ECONSTOR
*Make Your Publications Visible.*

A Service of

ZBW Leibniz-Informationszentrum Wirtschaft
Leibniz Information Centre for Economics

Haucap, Justus; Klein, Gordon J.

**Working Paper**

# How regulation affects network and service quality in related markets

DICE Discussion Paper, No. 52

**Provided in Cooperation with:**
Düsseldorf Institute for Competition Economics (DICE), Heinrich Heine University Düsseldorf

*Suggested Citation:* Haucap, Justus; Klein, Gordon J. (2012) : How regulation affects network and service quality in related markets, DICE Discussion Paper, No. 52, ISBN 978-3-86304-051-2, Heinrich Heine University Düsseldorf, Düsseldorf Institute for Competition Economics (DICE), Düsseldorf

This Version is available at:
https://hdl.handle.net/10419/58185

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

WWW.ECONSTOR.EU

Mitglied der Leibniz-Gemeinschaft

Düsseldorf Institute
for Competition Economics

# DISCUSSION PAPER

No 52

## How Regulation Affects Network and Service Quality in Related Markets

Justus Haucap,
Gordon J. Klein

May 2012

HEINRICH HEINE
UNIVERSITÄT DÜSSELDORF

IMPRINT

DICE DISCUSSION PAPER

Published by
Heinrich-Heine-Universität Düsseldorf, Department of Economics, Düsseldorf Institute for Competition Economics (DICE), Universitätsstraße 1, 40225 Düsseldorf, Germany

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

All rights reserved. Düsseldorf, Germany, 2012

ISSN 2190-9938 (online) – ISBN 978-3-86304-051-2

The working papers published in the Series constitute work in progress circulated to stimulate discussion and critical comments. Views expressed represent exclusively the authors' own opinions and do not necessarily reflect those of the editor.

# How Regulation Affects Network and Service Quality in Related Markets*

Justus Haucap & Gordon J. Klein
Düsseldorf Institute for Competition Economics (DICE)
Heinrich-Heine-University of Düsseldorf†

May 2012

**Abstract**

We analyze how network regulation affects investment into network infrastructure and complementary services. While regulation negatively affcets investment incentives in the regulated network market, the effects of network regulation on investment in complementary services can be either negative or positive, depending on the relative weight consumers assign to infrastructure versus service quality. We also find constellations, where regulation can enhance perceived total quality.

*JEL Classification*: D43, L13, L51, L96.

*We gratefully acknowledge comments received at the University of Marburg, Carnegie Mellon Portugal in Lisbon, the ITS Conferences in Montreal and Manama, the EEA Conference in Barcelona, and the EARIE Conference in Ljubljana. Part of this research was conducted while Gordon J. Klein worked at the ZEW, Mannheim.

†University of Düsseldorf, Düsseldorf Institute for Competition Economics (DICE), Universitätsstr. 1, D-40225 Düsseldorf, Germany; e-mail: Haucap@dice.hhu.de; Klein@dice.hhu.de.

# 1 Introduction

How to regulate access prices in network industries has been one of the major issues of debate both in academic circles and among policy makers and regulators over the last 10 to 20 years. While the literature has initially focused on pricing issues in a static context (see, e.g., Armstrong, 2002; Laffont and Tirole, 1998), more recent contributions have analyzed the relationship between access regulation and investment (see, for example, Gans and King, 2004; Foros, 2004; Kotakorpi, 2006; Vareda, 2007).[1] Much of this literature concludes that stricter access price regulation usually has a negative impact on infrastructure investment, even though Vareda (2007) shows that the negative relationship between access price level and infrastructure investment only holds for quality enhancing investments, but not necessarily for cost-reducing investment. Common to most of these papers, however, is their shared focus on the incumbent's investments to replace or to extend the own network. Hence, the emphasis is on the investment incentives faced by existing infrastructure owners.

In contrast, a second stream of literature has focused on the entrants' investment incentives. In this literature it is often argued that tighter access regulation initially encourages competitors to invest into complementary infrastructure which they can later use to build alternative networks in order to bypass the incumbent's bottlenecks. This so-called "ladder of investment" idea has gained support and popularity among regulators and policy makers, particularly in telecommunications markets (see Cave & Vogelsang, 2003; Cave, 2006). While the "ladder of investment" idea highlights the importance of complementary infrastructure, it ultimatively also focuses on network substitution and infrastructure competition.

Our paper focuses on a third type of investment, namely investment into the quality of strictly complementary goods or services. To be more precise, we analyze the relationship between access regulation and investment incentives into both network and service quality if network usage and service provision are in a strictly complementary relationship to each other. Hence, in contrast to the "ladder of investment" perspective we analyze strictly complementary services which cannot substitute the original infrastructure but rather have to rely on access to this infrastructure.

An important example may be the (potential) regulation of broadband access markets, which also affects investment incentives for firms providing Internet services. Similarly, in railway markets the investment incentives for train operating companies (into rolling stock and services) are also influenced by the regulation of access to the rail network (i.e., the tracks, stations, traction power, etc.). The same holds for airlines whose investment incentives are at least

[1] For an overview also see Vogelsang (2003), Guthrie (2006) and the contributions in Dewenter & Haucap (2006).

partially determined by airport regulation (slot allocation, landing fees, etc.) or for ports, where shipping companies have to purchase complementary pilotage, towage and discharging services and also pay dock dues. Maybe most importantly, the relation between network charges and incentives to invest into complementary services is increasingly receiving attention in the debate over net neutrality regulations of the Internet (see, e.g., Schuett, 2010).

Our analysis considers the complementarity between infrastructure investments and service quality and also accounts for potential differences regarding consumers' valuation of network and service quality. The latter is motivated by the observation that both the quality of the network and the quality of the consumed services are typically important for consumers, but not necessarily to the same extent. One example is broadband Internet access and Internet services (e.g., video streaming). The download speed for a particular service usually depends on both investment into network capacity/quality *and* investment into data compression techniques, the number of download servers and the like so that, from a consumer perspective, the perceived total quality depends on investment levels into both network *and* service quality which are complementary to each other. Given this constellation, the benefit from an increase in network quality may be below or above the utility of improved Internet service quality (such as better data compression for video download/streaming).

As we will show, in this context network price regulation clearly has a negative effect on the network operator's incentives to invest into network quality, but this may be more than compensated by an increase in investment incentives for providers of complementary services. However, we also show that tighter price regulation may not only reduce incentives to invest into network infrastructure, but investment incentives for complementary service providers may also *decrease* in the regulated network price. Put differently, higher access prices may not only increase investment incentives for network operators, but also for firms that provide complementary services. This finding contrasts the conventional wisdom among regulators that tighter network price regulation stimulates investment into complementary services. We show that either can be true, depending on (a) the relative cost of investment into network vis-à-vis service quality and (b) the relative importance of network versus service quality for consumers. Moreover, our paper demonstrates that a regulatory focus on how regulation affects incentives to invest into network infrastructure by either incumbent or entrant operators can be far too narrow if investment into the quality of complementary services is also important.

## 2 Model Setup

Consider a natural monopoly upstream network $N$ which is used to provide complementary downstream services $S$, which are offered by two firms $(S1, S2)$ who compete in Betrand fashion, offering differentiated services. The natural monopoly network is assumed to be regulated, and we analyze how changes in the regulated network charge $p_N^R$ affect all three firms' decisions to invest into quality $q_i$ $(i = N, S1, S2)$ as well as downstream firms' prices $p_i$ $(i = S1, S2)$. We take the network charge $(p_N^R)$ as exogenous. This appears sensible to us, as in many countries and most regulated industries the cost standard on which price regulation is based (such as long-run incremental cost) is enshrined in law and can only be changed by an act of parliament. Given the regulated network charge, all firms choose their quality $q_i$ before the two downstream firms set their prices $p_{S1}$ and $p_{S2}$. This sequence of moves reflects the idea that prices are typically easier to change than investments into quality or, put differently, quality decisions are rather long-term decisions while pricing decisions can be adjusted more quickly. Firms are assumed to maximize their profit:

$$\pi_i = p_i x_i - \frac{1}{2} k_i q_i^2 \tag{1}$$

for $i = N, S1, S2$.

The profit function consists of prices $p_i$ $(i = N, S1, S2)$ multiplied by quantities $x_i$, less the investment costs comprising the increase in quality $q_i$ given the quadratic investment costs $\frac{1}{2} k_i q_i^2$.[2] To reduce complexity we assume that there is no variable cost of production.

Consumers are assumed to jointly consume $N$ and $S$. A variation of the representative consumer model gives the following demand[3]:

$$p_{S_j} = a_S + q_{S_j} + \gamma q_N - p_N - x_{S_j} - b x_{S_{-j}} \tag{2}$$

with $j = 1, 2$. Note that due to the complementarity between $N$ and $S$ demand for $N$ is given as $x_N = x_{S1} + x_{S2}$. Note that the utility of minimum quality is given as $a_S > 0$ so that $q_{N,S1,S2}$ denote quality upgrades above the minimum quality level. The substitutability of the two downstream firms' services is reflected in $b$ which, therefore, also determines the intensity of competition. The factor $\gamma \geq 0$ reflects the relative importance consumers assign to network quality compared to service quality. That is, we assume that in the eyes of consumers total quality is given by $q_{S_j} + \gamma q_N$, where a lower $\gamma$ indicates less importance of network quality compared to the services' quality and vice versa. Prices $p_{S1,S2}$ and $p_N^R$ affect demand negatively.

[2] This requires $k_i \geq 1/2$ (Assumption 1) to ensure investment levels are non-negative.

[3] The underlying utility function is: $U = (a_S + q_{S1} + \gamma q_A) x_{S1} + (a_S + q_{S2} + \gamma q_A) x_{S2} - (p_A + p_{S1})(x_{S1}) - (x_{S2})(p_A + p_{S2}) - \frac{1}{2}(x_{S1}^2 + 2 b x_{S1} x_{S2} + x_{S2}^2)$; For a general description see, e.g., Vives 2001, pp. 144-148.

We now solve the game deriving Subgame Perfect Nash Equilibria and concentrate on a comparative static analysis of variations in $p_N^R$, as we consider this comparison to be most relevant for regulatory policy purposes. This is because (a) regulators are unlikely to pursue the objective of welfare maximization in reality and (b) even if they would, regulators usually lack the information and/or power to implement first-best prices. Hence, we focus on a comparative analysis of network price changes rather than on the calculation of first-best network charges.

## 3 Comparative Static Analysis

First, given an exogenously regulated network charge $p_N^R$, downstream price competition yields[4]:

$$p_{S_j}(\ q_N, q_{S_j}, q_{S_{-j}}, p_N^R) = \frac{\Lambda(2 - b(1+b))}{4 - b^2} \tag{3}$$

with $\Lambda = a_S + q_{S_j} + \gamma q_N - p_N^R$ for $j = 1, 2$.

Anticipating these prices, profit maximizing quality levels as a function of $p_N^R$ are given as:

$$q_N(p_N^R) = \frac{2}{(2-b)(1+b)} \frac{\gamma}{k_N} p_N^R \tag{4}$$

$$q_{S_j}(\ p_N^R) = \frac{2}{\lambda} \left( \underbrace{a_S - p_N^R}_{\text{direct effect}} + \underbrace{\frac{2\gamma^2}{k_N(2-b)(1+b)} p_N^R}_{\text{indirect effect}} \right) \left(2 - b^2\right) \tag{5}$$

for $j = 1, 2$ with $\lambda = \left(8k_S + 4bk_S + 2b^2 - 6b^2k_S - b^3k_S + b^4k_S - 4\right) > 0$ (Assumption 2).

The network operator's investment is always negatively affected by stricter regulation of network charges (equation 4), but the magnitude depends on the intensity of competition in services (as measured by $b$) in a U-shaped curve. Not surprisingly, the overall investment is smaller the more costly investments are (as measured by $k_i$).

How a change in $p_N^R$ affects $q_s$ is less obvious, as the sign of the derivative of $\partial q_s / \partial p_N^R$ is ambiguous. First, note that the sign of the nominator determines the sign of the derivative $\partial q_{S_j} / \partial p_N^R$ given Assumption 2. Secondly, as equation 5 shows, changes of $p_N^R$ affect $q_{S1}$ and $q_{S2}$ through a *direct* and an *indirect* effect. On the one hand, $p_N^R$ directly decreases the (residual)

[4]To ensure better readability, we assume symmetry of the competing downstream firms and present equilibrium values with $q_{S1} = q_{S2}$.

demand for services as given by 2 and, therefore, higher network charges negatively affect incentives to invest into service qualities. An increase in the access price $p_A^R$ by an amount $\epsilon$ reduces consumers' willingness-to-pay for the complementary services exactly by that amount $\epsilon$, i.e., by a factor of 1. Hence, a higher network charge decreases consumers' willingness-to-pay for services and, thereby, leads to a reduction of investment into service quality. On the other hand, there is a countervailing *indirect* effect: An increase in $p_N^R$ also leads to an increase in network quality by a factor of $2\gamma/[k_N(2-b)(1+b)]$ as can be seen from equation (4). Any increase in network quality in turn also shifts out the demand for $x_S$ by a factor of $\gamma$ as the demand equation (2) reveals, so that the *indirect* effect of an increase in $p_N^R$ is to raise consumers' willingness-to-pay by a factor of $2\gamma^2/[k_N(2-b)(1+b)]$ , due to the resulting increase in $q_N$. Hence, the total effect that a change in $p_N^R$ has on $q_S$ depends on the size of $\gamma$ and $k_N$. Put differently, the sign of the derivative $\partial q_S/\partial p_N^R$ is determined by the sign of $(2\gamma^2/[k_N(2-b)(1+b)]-1)$. If network quality is sufficiently important for consumers (as measured through $\gamma$) and/or if network upgrades are sufficiently inexpensive (as measured through $k_N$), network price regulation (a lower $p_N^R$) leads to lower network quality, $q_N$ and also to a lower quality of complementary services. If, however, service quality is more important for consumers (and $\gamma$ relatively small) and/or if network upgrades are sufficiently expensive (as measured through $k_N$), network price regulation (a lower $p_N^R$) leads to a higher quality of complementary services even though stricter regulation still induces a lower network quality, $q_N$.These findings are summarized in the following propositions:

**Proposition 1.** *Network price deregulation (i.e., a higher $p_N^R$) unambiguously leads to higher network quality and also to higher quality of related services if $\frac{2\gamma^2}{k_N(2-b)(1+b)}$ is sufficiently large.*

**Proposition 2.** *If the regulator strengthens price regulation for network charges (i.e., a lower $p_N^R$), network quality will decrease, but the quality level in the unregulated market for complementary services increases if $\frac{2\gamma^2}{k_N(2-b)(1+b)}$ is sufficiently small.*

Given the second proposition, we analyze the impact of regulation on the perceived total quality. To determine the perceived total quality, we ask how consumers' willingness-to-pay for $x_S$ is affected. Put differently, we use a concept of perceived quality which is derived from the consumers' utility function and define total quality as:

$$Q_{Total} = \gamma q_N + \frac{x_{S1}}{(x_{S1}+x_{S2})} q_{S1} + \frac{x_{S2}}{(x_{S1}+x_{S2})} q_{S2}. \tag{6}$$

The derivative of the so-defined total quality, $Q_{Total}$, with respect to $p_N^R$ is given by:

$$\frac{\partial Q_{Total}}{\partial p_N^R} = \frac{\gamma^2(4-b^2)k_S}{(2-b^2)k_A} - 1. \tag{7}$$

The more important network quality is (as measured by $\gamma$), the less likely it is that softer regulation of network charges has a positive impact on the overall perceived quality. The opposite is true for the cost of investment into network quality, $k_A$. This can be summarized in the following proposition:

**Proposition 3.** *Stricter regulation of network charges (i.e., a lower $p_N^R$) always leads to a decrease in network quality ($q_N$), but service quality ($q_{S_j}$) increases and overcompensates the loss in network quality so that the perceived total quality ($Q_{Total}$) increases iff $\gamma^2 \frac{k_S}{k_N}$ is sufficiently small.*

# 4 Conclusions

We have analyzed how network regulation affects investment into both a natural monopoly network infrastructure and complementary services provided by two firms competing in a differentiated Bertrand market. While stricter regulation of network charges negatively affects investment incentives for the regulated network operator, the effects on investment into complementary services can be either negative or positive, depending on the relative weight consumers assign to infrastructure vis-à-vis service quality. In fact, while stricter network price regulation always reduces the quality of the network infrastructure, it can still increase the perceived total quality if service quality is sufficiently important for consumers. From a policy perspective it may be interesting to note that a regulatory focus on how regulation affects incentives to invest into network infrastructure by either incumbent or entrant operators is too narrow if investment into the quality of complementary services is also important for consumers.

## References


[1] Armstrong, M. (2002), The theory of access pricing and interconnection, in: M. Cave, S. Majumdar & I. Vogelsang (eds.) *Handbook of Telecommunications Economics*, Vol. I, Elsevier: Amsterdam, 297-384.

[2] Cave, M. (2006), Encouraging infrastructure competition via the ladder of investment, *Telecommunications Policy* 30, 223-237.

[3] Cave, M. & I. Vogelsang (2003), How access pricing and entry interact, *Telecommunications Policy* 27, 717-727.

[4] Dewenter R. & J. Haucap (2006), *Access Pricing: Theory and Practice*, Elsevier: Amsterdam.

[5] Gans, J. & S. King (2004), Access holidays and the timing of infrastructure investment, *Economic Record* 80, 89-100.

[6] Guthrie, G. (2006), Regulating infrastructure: The impact on risk and investment, *Journal of Economic Literature* 44, 925-972.

[7] Foros, O. (2004), Strategic investments with spillovers, vertical integration and foreclosure in the broadband access market, *International Journal of Industrial Organization* 22, 1-24.

[8] Kotakorpi, K. (2006), Access price regulation, investment and entry in telecommunications, *International Journal of Industrial Organization* 24, 1013-1020.

[9] Laffont J., P. Rey & J. Tirole (1998), Network competition: I. Overview and nondiscriminatory pricing, *Rand Journal of Economics* 29, 1-37.

[10] Schuett, F. (2010), Network neutrality: A survey of the economic literature, *Review of Network Economics* 9, 1-13.

[11] Singh, N. & X. Vives (1984), Price and quantity competition in a differentiated duopoly, *Rand Journal of Economics* 15, 546-554.

[12] Vareda, J. (2007), Unbundling and incumbent investment in quality upgrades and cost reduction, Portuguese Competition Authority. Working Paper No. 526. Available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1079968S.

[13] Vives, X. (2001), *Oligopoly Pricing: Old Ideas and New Tools*, MIT-Press: Cambridge, MA.

[14] Vogelsang, I. (2003). Price regulation of access to telecommunications networks, *Journal of Economic Literature* 41, 830–862.

# PREVIOUS DISCUSSION PAPERS

52 Haucap, Justus and Klein, Gordon J., How Regulation Affects Network and Service Quality in Related Markets, May 2012.

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.
Forthcoming in: Telecommunications Policy.

45 Graf, Julia, The Effects of Rebate Contracts on the Health Care System, March 2012.

44 Pagel, Beatrice and Wey, Christian, Unionization Structures in International Oligopoly, February 2012.

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.
Forthcoming in: Review of Network Economics.

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.

37 Haucap, Justus, Herr, Annika and Frank, Björn, In Vino Veritas: Theory and Evidence on Social Drinking, November 2011.

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.
Forthcoming in: Journal of Economic Behavior and Organization.

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.
Forthcoming in: Information Economics and Policy.

32 Catik, 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.
Forthcoming in: Journal of Regulatory Economics.

28 Dewenter, Ralf, Haucap, Justus and Wenzel, Tobias, On File Sharing with Indirect Network Effects Between Concert Ticket Sales and Music Recordings, July 2011.
Forthcoming in: Journal of Media Economics.

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.
Forthcoming in: Journal of Economic Behavior and Organization.

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.
Forthcoming in: The Review of Economics and Statistics.

21 Karaçuka, Mehmet and Catik, 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 Catik, 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.
Forthcoming in: International Journal of Game Theory.

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 Luis Manuel Schultz, 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 978-3-86304-051-2