earns subcontracting profits in all states of nature with subcontracting surplus. Since the merged firm demands less subcontracting per consumer served, subcontracting outsiders earn less profits, notwithstanding the fact that the number of consumers served increases in equilibrium.

In general, we can expect that, in a market with small and large firms, the largest firm has the strongest incentive to merge because it conquers the market and thereby has the highest demand for contracting. In a setting where firms are asymmetrically sized, the effects of a merger between the two largest firms should be carefully assessed for the following reason. The equilibrium price follows crucially from the firm that is willing to offer the second-lowest price. So, after a merger between the two largest firms, the equilibrium price would crucially follow from the third-largest firm that was originally in the market. Since the third-largest firm is characterized by higher costs than the second-largest firm originally in the market, it is also less capable of charging a low price, which may enforce the price-increasing effect.

\textsuperscript{24} Similarly, this insight is also reflected in agreements falling short of a merger. E.g. in a European context, if bidding consortia are assessed as not restricting competition, there is no need to refer to the efficiency defense exemption provided by TFEU 101(3) to conclude that article TFEU 101(1) does not apply.
5. References


Marion, Justin, 2015, Sourcing from the enemy: Horizontal subcontracting in highway procurement, Journal of Industrial Economics, 63(1), 100-128.


**Appendix**

**Proof of proposition 2.**

We prove that $p^*(\sigma) < p^w \iff \sigma < \frac{N-1}{N}$. By plugging in the expressions for $p^*(\sigma)$ and $p^w$ we can write the equivalence

$$p^*(\sigma) < p^w \iff C_{\text{USD}} - \frac{N}{N-1} \sigma S_i < C_i,$$

which we can write as

$$p^*(\sigma) < p^w \iff \sigma < \frac{N-1}{N} \frac{C_i - C_{\text{USD}}}{S_i} = \frac{N-1}{N}$$

because $S_i = C_i - C_{\text{USD}}$.

**Proof of Lemma 1.**

The proof of lemma 1 will show that the unit subcontracting surplus *per outsider* is decreasing if the number of firms in the merger increases. We claim that, if the joint entity is smaller, the unit subcontracting surplus per outsider is larger.

The proof consists of two parts. The first part (1.) analyzes the unit subcontracting surplus. The second part (2.) analyzes the unit subcontracting surplus per outsider and shows the main result.
1.

Part one shows that, if the joint entity is smaller, the reduction in unit subcontracting surplus from merging is larger. To do so, we compare two mergers.

The first merger we consider is the merger from entity \( n \) that consists of \( 1 \leq n \leq N-2 \) firms to entity \( \{n+1\} \) that consists of an extra firm. The entity \( n \) has costs equal to \( k^n c_H \). After the merger, the entity \( \{n+1\} \) produces at cost \( k^{n+1} c_H \). We can write that the reduction in unit subcontracting surplus thanks to the first merger equals

\[
S_n - S_{[n+1]} = k^n c_H - k^{n+1} c_H .
\]

The second merger we consider is the merger from entity \( \{n+1\} \) to entity \( \{n+2\} \). Entity \( \{n+1\} \) has a cost equal to \( k^{n+1} c_H \). After the merger, the entity \( \{n+2\} \) produces at cost \( k^{n+2} c_H \). We can write that the reduction in unit subcontracting surplus from the second merger equals

\[
S_{[n+1]} - S_{[n+2]} = k^{n+1} c_H - k^{n+2} c_H .
\]

We prove that the reduction in unit subcontracting surplus \( S_n - S_{[n+1]} \) resulting from the first merger exceeds the reduction in unit subcontracting surplus \( S_{[n+1]} - S_{[n+2]} \) from the second merger. This can be written as

\[
k^n c_H - k^{n+1} c_H > k^{n+1} c_H - k^{n+2} c_H,
\]

or equivalently \( 1-k > k(1-k) \), which always holds. So, if the joint entity is smaller, a merger with an extra firm always achieves a larger reduction in unit subcontracting surplus.

2.

The reduction in unit subcontracting surplus from merging entity \( n \) to entity \( \{n+1\} \) equals \( S_n - S_{n+1} \). The remaining \( N-(n+1) \) successive mergers to monopoly lead to an average reduction in unit subcontracting surplus of \( \frac{S_{n+1} - S_{n}}{N-(n+1)} \). Note that \( S_N = \tilde{C}_{IND} - \tilde{C}_{IND} = 0 \).

From part 1 we know that the reduction in unit subcontracting surplus must satisfy
\[ \hat{S}_n - \hat{S}_{n+1} > \frac{\hat{S}_{n+1}}{N - (n+1)}, \]

which can be rewritten as \( \frac{\hat{S}_{n+1}}{N - (n+1)} < \frac{\hat{S}_n}{N - n} \). We conclude that the unit subcontracting surplus per outsider is smaller if the number of firms in the merger increases. For \( n = 1 \), we can rewrite the inequality as
\[ \frac{\hat{S}_n}{N - 2} < \frac{\hat{S}_n}{N - 1}. \]

**Proof of Lemma 2.**

First observe that \( p^{*}_{-\text{om}}(\sigma) \leq p^{*}_{-\text{om}}(\sigma) \). Indeed, the inequality
\[
\hat{C}_{\text{IND}} + (\sigma + B \frac{(1-k)^{k^{n-2}}}{k-k^n})\hat{S}_n + \frac{1}{N-2} \left[ (1-B)\sigma + B \frac{N-2}{N-1} \hat{S}_n \right] \hat{S}_n \leq \hat{C}_{\text{IND}} + (\sigma + B \frac{(1-k)^{k^{n-2}}}{k-k^n})\hat{S}_n + \frac{\sigma}{N-1} \hat{S}_n
\]
can be written as
\[
\frac{1}{N-2} \left[ (1-B)\sigma + B \frac{N-2}{N-1} \hat{S}_n \right] \hat{S}_n \leq \frac{\sigma}{N-1} \hat{S}_n.
\]

For \( \sigma = 0 \), the condition is always satisfied. For \( \sigma > 0 \), we can write \( (1-B) + B \frac{N-2}{N-1} \frac{\hat{S}_n}{N-2} \leq \frac{\hat{S}_n}{N-1} \) or \( (1-B) \leq (1-B) \frac{N-2}{N-1} \frac{\hat{S}_n}{N-2} \). Since Lemma 1 gives us \( \frac{\hat{S}_n}{N-2} < \frac{\hat{S}_n}{N-1} \) and consequently \( 1 < \frac{N-2}{N-1} \frac{\hat{S}_n}{N} \), and by using that \( B = \{0,1\} \), this inequality is always satisfied.

Second, observe that \( p^{*}_{m}(\sigma) - p^{*}_{-\text{om}}(\sigma) \) can be written as
\[
\hat{C}_{\text{IND}} + \left[ (1-B)\sigma + B \frac{N-2}{N-1} \hat{S}_n \right] \hat{S}_n + \frac{2\sigma}{N-1} \hat{S}_n + B \frac{(1-k)^{k^{n-2}}}{k-k^n} \hat{S}_n - \hat{C}_{\text{IND}} - (\sigma + B \frac{(1-k)^{k^{n-2}}}{k-k^n})\hat{S}_n - \frac{1}{N-2} \left[ (1-B)\sigma + B \frac{N-2}{N-1} \hat{S}_n \right] \hat{S}_n
\]

which can be written as
\[
p^{*}_{m}(\sigma) - p^{*}_{-\text{om}}(\sigma) = - \frac{N-3}{N-1} \sigma \hat{S}_n + \frac{N-3}{N-2} \left[ (1-B)\sigma + B \frac{N-2}{N-1} \hat{S}_n \right] \hat{S}_n.
\]
For $N = 3$ or $\sigma = 0$, we have $p_n^*(\sigma) = p_{n-m}^*(\sigma)$. For $N > 3$ and $\sigma > 0$, we can rewrite $p_m^*(\sigma) < p_{m-m}^*(\sigma)$ as $(1 - B) < (1 - B) \frac{N - 2 \bar{S}_n}{N - 1 \bar{S}_n}$, which always holds because of Lemma 1.

**Proof of proposition 3.**

We first show that the merged firm wins in equilibrium. Second, we rule out other possible equilibria apart from $p_{n-m}^*(\sigma)$. Finally, we show that $p_{n-m}^*(\sigma)$ is indeed an equilibrium.

In any equilibrium, there are two possibilities. Either firm $m$ wins, or a firm $o$ wins.

We first contradict that an outsider wins in equilibrium. The reason is that, if an outside firm wins in equilibrium, firm $m$ should prefer not to win instead, meaning that the equilibrium price should be weakly lower than $p_m^*(\sigma)$ (from Lemma 2). The winning outsider should prefer not to lose instead, meaning that the equilibrium price should weakly exceed $p_{n-m}^*(\sigma)$ (from Lemma 2). This leaves only the possibility that the equilibrium price is $p_m^*(\sigma) = p_{n-m}^*(\sigma)$. But if all firms charge $p_{n-m}^*(\sigma)$, the merged firm wins because of the tie-breaking rule. Therefore the merged firm wins in equilibrium.

Second, if the merged firm wins, the equilibrium price should not exceed $p_{n-m}^*(\sigma)$ to make sure that the outsider(s) do not wish to undercut the winning merged firm. At the same time, any lower price cannot be an equilibrium either. Indeed, charging $p_{n-m}^*(\sigma)$ weakly dominates charging a lower price for firm $o$, because at lower prices firm $o$ always prefers to lose rather than to win (from Lemma 2). As a consequence, the winning merged firm wants to charge up to $p_{n-m}^*(\sigma)$ from (A4). This leaves only the possibility that the equilibrium price is $p_{n-m}^*(\sigma)$.

Finally, price $p_{n-m}^*(\sigma)$ is an equilibrium for the following reason.

If $p_m^*(\sigma) = p_{n-m}^*(\sigma)$, which holds for $N = 3$ or $\sigma = 0$, the merged firm wins and charging a higher price or slightly undercutting is not profitable because all firms are indifferent between winning and losing at $p_{n-m}^*(\sigma)$. Moreover, from (A4), the merged firm neither wants to charge a lower price to increase demand.

If $p_m^*(\sigma) < p_{n-m}^*(\sigma)$, at least one outsider charges $p_{n-m}^*(\sigma)$ and firm $m$ wins by the tie-breaking rule. The outsiders cannot gain for the following reasons. Raising the price lead to the same situation where they lose. Reducing the price is not profitable because they are indifferent at $p_{n-m}^*(\sigma)$, and winning at a lower price leads to lower profits (also from (A4)). Price $p_{n-m}^*(\sigma)$ is also an equilibrium from the perspective of the
merged firm. Indeed, raising the price leads to lower profits since it would result in losing at $p_{n,m}^*(\sigma)$.

Reducing the price is also not profitable from (A4).

**Proof of proposition 4.**

The price effect of the merger equals

$$p_{n,m}^*(\sigma) - p_i(\sigma) = \bar{C}_{n,m} + (\sigma + B \frac{(1-k)^2 k^{N-2}}{k-k^N})\tilde{S}_n + \frac{1}{N-2} \left[(1-B)\sigma + B \frac{N-2}{N-1} \tilde{S}_m\sigma\right] \tilde{S}_n - C_{n,m} - \sigma S_i - \frac{\sigma}{N-1} S_i.$$  

Since $\bar{C}_{n,m} = C_{n,m}$ and $\tilde{S}_n = S_i$, we can write $B \frac{(1-k)^2 k^{N-2}}{k-k^N}\tilde{S}_n + \frac{1}{N-2} \left[(1-B)\sigma + B \frac{N-2}{N-1} \tilde{S}_m\sigma\right] \tilde{S}_n - \frac{\sigma}{N-1} \tilde{S}_n$. By using that $\tilde{S}_n = kc_H - k^Xc_H$, and rewriting, we obtain that the price effect is

$$B(1-k)^2 k^{N-2}c_H + (1-B)\left[\frac{1}{N-2} \sigma \tilde{S}_n - \frac{1}{N-1} \sigma \tilde{S}_n\right].$$

**Proof of proposition 5.**

By merging, firms replace the profits of two pre-merger firms with the profits of only one merged firm. A profitable merger therefore requires that the merged firm can earn at least double the profits of a pre-merger firm. The profit effect for the merged firm depends on the subcontracting market institutions.

**Bertrand subcontracting**

Since from proposition 4, we know that the equilibrium price went up, we can use (A4) to write that the profits of the merged firm exceed

$$w_m(p_{n,m}^*(\sigma))Q(p_{n,m}^*(\sigma)) > w_m(p_i(\sigma))Q(p_i(\sigma)) = p_i(\sigma)Q(p_i(\sigma)) - C_mQ(p_i(\sigma)) + (1 - \frac{N-2}{N-1} \tilde{S}_m\sigma) \tilde{S}_m Q(p_i(\sigma)).$$

By plugging in the expressions for $c_m$ and $\tilde{S}_m$, that final expression can be rewritten as

$$\frac{1}{N-1} \tilde{S}_m \sigma Q(p_i(\sigma)) + p_i(\sigma)Q(p_i(\sigma)) - k^Xc_H Q(p_i(\sigma)) - \sigma \tilde{S}_m Q(p_i(\sigma)).$$

The first term denotes a firm’s pre-merger profits. However, the merger is profitable only if it covers *twice* the pre-merger profits. This is satisfied because the additional terms equal $w_i(p_i(\sigma))$. This is checked by
using that $W_i(p^*(\sigma)) = p^*(\sigma)Q(p^*(\sigma)) - kc_iQ(p^*(\sigma)) + (1 - \sigma)S_iQ(p^*(\sigma))$, that $S_i = S_i = kc_i - \kappa c_i$, and that $C_i = kc_i$.

**Monopolistic subcontracting**

The merger is strictly profitable because

$$W_m(\tilde{p}^*(\sigma))Q(\tilde{p}^*(\sigma)) \geq L_m(\tilde{p}^*(\sigma))Q(\tilde{p}^*(\sigma)) = 2L_m(\tilde{p}^*(\sigma))Q(\tilde{p}^*(\sigma))$$

$$= 2 \frac{\sigma}{N - 1} \tilde{S}_oQ(\tilde{p}^*(\sigma)) > 2 \frac{\sigma}{N - 1} \tilde{S}_oQ(p^*(\sigma))$$

The first inequality follows from the fact that firm $m$ prefers to win rather than to lose in equilibrium (lemma 2). The next equality represents that firm $m$, from losing against $o$, earns twice the profits of an outside firm that would lose against $o$. These profits equal $\frac{1}{N - 1} \sigma S_oQ(\tilde{p}^*(\sigma))$. These profits exceed the last expression, which represents twice the pre-merger profits, because from proposition 4 we know that the merger strictly decreased the price, and hence, strictly increased demand (from (A1)).

**Monopsonistic subcontracting.** The merger is profit-neutral because, before as well as after the merger, all firms charge the unit average industry costs and earn zero.

∎