Düsseldorfer Institut
für Wettbewerbsökonomie

DISCUSSION PAPER

No 118

Downstream Mode of Competition With Upstream Market Power

Constantine Manasakis,
Minas Vlassis

November 2013

HEINRICH HEINE
UNIVERSITÄT DÜSSELDORF

d|u|p düsseldorf university press

IMPRINT

DICE DISCUSSION PAPER

Published by

düsseldorf university press (dup) on behalf of
Heinrich-Heine-Universität Düsseldorf, Faculty of Economics,
Düsseldorf Institute for Competition Economics (DICE), Universitätsstraße 1,
40225 Düsseldorf, Germany
www.dice.hhu.de

Editor:

Prof. Dr. Hans-Theo Normann
Düsseldorf Institute for Competition Economics (DICE)
Phone: +49(0) 211-81-15125, e-mail: normann@dice.hhu.de

DICE DISCUSSION PAPER

ISSN 2190-9938 (online) – ISBN 978-3-86304-117-5

Downstream Mode of Competition With Upstream Market Power*

Constantine Manasakis
Department of Political Science, University of Crete;
Düsseldorf Institute for Competition Economics (DICE)
Heinrich-Heine Universität Düsseldorf
E-mail: manasakis@uoc.gr

Minas Vlassis
Department of Economics, University of Crete
E-mail: vlassism@uoc.gr

November 2013

Abstract

In a two-tier oligopoly, where the downstream firms are locked in pair-wise exclusive relationships with their upstream input suppliers, the equilibrium mode of competition in the downstream market is endogenously determined as a renegotiation-proof contract signed between each downstream firm and its exclusive upstream input supplier. We find that the upstream-downstream exclusive relationships credibly sustain the Cournot (Bertrand) mode of competition in the downstream market, when the goods are substitutes (complements). In contrast to previous studies, this result holds irrespectively of the degree of product differentiation and the distribution of bargaining power between the upstream and the downstream firm, over the pair-specific input price.

JEL Classification: D43; L13; L42
Keywords: Oligopoly; Vertical relations; Wholesale prices; Equilibrium mode of competition

* We would like to thank Emmanuel Petrakis, Chrysovalantou Milliou, and Evangelos Mitrokostas for their helpful comments on earlier versions of this work. Part of this work was supported by the COST Action IS1104 “The EU in the new economic complex geography: models, tools and policy evaluation”. Manasakis acknowledges the hospitality at the Düsseldorf Institute for Competition Economics (Heinrich-Heine University), where part of this work was completed while he was on a research visit there. Full responsibility for all remaining errors is ours.

1. Introduction

The cornerstones of modern oligopoly theory are the models of Cournot-Nash, where rival firms compete by setting their own quantities, and Bertrand-Nash, where the firms' strategic variables are their own prices. Tremblay and Tremblay (2011) argue that "In the real world, both Cournot and Bertrand behavior are observed" and cite relevant evidence by Tremblay et al. (2013). Though these alternative models deliver highly significant implications to the theory and practice of industrial economics (see, e.g., Vives, 2001), a full understanding of what induces and sustains the mode of competition in oligopolistic industries is, however, still to come.

In their seminal paper, Singh and Vives (1984) analyzed a one-shot two-stage downstream duopoly game with differentiated goods. In the first stage of the game, each firm "commits" over the type of the binding contract to offer consumers. If a firm chooses the quantity (price) contract it is committed to set quantity (price) as the strategy variable in market competition, regardless of the rival's choice. In the second stage, firms compete by each choosing the level of its strategy variable, so as each to maximize own profits. Assuming that there are prohibitively high costs associated with changing the type of contract made to consumers in the first stage, the main finding is that when the goods are substitutes (complements), a firm's s dominant strategy is to choose the quantity (price) contract; as well as that Bertrand (Cournot) competition is more efficient.[1,2]

---

[1] Keeping the assumption for exogenous and identical marginal costs across firms, but allowing for vertical quality differences across the horizontally differentiated goods, Häckner (2000) finds that when goods are complements, Bertrand profits are higher than the Cournot ones. When goods are substitutes and quality differences are large (small), high-quality firms earn higher profits under Bertrand (Cournot) competition. In the context of vertical product differentiation with quality enhancement R&D investments, Symeonidis (2003) finds that quality enhancement is higher in the Cournot equilibrium, and that output, consumer surplus and total welfare are higher under Cournot if R&D spillovers are large and goods are not too differentiated.

In a similar vein, Kreps and Scheinkman (1983) study a game generating Cournot outcomes too. In the first stage, producers decide non-cooperatively how much they will produce, and this production takes place. In the second stage, they bring these quantities to market, each learns how much the other produced, and they engage in Bertrand-like price competition. They find that the Cournot outcome is the subgame Nash perfect equilibrium in output levels and prices.

More recently, Dastidar (1996) was the first to endogenize a firm's choice of quantity versus price as a strategic one. In his words "assuming that the technology of production and marketing makes either strategy feasible, it does seem fruitful to treat the choice of strategy itself as a variable". In a homogeneous product setting, duopolists, with symmetric and strictly convex costs, choose the strategic mode of operation in the first stage and in the second stage, price or output are chosen simultaneously according to the mode chosen in the first stage. He finds that both firms choosing quantity is always a Nash equilibrium, while both choosing prices can be a Nash equilibrium, but only in some situations, depending on the structure of the cost functions.

The bulk of the relevant literature is grounded on the assumption that downstream firms ex-ante commit to a particular competition conduct (price or quantity), i.e., there is a silent assumption according to which there is a *stage zero* in the game, where each firm *credibly commits* to a particular competition conduct. This reproduces the argument of Singh and Vives (1984) for "prohibitively high costs associated with changing the type of contract made to consumers", without unraveling any mechanism or device which might render credibility to such a commitment.

[2] Allowing for a wider range of cost asymmetry between firms, compared to Singh and Vives (1984), Zanchettin (2006) finds that for high degrees of cost asymmetry and low degrees of product differentiation, the efficient firm's profits are higher under price than under quantity competition.

In this framework, the following questions can then be addressed: How does a firm's particular competition conduct emerge? What sustains a particular competition conduct in a downstream market?

To address the above questions, we consider an industry with two upstream input suppliers and two downstream firms, producing substitute final goods, which are locked in pair-wise exclusive relationships.[3] Each downstream firm's cost is the price per-unit of input bought by its exclusive upstream supplier. In the first stage of the game, within each upstream – downstream pair, the downstream firm and its exclusive input supplier negotiate over the competition (price or quantity) conduct (which the firm will materialize in the second stage) and the contingent pair-specific input price. Note that any upstream – downstream pair's agreed input price / competition conduct scheme is not observable by the rival pair before market competition is in place, since there is nothing to prevent any upstream – downstream pair to shift from any (first stage- presumed) input price / competition conduct scheme to another. In the second stage, downstream firms compete in the product market, i.e., each downstream firm sets either its own price or its own quantity, based on the agreed competition conduct.

Our analysis is grounded on the postulate that a contract signed between a downstream firm and its exclusive input supplier must be *renegotiation-proof* (see, e.g., Dewatripont, 1988; Petrakis and Vlassis, 2000), implying that an upstream-downstream bargaining pair can deviate from a certain input price / competition conduct scheme to another one only if this deviation is beneficial for both the downstream and the upstream firm. Therefore, a downstream firm cannot

---

[3] Lafontaine and Slade (2008) refer to a series of industries with vertical chains' exclusive relations: Car equipment suppliers have exclusive contracts with car manufacturers, petroleum firms with gasoline retailers and soft drinks producers with food retailers.

unanimously (e.g., without the consent of its input supplier) deviate, after the input price has been set, from a particular downstream competition conduct to another. Such upstream-downstream contracts may thus effectively act as commitment devices for the emergence and sustainability of a particular mode of competition in the market of the final good.

Our central result is that, when the goods are substitutes (complements), the Cournot (Bertrand) mode of competition is endogenously sustained in the market of the final good, and that this holds independently of the degree of product differentiation and the distribution of bargaining power, over the input price, between the upstream and the downstream firm, within each bargaining pair.[4] The reason is that, compared with a price-setting downstream firm, a quantity-setting one can raise more its price above its marginal cost, since its elasticity of demand is lower than the respective when taking the rival's price as given. The input supplier can thus enjoy a share from a larger pie in the first than in the second instance. Therefore, what sustains the Cournot mode of competition is the upstream and downstream firm's unanimous agreement, within each bargaining pair.[5]

Our finding contributes to the literature by addressing a plausible solution for the emergence and sustainability of the mode of competition in the downstream tier of a vertically related market. Hence, exclusive upstream-downstream relations within a vertical chain can be a plausible mechanism for the downstream firms' credible commitment over a particular competition conduct. Our finding is in line with Singh and Vives (1984) and Kreps and Scheinkman (1983), according to which, when the

[4] This is in contrast to Correa-López and Naylor (2004) and Correa-López (2007) who suggest that the downstream firms' mode of competition depends on the distribution of bargaining power between the downstream firms and the input suppliers (labour unions), over the input price (wage rate).

[5] In a similar vein, Petrakis and Vlassis (2000) endogenously determine the scope of firm - union bargaining, i.e., the issues over which firms and unions negotiate, arguing that the equilibrium scope of bargaining is the one resulting to the most beneficial outcome for both the firm and its labour union.

goods are substitutes, the Cournot mode of competition is endogenously sustained in the market. However, based on the diversity of results reported in the relevant literature (see footnotes 1 and 2), we cannot conclude that when the goods are substitutes**,** the Cournot outcome is the natural equilibrium mode of competition. This is in line with Kreps and Scheinkman (1983, p. 327) suggesting that "solutions to oligopoly games depend on both the strategic variables that firms are assumed to employ and on the context (game form) in which those variables are employed."

Notice that our finding partially reconfirms Dastidar (1996), as long as, besides the case where both firms choose quantities, he further finds that the case where both firms choose prices can be a Nash equilibrium, depending on the structure of the cost functions. Interestingly, the contrast between this finding and our result can be interpreted by the two differences in the cost function. First, Dastidar (1996) assumes strictly convex cost while we consider a linear cost function. Second, in Dastidar (1996) the cost per unit of output is exogenous while in our framework it is endogenously determined through bargaining between the downstream firm and its exclusive input supplier within each vertical chain.

Our paper also contributes to the literature studying the upstream supplier's optimal pricing policy with respect to downstream market competition. In the context of a single upstream supplier selling input to downstream firms producing differentiated products under free entry, Pinopoulos (2011) finds that the supplier charges a higher input price under Bertrand downstream competition than under Cournot. In our context, an upstream supplier charges a higher input price to a downstream firm setting its quantity as compared to the respective price to a downstream firm setting its price.

Our analysis further entails that the consumer surplus-effect always dominates the vertical chains' joint profits-effect. Hence, we reconfirm that the symmetric Bertrand (Cournot) mode of competition always leads to the highest (lowest) social welfare; we further suggest that the asymmetric configuration, where the one downstream firm sets its quantity while the other firm sets its price, lies-in between.

The rest of the paper is organized as follows. Section 2 presents the model. In Section 3 the various configurations-modes of competition in the product market are postulated. In Section 4 we determine the equilibrium mode of competition and Section 5 contains our welfare analysis. In Section 6, we consider a number of extensions of our model and in Section 7, we conclude.

2. The model

We consider a two-tier industry consisting of two upstream and two downstream firms. One could think of the upstream and the downstream firms as respectively being input producers and final good manufacturers, or wholesalers and retailers. There is a one-to-one relation between the products of the upstream and the downstream firms and an exclusive relation between upstream firm i and downstream firm i, with $i = 1,2$.[6] The latter can result from various sources; like for instance in Milliou and Petrakis (2007) where "when the upstream firms produce inputs which are tailored for specific final good manufacturers, there may be irreversible R&D investments that create *lock-in* effects and high switching costs".

Following Singh and Vives (1984), it is assumed that the representative consumer's preferences are described by the utility function

[6] This is a quite common assumption in the vertical relations literature (see e.g. Horn and Wolinsky, 1988; Ziss, 1995; Lommerud et al., 2005). In Section 6, we relax it and in line with some recent papers (see e.g. de Fontenay and Gans, 2005, 2013; Björnerstedt and Stennek, 2006) we discuss what would happen if we allow for non-exclusive relations.

$U(q_i, q_j) = (q_i + q_j) - (q_i^2 + q_j^2 + 2\gamma q_i q_j)/2$, where q_i is the downstream firm i's quantity. Hence, each downstream firm faces the following demand function:

$$q_i(p_i, p_j) = \frac{(1-\gamma) - p_i + \gamma p_j}{1-\gamma^2}, i,j = 1,2,\ i \neq j \tag{1}$$

Where p_i and q_i are respectively firm i's price and output. $\gamma \in (0,1]$ denotes the degree of product substitutability; as $\gamma \to 0$ brands are regarded as unrelated, whereas $\gamma \to 1$ corresponds to the case of homogeneous goods.[7] The corresponding inverse demand function is given by:

$$p_i = 1\text{-}q_i\text{-}\gamma q_j,\ \ i,j = 1,2,\ i \neq j \tag{2}$$

Downstream firms are endowed with constant returns to scale technologies which transform one unit of input to one unit of output, that is, $q_i = L_i;\ i = 1,2$, where L_i denotes the downstream firm i's specific input bought from its exclusive supplier, upstream firm i. Each downstream firm faces no other costs than the cost of obtaining the input from its upstream supplier. The latter consists of a per-unit of input price w_i, i.e., trading is conducted through a linear wholesale price contract. Moreover, each upstream firm faces a normalized to zero unit cost. Hence, upstream firm i's profit function is:[8]

$$\pi_i(w_i, L_i) = w_i L_i,\ \ i,j = 1,2,\ i \neq j \tag{3}$$

---

[7] In section 6, we also examine the case where the products are complements.

[8] The existence of an exclusive relation within each upstream-downstream pair is a natural assumption if input suppliers are trade unions. In this case, we would assume that all workers have identical skills and are organized into two separate firm-level unions. Each union is of the utilitarian type, maximizing the sum of its (risk-neutral) members' utilities, given fixed union membership (see e.g. Oswald, 1982; Booth 1996). That is, union i's objective is to maximize $U_i(w_i, L_i) = (w_i)^b L_i$. Where, w_i is the wage paid by firm i and captures all short-run marginal costs for the downstream firm i (Correa-López and Naylor, 2004) and $b \in (0,1]$ can be thought of as the representative member's relative rate of risk aversion, provided that union membership is fixed and all members are identical. Alternatively, b, which in our context is normalized to unity, denotes the representative union member's elasticity of substitution between wages and employment. We have also applied our model for the case of $b \in (0,1]$ and our results remain robust.

We assume that upstream firms are symmetric and endowed with the same bargaining power, during negotiations with their downstream firms. We invoke the Nash equilibrium of simultaneous generalized Nash bargaining problems, in which the upstream and the downstream firm's bargaining power is given respectively by β and $1-\beta$, with $0<\beta\leq 1$. This implies that during the negotiations within a bargaining pair, each of its agents takes as given the outcome of the simultaneously-run negotiations of the other bargaining pair.

In this market, we consider the following two-stage game: In the first stage, within each upstream – downstream pair i, the downstream firm and its exclusive input supplier negotiate over $[M, w(M)]$, $M = P, Q$ that is, they negotiate over the competition conduct (*P*rice or *Q*uantity, discrete variable) that downstream firm i will materialize in the second stage, and the contingent pair-specific input price (continuous variable). Similarly to Petrakis and Vlassis (2000), the crucial and reasonable assumption here is that upstream – downstream pair i's agreed input price / competition conduct scheme is not observable by the rival pair before negotiations are everywhere completed. In the second stage, downstream firms compete in the product market, i.e., each downstream firm sets either its own price or its own quantity, based on the agreed competition conduct.

The above structure of the game allows us to capture the idea that contracts signed between each downstream firm and its input supplier must be *renegotiation-proof* (see, e.g., Dewatripont, 1988; Petrakis and Vlassis, 2000). This implies that an upstream – downstream bargaining pair can deviate from a certain $[M, w(M)]$ scheme to another one, only if such a deviation is beneficial for both the downstream firm and its upstream supplier. On the other hand, if any deviation from a certain

$[M, w(M)]$ scheme hurts the downstream firm and/or its supplier, then the original scheme is immune to renegotiation.

In this context, a first-stage agreement over a $[M, w(M)]$ scheme would be sustained ex-post, implying that an input price contract is a credible commitment devise for downstream firm i over a particular competition conduct to be materialized in the second stage. The reason is that downstream firm i cannot unilaterally deviate from a particular competition conduct, once the input price has been set contingent on that. In such an event, downstream firm i's exclusive supplier would naturally reset its pair-specific input price, as the downstream firm's deviation to a different competition conduct would prove to be time inconsistent for the supplier's objective regarding the quantity of input to be sold. Therefore both agents have better to agree on a particular scheme, in advance, and stick to it to the end of the game.

3. Modes of competition

In this section, we define all the possible modes of competition that can emerge in equilibrium in the downstream market. In particular, in Section 3.1, we present the configuration where both downstream firms set prices, i.e., $[P, w^P], [P, w^P]$ and in Section 3.2, the configuration where they both set quantities, i.e., $[Q, w^Q], [Q, w^Q]$. Then, in Section 3.3 we consider the case where the one downstream firm sets its quantity while the other firm sets its price, i.e., $[Q, w^Q], [P, w^P]$.

3.1 Universal price setting

Under this scenario, in the second stage of the game, each downstream firm i chooses its price p_i to maximize own profits:

$$\Pi_i^P\left(p_i, p_j, w_i\right) = \left(p_i - w_i\right)\frac{(1-\gamma) - p_i + \gamma p_j}{1-\gamma^2} \tag{4}$$

Taking the first order conditions and solving the system of equations, the respective downstream firm i 's price and profits are:

$$p_i^P\left(w_i, w_j\right) = \frac{\left(2-\gamma-\gamma^2\right) + 2w_i + \gamma w_j}{4-\gamma^2} \tag{5}$$

$$\Pi_i^P\left(w_i, w_j\right) = \left[\frac{\left(2-\gamma-\gamma^2\right) - \left(2-\gamma^2\right)w_i + \gamma w_j}{4-5\gamma^2+\gamma^4}\right]^2 \tag{6}$$

Substituting $p_i^P\left(w_i, w_j\right)$ into (1) and (3), we get downstream firm i 's demand for input and upstream firm i 's profits, respectively:

$$L_i^P\left(w_i, w_j\right) = \frac{\left(2-\gamma-\gamma^2\right) - \left(2-\gamma^2\right)w_i + \gamma w_j}{4-5\gamma^2+\gamma^4} \tag{7}$$

$$\pi_i^P\left(w_i, w_j\right) = w_i L_i^P\left(w_i, w_j\right) \tag{8}$$

To solve for the equilibrium input prices, we employ the Nash equilibrium between two simultaneous upstream - downstream generalized Nash Bargaining games. Hence, in the first stage of the game each upstream – downstream bargaining pair i chooses w_i to maximize $\left[\Pi_i^P\left(\mathrm{w}_i, \mathrm{w}_j\right)\right]^\beta\left[\pi_i^P\left(\mathrm{w}_i, \mathrm{w}_j\right)\right]^{1-\beta}$, given the input price negotiated in the pair j, w_j. The respective upstream – downstream bargaining pair i 's input price reaction function is given by:

$$w_i^P\left(w_j\right) = \frac{(1-\beta)\left[2-\gamma\left(1+\gamma-\mathrm{w}_j\right)\right]}{2\left(2-\gamma^2\right)} \tag{9}$$

Solving the system of the input price reaction functions, we get a unique stable solution for the input prices w^P. Then, using w^P, we subsequently derive downstream firm i 's price p^P; quantity q^P, profits Π^P; and upstream firm i 's profits π^P (see Appendix 1A).

3.2 Universal quantity setting

We next consider the scenario, where, in the second stage of the game, each downstream firm i chooses its quantity q_i to maximize own profits:

$$\Pi_i^Q(q_i, q_j, w_i) = (1 - q_i - \gamma q_j - w_i)q_i \tag{10}$$

Taking the first order conditions and solving the system of equations, the respective downstream firm i's input demand and profits are:

$$L_i^Q(w_i, w_j) = \frac{(2 - \gamma) - 2w_i + \gamma w_j}{\gamma^2 - 4} \tag{11}$$

$$\Pi_i^Q(w_i, w_j) = \left[L_i^Q(w_i, w_j)\right]^2 \tag{12}$$

Substituting $L_i^Q(w_i, w_j)$ into (3), we get upstream firm i's profits:

$$\pi_i^Q(w_i, w_j) = w_i L_i^Q(w_i, w_j) \tag{13}$$

In the first stage of the game, each upstream – downstream bargaining pair i chooses w_i to maximize $\left[\Pi_i^Q(w_i, w_j)\right]^\beta \left[\pi_i^Q(w_i, w_j)\right]^{1-\beta}$, given the input price negotiated in the upstream – downstream bargaining pair j, w_j. The respective upstream – downstream bargaining pair i's input price reaction function is given by:

$$w_i^Q(w_j) = \frac{1}{4}(1 - \beta)[2 + \gamma(w_j - 1)] \tag{14}$$

Solving the system of the input price reaction functions, we get a unique stable solution for the input prices w^Q. Then, using w^Q, we subsequently derive downstream firm i's price p^Q; quantity q^Q, profits Π^Q; and upstream firm i's profits π^Q (see Appendix 1B).

3.3 Coexistence of quantity setting and price setting

Let us finally consider the case where, in the second stage of the game, downstream firm $i(j)$ chooses its own quantity (price), q_i (p_j) to maximize its profits:[9] Suppose, without loss of generality that, in the second stage, downstream firm 1 sets its quantity and firm 2 sets its price. That is, firm 1 chooses q_1 so as to maximize its profits, subject to $p_1 = (1-\gamma) + \gamma p_2 - (1-\gamma^2)q_1$, taking p_2 as given. Hence, firm 1's profit function is:

$$\Pi_1^{QP} = q_1\left[(1-\gamma) + \gamma p_2 + (\gamma^2 - 1)q_1 - w_1\right] \tag{15}$$

On the other hand, firm 2 sets p_2 in order to maximize its profits subject to $q_2 = 1 - \gamma q_1 - p_2$ taking p_1 as given. Thus firm 2's profit function is:

$$\Pi_2^{QP} = (p_2 - w_2)(1 - \gamma q_1 - p_2) \tag{16}$$

Taking the first order conditions and solving the system of equations, the respective downstream firm 1's input demand and firm 2's price are:

$$L_1^{QP}(w_1, w_2) = \frac{(\gamma - 2) + 2w_1 - \gamma w_2}{3\gamma^2 - 4} \tag{17}$$

$$p_2^{QP}(w_1, w_2) = \frac{(2 - \gamma - \gamma^2) + \gamma w_1 - (2\gamma^2 - 2)w_2}{4 - 3\gamma^2} \tag{18}$$

It follows that firm 2's input demand is:

$$L_2^{QP}(w_1, w_2) = \frac{(2 - \gamma - \gamma^2) + \gamma w_1 - (2 - \gamma^2)w_2}{4 - 3\gamma^2} \tag{19}$$

Hence, the respective downstream firm 1's and firm 2's profits are:

$$\Pi_1^{QP}(w_1, w_2) = \frac{(1 - \gamma^2)[(\gamma - 2) + 2w_1 - \gamma w_2]^2}{(3\gamma^2 - 4)^2} \tag{20}$$

$$\Pi_2^{QP}(w_1, w_2) = \left[\frac{(2 - \gamma - \gamma^2) + \gamma w_1 - (2 - \gamma^2)w_2}{4 - 3\gamma^2}\right]^2 \tag{21}$$

Substituting $L_1^{QP}(w_1, w_2)$ and $L_2^{QP}(w_1, w_2)$ into (3), we get the respective upstream firm 1's and 2's profits:

---

[9] Of course, due to the symmetric industry structure, the reverse configuration is by default addressed as similar candidate equilibrium.

$$\pi_1^{QP}(w_1, w_2) = w_1 L_1^{QP}(w_1, w_2) \tag{22}$$

$$\pi_2^{QP}(w_1, w_2) = w_2 L_2^{QP}(w_1, w_2) \tag{23}$$

In the first stage of the game the upstream – downstream bargaining pair 1 chooses w_1 to maximize $\left[\Pi_1^{QP}(w_1, w_2)\right]^{\beta}\left[\pi_1^{QP}(w_1, w_2)\right]^{1-\beta}$, and pair 2 chooses w_2 to maximize $\left[\Pi_2^{QP}(w_1, w_2)\right]^{\beta}\left[\pi_2^{QP}(w_1, w_2)\right]^{1-\beta}$. The respective pair 1's and 2's input price reaction function is given by:

$$w_1^{QP}(w_2) = \frac{(1-\beta)[2+\gamma(w_2-1)]}{4} \tag{24}$$

$$w_2^{QP}(w_1) = \frac{(1-\beta)[2-\gamma(1+\gamma-w_1)]}{2(2-\gamma^2)} \tag{25}$$

Solving the system of these reaction functions, we then get a unique stable solution for the input prices w_1^{QP} and w_2^{QP}. Then, using w_1^{QP} and w_2^{QP}, we subsequently derive each downstream firm's quantity $(q_1^{QP}; q_2^{QP})$, price $(p_1^{QP}; p_2^{QP})$, and profits $(\Pi_1^{QP}; \Pi_2^{QP})$ as well as each upstream firm's profits $(\pi_1^{QP}; \pi_2^{QP})$ (see Appendix 1C).

4. Equilibrium mode of competition

In order to obtain a Nash equilibrium in the first stage (negotiation stage) of the game, we consider a candidate equilibrium and then test whether it is immune to all possible deviations. For the *universal price setting* configuration, i.e., $[P, w^P],[P, w^P]$, there is only one possible deviation: an upstream – downstream bargaining pair switches to quantity-setting, readjusting the pair-specific input price, i.e., $[Q, w_{1d}^Q]$. Such a deviation has to be profitable for both the upstream and the downstream firm, within pair i, otherwise the partner who is hurt will certainly veto this deviation. For the *universal quantity setting* configuration, i.e., $[Q, w^Q],[Q, w^Q]$, there is only one possible deviation: an upstream – downstream bargaining pair switches to price-setting, readjusting the pair-specific input price accordingly, i.e., $\left[P, w_{1d}^{P}\right]$. Finally, in the *quantity - price* configuration, both the aforementioned deviations have to be checked. Note that the above exercise reflects the idea that switching from a certain competition conduct to another, requires agreement between the upstream and the downstream firm within the bargaining pair. The veto of one of them is sufficient to block the switching.

4.1 Universal price setting

The configuration $\left[P, w^{P}\right],\left[P, w^{P}\right]$ constitutes a sub-game perfect Nash equilibrium only if no upstream – downstream bargaining pair has an incentive to unilaterally deviate to a different input price / competition conduct scheme, in the first stage of the game.

Suppose that upstream – downstream pair $i \equiv 2$ sticks to $\left[P, w^{P}\right]$. Does upstream – downstream pair $i \equiv 1$ have incentives to switch to $\left[Q, w_{1d}^{Q}\right]$? In such a deviation, w_{1d}^{Q} would be the pair $i \equiv 1$'s best response to w^{P}, in the ensuing *Coexistence of quantity setting and price setting* game (see eq. 24). Note that $w_{1d}^{Q} > w^{P}$ always.[10] This inequality holds because the elasticity of input demand of downstream firm i when firm $j(i)$ sets the quantity (price) is lower than the respective one in case where both firms set their own prices in the second stage.[11] In this scenario, the upstream firm 1 exploits a relatively higher input level capacity per

---

[10] Because of space limitations, the analytical expression for the input price, upstream firm's and downstream firm's profits under the considered deviation, are available from the authors upon request.

[11] The elasticity of input demand for downstream firm i, when both downstream firms set the price is $\left|\varepsilon_{Li}^{P}\right| = \dfrac{\left(2-\gamma^{2}\right)w_{i}}{\left(2-\gamma-\gamma^{2}\right)-\left(2-\gamma^{2}\right)w_{i}+\gamma w_{j}}$. The respective elasticity, when downstream firm i sets the quantity and firm j sets the price is $\left|\varepsilon_{Li}^{QP}\right| = \dfrac{2w_{i}}{\left(2-\gamma\right)-2w_{i}+\gamma w_{j}}$.

unit of input price increase and sets a higher input price. This in turn, since $\frac{\vartheta q_i^{PQ}(w_i, w_j)}{\vartheta w_i} = \frac{2}{3\gamma^2 - 4} < 0$, decreases downstream firm 1's demand for input, reduces its output, and increases the final good's market-clearing price.

In such a deviation, it is easy to see that the downstream firm 1 would become the Stackelberg leader in the product market, since its input and output level decisions precede the downstream firm 2's respective decisions (Dewatripont, 1987, 1988; Petrakis and Vlassis, 2000).[12]

Given w_{1d}^Q and w^P, for downstream firms 1 and 2 respectively, upstream firm 1's profits, under the considered deviation, would be given by the ensuing price-quantity setting game, i.e., $\pi_{1d}^Q = \pi_1^{QP}(w_{1d}^Q, w^P)$ (see eq. 22). It holds that $\pi_{1d}^Q > \pi^P$ always, and hence, it proves that the upstream firm 1 has an incentive that downstream firm 1 switches from price-setting to quantity-setting. Intuitively, the positive input price-increase effect on upstream 1's profits dominates the negative input quantity-reduction effect. Regarding the downstream firm 1, its profits under the considered deviation would be $\Pi_{1d}^Q = \Pi_1^{QP}(w_{1d}^Q, w^P)$ (see eq. 20). It holds that $\Pi_{1d}^Q > \Pi^P$ always, and hence, downstream firm 1 also has an incentive to switch from price-setting to quantity-setting. The reason is that the positive final good price-increase effect on its profits dominates two negative effects: The input price-reduction effect and the output-reduction effect. The following proposition summarizes.

Proposition 1

Universal price setting can never be an equilibrium mode of competition configuration.

---

[12] The same mechanism exists in the strategic delegation literature (see e.g. Vickers, 1985; Fershtman and Judd, 1987; Sklivas, 1987).

4.2 Universal quantity setting

Here too, the configuration $[Q, w^Q],[Q, w^Q]$ constitutes a sub-game perfect Nash equilibrium only if no upstream – downstream bargaining pair has an incentive to deviate to a different input price / competition conduct scheme, in the first stage of the game.

Suppose that upstream – downstream pair $i \equiv 2$ sticks to $[Q, w^Q]$. Does upstream – downstream pair $i \equiv 1$ have incentives to switch to $[P, w_{1d}^P]$? In such a deviation, w_{1d}^P would be the pair $i \equiv 1$'s best response to w^Q, in the ensuing *Coexistence of price setting and quantity setting* game (see eq. 25). Note that $w_{1d}^P < w^Q$ always. This inequality holds because the elasticity of input demand for downstream firm i, when firm $i(j)$ sets the price (quantity), is higher than the respective elasticity when both downstream firms set the quantity in the second stage of the game.[13] Hence, in case of a percentage increase in the input price that the downstream firm i faces, the resulting percentage decrease in its respective demand for input will be higher in the former than in the latter configuration. This, in turn, implies a direct cost saving for the deviant downstream firm 1 which, since $\dfrac{\vartheta p_i^{PQ}(\gamma, w_i, w_j)}{\vartheta w_i} = \dfrac{2(\gamma^2 - 1)}{3\gamma^2 - 4} > 0$, decreases the price of the (final) good. An immediate consequence will then be the expansion of downstream firm 1's final good sold in the market.

[13] The elasticity of input demand for downstream firm i, when both downstream firms set the quantity, is $|\varepsilon_{Li}^{Q}| = \dfrac{2w_i}{a(2-\gamma) - 2w_i + \gamma w_j}$. The respective elasticity, when downstream firm i sets the price and firm j sets the quantity, is $|\varepsilon_{Li}^{PQ}| = \dfrac{(2-\gamma^2)w_i}{a(2-\gamma-\gamma^2) - (2-\gamma^2)w_i + \gamma w_j}$.

Given w_{1d}^{P} and w^{Q}, for downstream firms 1 and 2 respectively, upstream firm 1's profits under the considered deviation would be given by the ensuing price-quantity setting game, i.e., $\pi_{1d}^{P} = \pi_{1}^{PQ}\left(w_{1d}^{P}, w^{Q}\right)$ (see eq. 23). One can check that $\pi_{1d}^{P} < \pi^{Q}$ always. Hence, upstream firm 1 has no incentive for downstream firm 1 to switch from quantity-setting to price-setting. This is so, because the negative input price-reduction effect dominates the positive output-expansion effect. Similarly, since $\Pi_{1d}^{Q}(\gamma) < \Pi_{1}^{Q}(\gamma)$ always, the downstream firm 1 has no incentive to switch from quantity-setting to price-setting. Intuitively, the negative price-reduction effect dominates two positive effects: The cost-saving effect and the output-expansion effect. The following proposition summarizes.

Proposition 2

Universal quantity setting is always an equilibrium mode of competition configuration.

4.3 Coexistence of price setting and quantity setting

In an analogous way, the configuration $\left[Q, w_{1}^{QP}\right], \left[P, w_{2}^{QP}\right]$ has two deviations to be checked: The upstream - downstream pair 1 (2) may consider the downstream firm 1 (2) to adjust its own price (quantity), instead of its quantity (price) at the second stage. If at least one of the above two deviations is profitable, for both the upstream and the downstream firm within a pair, the *Coexistence of price setting and quantity setting* configuration can never be an equilibrium mode of competition configuration.

Let us consider whether upstream – downstream bargaining pair $i \equiv 2$ has incentives to switch to $\left[Q, w_{2d}^{Q}\right]$, given that firm - union pair $i \equiv 1$ sticks to $\left[Q, w_{1}^{QP}\right]$. In this scenario, w_{2d}^{Q} would be the upstream – downstream pair $i \equiv 2$'s best response to w_1^{QP}, in the ensuing *Universal quantity setting* game (see eq. 14), with $L_{2d}^{Q} > L_2^{QP}$ and $w_{2d}^{Q} > w_2^{QP}$ always. Then, given w_{2d}^{Q} and w_1^{QP}, downstream firm 2's profits and upstream firm 2's profits, under the considered deviation, would be given by $\Pi_{2d}^{Q} = \Pi_i^{Q}\left(w_1^{QP}, w_{2d}^{Q}\right)$ (see eq. 12) and $\pi_{2d}^{Q} = \pi_i^{Q}\left(w_1^{QP}, w_{2d}^{Q}\right)$ (see eq. 13) respectively. It proves that $\Pi_{2d}^{Q} > \Pi_2^{QP}$ and $\pi_{2d}^{Q} > \pi_2^{QP}$ always hold and hence both upstream firm 2 and downstream firm 2 have incentives that the latter switches from price-setting to quantity-setting. The following proposition summarizes.

Proposition 3

The Coexistence of price setting and quantity setting configuration can never be an equilibrium mode of competition configuration.

5. Welfare analysis

In this Section we focus on the welfare effects of the different modes of competition. Social welfare is defined as the sum of consumers' surplus, downstream firms' profits, and upstream firms' profits:

$$SW^m = \frac{1+\gamma}{4}\left(Q^m\right)^2 + 2\Pi_i^m + 2\pi_i^m, m = Q, P, QP \tag{26}$$

Q^m is the total quantity of the final products. Substituting the relevant expressions into eq. (26), we obtain social welfare in the three cases under consideration.[14] The following proposition summarizes.

Proposition 4

Universal price setting competition always leads to the highest social welfare; Universal quantity setting competition always leads to the lowest; Coexistence of price setting and quantity setting lies in-between, i.e., $SW^P > SW^{QP} > SW^Q$.

[14] Due to space limitations, the mathematical expressions for the three cases are available from the authors upon request.

The intuition behind this result is straightforward. Downstream firms' profits are the highest (lowest) in the *Universal quantity* (*price*) *setting* competition, while the *Universal quantity* (*price*) *setting* competition results in the lowest (highest) consumers' surplus. This is a direct consequence of the fact that prices in the Cournot competition are higher than those in the Bertrand competition (Singh and Vives, 1984).

Regarding the upstream firms' profits, they are higher in the *Coexistence of price setting and quantity setting* as compared with the respective ones in the *Universal quantity setting*. Yet, in the *Universal price setting*, if products are sufficiently differentiated (homogenous), the upstream firms' profits are higher than the respective ones in the *Coexistence of price setting and quantity setting* configuration (*Universal quantity setting*). On the contrary, if products are relatively homogenous the upstream firms' profits in the *Universal price setting* are higher than the respective ones in the *Universal quantity setting*. Nevertheless, the consumer surplus-effect always dominates the sum of the downstream firm's profits- and the upstream firm's profits- effects. As a consequence, the *Universal price setting* is always preferable from the social welfare point of view.

Moreover, social welfare exhibits a U-shaped in the degree of product differentiation. This happens because product differentiation has a negative effect on both the downstream and upstream firms' profits, whilst it has a positive effect on consumers' surplus. Hence, if products are sufficiently differentiated the profits effect dominates, while as products become more homogenous, i.e., closer substitutes, the consumer surplus effect dominates.[15]

[15] This is in the spirit of Fanti and Meccheri (2011) who find that, as the two goods become closer substitutes and market competition becomes fiercer, besides the standard downstream competition effect that tends to reduce profits, there is an upstream competition effect too, suggesting an increase of

6. Discussion – extensions

We now briefly discuss two extensions of our model.

6.1 Non-exclusive relationships

Throughout we have assumed that there is an exclusive relationship between upstream firm i and downstream firm i, in each pair $i = 1,2$. We may now in short discuss the effects of non-exclusive relationships, where each downstream firm can obtain its input from both input suppliers. In this case, if upstream suppliers sell perfectly homogenous inputs, they will be driven to zero profits, implying that they will be unable to affect the mode of competition that downstream firms will materialize. If, on the other hand, exists a positive degree of input-specificity, then upstream profits will be positive but lower than the respective ones under exclusive relationships. In the background, the higher is the degree of input-specificity the higher will be the input suppliers' bargaining power over the input price / competition conduct scheme.

6.2 Complement products

In our model we have also assumed that final products are substitutes. Assume now that final products are complements. It proves that the *Universal price setting* will always emerge in equilibrium, irrespective to the degree of product complementarity.[16] Intuitively, this happens because Bertrand competition with complements is the dual of Cournot competition with substitutes (Singh and Vives, 1984).

---

competition between labour unions which drives them to wage undercutting in order to sufficiently preserve employment.

[16] The detailed proof is available from the authors upon request.

7. Conclusions

The objective of this paper is to study the endogenous emergence of the mode of competition in the downstream tier of a vertically related industry.

In a two-tier oligopoly, the equilibrium mode of competition in the downstream market is endogenously determined as a *renegotiation-proof* contract, signed between each downstream producer and its exclusive input supplier. We find that if the final products are substitutes, the Cournot mode of competition endogenously emerges in the industry. This holds independently of the degree of product differentiation and the distribution of bargaining power, over the input price, between the upstream and the downstream firm, within each bargaining pair. In contrast with previous studies, we therefore suggest that what sustains the Cournot mode of competition in the downstream tier of a vertically related market is the downstream and upstream firm's unanimous agreement, within the bargaining pair. This finding contributes to the literature by addressing a plausible solution for the emergence and sustainability of the equilibrium mode of competition in the downstream tier of a vertically related market.

In our analysis we have assumed two separate upstream firms. An interesting direction for further research is giving those firms the opportunity to merge. By doing so, we can investigate the input market structure which will endogenously emerge. Another direction is allowing the upstream firms to trade with their downstream firms through two-part tariff contracts instead through wholesale price contracts. Both the above directions would link our research to the literature of mergers and contracting in vertically related industries.

Appendix 1A: Universal price setting

$$w^P = \frac{\left(2-\gamma-\gamma^2\right)(1-\beta)}{4+\gamma(\beta-2\gamma-1)}$$

$$q^P = \frac{\left(2-\gamma^2\right)(1+\beta)}{\left[2\gamma^2+\gamma(1-\beta)-4\right]\left(\gamma^2-\gamma-2\right)}$$

$$p^P = \frac{2(1-\gamma)\left(3-\beta-\gamma^2\right)}{\left[2\gamma^2+\gamma(1-\beta)-4\right](\gamma-2)}$$

$$\Pi^P = \left(p^P - w^P\right)q^P;\ \pi^P = w^P q^P$$

Appendix 1B: Universal quantity setting

$$w^Q = \frac{(\gamma-2)(\beta-1)}{4+\gamma(\beta-1)}$$

$$q^Q = \frac{2(1+\beta)}{(\gamma+2)[4+\gamma(\beta-1)]}$$

$$p^Q = \frac{\gamma^2(\beta-1)-2\beta+6}{(\gamma+2)[4+\gamma(\beta-1)]}$$

$$\Pi^Q = \left(p^Q - w^Q\right)q^Q;\ \pi^Q = w^Q q^Q$$

Appendix 1C: Coexistence of price setting and quantity setting

$$w_1^{QP} = \frac{(1-\beta)\left[8+\gamma\left[\beta\left(\gamma^2+\gamma-2\right)-\gamma(5-\gamma)-2\right]\right]}{16-\gamma^2[9+\beta(\beta-2)]}$$

$$w_2^{QP} = \frac{(1-\beta)\left[8-2(1+\beta)\gamma-5(5-\beta)\gamma^2\right]}{16-\gamma^2[9+\beta(\beta-2)]}$$

$$L_1^{QP} = \frac{2(1+\beta)\left[8+\gamma\left[\beta\left(\gamma^2+\gamma-2\right)-\gamma(5-\gamma)-2\right]\right]}{\left(4-3\gamma^2\right)\left[16-\gamma^2[9+\beta(\beta-2)]\right]}$$

$$L_2^{QP} = \frac{(1+\beta)\left(2-\gamma^2\right)\left[8-2(1+\beta)\gamma-5(5-\beta)\gamma^2\right]}{\left(4-3\gamma^2\right)\left[16-\gamma^2[9+\beta(\beta-2)]\right]}$$

$$p_1^{QP} = 1-L_1^{QP}-\gamma L_2^{QP};\ p_2^{QP} = 1-L_2^{QP}-\gamma L_1^{QP}$$

$$\Pi_1^{QP} = \left(p_1^{QP}-w_1^{QP}\right)L_1^{QP};\ \Pi_2^{QP} = \left(p_2^{QP}-w_2^{QP}\right)L_2^{QP}$$

$$\pi_1^{QP} = w_1^{QP}L_1^{QP};\ \pi_2^{QP} = w_2^{QP}L_2^{QP}$$

References

Björnerstedt, J., Stennek, J., 2006. Bilateral oligopoly - The efficiency of intermediate goods markets. International Journal of Industrial Organization 25, 884-907.

Booth, A., 1996. The Economics of the Trade Union. Cambridge University Press.

Correa-López, M., 2007. Price and Quantity Competition in a Differentiated Duopoly with Upstream Suppliers. Journal of Economics and Management Strategy 16, 496-505.

Correa-López, M., Naylor, R., 2004. The Cournot-Bertrand Profit Differential: A Reversal Result in a Differentiated Duopoly with Wage Bargaining. European Economic Review 48, 681-696.

Dastidar, K.G., 1996. Quantity vs price in a homogeneous product duopoly. Bulletin of Economic Research 48, 83-91.

de Fontenay, C.C., Gans, J.S., 2005. Vertical integration in the presence of upstream competition. Rand Journal of Economics 36, 544-572.

de Fontenay, C.C., Gans, J.S., 2013. Bilateral bargaining with externalities. Melbourne Business School Discussion Paper No. 2004-32.

Dewatripont, M., 1987. Entry deterrence under trade unions. European Economic Review 31, 149-156.

Dewatripont, M., 1988. Commitment through renegotiation-proof contracts with third parties. Review of Economic Studies 55, 377-390.

Fanti, L., Meccheri, N., 2011. The Cournot-Bertrand profit differential in a differentiated duopoly with unions and labour decreasing returns. Economics Bulletin 31, 233-244.

Fershtman, C., Judd, K., 1987. Equilibrium incentives in oligopoly. American Economic Review 77, 927-940.

Häckner, J., 2000. A Note on Price and Quantity Competition in Differentiated Oligopolies. Journal of Economic Theory 93, 233-239.

Horn, H., Wolinsky, A., 1988. Bilateral Monopolies and Incentives for Merger. Rand Journal of Economics 19, 408-419.

Kreps, D.M., Scheinkman, J.A., 1983. Quantity Precommitment and Bertrand Competition Yield Cournot Outcomes. The Bell Journal of Economics 14, 326-337.

Lafontaine, F., Slade, M., 2008. Exclusive Contracts and Vertical Restraints: Evidence and Public Policy. In: Buccirossi, P. (ed.), Handbook of Antitrust Economics, MIT Press, Cambridge.

Lommerud, K.E., O.R. Straume, Sorgard, L., 2005. Downstream merger with upstream market power. European Economic Review 49, 717-743.

Milliou, C., Petrakis, E., 2007. Upstream Horizontal Mergers, Vertical Contracts, and Bargaining. International Journal of Industrial Organization 25, 963-987.

Oswald, A.J., 1982. The microeconomic theory of the trade union. Economic Journal 92, 269-283.

Petrakis, E., Vlassis, M., 2000. Endogenous scope of bargaining in a union-oligopoly model: when will firms and unions bargain over employment?. Labour Economics 7, 261-281.

Pinopoulos, I.N., 2011. Input pricing by an upstream monopolist into imperfectly competitive downstream markets. Research in Economics 65, 144-151.

Singh, N., Vives, X., 1984, Price and Quantity Competition in a Differentiated Duopoly. Rand Journal of Economics 15, 546-554.

Sklivas, S. 1987. The strategic choice of managerial incentives. RAND Journal of Economics 18, 452-458.

Symeonidis, G., 2003. Comparing Cournot and Bertrand equilibria in a differentiated duopoly with product R&D. International Journal of Industrial Organization 21, 39-55.

Tremblay, C.H., Tremblay, V.J., 2011. The Cournot-Bertrand model and the degree of product differentiation. Economics Letters 111, 233-235.

Tremblay, V.J., Tremblay, C.H., Isariyawongse, K., 2013. Cournot and Bertrand Competition when Advertising Rotates Demand: The Case of Honda and Scion. International Journal of the Economics of Business 20, 125-141.

Vickers J. 1985. Delegation and the theory of the firm. The Economic Journal (supplement) 95, 138-147.

Vives, X., 2001. Oligopoly Pricing, Old Ideas and New Tools. MIT Press.

Zanchettin, P., 2006. Differentiated duopoly with asymmetric costs. Journal of Economics and Management Strategy 15, 999-1015.

Ziss, S., 1995. Vertical Separation and Horizontal Mergers. Journal of Industrial Economics 43, 63–75.

PREVIOUS DISCUSSION PAPERS

118 Manasakis, Constantine and Vlassis, Minas, Downstream Mode of Competition With Upstream Market Power, November 2013.

117 Sapi, Geza and Suleymanova, Irina, Consumer Flexibility, Data Quality and Targeted Pricing, November 2013.

116 Hinloopen, Jeroen, Müller, Wieland and Normann, Hans-Theo, Output Commitment Through Product Bundling: Experimental Evidence, November 2013.
Forthcoming in: European Economic Review.

115 Baumann, Florian, Denter, Philipp and Friehe Tim, Hide or Show? Endogenous Observability of Private Precautions Against Crime When Property Value is Private Information, November 2013.

114 Fan, Ying, Kühn, Kai-Uwe and Lafontaine, Francine, Financial Constraints and Moral Hazard: The Case of Franchising, November 2013.

113 Aguzzoni, Luca, Argentesi, Elena, Buccirossi, Paolo, Ciari, Lorenzo, Duso, Tomaso, Tognoni, Massimo and Vitale, Cristiana, They Played the Merger Game: A Retrospective Analysis in the UK Videogames Market, October 2013.

112 Myrseth, Kristian Ove R., Riener, Gerhard and Wollbrant, Conny, Tangible Temptation in the Social Dilemma: Cash, Cooperation, and Self-Control, October 2013.

111 Hasnas, Irina, Lambertini, Luca and Palestini, Arsen, Open Innovation in a Dynamic Cournot Duopoly, October 2013.

110 Baumann, Florian and Friehe, Tim, Competitive Pressure and Corporate Crime, September 2013.

109 Böckers, Veit, Haucap, Justus and Heimeshoff, Ulrich, Benefits of an Integrated European Electricity Market, September 2013.

108 Normann, Hans-Theo and Tan, Elaine S., Effects of Different Cartel Policies: Evidence from the German Power-Cable Industry, September 2013.
Forthcoming in: Industrial and Corporate Change.

107 Haucap, Justus, Heimeshoff, Ulrich, Klein, Gordon J., Rickert, Dennis and Wey, Christian, Bargaining Power in Manufacturer-Retailer Relationships, September 2013.

106 Baumann, Florian and Friehe, Tim, Design Standards and Technology Adoption: Welfare Effects of Increasing Environmental Fines when the Number of Firms is Endogenous, September 2013.

105 Jeitschko, Thomas D., NYSE Changing Hands: Antitrust and Attempted Acquisitions of an Erstwhile Monopoly, August 2013.

104 Böckers, Veit, Giessing, Leonie and Rösch, Jürgen, The Green Game Changer: An Empirical Assessment of the Effects of Wind and Solar Power on the Merit Order, August 2013.

103 Haucap, Justus and Muck, Johannes, What Drives the Relevance and Reputation of Economics Journals? An Update from a Survey among Economists, August 2013.

102 Jovanovic, Dragan and Wey, Christian, Passive Partial Ownership, Sneaky Takeovers, and Merger Control, August 2013.

101 Haucap, Justus, Heimeshoff, Ulrich, Klein, Gordon J., Rickert, Dennis and Wey, Christian, Inter-Format Competition Among Retailers – The Role of Private Label Products in Market Delineation, August 2013.

100 Normann, Hans-Theo, Requate, Till and Waichman, Israel, Do Short-Term Laboratory Experiments Provide Valid Descriptions of Long-Term Economic Interactions? A Study of Cournot Markets, July 2013.
Forthcoming in: Experimental Economics.

99 Dertwinkel-Kalt, Markus, Haucap, Justus and Wey, Christian, Input Price Discrimination (Bans), Entry and Welfare, June 2013.

98 Aguzzoni, Luca, Argentesi, Elena, Ciari, Lorenzo, Duso, Tomaso and Tognoni, Massimo, Ex-post Merger Evaluation in the UK Retail Market for Books, June 2013.

97 Caprice, Stéphane and von Schlippenbach, Vanessa, One-Stop Shopping as a Cause of Slotting Fees: A Rent-Shifting Mechanism, May 2012.
Published in: Journal of Economics and Management Strategy, 22 (2013), pp. 468-487.

96 Wenzel, Tobias, Independent Service Operators in ATM Markets, June 2013.
Forthcoming in: Scottish Journal of Political Economy.

95 Coublucq, Daniel, Econometric Analysis of Productivity with Measurement Error: Empirical Application to the US Railroad Industry, June 2013.

94 Coublucq, Daniel, Demand Estimation with Selection Bias: A Dynamic Game Approach with an Application to the US Railroad Industry, June 2013.

93 Baumann, Florian and Friehe, Tim, Status Concerns as a Motive for Crime?, April 2013.

92 Jeitschko, Thomas D. and Zhang, Nanyun, Adverse Effects of Patent Pooling on Product Development and Commercialization, April 2013.

91 Baumann, Florian and Friehe, Tim, Private Protection Against Crime when Property Value is Private Information, April 2013.
Published in: International Review of Law and Economics, 35 (2013), pp. 73-79.

90 Baumann, Florian and Friehe, Tim, Cheap Talk About the Detection Probability, April 2013.
Forthcoming in: International Game Theory Review.

89 Pagel, Beatrice and Wey, Christian, How to Counter Union Power? Equilibrium Mergers in International Oligopoly, April 2013.

88 Jovanovic, Dragan, Mergers, Managerial Incentives, and Efficiencies, April 2013.

87 Heimeshoff, Ulrich and Klein Gordon J., Bargaining Power and Local Heroes, March 2013.

86 Bertschek, Irene, Cerquera, Daniel and Klein, Gordon J., More Bits – More Bucks? Measuring the Impact of Broadband Internet on Firm Performance, February 2013.
Forthcoming in: Information Economics and Policy.

85 Rasch, Alexander and Wenzel, Tobias, Piracy in a Two-Sided Software Market, February 2013.
Published in: Journal of Economic Behavior & Organization, 88 (2013), pp. 78-89.

84 Bataille, Marc and Steinmetz, Alexander, Intermodal Competition on Some Routes in Transportation Networks: The Case of Inter Urban Buses and Railways, January 2013.

83 Haucap, Justus and Heimeshoff, Ulrich, Google, Facebook, Amazon, eBay: Is the Internet Driving Competition or Market Monopolization?, January 2013.
Forthcoming in: International Economics and Economic Policy.

82 Regner, Tobias and Riener, Gerhard, Voluntary Payments, Privacy and Social Pressure on the Internet: A Natural Field Experiment, December 2012.

81 Dertwinkel-Kalt, Markus and Wey, Christian, The Effects of Remedies on Merger Activity in Oligopoly, December 2012.

80 Baumann, Florian and Friehe, Tim, Optimal Damages Multipliers in Oligopolistic Markets, December 2012.

79 Duso, Tomaso, Röller, Lars-Hendrik and Seldeslachts, Jo, Collusion through Joint R&D: An Empirical Assessment, December 2012.
Forthcoming in: The Review of Economics and Statistics.

78 Baumann, Florian and Heine, Klaus, Innovation, Tort Law, and Competition, December 2012.
Forthcoming in: Journal of Institutional and Theoretical Economics.

77 Coenen, Michael and Jovanovic, Dragan, Investment Behavior in a Constrained Dictator Game, November 2012.

76 Gu, Yiquan and Wenzel, Tobias, Strategic Obfuscation and Consumer Protection Policy in Financial Markets: Theory and Experimental Evidence, November 2012.
Forthcoming in: Journal of Industrial Economics under the title "Strategic Obfuscation and Consumer Protection Policy".

75 Haucap, Justus, Heimeshoff, Ulrich and Jovanovic, Dragan, Competition in Germany's Minute Reserve Power Market: An Econometric Analysis, November 2012.
Forthcoming in: The Energy Journal.

74 Normann, Hans-Theo, Rösch, Jürgen and Schultz, Luis Manuel, Do Buyer Groups Facilitate Collusion?, November 2012.

73 Riener, Gerhard and Wiederhold, Simon, Heterogeneous Treatment Effects in Groups, November 2012.

72 Berlemann, Michael and Haucap, Justus, Which Factors Drive the Decision to Boycott and Opt Out of Research Rankings? A Note, November 2012.

71 Muck, Johannes and Heimeshoff, Ulrich, First Mover Advantages in Mobile Telecommunications: Evidence from OECD Countries, October 2012.

70 Karaçuka, Mehmet, Çatik, A. Nazif and Haucap, Justus, Consumer Choice and Local Network Effects in Mobile Telecommunications in Turkey, October 2012.
Published in: Telecommunications Policy, 37 (2013), pp. 334-344.

69 Clemens, Georg and Rau, Holger A., Rebels without a Clue? Experimental Evidence on Partial Cartels, April 2013 (First Version October 2012).

68 Regner, Tobias and Riener, Gerhard, Motivational Cherry Picking, September 2012.

67 Fonseca, Miguel A. and Normann, Hans-Theo, Excess Capacity and Pricing in Bertrand-Edgeworth Markets: Experimental Evidence, September 2012.
Published in: Journal of Institutional and Theoretical Economics, 169 (2013), pp. 199-228.

66 Riener, Gerhard and Wiederhold, Simon, Team Building and Hidden Costs of Control, September 2012.

65 Fonseca, Miguel A. and Normann, Hans-Theo, Explicit vs. Tacit Collusion – The Impact of Communication in Oligopoly Experiments, August 2012.
Published in: European Economic Review, 56 (2012), pp. 1759-1772.

64 Jovanovic, Dragan and Wey, Christian, An Equilibrium Analysis of Efficiency Gains from Mergers, July 2012.

63 Dewenter, Ralf, Jaschinski, Thomas and Kuchinke, Björn A., Hospital Market Concentration and Discrimination of Patients, July 2012.

62 Von Schlippenbach, Vanessa and Teichmann, Isabel, The Strategic Use of Private Quality Standards in Food Supply Chains, May 2012.
Published in: American Journal of Agricultural Economics, 94 (2012), pp. 1189-1201.

61 Sapi, Geza, Bargaining, Vertical Mergers and Entry, July 2012.

60 Jentzsch, Nicola, Sapi, Geza and Suleymanova, Irina, Targeted Pricing and Customer Data Sharing Among Rivals, July 2012.
Published in: International Journal of Industrial Organization, 31 (2013), pp. 131-144.

59 Lambarraa, Fatima and Riener, Gerhard, On the Norms of Charitable Giving in Islam: A Field Experiment, June 2012.

58 Duso, Tomaso, Gugler, Klaus and Szücs, Florian, An Empirical Assessment of the 2004 EU Merger Policy Reform, June 2012.
Forthcoming in: Economic Journal.

57 Dewenter, Ralf and Heimeshoff, Ulrich, More Ads, More Revs? Is there a Media Bias in the Likelihood to be Reviewed?, June 2012.

56 Böckers, Veit, Heimeshoff, Ulrich and Müller Andrea, Pull-Forward Effects in the German Car Scrappage Scheme: A Time Series Approach, June 2012.

55 Kellner, Christian and Riener, Gerhard, The Effect of Ambiguity Aversion on Reward Scheme Choice, June 2012.

54 De Silva, Dakshina G., Kosmopoulou, Georgia, Pagel, Beatrice and Peeters, Ronald, The Impact of Timing on Bidding Behavior in Procurement Auctions of Contracts with Private Costs, June 2012.
Published in: Review of Industrial Organization, 41 (2013), pp.321-343.

53 Benndorf, Volker and Rau, Holger A., Competition in the Workplace: An Experimental Investigation, May 2012.

52 Haucap, Justus and Klein, Gordon J., How Regulation Affects Network and Service Quality in Related Markets, May 2012.
Published in: Economics Letters, 117 (2012), pp. 521-524.

51 Dewenter, Ralf and Heimeshoff, Ulrich, Less Pain at the Pump? The Effects of Regulatory Interventions in Retail Gasoline Markets, May 2012.

50 Böckers, Veit and Heimeshoff, Ulrich, The Extent of European Power Markets, April 2012.

49 Barth, Anne-Kathrin and Heimeshoff, Ulrich, How Large is the Magnitude of Fixed-Mobile Call Substitution? - Empirical Evidence from 16 European Countries, April 2012.

48 Herr, Annika and Suppliet, Moritz, Pharmaceutical Prices under Regulation: Tiered Co-payments and Reference Pricing in Germany, April 2012.

47 Haucap, Justus and Müller, Hans Christian, The Effects of Gasoline Price Regulations: Experimental Evidence, April 2012.

46 Stühmeier, Torben, Roaming and Investments in the Mobile Internet Market, March 2012.
Published in: Telecommunications Policy, 36 (2012), pp. 595-607.

45 Graf, Julia, The Effects of Rebate Contracts on the Health Care System, March 2012,
Forthcoming in: The European Journal of Health Economics.

44 Pagel, Beatrice and Wey, Christian, Unionization Structures in International Oligopoly, February 2012.
Published in: Labour: Review of Labour Economics and Industrial Relations, 27 (2013), pp. 1-17.

43 Gu, Yiquan and Wenzel, Tobias, Price-Dependent Demand in Spatial Models, January 2012.
Published in: B. E. Journal of Economic Analysis & Policy, 12 (2012), Article 6.

42 Barth, Anne-Kathrin and Heimeshoff, Ulrich, Does the Growth of Mobile Markets Cause the Demise of Fixed Networks? – Evidence from the European Union, January 2012.

41 Stühmeier, Torben and Wenzel, Tobias, Regulating Advertising in the Presence of Public Service Broadcasting, January 2012.
Published in: Review of Network Economics, 11/2 (2012), Article 1.

40 Müller, Hans Christian, Forecast Errors in Undisclosed Management Sales Forecasts: The Disappearance of the Overoptimism Bias, December 2011.

39 Gu, Yiquan and Wenzel, Tobias, Transparency, Entry, and Productivity, November 2011.
Published in: Economics Letters, 115 (2012), pp. 7-10.

38 Christin, Clémence, Entry Deterrence Through Cooperative R&D Over-Investment, November 2011.
Forthcoming in: Louvain Economic Review.

37 Haucap, Justus, Herr, Annika and Frank, Björn, In Vino Veritas: Theory and Evidence on Social Drinking, November 2011.
In a modified version forthcoming in: European Journal of Law and Economics.

36 Barth, Anne-Kathrin and Graf, Julia, Irrationality Rings! – Experimental Evidence on Mobile Tariff Choices, November 2011.

35 Jeitschko, Thomas D. and Normann, Hans-Theo, Signaling in Deterministic and Stochastic Settings, November 2011.
Published in: Journal of Economic Behavior and Organization, 82 (2012), pp.39-55.

34 Christin, Cémence, Nicolai, Jean-Philippe and Pouyet, Jerome, The Role of Abatement Technologies for Allocating Free Allowances, October 2011.

33 Keser, Claudia, Suleymanova, Irina and Wey, Christian, Technology Adoption in Markets with Network Effects: Theory and Experimental Evidence, October 2011.
Published in: Information Economics and Policy, 24 (2012), pp. 262-276.

32 Çatik, A. Nazif and Karaçuka, Mehmet, The Bank Lending Channel in Turkey: Has it Changed after the Low Inflation Regime?, September 2011.
Published in: Applied Economics Letters, 19 (2012), pp. 1237-1242.

31 Hauck, Achim, Neyer, Ulrike and Vieten, Thomas, Reestablishing Stability and Avoiding a Credit Crunch: Comparing Different Bad Bank Schemes, August 2011.

30 Suleymanova, Irina and Wey, Christian, Bertrand Competition in Markets with Network Effects and Switching Costs, August 2011.
Published in: B. E. Journal of Economic Analysis & Policy, 11 (2011), Article 56.

29 Stühmeier, Torben, Access Regulation with Asymmetric Termination Costs, July 2011.
Published in: Journal of Regulatory Economics, 43 (2013), pp. 60-89.

28 Dewenter, Ralf, Haucap, Justus and Wenzel, Tobias, On File Sharing with Indirect Network Effects Between Concert Ticket Sales and Music Recordings, July 2011.
Published in: Journal of Media Economics, 25 (2012), pp. 168-178.

27 Von Schlippenbach, Vanessa and Wey, Christian, One-Stop Shopping Behavior, Buyer Power, and Upstream Merger Incentives, June 2011.

26 Balsmeier, Benjamin, Buchwald, Achim and Peters, Heiko, Outside Board Memberships of CEOs: Expertise or Entrenchment?, June 2011.

25 Clougherty, Joseph A. and Duso, Tomaso, Using Rival Effects to Identify Synergies and Improve Merger Typologies, June 2011.
Published in: Strategic Organization, 9 (2011), pp. 310-335.

24 Heinz, Matthias, Juranek, Steffen and Rau, Holger A., Do Women Behave More Reciprocally than Men? Gender Differences in Real Effort Dictator Games, June 2011.
Published in: Journal of Economic Behavior and Organization, 83 (2012), pp. 105-110.

23 Sapi, Geza and Suleymanova, Irina, Technology Licensing by Advertising Supported Media Platforms: An Application to Internet Search Engines, June 2011.
Published in: B. E. Journal of Economic Analysis & Policy, 11 (2011), Article 37.

22 Buccirossi, Paolo, Ciari, Lorenzo, Duso, Tomaso, Spagnolo Giancarlo and Vitale, Cristiana, Competition Policy and Productivity Growth: An Empirical Assessment, May 2011.
Published in: The Review of Economics and Statistics, 95 (2013), pp. 1324-1336.

21 Karaçuka, Mehmet and Çatik, A. Nazif, A Spatial Approach to Measure Productivity Spillovers of Foreign Affiliated Firms in Turkish Manufacturing Industries, May 2011.
Published in: The Journal of Developing Areas, 46 (2012), pp. 65-83.

20 Çatik, A. Nazif and Karaçuka, Mehmet, A Comparative Analysis of Alternative Univariate Time Series Models in Forecasting Turkish Inflation, May 2011.
Published in: Journal of Business Economics and Management, 13 (2012), pp. 275-293.

19 Normann, Hans-Theo and Wallace, Brian, The Impact of the Termination Rule on Cooperation in a Prisoner's Dilemma Experiment, May 2011.
Published in: International Journal of Game Theory, 41 (2012), pp. 707-718.

18 Baake, Pio and von Schlippenbach, Vanessa, Distortions in Vertical Relations, April 2011.
Published in: Journal of Economics, 103 (2011), pp. 149-169.

17 Haucap, Justus and Schwalbe, Ulrich, Economic Principles of State Aid Control, April 2011.
Forthcoming in: F. Montag & F. J. Säcker (eds.), European State Aid Law: Article by Article Commentary, Beck: München 2012.

16 Haucap, Justus and Heimeshoff, Ulrich, Consumer Behavior towards On-net/Off-net Price Differentiation, January 2011.
Published in: Telecommunication Policy, 35 (2011), pp. 325-332.

15 Duso, Tomaso, Gugler, Klaus and Yurtoglu, Burcin B., How Effective is European Merger Control? January 2011.
Published in: European Economic Review, 55 (2011), pp. 980-1006.

14 Haigner, Stefan D., Jenewein, Stefan, Müller, Hans Christian and Wakolbinger, Florian, The First shall be Last: Serial Position Effects in the Case Contestants evaluate Each Other, December 2010.
Published in: Economics Bulletin, 30 (2010), pp. 3170-3176.

13 Suleymanova, Irina and Wey, Christian, On the Role of Consumer Expectations in Markets with Network Effects, November 2010.
Published in: Journal of Economics, 105 (2012), pp. 101-127.

12 Haucap, Justus, Heimeshoff, Ulrich and Karaçuka, Mehmet, Competition in the Turkish Mobile Telecommunications Market: Price Elasticities and Network Substitution, November 2010.
Published in: Telecommunications Policy, 35 (2011), pp. 202-210.

11 Dewenter, Ralf, Haucap, Justus and Wenzel, Tobias, Semi-Collusion in Media Markets, November 2010.
Published in: International Review of Law and Economics, 31 (2011), pp. 92-98.

10 Dewenter, Ralf and Kruse, Jörn, Calling Party Pays or Receiving Party Pays? The Diffusion of Mobile Telephony with Endogenous Regulation, October 2010.
Published in: Information Economics and Policy, 23 (2011), pp. 107-117.

09 Hauck, Achim and Neyer, Ulrike, The Euro Area Interbank Market and the Liquidity Management of the Eurosystem in the Financial Crisis, September 2010.

08 Haucap, Justus, Heimeshoff, Ulrich and Schultz, Luis Manuel, Legal and Illegal Cartels in Germany between 1958 and 2004, September 2010.
Published in: H. J. Ramser & M. Stadler (eds.), Marktmacht. Wirtschaftswissenschaftliches Seminar Ottobeuren, Volume 39, Mohr Siebeck: Tübingen 2010, pp. 71-94.

07 Herr, Annika, Quality and Welfare in a Mixed Duopoly with Regulated Prices: The Case of a Public and a Private Hospital, September 2010.
Published in: German Economic Review, 12 (2011), pp. 422-437.

06 Blanco, Mariana, Engelmann, Dirk and Normann, Hans-Theo, A Within-Subject Analysis of Other-Regarding Preferences, September 2010.
Published in: Games and Economic Behavior, 72 (2011), pp. 321-338.

05 Normann, Hans-Theo, Vertical Mergers, Foreclosure and Raising Rivals' Costs – Experimental Evidence, September 2010.
Published in: The Journal of Industrial Economics, 59 (2011), pp. 506-527.

04 Gu, Yiquan and Wenzel, Tobias, Transparency, Price-Dependent Demand and Product Variety, September 2010.
Published in: Economics Letters, 110 (2011), pp. 216-219.

03 Wenzel, Tobias, Deregulation of Shopping Hours: The Impact on Independent Retailers and Chain Stores, September 2010.
Published in: Scandinavian Journal of Economics, 113 (2011), pp. 145-166.

02 Stühmeier, Torben and Wenzel, Tobias, Getting Beer During Commercials: Adverse Effects of Ad-Avoidance, September 2010.
Published in: Information Economics and Policy, 23 (2011), pp. 98-106.

01 Inderst, Roman and Wey, Christian, Countervailing Power and Dynamic Efficiency, September 2010.
Published in: Journal of the European Economic Association, 9 (2011), pp. 702-720.

Heinrich-Heine-University of Düsseldorf

Düsseldorf Institute for Competition Economics (DICE)

Universitätsstraße 1 _ 40225 Düsseldorf
www.dice.hhu.de

ISSN 2190-9938 (online)
ISBN 978-3-86304-117-5