Five Essays on Scholarly Communication and Mobile Telecommunications

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der Heinrich-Heine Universität Düsseldorf

vorgelegt von: Dipl.-Vw. Dipl.-Kfm. Johannes Muck

aus: Mömbris

Preface

I would not have been able to complete this thesis in its present form without the help and support of many others along the way. First of all, I would like to express my gratitude to my co-authors, namely Michael Bräuninger, Justus Haucap, Ulrich Heimeshoff, Jost Sieweke, and Stefan Süß, who obviously contributed substantially to this thesis.

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Chapter 1: Introduction

This thesis analyzes competition problems in two different communication markets. Part A focuses on the market for scholarly communication, whereas part B analyzes mobile telecommunications markets.

Both markets differ from classical homogeneous products markets in an important aspect. Products in the market for scholarly communication, i.e., academic publications, are intangible and, therefore, assessing their quality is difficult. At the same time, the quality of academic publications is one of the key parameters over which competition between researchers typically takes place. Employment of academic personnel, i.e., post-docs and professors, is usually based on an assessment of their achievements as researchers as reflected by the quality of their scientific publications (Müller-Camen and Salzgeber 2005, p. 277, Schulze, Warning, and Wiemann 2008). Since assessing the quality of a single publication is very laborious and time-consuming, the quality of a publication is typically substituted by the quality of the journal in which it was published, although this approach has been increasingly criticized in recent years (see, e.g., Frey 2005, Frey and Rost 2010). The quality of academic journals, on the other hand, is easier to infer due to the existence of publicly available journal rankings such as, for instance, the Journal Ranking of the Handelsblatt (Handelsblatt 2011) or the ranking of the German Economic Association (GEA) (Schneider and Ursprung 2008).

On the other hand, in markets for mobile telecommunications, product quality can be measured by objective criteria such as, for instance, the extent of network coverage, the quality of voice transmission, or the speed of data transmission. Instead, two distinct features characterize mobile telecommunication markets. These are, first, sequential market entry which follows from the sequential issuing of licenses necessary to take up operations and which leads to market structures in which one large (typically formerly state-owned) incumbent network operator faces competition from several smaller entrants. The second key characteristic of mobile telecommunication markets is the existence of network effects. Asymmetric market shares resulting from sequential market entry raise concerns about the existence and the extent of first mover advantages, i.e., sustainable competitive advantages due to early market entry. Since in most countries mobile telecommunications markets are regulated, potential first mover advantages should be taken into account by national regulatory agencies when designing regulatory measures in order to provide a level playing field for all network operators. One source of first mover advantages that has received considerable attention in the extant literature are tariff-mediated network effects. These occur if networks price discriminate between calls originating and terminating on their own network (on-net calls) and those terminating on a competitor's network (off-net calls). Since - in the past and to a lesser extent still today - on-net calls were priced below off-net calls, consumers had an incentive to join the largest network since this maximized the probability of making an on-net call and, hence, minimized the telephone bill.

To analyze competition problems stemming from the aforementioned distinct features of the markets for scholarly communication and mobile telecommunications, this thesis proceeds as follows. Chapter

2, entitled **"What do German Economist Read and Value Today?"** (co-authored by Michael Bräuninger and Justus Haucap and published in Perspektiven der Wirtschaftspolitik 2011, 12, 339-371), analyzes the role of journals as quality signals for scholarly communication by investigating the relevance and reputation of economics journals as perceived by their readers. More specifically, we present the results of a survey among the members of the GEA who were asked to rate the relevance and reputation of different economic journals. Our results show that internationally-oriented, English journals are rated as the most relevant. German journals, however, receive a higher rating of relevance in our survey than in published journal rankings, which are typically citation-based. Moreover, while older economists favor policy-oriented journals, younger economists largely prefer technically-oriented ones. Internationally-oriented journals also dominate the ranking of journals based on their reputation, whereas German journals fare rather poorly. While research-oriented journals are perceived as more renowned than applied journals, we find only slight differences in the ratings across different age groups. Compared to our survey from the year 2000 (Bräuninger and Haucap 2001), all journals are rated as more relevant but less renowned.

In chapter 3, **"What Drives the Relevance and Reputation of Economics Journals?"** (co-authored by Justus Haucap and forthcoming in Scientometrics), we analyze the interrelationship between perceived journal relevance and reputation by relying on the survey among the members of the GEA presented in chapter 3. We find a strong interrelationship between journal reputation and relevance, where a journal's perceived relevance has a stronger effect on the journal's reputation than vice versa. Moreover, past journal ratings conducted by the Handelsblatt and the GEA directly affect journals' reputation among German economists and indirectly also their perceived relevance, but the effect on reputation is more than twice as large as the effect on perceived relevance. In general, citations have a non-linear impact on perceived journal reputation and relevance. While the number of landmark articles published in a journal increases reputation, an increase in the so-called H-index even tends to decrease a journal's perceived relevance, as long as this is not simultaneously reflected in a higher Handelsblatt- and/or GEA-rating. We also identify significant differences in the views on journal relevance and reputation between different age groups.

Chapter 4, entitled **"Research Evaluation at Universities – Findings of an Explorative Study of Economics and Law Departments"** (co-authored by Jost Sieweke, Stefan Süß, and Justus Haucap and published in zfbf 2014, 66, 274-305), explores how the research performance of academics can generally be evaluated. To this end, we survey different tools to measure research quality, which are discussed in the extant literature, and contrast these results with the findings from an explorative study which analyzes how research performance is actually measured at the business, economics, and law departments of German universities. The findings reveal that a substantial mismatch exists between the measures discussed in the literature to evaluate research performance and the ones actually employed in practice. Furthermore, we find that the implementation of systems to measure research performance is influenced by factors such as department size, department homogeneity with regard to subjects and the dominant subject within the department.

Part B of this thesis addresses competition problems in mobile telecommunication markets by analyzing the existence and the extent of first mover advantages in mobile telecommunications. In chapter 5, entitled **"First Mover Advantages in Mobile Telecommunications – Evidence from OECD Countries"** (co-authored by Ulrich Heimeshoff), we explore the existence of first mover advantages in mobile telecommunications markets. Building on a data set comprising monthly penetration rates, market concentration, number of active operators, and market shares of 90 followers from 33 OECD countries, we estimate a dynamic growth model. Our analysis delivers five key results. Regarding a follower's long-run market share, we observe that (1) the penetration rate at the time of market entry exerts an inverted U-shaped effect, suggesting the existence of an optimal time for issuing additional licenses for mobile network operation; (2) the concentration rate at market entry exerts a positive effect, implying that it is easier for followers to enter a more concentrated market; (3) both the number of active operators at market entry and the number of currently active operators have a negative impact. Furthermore, we find that a follower's rate of convergence to the long-run market share is (4) negatively influenced by the current market concentration and number of active operators; and (5) negatively affected by changes in the penetration rate since market entry, which strongly indicates the presence of substantial first mover advantages for pioneers.

Finally, chapter 6, entitled **"Tariff-Mediated Network Effects with Incompletely Informed Consumers"** (single authored), investigates in more detail one particular source of first mover advantages, namely tariff-mediated network effects. More specifically, this chapter explores the competitive effects of on-net/off-net differentiation in a market with two asymmetric networks by combining the literature on on-net/off-net differentiation with research on costly consumer search in an agent-based simulation model. All consumers in the market are subscribed to one of two networks whereby, initially, clusters of subscribers to network B exist. A priori, consumers lack information on the market shares of both networks which they obtain by using a costly fixed sample size search strategy. With respect to the extent of search costs, I distinguish between three types of consumers: First, fully informed consumers (FICs) have non-positive search costs and, accordingly, are always perfectly informed about networks' market shares; second, partially informed consumers (PICs) have moderate search costs and, therefore, are assumed to observe market shares within a circular sensing field; and, third, locally informed consumers (LICs) have high search costs and are assumed to be able to observe market shares only among their immediate eight neighbors. Irrespective of their type, consumers maximize their expected utility by subscribing to the network offering the lowest expected cost for a call to a random consumer. The results of a systematic variation of the key parameters of the model show that the larger network's probability to increase its market share or to corner the market is negatively affected by the fraction of PICs and LICs, whereas it is positively affected by PICs' sensing radius, the large network's initial market share, and the number of clusters. The introduction of calling clubs reveals that the probability of calling a friend inflicts a negative effect while the size of the calling clubs has a positive effect. These findings highlight the pivotal role of the amount of information available to consumers for the competitive effect of on-net/off-net differentiation.

References

Bräuninger, M., Haucap, J. (2001), Was Ökonomen lesen und schätzen. *Perspektiven der Wirtschaftspolitik*, 2, 185-210.

Bräuninger, M., Haucap, J., Muck, J. (2011), Was schätzen und lesen deutschsprachige Ökonomen heute? *Perspektiven der Wirtschaftspolitik,* 12, 339-371.

Frey, B. S. (2005), Problems with Publishing: Existing State and Solutions. *European Journal of Law and Economics*, 19, 173-190.

Frey, B. S., Rost, K. (2010), Do Rankings Reflect Research Quality? *Journal of Applied Economics*, 13, 1-38.

Handelsblatt (2011), *So funktioniert das VWL-Ranking*. Online at: http://www.handelsblatt.com/politik/oekonomie/vwl-ranking/methodik-so-funktioniert-das-vwl-ranking/4575334.html

Haucap, J., Muck, J. (2015), What Drives the Relevance and Reputation of Economics Journals? An Update from a Survey among German Speaking Economists. Forthcoming in *Scientometrics*.

Muck, J., Heimeshoff, U. (2012), First Mover Advantages in Mobile Telecommunications: Evidence from OECD Countries. *DICE Discussion Paper*, 71, 1-41.

Müller-Camen, M., Salzgeber, S. (2005), Changes in Academic Work and the Chair Regime: The Case of German Business Administration Academics. *Organization Studies*, 26, 271-290.

Schneider, F., Ursprung, H. W. (2008), The 2008 GEA Journal Ranking for the Economics Profession. *German Economic Review,* 9, 532-538.

Schulze, G. G., Warning, S., Wiermann, C. (2008), What and How Long Does It Take to Get Tenure? The Case of Economics and Business Administration in Austria, Germany, and Switzerland. *German Economic Review,* 9, 473-505.

Sieweke, J., Muck, J., Süß, S., Haucap, J. (2014), Forschungsevaluation an Universitäten – Ergebnisse einer explorativen Studie rechts- und wirtschaftswissenschaftlicher Fakultäten. *Zeitschrift für Betriebswirtschaftliche Forschung*, 66, 274-305.

PART A:

SCHOLARLY COMMUNICATION

Chapter 2: What do German Economists Read and Value Today? (Was lesen und schätzen deutschsprachige Ökonomen heute?)[1]

1. Einleitung

Das Ranking ökonomischer Fachzeitschriften hat in den letzten Jahren enorm an Bedeutung gewonnen. Bei der Evaluation von Forschungsvorhaben, einzelnen Forschern,[2] Fachbereichen an Universitäten und auch bei der Bewertung der Forschungsleistung von Wirtschaftsforschungsinstituten ist heute eine zentrale Frage, in welchen Fachzeitschriften die Wissenschaftler publizieren (Keil und Huber 2004, Steininger und Süssmuth 2005, Frey 2007, Schneider und Ursprung 2008, Schulze, Warning und Wiermann 2008a, 2008b, Graber, Launov und Wälde 2008, Frey und Rost 2010). Von überragender Bedeutung für die Volkswirtschaftslehre im deutschsprachigen Raum ist sicherlich das von Olaf Storbeck initiierte Handelsblatt-Ranking (Storbeck 2010, 2011), das dementsprechend auch kritisch kommentiert wird (z. B. Hofmeister und Ursprung 2008, Seiler und Wohlrabe 2010). Für die BWL hat das Handelsblatt-BWL-Ranking von Journalen nicht unbedingt dieselbe Bedeutung, da der Verband der Hochschullehrer für Betriebswirtschaftslehre mit dem VHB-JOURQUAL schon frühzeitig eine eigene Klassifikation von Zeitschriften in die Klassen A+ bis E vorgenommen hat (Hennig-Thurau, Walsh und Schrader 2004, Schrader und Hennig-Thurau 2009).

Rankings und Ratings ökonomischer Fachzeitschriften sind keineswegs neu, sie besitzen inzwischen eine lange Tradition. Eine der ersten Einordnungen erfolgte international durch Liebowitz und Palmer (1984) und für den deutschsprachigen Raum durch Pommerehne (1986). Weitere prominente internationale Ranglisten für ökonomische Fachzeitschriften sind erstellt worden von Laband and Piette (1994), Kalaitzidakis, Mamuneas und Stengos (2003, 2011), Kodrzycki und Yu (2006) sowie Ritzberger (2008).

Die Methodik zur Bildung der Ranglisten variiert dabei, basiert aber meistens auf mehr oder minder ausgeklügelten Auswertungen von Zitationen oder aber auf durch Surveys abgefragten Einschätzungen in der jeweiligen Profession. Inzwischen ist die Anzahl der Rankings jedoch kaum noch zu überschauen, sodass teilweise bereits auf Meta-Rankings zurückgegriffen wird (Schulze, Warning und Wiermann

[1] Wir danken allen Teilnehmern der Umfrage für ihre Unterstützung bei diesem Projekt. Elisabeth Flieger, Susanne Schäfers und Olaf Siegert (alle ZBW-Leibniz-Informationszentrum Wirtschaft) danken wir für die ganz ausgezeichnete Unterstützung bei der Durchführung der Befragung und der Aufbereitung der Daten. Dem Vorstand des Vereins für Socialpolitik danken wir für die Bereitstellung der Mitgliederadressen sowie der Daten über die Altersstruktur der Vereinsmitglieder. Für kritische Kommentare und Anregungen danken wir Ralf Dewenter, Lars P. Feld, Susanne Schäfers, Bernd Süßmuth und Walter Krämer. Für verbleibende Fehler geben sich die Autoren gegenseitig die Schuld.

[2] Zur besseren Lesbarkeit verzichten wir auf geschlechtsspezifische Formulierungen. Gemeint sind stets Frauen und Männer.

2008a). Zudem bemühen sich diverse Institutionen, wie z.B. das ZBW Leibniz Informationszentrum Wirtschaft, einen Überblick über verschiedene Rankings herzustellen.

Die diversen Ranglisten sind mittlerweile aus durchaus unterschiedlichen Gründen zu einem Instrument der Bewertung von Forschungsleistungen insgesamt geworden, auch wenn die Klassifikation einer Zeitschrift lediglich ein sehr einfaches Hilfsmittel sowohl für die Evaluation eines Aufsatzes als auch für die von Forschern oder Forschungsvorhaben ist.

Die Reputation einer Zeitschrift wiederum kann durch ganz unterschiedliche Faktoren beeinflusst werden, wie z. B. durch die Qualität der bisher erschienenen Aufsätze, die Ablehnungsquote, die Zitationshäufigkeit und -verteilung, die Klassifikation in Ranglisten, die Bekanntheit der Herausgeber, Aussagen von Kollegen, die mit dem Spezialgebiet einer Zeitschrift besser vertraut sind, und vieles mehr. Es ist aber wohl davon auszugehen, dass viele Ökonomen von der Reputation einer Zeitschrift indirekt auf die Qualität eines ihnen ansonsten unbekannten Artikels schließen, entweder um den Aufsatz dann ggf. zu studieren oder um sich ein (erstes) Bild von der wissenschaftlichen Leistung eines Autors zu verschaffen. Die Reputation der Zeitschrift färbt somit auf die Autoren ab,[3] obwohl selbst in hochkarätigen Zeitschriften publizierte Aufsätze teilweise gar nicht zitiert werden und ganz allgemein festzustellen ist, dass die Verteilung der Zitationen über die Artikel einer Zeitschrift sehr schief ist, d. h. viele Zitationen verteilen sich auf wenige Aufsätze. Anders ausgedrückt ist der durchschnittliche Impact-Faktor für die in einer Zeitschrift publizierten Aufsätze deutlich höher als der Median. Zudem variiert die Schiefe der Verteilung zwischen Fachzeitschriften, und schließlich werden viele Aufsätze in hochkarätigen Journalen weniger häufig zitiert als ein typischer Aufsatz in manchen weniger renommierten Zeitschriften (Oswald 2007, Wall 2009).

Trotz dieser Schwächen gilt die Auswertung von durchschnittlichen Zitationszahlen als Standard, wobei die Journal Citations Reports (JCR), die auf der Basis des Social Science Citations Index (SSCI) erstellt werden, Marktführer sind. Die bekannteste unter den in den JCR ermittelten Messzahlen ist der bereits erwähnte Impact-Factor, der die durchschnittliche Zahl von Zitationen der in den letzten zwei Jahren erschienen Artikel in Beziehung zueinander setzt.

In den letzten Jahren hat es jedoch teilweise heftige Kritik an der Zusammensetzung des SSCI und den JCR gegeben: die Datenbank fokussiere zu stark auf den angloamerikanischen Publikationsmarkt, und die Formel für die Berechnung des Impact-Faktors pauschaliere zu sehr. In der Folge wurden neue Datenbanken für Auswertungen herangezogen (SCOPUS, EconLit, RePEc) und neue Messverfahren und Indikatoren (H-index, Eigenfactor, Article Influence) entwickelt. Vor diesem Hintergrund gewinnt die subjektive Einschätzung der Qualität von Zeitschriften durch Experten wieder an Bedeutung, um fachspezifische, regionale und institutionelle Besonderheiten zu berücksichtigen.

Zunehmend finden heute zudem ersatzweise oder aber auch ergänzend zitationsbasierte Analysen Anwendung, um Forschungsleistungen zu evaluieren, d.h. es werden konkret die Zitationen einzelner

[3] Zumindest teilweise geschieht dies auch umgekehrt (Bergstrom 2001, Chang, McAleer und Oxley 2011).

Aufsätze bzw. Forscher ermittelt und interpretiert z.B. mit Hilfe des persönlichen H-indexes (Ursprung und Zimmer 2007, Müller 2010, Schläpfer und Schneider 2010). Während das direkte Auszählen von Zitationen einzelner Artikel oder Wissenschaftler in der Vergangenheit mit prohibitiv hohen Kosten verbunden war, sodass die Reputation bzw. der Impact-Faktor einer Zeitschrift als Proxy für die zu erwartenden Zitationen eines Aufsatzes verwendet wurde, kann heute mit Hilfe von Datenbanken wie z. B. SCOPUS sehr einfach (auf Knopfdruck) ermittelt werden, wie oft die Beiträge eines Autors zitiert worden sind, sodass der „Umweg" über die Reputation der Fachzeitschriften im Grunde nicht mehr notwendig wäre. Jedoch ist auch das Auszählen von Zitationen immer noch ein imperfekter Indikator für die wissenschaftliche Qualität eines Beitrages, da sich z. B. die Halbwertszeit für zitierte Artikel („Cited Half-Life") zwischen Zeitschriften sehr unterscheidet, die Bewertung gerade jüngerer Wissenschaftler anhand erzielter Zitationen problematisch ist, Zitationen sich strategisch (z. B. durch sogenannte Zitationskartelle) beeinflussen lassen, Autoren selbst ohne Zitationskartell durchaus strategisch zitieren oder auch nicht zitieren, Ignoranz auch unter Wissenschaftlern verbreitet ist[4] und sogar der Zufall eine Rolle zu spielen scheint (Hudson 2007).[5] Die Einstufung von Journalen in verschiedene Güteklassen wird daher nach wie vor als Hilfsmittel zur Beurteilung von Forschungsleistungen verwendet. Ellison (2010) argumentiert sogar, dass die Funktion der Zeitschriften als Qualitätssignal, Papiere mit einem Gütesiegel zu versehen, heute die wesentliche Aufgabe von ökonomischen Fachzeitschriften ist, während die Funktion der direkten Informationsverbreitung der Inhalte immer stärker in den Hintergrund tritt, da die meisten Aufsätze bereits lange vor der etwaigen Veröffentlichung in einer Zeitschrift als Arbeitspapiere im Internet und in Datenbanken wie SSRN, RePEc und Econstor verfügbar sind (Ellison 2010). Damit würden die Reputation von Zeitschriften und ihr Ranking heute noch wichtiger bei der Entscheidung, bei welchen Organen Wissenschaftler ihre Beiträge einreichen.

Im Jahr 2000 haben wir selbst einen Beitrag zur Debatte um die Einordnung ökonomischer Fachzeitschriften geliefert und dazu eine Umfrage unter den damaligen Mitgliedern des *Vereins für Socialpolitik* über die Relevanz und die Reputation ökonomischer Fachzeitschriften durchgeführt (Bräuninger und Haucap 2001, 2003). Drei Ergebnisse der damaligen Umfrage sollen hier in Erinnerung gerufen werden: Erstens war ein deutlicher Unterschied in der Beurteilung der Relevanz und der Reputation bei vielen Zeitschriften festzustellen, insbesondere bei im deutschsprachigen Raum beheimateten Journalen. Zweitens war ganz allgemein festzustellen, dass Zeitschriften aus dem deutschsprachigen Raum und aus Europa sowohl in ihrer Reputation als auch in ihrer Relevanz im Vergleich zu außereuropäischen Zeitschriften mit ähnlichen Impact-Faktoren tendenziell besser

[4] So hat uns Walter Krämer beispielsweise berichtet, dass die wesentlichen Ergebnisse des berühmten Aufsatzes von White (1980) sich bereits bei Friedhelm Eicker (1967) finden, Eicker (1967) jedoch im Gegensatz zu White (1980) kaum zitiert worden ist.

[5] So belegt Hudson (2007), dass die Aufsätze in einer Ausgabe der *American Economic Review* oder des *Economic Journals* im Durchschnitt häufiger zitiert werden, wenn sich ein anderer wichtiger Aufsatz (gemessen anhand der Zitationen in der Folgezeit) in derselben Ausgabe befindet.

bewertet wurden. Und drittens war ein deutlicher Unterschied in der Beurteilung der Zeitschriften zwischen verschiedenen Altersgruppen zu erkennen.

Ziel der erneuten Umfrage im Jahr 2011 war deshalb weniger, ein weiteres Ranking von Zeitschriften zu erstellen, sondern vor allem zu eruieren, was sich in den vergangenen Jahren vor dem Hintergrund der Veränderungen in der Universitätslandschaft im deutschsprachigen Raum an der Einschätzung ökonomischer Fachzeitschriften geändert hat. Inwiefern haben die Befunde von 2000 auch heute noch Gültigkeit? Und werden die zunehmende Internationalisierung und der sich vollziehende Generationenwechsel in der Einschätzung der Fachpublikationen reflektiert?

Dieser Frage werden wir im Folgenden nachgehen und die Resultate unserer Umfrage berichten, die wir im März 2011 unter den Mitgliedern des Vereins für Socialpolitik durchgeführt haben. In Abschnitt 2 erklären wir zunächst die Methode der Datenerhebung und beschreiben einige demographische Eigenschaften der Umfrageteilnehmer, bevor in Abschnitt 3 die Ergebnisse der Umfrage präsentiert werden. Dabei gehen wir in Abschnitt 3.1 zunächst auf die Bedeutung der Zeitschriften für die eigene Arbeit ein und in Abschnitt 3.2 dann auf die Ergebnisse bzgl. der Reputation der Zeitschriften. Im vierten Abschnitt werden dann die Ergebnisse unserer Umfrage mit denen der Umfrage von 2000 sowie mit anderen Bewertungen von Zeitschriften verglichen. Abschnitt 5 beendet den Beitrag mit einem Fazit.

2. Methode und Daten

Wie bei unserer Umfrage aus dem Jahr 2000 wurden die Befragten gebeten, bis zu 150 ausgewählte ökonomische Fachzeitschriften zu bewerten. Die ausgewählten Zeitschriften umfassen die wichtigsten in internationalen Ranglisten berücksichtigten Fachzeitschriften sowie einen Großteil der deutschsprachigen bzw. in Deutschland, Österreich oder der Schweiz herausgegebenen deutsch- und englischsprachigen VWL-Fachzeitschriften. Ein großer Teil der Zeitschriften war bereits Bestanteil unserer Umfrage aus dem Jahr 2000 (Bräuninger und Haucap 2001). Die Befragten wurden gebeten, entweder 50, 100 oder 150 Zeitschriften zu bewerten. Dabei sollte (a) die Bedeutung der jeweiligen Zeitschrift für die eigene Arbeit sowie (b) die Reputation auf einer Skala von 0 (keine Bedeutung/Reputation) bis 5 (sehr hohe Bedeutung/Reputation) beurteilt werden. Um für alle Zeitschriften etwa gleich viele Bewertungen zu erhalten, wurden die 150 Zeitschriften nach dem Zufallsprinzip in drei Blöcke (A, B und C) unterteilt, die dann in unterschiedlicher Reihenfolge (ABC, BCA, CAB) an drei gleich große, alphabetisch nach Nachnamen sortierte Adressatengruppen verschickt wurden.[6]

Versendet wurden 2991 E-Mails an Mitglieder des Vereins für Socialpolitik, von denen 909 (30,4 %) beantwortet wurden. Dabei haben aber nur 705 Teilnehmer (23,5 %) mindestens einen, 76 von ihnen alle drei Blöcke bewertet. 204 Mitglieder haben sich zwar an der Umfrage beteiligt, gaben jedoch für keine der 150 Zeitschriften eine Bewertung der Relevanz oder Reputation ab. Durchschnittlich hat jeder Teilnehmer die Relevanz von 102 Zeitschriften und die Reputation von 87 Zeitschriften bewertet. Jede

[6] Eine vollständige Version des Fragebogens findet sich in Bräuninger, Haucap und Muck (2011).

Zeitschrift wurde im Durchschnitt von 478 Teilnehmern bezüglich ihrer Bedeutung und von 408 Teilnehmern bezüglich ihrer Reputation bewertet. Damit hat sich im Vergleich zu der Umfrage aus dem Jahr 2000 sowohl die Zahl der insgesamt verschickten Fragebögen (2000: 2223) als auch die Rücklaufquote (2000: 19,3 %) erhöht. Insgesamt ist die Zahl der auswertbaren Fragebögen um 64 % gestiegen. Dies dürfte erstens darauf zurückzuführen sein, dass die Beantwortung 2011 internetbasiert und damit einfacher als über Excel-Tabellen in 2000 erfolgte. Zweitens haben die Häufigkeit und damit auch die Akzeptanz von Befragungen in den letzten Jahren zugenommen. Und drittens ist auch die Bedeutung von Zeitschriftenrankings in den letzten Jahren weiter angestiegen.

Wir haben die Teilnehmer zusätzlich um einige demographische Angaben gebeten, die gruppenspezifische Auswertungen ermöglichen. Unter den auswertbaren Fragebögen befinden sich Antworten von 390 Universitätsprofessoren, 36 Privatdozenten, 39 Fachhochschulprofessoren und 106 Mitarbeitern von Forschungsinstituten. Insgesamt sind 594 Teilnehmer promoviert oder auch habilitiert. Im Vergleich zur vorangegangenen Umfrage wurde die stärkste Steigerung im Bereich der Professoren erreicht: Hier hat sich die Zahl der Antwortenden verdreifacht.

Neben dem beruflichen Status wurde auch die Altersgruppe abgefragt. Die Rücklaufquote bei jüngeren Vereinsmitgliedern lag höher als bei älteren. Allerdings haben die Differenzen zwischen den Rücklaufquoten im Vergleich zu der Umfrage im Jahr 2000 deutlich abgenommen. Die Altersstruktur der Antwortenden 2000 und 2011 sowie die der Mitglieder des *Vereins für Socialpolitik* sind in Tabelle 1 angegeben.[7] Im Jahr 2000 haben wir vermutet, dass die höhere Rücklaufquote bei jüngeren Ökonomen am Befragungsmedium E-Mail gelegen haben könnte. Andere Erklärungsmöglichkeiten haben wir in unterschiedlichen Opportunitätskosten für den Zeitaufwand der Befragung und in der Tatsache, dass für jüngere Wissenschaftler zukünftige Evaluationen und die damit verbundene Bewertung von Zeitschriften von höherer Bedeutung sind als für ältere, gesehen. Der deutlich geringere Unterschied zwischen den Rücklaufquoten der Altersgruppen in der neuen Befragung deutet darauf hin, dass es nicht an der unterschiedlichen Bedeutung von Evaluationen gelegen hat. Einschränkend ist dabei festzustellen, dass Evaluationen zwar insgesamt an Bedeutung gewonnen haben, aber die Bedeutung von Evaluationen für die verschiedenen Altersgruppen und den damit verbunden Karrierestufen noch immer unterschiedlich ist. Die Opportunitätskosten sind durch die benutzerfreundlichere Befragungsform in 2011 sicherlich insgesamt gesunken. Unterschiede in den Opportunitätskosten zwischen den Altersgruppen dürften jedoch Zeitablauf relativ konstant sein. So spricht vieles dafür, dass die Differenz zwischen den Rücklaufquoten von 2000 und 2011 auf den unterschiedlichen Zugang zum Befragungsmedium zurückzuführen ist.

Schließlich haben wir die Teilnehmer auch gebeten anzugeben, wo sich ihr derzeitiger Arbeitsort befindet (Deutschland, Österreich, Schweiz oder Sonstiges) und welches ihre derzeitigen Arbeitsschwerpunkte sind (VWL-Politik, VWL-Theorie, Statistik/Ökonometrie, Finanzwissenschaft, BWL oder sonstiges). 550 Teilnehmer gaben an, derzeit in Deutschland tätig zu sein, 24 bzw. 45 arbeiten

[7] Alle Tabellen finden sich im Anhang.

derzeit in Österreich bzw. der Schweiz und 86 stammen aus dem nicht-deutschsprachigen Ausland. Bei der Frage nach dem Arbeitsschwerpunkt konnten die Teilnehmer auch angeben, auf mehreren Gebieten tätig zu sein. Wie Tabelle 2 zeigt, arbeitet knapp die Hälfte der Teilnehmer auf dem Gebiet der Wirtschaftspolitik (47,2 %) und etwa ein Drittel auf den Gebieten VWL-Theorie und Statistik/Ökonometrie. Nur rund jeder zehnte Befragte gab an, im Bereich BWL zu arbeiten. Interessant ist auch der Unterschied in den Arbeitsschwerpunkten zwischen den verschiedenen Altersklassen. Beispielsweise geben 42,0 % der unter 36-Jährigen an, auf dem Gebiet der Statistik und Ökonometrie tätig zu sein, während dies bei den über 55-Jährigen lediglich 12,3 % angeben (Gesamtdurchschnitt 27,1 %). Auch die VWL-Theorie scheint unter jüngeren Ökonomen etwas beliebter zu sein als im Durchschnitt aller Teilnehmer (39,7 % vs. 36,3 %). Auf dem Gebiet der Betriebswirtschaftslehre schließlich sind vornehmlich die 36- bis 55-Jährigen aktiv (16,0 % bzw. 14,6 %, Gesamtdurchschnitt 11,8 %).

3. Ergebnisse der Umfrage

3.1. Bedeutung der Zeitschrift für die eigene Arbeit

Tabelle 3 zeigt die Ergebnisse der Umfrage in Bezug auf die Bedeutung der Zeitschriften für die Arbeit der Befragten. Aus Spalte 2 lässt sich ablesen, wie oft die Bedeutung jeder Zeitschrift im Rahmen der Umfrage bewertet wurde. Spalte 3 zeigt den Rang, den eine Zeitschrift gemäß der in Spalte 4 angegebenen durchschnittlichen Bewertung der Relevanz für die eigene Arbeit erhält. Berechnet wurde der Durchschnittswert wie in Bräuninger und Haucap (2001) wieder als gewichtetes Mittel der verschiedenen Altersgruppen, wobei die Gewichte der tatsächlichen Altersstruktur der 3663 Mitglieder des *Vereins für Socialpolitik* zum Stichtag 01.04.2011 innerhalb der vier verschiedenen Altersklassen (unter 36, 36 bis 45, 46 bis 55 und über 55) entsprechen. Die Spalten 5 bis 9 enthalten die Ränge der Zeitschriften für bestimmte Untergruppen. In Spalte 5 finden sich die Ränge, die sich aus den Bewertungen von Professoren ergeben, in den Spalten 6 bis 9 sind die Rangfolgen innerhalb der vier verschiedenen Altersklassen eingetragen. Spalte 10 zeigt den Anteil der Befragten, der die Bedeutung einer Zeitschrift für die eigene Arbeit mit 4 („hohe Bedeutung“) oder 5 („sehr hohe Bedeutung“) bewertet hat, wiederum berechnet als gewichtetes Mittel der vier verschiedenen Altersgruppen. In Spalte 11 ist der Rang aufgeführt, der sich aus dieser Bewertung ergibt. Die Zeitschriftenränge, welche sich aus der Durchschnittspunktzahl der Befragung aus dem Jahr 2000 ergaben, finden sich in Spalte 12.

3.1.1. Allgemeine Auswertung

Wie aus Spalte 2 von Tabelle 3 hervorgeht, wurde jede Zeitschrift von mindestens 447 Teilnehmern bewertet, der Durchschnitt liegt bei 478 Bewertungen je Zeitschrift, das Maximum bei 543. Auffällig ist, dass die Zeitschriften auf den vorderen Rängen im Durchschnitt etwas häufiger bewertet wurden als solche auf den hinteren Rängen. Eine mögliche Erklärung hierfür könnte der mangelnde Bekanntheitsgrad der weniger bedeutenden Zeitschriften sein, der dazu geführt haben könnte, dass die Befragten statt einer 0 („keine Bedeutung“) lieber gar keine Bewertung abgegeben haben.

Die durchschnittliche Bewertung der Relevanz einer Zeitschrift fällt auf den ersten 15 Rängen relativ schnell ab, wohingegen sich auf den hinteren Rängen nur noch sehr geringe Unterschiede in den Bewertungen der Relevanz ergeben. So beträgt der Unterschied in der durchschnittlichen Bewertung der Relevanz zwischen Platz 100 und 150 lediglich 0,46 Punkte, was in etwa dem Unterschied zwischen dem ersten und dritten Platz entspricht. Diese relativ starke Konzentration bei den Durchschnittsbewertungen spiegelt sich auch in der in Abbildung 1 dargestellten Lorenz-Konzentrationskurve der Relevanzbewertungen sowie in einem Gini-Koeffizienten in Höhe von 0,263 wider.

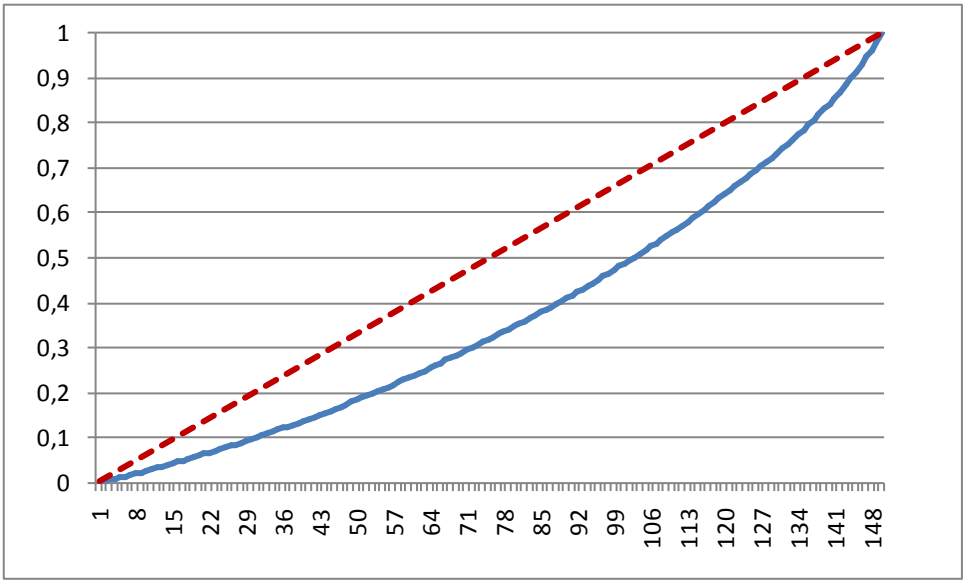


Abbildung 2-1: Lorenz-Konzentrationskurve der Relevanzbewertungen

Die Tatsache, dass selbst die als am wenigsten relevant eingestufte Zeitschrift, das *Journal of Accounting and Economics*, immer noch eine durchschnittliche Bewertung von 0,36 erhalten hat, ist im Wesentlichen auf die Auswahl der Zeitschriften zurückzuführen. Hierbei haben wir bewusst auf solche Zeitschriften verzichtet, die nur einen sehr geringen Bekanntheitsgrad aufweisen oder die nur für eine sehr ausgewählte Gruppe von Ökonomen interessant ist. Dementsprechend ist die empirische Verteilung der Relevanzbewertungen in unserer Umfrage an ihrem linken Rand abgeschnitten.[8]

Anhand der Spalten 3 und 4 von Tabelle 3 wird deutlich, dass im Rahmen unserer Umfrage vor allem die international bekannten englischsprachigen Journale die vorderen Ränge belegen. Die Zeitschrift mit der höchsten Bedeutung für die eigene Arbeit ist die *American Economic Review*, die unser Ranking mit einer durchschnittlichen Bewertung von 3,33 mit einem deutlichen Vorsprung von 0,29 Punkten anführt. Auf den Plätzen 2 bis 5 finden sich das *Journal of Economic Literature* mit einer durchschnittlichen Bewertung von 3,04, das *Journal of Political Economy* (2,85), das *Quarterly Journal of Economics* (2,82) sowie das *Journal of Economic Perspectives* (2,75).

[8] Nichtsdestotrotz sind wir von verschiedenen Teilnehmern darauf hingewiesen worden, dass ihnen bestimmte Zeitschriften in unserer Umfrage fehlten. Bei den 1535 in EconLit aufgelisteten Zeitschriften (Stand: Juli 2011, vgl. http://www.aeaweb.org/econlit/journal_list.php) ist dies jedoch auch wenig verwunderlich.

Für manche vielleicht überraschend gut schneiden die *Perspektiven der Wirtschaftspolitik* ab, die mit Platz 13 als einzige deutsche Zeitschrift den Sprung in die Top 15 schaffen. Die zweitwichtigste deutsche Zeitschrift, die *German Economic Review*, liegt auf dem 18. Rang. Somit stellen die beiden vom *Verein für Socialpolitik* herausgegeben Zeitschriften aus der Sicht der befragten Ökonomen die bedeutendsten Fachzeitschriften im deutschsprachigen Raum dar. Noch deutlicher tritt dieses Ergebnis im Rahmen der gruppenspezifischen Auswertung zu Tage, die in Abschnitt 3.1.2 erfolgt. Unter den Zeitschriften aus dem deutschsprachigen Raum folgt *Kyklos* mit einem gewissen Abstand auf Platz 25, gefolgt von den *Jahrbüchern für Nationalökonomie und Statistik* (Platz 28), dem *Journal of Institutional and Theoretical Economics (JITE)* (Platz 29) und den *CESifo Economic Studies* (Platz 30).

Weiterhin auffällig ist, dass die vordersten Plätze unseres Rankings ausnahmslos von allgemeinen Zeitschriften belegt werden; die erste spezialisierte Zeitschrift ist das *Journal of Public Economics*, welches mit einer durchschnittlichen Bewertung von 1,97 Platz 14 belegt. In Bezug auf die Thematik der Zeitschriften lässt sich weiterhin erkennen, dass wirtschaftspolitisch orientierte Zeitschriften eine hohe Relevanz für die eigene Arbeit der Umfrageteilnehmer besitzen, auch wenn diese keine originären Forschungsergebnisse publizieren. So belegen die *Brookings Papers on Economic Activity* Platz 23, der *ifo-Schnelldienst* und der *Wirtschaftsdienst* liegen auf den Rängen 34 und 35.

Schließlich ist noch anzumerken, dass sich die Rangfolge teilweise nicht unerheblich verändert, wenn nicht die durchschnittliche Punktzahl (Spalte 4) sondern der Anteil der Befragten herangezogen wird, der die Relevanz mit 4 oder 5 bewertet hat (Spalte 10). So nimmt z. B. das *Journal of Econometrics* in Spalte 11 Platz 18 statt Platz 40 ein und das *Journal of Money, Credit, and Banking* Platz 19 statt Platz 37. Der *Wirtschaftsdienst* steht in Spalte 11 auf Platz 21, in Spalte 3 hingegen auf Platz 35. Auf der anderen Seite würde sich beispielsweise das *Scandinavian Journal of Economics* von Rang 15 auf 36 und die *German Economic Review* von Rang 18 auf 43 verschlechtern.

3.1.2. Gruppenspezifische Auswertungen

Im Rahmen der gruppenspezifischen Auswertungen betrachten wir im Folgenden die Unterschiede zwischen (1) den verschiedenen Altersklassen, (2) Professoren und anderen Vereinsmitgliedern, (3) Mitgliedern aus Deutschland, Österreich, der Schweiz und anderen Staaten sowie (4) den verschiedenen Arbeitsgebieten der Teilnehmer.

Auffallend ist, dass Zeitschriften aus dem deutschsprachigen Raum von älteren Teilnehmern als deutlich relevanter für die eigene Arbeit eingestuft werden als von jüngeren Ökonomen. Beispielsweise erreichen die *Perspektiven der Wirtschaftspolitik* unter Teilnehmern bis 35 Jahre Rang 30, wohingegen sie bei über 55-Jährigen Platz 5 einnehmen. Noch deutlicher fällt dieser Unterschied bei *Kyklos* und dem *Journal of Theoretical and Institutional Economics (JITE)* aus, welche bei den unter 36-Jährigen Rang 57 bzw. 69, bei den über 55-Jährigen hingegen Rang 8 bzw. 10 erreichen. Ein weiterer Unterschied ergibt sich hinsichtlich der thematischen Ausrichtung der Journale. Während ältere Teilnehmer tendenziell wirtschaftspolitisch orientierte Zeitschriften als relevanter erachten, sind dies bei der jüngeren Generation die eher technisch orientierten Zeitschriften. Als Beispiel hierfür lassen sich neben

den *Perspektiven der Wirtschaftspolitik* auch der *ifo-Schnelldienst* und der *Wirtschaftsdienst* heranziehen, welche bei den unter 36-Jährigen Rang 64 bzw. 74, bei den über 55-Jährigen hingegen Rang 19 bzw. 21 und bei den 46 bis 55-Jährigen sogar Rang 15 bzw. 12 erreichen. Umgekehrt nimmt das *Journal of Econometrics*, welches bei den unter 36-Jährigen auf Platz 17 liegt, bei den über 55-Jährigen jedoch nur Platz 100 ein. Diese Ergebnisse spiegeln in gewisser Weise auch die als „Ökonomenstreit" bezeichnete Diskussion um die grundsätzliche Ausrichtung der Volkswirtschaftslehre in Deutschland wider, bei der es unter anderem auch um unterschiedliche Vorstellungen über die Bedeutung und die Art der wirtschaftspolitischen Forschung und Beratung an den Universitäten ging.[9] Schließlich lässt sich noch erkennen, dass Gebiete außerhalb des Mainstreams in der VWL für die jüngere Generation nur noch eine sehr geringe Rolle spielen, für die Älteren jedoch noch immer eine gewisse Relevanz besitzen. Als Beleg hierfür können das *Journal of Economic History* sowie das *Journal of Evolutionary Economics* dienen, welche bei den unter 36-Jährigen die Ränge 98 und 125 erreichen, bei den über 55-Jährigen hingegen die Ränge 42 und 33.

Bei den Relevanzbewertungen von Professoren zeichnet sich ein ähnliches Muster ab wie bei den Bewertungen innerhalb der vier verschieden Altersklassen. Die Urteile ähneln sehr stark den Bewertungen der beiden mittleren Altersklassen (36 bis 45 und 46 bis 55), was wenig überraschen dürfte angesichts der Tatsache, dass im Rahmen unserer Umfrage zwei Drittel der Professoren diesen beiden Altersklassen angehören.

Hinsichtlich der Herkunft der Teilnehmer lässt sich erkennen, dass vor allem deutsche, aber auch europäische Zeitschriften für Ökonomen, die nicht im deutschsprachigen Raum arbeiten, eine deutlich geringere Relevanz besitzen.[10] Die *Perspektiven der Wirtschaftspolitik* beispielsweise erreichen unter den Teilnehmern, die in Deutschland, Österreich oder der Schweiz arbeiten, die Plätze 13, 9 bzw. 17, während sie unter den übrigen Teilnehmern auf Rang 46 rangieren. Gleiches gilt für die *German Economic Review* und das *European Journal of Political Economy*, welche unter Teilnehmern aus Deutschland, Österreich und der Schweiz die Plätze 18, 15 und 27 bzw. 23, 21 und 19 erreichen, unter Teilnehmern, die im nicht-deutschsprachigen Ausland arbeiten, jedoch lediglich die Plätze 40 und 63. Darüber hinaus sind drei Zeitschriften ganz besonders für die deutschen Teilnehmer unserer Umfrage interessant. Hierbei handelt es sich um den *Wirtschaftsdienst*, den *DIW Wochenbericht* sowie den *ifo-Schnelldienst*.[11]

Schließlich ergeben sich auch Unterschiede, wenn die Auswertung differenziert nach den Arbeitsfeldern der Teilnehmer erfolgt.[12] Diejenigen Teilnehmer, welche in Finanzwissenschaft oder Statistik tätig sind,

[9] Es ist kaum möglich, die gesamte Debatte hier angemessen zu reflektieren, exemplarisch sei auf die verschiedenen Beiträge im *ifo-Schnelldienst* 14/2009 verwiesen sowie die Artikelsammlung auf der Homepage von Wolf-Heimo Grieben (Universität Konstanz): http://www.wiwi.uni-konstanz.de/grieben/ home/economics-in-the-newspapers/methodenstreit-der-volkswirte/.

[10] Eine vollständige Übersicht der Bewertungen der Relevanz abhängig vom Arbeitsort der Teilnehmer findet sich in Bräuninger, Haucap und Muck (2011), S. 35-37.

[11] Der *ifo-Schnelldienst* wird auch in Österreich als sehr relevant angesehen. Die kleine Teilnehmerzahl aus Österreich lässt jedoch eine vorsichtige Interpretation ratsam erscheinen.

[12] Eine Übersicht der Bewertungen der Relevanz abhängig vom Arbeitsgebiet der Teilnehmer findet sich in Tabelle 5, wobei aus Platzgründen nur die ersten 100 Ränge angegeben sind.

erachten vor allem die für den entsprechenden Bereich einschlägigen fachspezifischen Zeitschriften als besonders relevant. Im Bereich der Finanzwissenschaft sind dies z. B. das *Journal of Public Economics*, *Public Choice* sowie das *Journal of Public Economic Theory*, welche unter Finanzwissenschaftlern die Ränge 1, 7 und 13 belegen, im Gesamtranking hingegen die Ränge 14, 24 und 55. Unter den Statistikern sind entsprechend orientierte Journale wie z. B. *Review of Economics and Statistics*, *Journal of Econometrics* oder *Journal of the American Statistical Association* von hoher Relevanz für die eigene Arbeit, unter den Betriebswirten hingegen eher die management- bzw. finance-orientierten Zeitschriften wie z. B. *Journal of Finance*, *Journal of Financial Economics*, oder *Zeitschrift für Betriebswirtschaftslehre*. Dies dürfte prinzipiell sicher auch für Arbeitsmarktökonomen, Industrieökonomen oder Vertreter anderer Spezialisierungen gelten – diese wurden jedoch von uns nicht gesondert erhoben. Weiterhin zeigt sich auch ein deutlicher Unterschied in den Relevanzbewertungen derjenigen Teilnehmer, die auf dem Gebiet der Wirtschaftspolitik tätig sind, und den eher theoretisch arbeitenden Ökonomen. Beispielsweise sind die *Perspektiven der Wirtschaftspolitik*, *Brookings Papers on Economic Activity* oder der *DIW Wochenbericht* für die Arbeit wirtschaftspolitisch orientierter Teilnehmer deutlich relevanter als für theoretisch orientierte Ökonomen. Für das *Journal of Economic Theory*, *Economic Theory* oder *Games and Economic Behavior* hingegen gilt das Gegenteil. Weiterhin zeigt sich, dass Teilnehmer, die auf dem Gebiet der Wirtschaftspolitik tätig sind, empirisch ausgerichteten Zeitschriften tendenziell eine höhere Relevanz für die eigene Arbeit beimessen als dies bei theoretisch arbeitenden Ökonomen der Fall ist.

3.2. Reputation der Zeitschriften

Die Bewertung der Reputation der Zeitschriften findet sich in Tabelle 4. Analog zu Tabelle 3 ist in Spalte 2 die Zahl der Bewertungen für jede Zeitschrift aufgeführt. Spalte 3 zeigt den Rang jeder Zeitschrift, der sich aus der gewichteten durchschnittlichen Bewertung ergibt, die in Spalte 4 abgedruckt ist. Auch im Fall der Reputationsbewertungen entsprechen die Gewichte der tatsächlichen Altersstruktur des *Vereins für Socialpolitik* zum Stichtag 01.04.2011. Die Spalten 5 bis 9 enthalten die Zeitschriftenränge, welche sich aus den Bewertungen von Professoren bzw. der vier verschiedenen Altersgruppen ergeben. Der Anteil der Teilnehmer, der die Reputation einer Zeitschrift mit 4 („hohe Reputation“) oder 5 („sehr hohe Reputation“) bewertet, und der sich daraus ergebende Rang sind in den Spalten 10 und 11 angegeben. Der Zeitschriftenrang, der sich aus der durchschnittlichen Punkbewertung unserer Umfrage aus dem Jahr 2000 ergeben hat, findet sich in Spalte 12. Die Spalten 13 und 14 beinhalten die Klassifikation der Zeitschriften im Ranking des Handelsblatts von 2011 (Handelsblatt 2011) sowie die Klassifikation des *Vereins für Socialpolitik* (Schneider und Ursprung 2008).

3.2.1. Allgemeine Auswertung

Auch im Fall der Reputationsbewertungen stützt sich unsere Analyse auf eine breite Datenbasis: Jede Zeitschrift wurde durchschnittlich von 408 Teilnehmern bewertet, das Maximum liegt bei 530 Bewertungen und das Minimum bei 352. Auffällig ist, dass analog zur Bewertung der Relevanz die durchschnittliche Bewertung der Reputation einer Zeitschrift nach den ersten vier Plätzen relativ schnell

abfällt, auf den hinteren Rängen hingegen nur sehr langsam sinkt. Der Unterschied in der durchschnittlichen Reputationsbewertung zwischen Platz 100 und 150 beträgt 0,78 Punkte und damit in etwa so viel wie zwischen Platz 1 und Platz 5. Die Lorenz-Kurve für die Reputationsbewertungen ist in Abbildung 2 dargestellt, wobei der Gini-Koeffizient für die Reputationsbewertungen 0,239 beträgt.

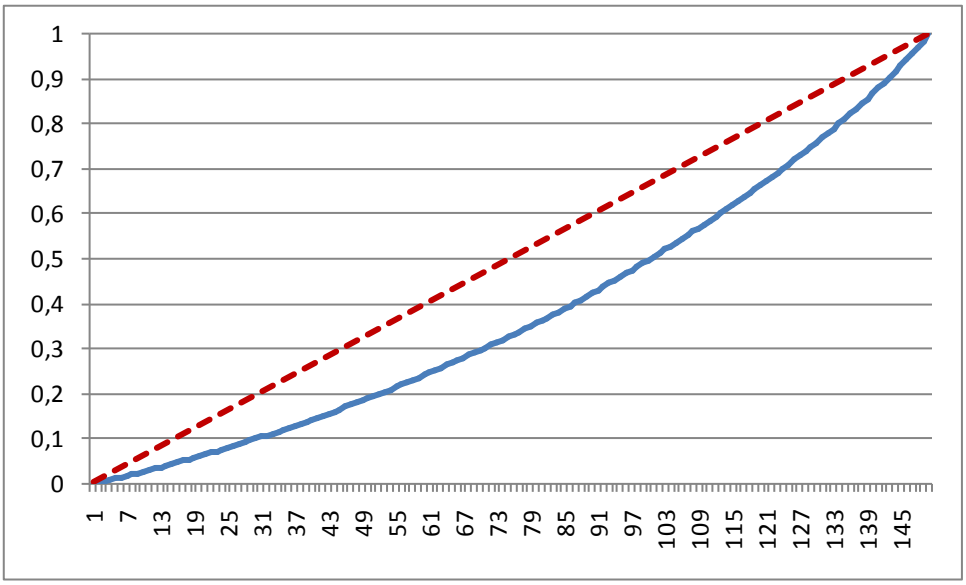


Abbildung 2-2: Lorenz-Konzentrationskurve der Reputationsbewertungen

Erwartungsgemäß genießen vor allem die international bekannten, englischsprachigen Zeitschriften eine hohe Reputation. Angeführt wird das Ranking von der *American Economic Review* mit einer durchschnittlichen Bewertung von 4,72. Auf den Rängen 2 bis 5 folgen *Econometrica* (4,34), das *Quarterly Journal of Economics* (4,33), das *Journal of Political Economy* (4,32) sowie das *Journal of Economic Literature* (3,97).

Von den Zeitschriften aus dem deutschsprachigen Raum schafft keine den Sprung in die Top 15. Die Zeitschrift mit der besten Bewertung innerhalb dieser Gruppe ist das *Journal of Institutional and Theoretical Economics (JITE)*, welches sich mit einer durchschnittlichen Bewertung von 2,30 auf Platz 50 findet, gefolgt von *Kyklos* (2,14) auf Platz 62 und der *German Economic Review* (2,00) auf Platz 67. Auffällig ist auch, dass europäische Zeitschriften wie das *Economic Journal* (Platz 7), die *European Economic Review* (Platz 16), das *Journal of the European Economic Association* (Platz 17) und das *Scandinavian Journal of Economics* (Platz 25) relativ gut abschneiden.

Gerade anhand der Zeitschriften aus dem deutschsprachigem Raum wird deutlich, dass es eine Reihe von Zeitschriften gibt, die von den Teilnehmern unserer Umfrage zwar als relevant für die eigene Arbeit erachtet werden, denen aber gleichzeitig jedoch nur eine geringe Reputation zugeschrieben wird. So belegen die *Perspektiven der Wirtschaftspolitik* im Ranking der Relevanz Platz 13, im Ranking der Reputation hingegen lediglich Platz 81. Noch deutlicher fällt der Unterschied beim i*fo-Schnelldienst* oder *Wirtschaftsdienst* aus, die in der Bewertung der Relevanz auf den Plätzen 34 und 35 rangieren, wohingegen sie bei der Bewertung der Reputation auf den Plätzen 123 und 140 liegen. Dieses Phänomen beschränkt sich jedoch nicht auf Zeitschriften aus dem deutschsprachigen Raum, sondern trifft ebenfalls

auf einige internationale Zeitschriften zu, wenngleich in abgeschwächter Form. Als Beispiel sei *Applied Economics* genannt, das im Ranking der Relevanz Platz 32, aber im Ranking der Reputation Platz 60 belegt. Jedoch gibt es auch einige Zeitschriften, die für die tägliche Arbeit der Teilnehmer zwar kaum relevant sind, aber dennoch eine hohe Reputation genießen. So erreichen *Science* und *Nature* im Rahmen der Relevanzbewertungen lediglich Platz 75 und 104, während sie bei der Reputationsbewertung Rang 8 und 10 belegen.

Weiterhin geht aus Tabelle 4 hervor, dass sich auf den vorderen Plätzen hauptsächlich allgemeine Journale befinden, wenngleich die Trennung nicht so deutlich ausfällt wie im Falle der Bewertung der Relevanz. Mit dem *Journal of Economic Theory* erreicht das erste spezielle Journal in unserem Ranking der Reputation Platz 9. Darüber hinaus ist auffallend, dass die führenden Spezialzeitschriften aus den einzelnen Disziplinen nicht nur von den Teilnehmern aus den entsprechenden Gebieten eine hohe Bewertung ihrer Reputation erhalten, sondern in der gesamten Gemeinschaft der Ökonomen ein hohes Ansehen genießen. Dementsprechend schaffen das *Journal of Public Economics*, das *Journal of Finance*, das *RAND Journal of Economics*, das *Journal of Monetary Economics* und das *Journal of Econometrics* den Sprung in die Top 20 des Reputationsrankings.

Insgesamt werden primär forschungsorientierte Zeitschriften als besonders renommiert eingestuft, während Zeitschriften mit starkem Bezug zur Praxis bei der Bewertung ihrer Reputation schlechter abschneiden. Dies dürfte ein Grund sein, weshalb die *Perspektiven der Wirtschaftspolitik*, der *ifo-Schnelldienst* und der *DIW Wochenbericht* im Ranking der Reputation deutlich schlechter bewertet werden als im Ranking der Relevanz.

3.2.2. Gruppenspezifische Auswertungen

Analog zum Vorgehen in Abschnitt 3.1.2. liegt im Rahmen der gruppenspezifischen Auswertung der Reputationsbewertungen der Fokus unserer Betrachtung vor allem auf den Unterschieden zwischen (1) den verschiedenen Altersklassen, (2) Professoren und Nicht-Professoren, (3) Teilnehmern aus Deutschland, Österreich, der Schweiz und dem nicht-deutschsprachigen Ausland sowie (4) den verschiedenen Tätigkeitsschwerpunkten der Teilnehmer.

Was die Reputation der Zeitschriften angeht, so zeigt sich zwischen den verschiedenen Altersklassen ein erstaunlich homogenes Bild. Allenfalls bei der Gruppe der über 55-Jährigen lassen sich einige Abweichungen erkennen, die jedoch weit weniger stark ausgeprägt sind als bei den Relevanzbewertungen. So erreicht zum Beispiel das *Journal of Finance* bei den über 55-Jährigen nur Rang 27, in den übrigen Altersgruppen sowie im Gesamtranking hingegen rangiert es auf den Plätzen 11 oder 13. Weitere Beispiele sind das *Journal of Financial Economics*, das *Journal of Health Economics* oder das *Journal of Banking and Finance*, welche bei den älteren Teilnehmern die Ränge 57, 71 und 74 belegen, im Gesamtranking jedoch die Ränge 30, 40 und 44. Auf der anderen Seite erreichen beispielsweise das *Scandinavian Journal of Economics*, die *Brookings Papers on Economic Activity* oder das *Journal of Institutional and Theoretical Economics* auf den Rängen 18, 20 und 29 eine deutlich höhere Platzierung als im Gesamtranking (25, 37 und 50). Auch schneiden Zeitschriften aus

dem Bereich Finance bei den über 55-Jährigen tendenziell etwas schlechter ab, wie beispielsweise das *Journal of Banking and Finance*, das in dieser Altersgruppe Platz 74 belegt (Gesamtranking Platz 44). Eine mögliche Erklärung hierfür könnte die Tatsache sein, dass unter den Teilnehmern, die auf dem Gebiet der BWL arbeiten, lediglich 8,4 % über 55 Jahre alt sind.

Wie sich aus Spalte 5 von Tabelle 4 ablesen lässt, unterscheiden sich die Zeitschriftenränge, die sich aus den Bewertungen durch Professoren ergeben, kaum von den Rängen, die aus den Bewertungen aller Teilnehmer resultieren.

Auch hinsichtlich des derzeitigen Arbeitsorts der Teilnehmer zeigen unsere Ergebnisse kaum nennenswerte Abweichungen.[13] Größere Unterschiede lassen sich hier allenfalls bei den Teilnehmern, die in Österreich arbeiten, erkennen. Allerdings könnte dies darauf zurückzuführen sein, dass lediglich 24 Ökonomen aus Österreich an unserer Umfrage teilgenommen haben.

Auf der anderen Seite finden sich jedoch durchaus Unterschiede zwischen den Bewertungen der Teilnehmer, die auf verschiedenen Gebieten der VWL tätig sind.[14] Wie im Fall der Relevanzbewertung genießen spezialisierte Fachzeitschriften ein höheres Ansehen unter den Teilnehmern aus dem entsprechenden Fachgebiet. So liegen das *Journal of Econometrics*, das *Journal of the American Statistical Association* und das *Journal of Business and Economic Statistics* unter Statistikern auf den Plätzen 9, 11 und 19, während sie im Gesamtranking die Plätze 20, 28 und 61 belegen. Für Finanzwissenschaftler trifft dies auf das *Journal of Public Economics* oder *Public Choice* zu, die Rang 5 und 19 statt 14 und 33 erreichen. Unter den Betriebswirten erhalten das *Journal of Financial Economics*, das *Journal of Banking and Finance* oder die *Zeitschrift für betriebswirtschaftliche Forschung* eine deutlich höhere Bewertung ihrer Reputation als im Gesamtranking (Plätze 11, 23 und 57 statt 30, 44 und 125). Auch zwischen Teilnehmern aus dem Bereich der Wirtschaftspolitik und solchen, die auf dem Gebiet der VWL-Theorie arbeiten, ergeben sich einige Unterschiede, wenngleich diese auch weniger stark ausgeprägt sind als im Fall der Relevanzbewertung. Besonders deutlich treten die Unterschiede bei den speziell auf diese beiden Bereiche ausgerichteten Zeitschriften hervor. Beispielsweise belegen *Games and Economic Behavior* oder die *Economic Theory* bei theoretisch arbeitenden Ökonomen die Plätze 20 und 22, bei wirtschaftspolitisch arbeitenden Ökonomen jedoch die Plätze 31 und 37. Im umgekehrten Fall erreichen die *Brookings Papers on Economic Activity* oder die *Perspektiven der Wirtschaftspolitik* in der ersten Gruppe Platz 43 und 107, in der zweiten Gruppe hingegen Platz 29 und 90. Weiterhin zeichnet sich ab, dass unter den wirtschaftspolitisch orientierten Teilnehmern empirisch ausgerichtete Zeitschriften tendenziell etwas besser abschneiden als unter theoretisch orientierten Ökonomen. Dies lässt sich beispielsweise an der *Review of Economics and Statistics* (Platz 11 statt 17), dem *Journal of Econometrics* (Platz 20 statt 24) oder dem *Econometric Journal* (Platz 46 statt 60) erkennen.

[13] Eine vollständige Übersicht der Bewertung der Reputation abhängig vom Arbeitsort der Teilnehmer findet sich in Bräuninger, Haucap und Muck (2011), S. 38-40.
[14] Eine Übersicht der Bewertung der Reputation abhängig vom Tätigkeitsgebiet der Teilnehmer findet sich in Tabelle 6, wobei aus Platzgründen nur die ersten 100 Ränge angeben sind.

4. Vergleich der Ergebnisse zu anderen Ranglisten

4.1. Vergleich zu unserer Studie aus dem Jahr 2000

Insgesamt zeigt sich im Vergleich zu unserer Studie aus dem Jahr 2000 ein genereller Trend dahin gehend, dass die Relevanz der Zeitschriften etwas besser, ihre Reputation aber schlechter bewertet wurden: So erhielten gut drei Viertel der Zeitschriften (111 von 141; neun Zeitschriften sind neu dabei) eine höhere Punktbewertung ihrer Relevanz, aber 87 % von ihnen (123 von 141) eine geringere Punktbewertung ihrer Reputation. Scheinbar sind die Befragten heute etwas kritischer bei der Bewertung der Reputation, was darauf zurückzuführen sein könnte, dass sie durch eine Vielzahl von Rankings stärker für das Thema sensibilisiert sind als dies im Jahr 2000 noch der Fall war. Die tendenziell etwas bessere Bewertung der Relevanz könnte darauf zurückzuführen sein, dass Zeitschriften insgesamt im Vergleich zu Büchern weiter an Bedeutung gewonnen haben. Dies zeigt sich z. B. auch darin, dass in den letzten Jahren eine größere Zahl von Fakultäten die kumulative Dissertation eingeführt oder sogar zum Standard gemacht hat.

Die Analyse der Bewertung der Relevanz zeigt, dass diese für die zehn Top-Zeitschriften sehr stabil ist. Auf den hinteren Rängen finden sich verschiedene Sprünge, die jedoch in wesentlichen Teilen auf relativ geringe Unterschiede in der durchschnittlichen Bewertung zurückzuführen sind. Einige größere Sprünge nach oben gab es insbesondere bei speziellen Zeitschriften, die im Jahr 2000 noch relativ neu waren. Beispiele dafür sind das *Journal of Health Economics*, das *Econometric Journal*, das *Journal of Population Economics*, *Research Policy*, das *Journal of Public Economic Theory* und *Labour Economics*. Die Tabellen 7 und 8 zeigen die zehn Zeitschriften, die hinsichtlich der Rang- und Punktbewertung ihrer Relevanz im Vergleich zu 2000 die größten Verbesserungen bzw. Verschlechterungen erfahren haben.

Von den vier neuen Zeitschriften der *American Economic Association*, die seit 2009 erscheinen, haben wir, um die Zahl von 150 Zeitschriften nicht zu überschreiten, exemplarisch nur das *American Economic Journal: Applied Economics* abgefragt, auch wenn sich Relevanz und Reputation der vier Journale durchaus unterscheiden mögen. Es zeigt sich aber auch so, dass das neue *American Economic Journal: Applied Economics* bereits für relevant erachtet und hoch geschätzt wird. In der Bewertung der Relevanz erreicht die Zeitschrift als bestplatzierter Neueinsteiger Rang 17 und bei der Reputation Platz 22, obwohl es in der Klassifizierung des *Vereins für Socialpolitik* gar nicht geführt wird und im Handelsblatt-Ranking nur 0,2 Punkte erhält. Wir gehen davon aus, dass dies für die anderen drei neuen Zeitschriften in der *American Economic Journal*-Reihe prinzipiell ähnlich sein dürfte.

Auffällig ist, dass die Bedeutung der deutschen Zeitschriften 2011 schlechter bewertet wurde als noch im Jahr 2000. Im Durchschnitt verloren sie gut 30 Plätze. Zugelegt haben nur die *Perspektiven der Wirtschaftspolitik* (Platz 13 statt 19) und die *CESifo Economic Studies* (Platz 30 statt 34). Geringe Verluste gab es beim *Wirtschaftsdienst*, der *German Economic Review* und bei *intereconomics*. Sehr

viel höhere Verluste gab es hingegen bei *WiSt* (Platz 88 statt 28), *Aussenwirtschaft* (Platz 119 statt 55) und *WISU* (Platz 103 statt 37).

Im Vergleich zur Umfrage aus dem Jahr 2000 ist auch die Bewertung der Reputation im vorderen Bereich sehr stabil. Einige Verschiebungen in den Rängen sind auf die zusätzliche Aufnahme der beiden nicht ökonomischen Zeitschriften *Science* und *Nature* zurückzuführen, welche inzwischen auch im Handelsblatt-Ranking als Top-Publikationen geführt werden und in unserer aktuellen Umfrage die Plätze 8 und 10 belegen. Eine Übersicht über die zehn Zeitschriften, die sich hinsichtlich der Rang- und Punktbewertung ihrer Reputation im Vergleich zu 2000 am stärksten verbessert bzw. verschlechtert haben, findet sich in den Tabellen 9 und 10.

Wie bei der Bewertung der Bedeutung konnten die spezialisierten und relativ neuen Zeitschriften auch bei der Reputation Gewinne verzeichnen, während die Zeitschriften aus dem deutschsprachigen Raum wieder starke Verluste hinnehmen mussten. Letztere wurden im Durchschnitt um 16 Plätze schlechter bewertet. Auffällig sind dabei Reputationsverluste insbesondere bei den forschungsstarken, referierten Zeitschriften. So haben die beiden am besten bewerteten Zeitschriften aus dem deutschsprachigen Raum, das *Journal of Institutional and Theoretical Economics (JITE)* (Platz 50) und *Kyklos* (Platz 62), jeweils 17 Ränge verloren. Noch ausgeprägter sind die Verluste bei der *Schweizerischen Zeitschrift für Volkswirtschaft und Statistik* und bei *Kredit und Kapital* mit jeweils 30 Plätzen, beim *Finanzarchiv* mit 34 Plätzen, beim *Journal of Economics* mit 37 Plätzen, bei der *Review of Worldeconomics* (früher: *Weltwirtschaftliches Archiv*) mit 41 Plätzen, bei *Schmollers Jahrbuch* mit 47 Plätzen und bei *Aussenwirtschaft* mit 52 Plätzen. Dabei ist auffällig, dass diese Zeitschriften in den Altersgruppen bis 55 relativ homogen, in der Altersgruppe 55+ aber sehr viel besser bewertet wurden. Insofern ist der Reputationsverlust darauf zurückzuführen, dass der Anteil der in einem eher nationalen Markt sozialisierten Ökonomen in den letzten Jahren zurückgegangen ist und damit der Reputationsvorteil der deutschen Zeitschriften weiter abgenommen hat.[15] Es ist jedoch festzuhalten, dass die unterschiedliche Bewertung von Zeitschriften wie bereits im Jahr 2000 (noch immer) vorhanden ist, auch wenn inzwischen die Bewertung in den Altersgruppen bis 55 relativ homogen ist.

Eine formale Untersuchung auf Basis von Spearman-Rangkorrelation für die Bewertungen von Relevanz und Reputation zeigt besonders bei der Bewertung der Relevanz gewisse Unterschiede zwischen den Altersgruppen, wie Tabelle 11 zu entnehmen ist. Dabei nehmen die Unterschiede mit dem Altersabstand deutlich zu. Die Bewertung der Reputation ist sehr viel homogener. Hier ergeben sich im Wesentlichen einige Unterschiede für die Gruppe 55+.

Die Rangkorrelationen für die Kohortenbewertungen, bei denen die Bewertung einer Altersjahrgangsgruppe der Umfrage aus dem Jahr 2000 mit derselben um zehn Jahren gealterten Gruppe der Umfrage aus dem Jahr 2011 verglichen wird, ergibt, dass sich in allen Altersgruppen Bewertungen verschoben haben, wie Tabelle 12 im Anhang zeigt. Dabei sind die Ranglisten der Reputation in den

[15] Für eine Analyse der unterschiedlichen Bewertungen von Bedeutung und Reputation in den verschiedenen Altersgruppen vgl. Bräuninger und Haucap (2003).

meisten Altersgruppen höher korreliert als die der Relevanz. Eine Ausnahme bildet die Gruppe derer, die im Jahr 2000 zwischen 36 und 45 Jahre alt waren. In dieser Gruppe haben sich die größten Veränderungen bei der Reputation ergeben. Dies ist insofern interessant, als dass bei dieser Altersgruppe der größte Anteil der Befragten sein wird, bei denen sich in den letzten zehn Jahren ein Statuswechsel ergeben hat. So könnte hier vermutet werden, dass sich mit einer veränderten beruflichen Situation auch die Reputationsbewertung verändert. Andererseits könnte auch die in diesen Jahren gewonnene Forschungserfahrung zu einer veränderten Bewertung geführt haben. Weiterhin zeigt Tabelle 12 die Rangkorrelationen für die Altersgruppen bei der Befragung 2000 und 2011. Die Korrelation einheitlicher Altersjahrgänge ist etwas geringer als die Korrelation der Bewertung innerhalb der Kohorte. Ob nun Alterungsseffekte oder Kohorteneffekte dominieren, kann dieser einfachen Analyse nicht entnommen werden. Es ist wohl davon auszugehen, dass beide Effekte eine Rolle spielen.

Ein Vergleich der Spearman-Rangkorrelationskoeffizienten zwischen Reputation und Relevanz zeigt, dass dieser heute 0,77 beträgt, während er im Jahr 2000 lediglich 0,65 betrug. Somit hat die Korrelation in den Einschätzungen von Reputation und Relevanz offenbar seit 2000 zugenommen, auch wenn bei einzelnen Zeitschriften noch immer drastische Unterschiede in den Bewertungen von Reputation und Relevanz festzustellen sind.

4.2. Vergleich zu anderen Bewertungen von Zeitschriften

Insgesamt besteht eine hohe Korrelation zwischen der Reputationsbewertung und den Klassifizierungen des Handelsblatts und des *Vereins für Socialpolitik* (VfS). Tabelle 13 stellt die Zahl der Journale in den Klassen des VfS-Ratings, deren durchschnittliche Bewertung der Reputation und den daraus resultierenden Rang in unserer aktuellen Umfrage sowie die durchschnittlichen Punkte im Rating des Handelsblatts dar.

Die Journale aus den oberen Kategorien im Rating des VfS haben auch in unserer Umfrage deutlich höhere durchschnittliche Reputationsbewertungen erhalten. Dennoch gibt es auch erhebliche Unterschiede. So finden sich in der A+-Kategorie des VfS-Ratings drei Journale, die von den Teilnehmern unserer Umfrage ähnlich bewertet wurden wie Journale im oberen A-Bereich des VfS-Ratings, und die im VfS-Rating nur mit B+ bewertete *European Economic Review* erhielt bei uns eine höhere Reputationsbewertung als die mit A+ bewertete *International Economic Review*. Damit ist die *European Economic Review* die einzige B+-Zeitschrift, deren Bewertung bei uns über dem Durchschnitt der A-Zeitschriften liegt. Gleichzeitig haben 17 von 28 B+-Zeitschriften bei uns Bewertungen erhalten, die sie in den A-Bereich bringen würden, und zwar selbst dann, wenn das *Journal of Accounting and Economics* mit der schlechtesten Bewertung unter den mit A bewerteten Journalen im VfS-Rating nicht berücksichtigt wird. Dies gilt auch für acht B-Journale. Insgesamt 20 von 24 der B-Journale haben keine wesentlich andere Bewertung erhalten als B+-Journale im unteren Bereich. Selbst drei C+-Journale (*Econometric Journal*, *Journal of Institutional and Theoretical Economics (JITE)*, *Review of International Economics*) hätten in den A-Bereich, 25 Zeitschriften in den B+-Bereich und eigentlich alle Zeitschriften in den B-Bereich gelangen können. Im VfS-Rating wurden die nicht-ökonomischen

Zeitschriften, einige neuere Zeitschriften und einige Zeitschriften ohne „normales“ Einreichungsverfahren nicht berücksichtigt. Diese Zeitschriften genießen zum Teil dennoch eine sehr hohe Reputation in unserer Umfrage. Es wurden zudem einige deutsche Zeitschriften im VfS-Rating nicht berücksichtigt. Diese haben zwar in der Regel relativ niedrige Reputationsbewertungen bei uns erhalten, werden aber oftmals nicht schlechter bewertet als Journale der C+-Kategorie.

Bemerkenswert ist sicherlich, dass das *Journal of Economic Perspectives* und das *Journal of Economic Literature* unter den Mitgliedern des *Vereins für Socialpolitik* sowohl eine exzellente Reputation genießen als auch für enorm relevant gehalten werden (hier sind beide Zeitschriften sogar unter den Top 5), die Zeitschriften aber im VfS-Ranking gar nicht gewertet werden und im Handelsblatt-Ranking beiden Zeitschriften mit 0,2 Punkten eine eher marginale Bedeutung zuerkannt wird. Umgekehrt schneiden Zeitschriften wie das *Journal of Accounting and Economics* oder *International Organization* in den Ranglisten von Handelsblatt und VfS zwar sehr gut ab (0,6/A bzw. 0,6/B), unter den deutschsprachigen Volkswirten genießen diese Zeitschriften jedoch keine besondere Reputation (beide landen nicht in den Top 100), und ihre Bedeutung wird bestenfalls als marginal eingestuft. Die Zeitschriften belegen bei der Einschätzung der Relevanz die Plätze 150 und 135 von 150.

5. Fazit

Die Ergebnisse unserer Umfrage lassen darauf schließen, dass der Markt für ökonomische Publikationen zunehmend international integriert ist. Zwar haben für deutschsprachige Ökonomen die einheimischen Zeitschriften eine relativ hohe Bedeutung für ihre eigene Arbeit. Dies gilt besonders für die wirtschaftspolitisch ausgerichteten Zeitschriften, aber auch für stärker forschungsorientierte Zeitschriften, wenn auch nicht ganz so stark ausgeprägt. Im Vergleich zu unserer Umfrage im Jahr 2000 scheint die systematisch höhere Bedeutung der Zeitschriften aus dem deutschsprachigen Raum aber abgenommen zu haben. Nichtsdestotrotz lassen sich auch heute bei einzelnen Zeitschriften erhebliche Unterschiede zwischen Relevanz und Reputation ausmachen.

Sowohl die Bewertungen der Relevanz als auch die der Reputation der Zeitschriften scheinen sich in den letzten zehn Jahren internationalen Ranglisten angenähert zu haben. Schon im Jahr 2000 dominierten auch unter deutschsprachigen Ökonomen internationale Zeitschriften die Reputationsrangliste. Inzwischen ist jedoch – mit Ausnahme der Gruppe der über 55-jährigen Ökonomen – insgesamt kaum noch ein Bias zugunsten der einheimischen Zeitschriften festzustellen. Im Jahr 2000 war die höhere Reputation der deutschen Zeitschriften wesentlich auf die Bewertung der älteren Ökonomen zurückzuführen. Damals mussten wir die Frage offen lassen, ob sich die jüngeren Ökonomen in einem stärker internationalisierten Markt bewegen oder ob bestimmte Zeitschriften für die Arbeit jüngerer und älterer Ökonomen unterschiedlich bedeutsam sind, weil jüngere Ökonomen anderen Anreizen ausgesetzt sind als ältere. Heute bewerten die Altersgruppen bis 55 die Zeitschriften relativ homogen und zwar weitgehend unabhängig von Berufsgruppen oder Karrierestufen. Somit scheint tatsächlich die Internationalisierung im Zeitverlauf zugenommen haben.

Die Verwendung von Rankings ist stets mit Vorsicht zu genießen, so auch unseres. Für die Evaluation von Forschungsleistungen hat ihre Verwendung in den letzten Jahren jedoch zweifelsohne zugenommen, auch wenn dies nur ein temporäres Phänomen sein mag, z. B. weil der technische Fortschritt individualisierte zitationsbasierte Auswertungen auf Autorenebene sehr erleichtert hat. Insbesondere ist auch festzuhalten, dass Reputation und Relevanz von Forschung nicht dasselbe sind[16] und ihre Einschätzung sich durchaus unterscheiden kann. Zumindest in Bezug auf ökonomische Fachzeitschriften zeigt sich, dass Reputation und Relevanz zwar tendenziell korreliert sind, im Einzelfall aber durchaus stark divergieren.

Die gängigen Bewertungen von VfS und Handelsblatt orientieren sich stark an der Reputation der Journale und weniger an ihrer Relevanz. Im Durchschnitt dürfte diese Vorgehensweise aufgrund der Korrelation zwischen Reputation und Relevanz unproblematisch sein, im Einzelfall mag dies aber auch zu Fehlbewertungen führen. Auffällig ist hier, dass gerade bei wirtschaftspolitisch orientierten Zeitschriften Relevanz und Reputation teilweise stark divergieren. Dies mag auch mithelfen zu erklären, warum insbesondere einige eher wirtschaftspolitisch orientierte Volkswirte die Rolle der Wirtschaftspolitik in der VWL nicht hinreichend gewürdigt sehen (wie sich z. B. im sogenannten „Ökonomenstreit“ gezeigt hat). Anzumerken ist in jedem Fall, dass wirtschaftspolitisch relevante und auf den deutschsprachigen Raum ausgerichtete Veröffentlichungen an Attraktivität verlieren, je stärker eine Bewertung von Wissenschaftlern allein auf Basis der heute gängigen Rankings vorgenommen wird, die sich stärker an der Reputation und weniger an der Relevanz der Arbeiten orientieren.

[16] Interessant ist in diesem Kontext der Beitrag von Ellison (2002), demzufolge durch die Praxis der Begutachtungsverfahren bei wissenschaftlichen Zeitschriften ein systematischer Bias zugunsten der technischen Qualität und zulasten der Relevanz der Arbeiten ausgelöst wird. Die technische Qualität eines Aufsatzes (Robustheit von Modellen, Schätzverfahren) ließe sich im Zuge der (oft mehrmaligen) Überarbeitung von Aufsätzen meist verbessern, die Relevanz der Fragestellung sei jedoch in aller Regel gegeben (oder eben nicht) und ließe sich nicht inkrementell erhöhen, sodass die Gutachter meist Vorschläge zur Erhöhung der technischen Qualität unterbreiteten, nicht aber zur Steigerung der Relevanz des Themas.

Literatur

Bergstrom, T. (2001), Free Labor for Costly Journals? *Journal of Economic Perspectives,* 15 (3), 183-198.

Bräuninger, M. und Haucap, J. (2001), Was Ökonomen lesen und schätzen. *Perspektiven der Wirtschaftspolitik,* 2, 185-210.

Bräuninger, M. und Haucap, J. (2003), Reputation and Relevance of Economics Journals. *Kyklos,* 56, 175-198.

Bräuninger, M., Haucap, J. und Muck, J. (2011), Was lesen und schätzen Ökonomen im Jahr 2011? *DICE Ordnungspolitische Perspektiven* 18, online unter http://econpapers.repec.org/paper/zbwdiceop/18.htm.

Chang, C.-L., McAleer, M. und Oxley, L. (2011), What Makes a Great Journal in Economics? The Singer, not the Song. *Journal of Economic Surveys,* 25, 326-361.

Eicker, F. (1967), Limit Theorems for Regressions with Unequal and Dependent Errors. In: *Proceedings of the Fifth Berkeley Symposium on Mathematical Statistics and Probability,* Vol. 1. University of California Press, Berkeley, 59-82.

Ellison, G. (2002), Evolving Standards for Academic Publishing: A q-r Theory. *Journal of Political Economy,* 110, 994-1034.

Ellison, G. (2010), Is Peer Review in Decline? *Economic Inquiry,* 49, 635-657.

Frey, B. S. (2007), Evaluierungen, Evaluierungen…Evaluitis. *Perspektiven der Wirtschaftspolitik,* 8, 207-220.

Frey, B. S. und Rost, K. (2010), Do Rankings Reflect Research Quality? *Journal of Applied Economics,* 13, 1-38.

Graber, M., Launov, A. und Wälde, K. (2008), Publish or Perish? The Increasing Importance of Publications for Prospective Economics Professors in Austria, Germany and Switzerland. *German Economic Review*, 9, 457-472.

Handelsblatt (2011), *Handelsblatt-Ranking Volkswirtschaftslehre*, online unter http://tool.handelsblatt.com /tabelle/?id=33, abgerufen am 18.07.2011.

Hennig-Thurau, T., Walsh, G. und Schrader, U. (2004), VHB-JOURQUAL: Ein Ranking von betriebswirtschaftlich-relevanten Zeitschriften auf der Grundlage von Expertenurteilen. *Zeitschrift für betriebswirtschaftliche Forschung,* 56, 520-543.

Hofmeister, R. und Ursprung, H. W. (2008), Das Handelsblatt-Ökonomen-Ranking 2007: Eine kritische Beurteilung. *Perspektiven der Wirtschaftspolitik,* 9, 254-266.

Hudson, J. (2007), Be Known by the Company You Keep: Citations – Quality or Chance? *Scientometrics*, 71, 231-238.

Kalaitzidakis, P., Mamuneas, T. P. und Stengos, T. (2003), Rankings of Academic Journals and Institutions in Economics. *Journal of the European Economic Association,* 1, 1346-1366.

Kalaitzidakis, P., Mamuneas, T. P. und Stengos, T. (2011), An Updated Ranking of Journals in Economics. *Canadian Journal of Economics,* 44, 1525-1538.

Keil, A. und Huber, P. (2004), „Wo die Luft dünn wird…" – Zur Publikationstätigkeit der Wirtschaftsforschungsinstitute Österreichs und Deutschlands. *Perspektiven der Wirtschaftspolitik,* 5, 363-375.

Kodrzycki, Y. K. und Yu, P. (2006), New Approaches to Ranking Economic Journals. *Contributions to Economic Analysis and Policy,* 5, Artikel 24.

Laband, D. N. und Piette, M. J. (1994), The Relative Impacts of Economics Journals: 1970-1990. *Journal of Economic Literature,* 32, 640-666.

Liebowitz, S. J. und Palmer, J. P. (1984), Assessing the Relative Impacts of Economics Journals. *Journal of Economic Literature,* 22, 77-88.

Müller, H. (2010), Wie valide ist das Handelsblatt-BWL-Ranking? Zeitschriften- und zitationsbasierte Personenrankings im Vergleich. *Betriebswirtschaftliche Forschung und Praxis,* 2, 150-164.

Oswald, A. J. (2007), An Examination of the Reliability of Prestigious Scholarly Journals: Evidence and Implications for Decision-Makers. *Economica,* 74, 21-31.

Pommerehne, W. W. (1986), Die Reputation wirtschaftswissenschaftlicher Fachzeitschriften: Ergebnisse einer Befragung deutscher Ökonomen. *Jahrbücher für Nationalökonomie und Statistik,* 201, 280-306.

Ritzberger, K. (2008), Eine invariante Bewertung wirtschaftswissenschaftlicher Fachzeitschriften. *Perspektiven der Wirtschaftspolitik*, 9, 267-285.

Schläpfer, F. und Schneider, F. (2010), Messung der akademischen Forschungsleistung in den Wirtschaftswissenschaften: Reputation vs. Zitierhäufigkeiten. *Perspektiven der Wirtschaftspolitik,* 11, 325-339.

Schneider, F. und Ursprung, H. W. (2008), The 2008 GEA Journal Ranking for the Economics Profession. *German Economic Review,* 9, 532-538.

Schrader, U. und Hennig-Thurau, T. (2009), VHB-JOURQUAL2: Method, Results, and Implications of the German Academic Association for Business Research's Journal Ranking. *BuR - Business Research,* 2, 180-204.

Schulze, G. G., Warning, S. und Wiermann, C. (2008a), Zeitschriftenrankings für die Wirtschaftswissenschaften – Konstruktion eines umfassenden Metaindexes. *Perspektiven der Wirtschaftspolitik,* 9, 286-305.

Schulze, G. G., Warning, S. und Wiermann, C. (2008b), What and How Long Does It Take to Get Tenure? The Case of Economics and Business Administration in Austria, Germany, and Switzerland. *German Economic Review,* 9, 473-505.

Seiler, C. und Wohlrabe, K. (2010), Eine Anmerkung zur Zeitschriftengewichtung im Handelsblatt-Ranking 2010. *ifo Schnelldienst,* 63, 38-39.

Steininger, M. und Süssmuth, B. (2005), Elfenbeinligen und ihre Erfassung: Ein Kommentar und eine neuerliche Messung der Publikationstätigkeit der Wirtschaftsforschungsinstitute im deutschsprachigen Raum: 1989–2003. *Perspektiven der Wirtschaftspolitik,* 6, 409-420.

Storbeck, O. (2010), Handelsblatt-Ranking VWL: Berliner VWL-Fakultäten verlieren den Anschluss, *Handelsblatt* vom 8.3.2010, online unter: http://www.handelsblatt.com/politik/oekonomie/nachrichten/berliner-vwl-fakultaeten-verlieren-den-anschluss/3385494.html

Storbeck, O. (2011), VWL-Ranking 2011: Mannheimer Volkswirte verdrängen Zürich von Platz 1, *Handelsblatt* vom 4.9.2011, online unter: http://www.handelsblatt.com/politik/oekonomie/vwl-ranking/mannheimer-volkswirte-verdraengen-zuerich-von-platz-1/4574158.html

Ursprung, W. und Zimmer, M. (2007), Who Is the "Platzhirsch" of the German Economics Profession? A Citation Analysis. *Jahrbücher für Nationalökonomie und Statistik,* 227, 187-208.

Wall, H. J. (2009), Don't Get Skewed over by Journal Rankings. *B.E. Journal of Economic Analysis and Policy,* 9, Artikel 34.

White H. (1980), A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity. *Econometrica,* 48, 817-838.

Appendix

Tabelle 2-1: Alter und beruflicher Status der Teilnehmer

	Umfrage 2000	VfS 1999	Umfrage 2011	VfS 2011
unter 36	45.9%	29.1%	31.8%	25.4%
36-45	28.4%	23.2%	32.8%	29.5%
46-55	13.3%	16.2%	20.4%	19.8%
über 55	12.4%	31.6%	15.0%	25.4%
Anzahl	429	2609[a]	705	3663[b]

[a] Über 115 Mitglieder lagen uns keine Altersangaben vor.

[b] Die Anteile beziehen sich auf 3581 Mitglieder, deren Alter zum Stichtag 01.04.2011 bekannt war.

Tabelle 2-2: Arbeitsfelder der Teilnehmer 2011

	unter 36	36-45	46-55	über 55	gesamt[a]
VWL-Politik	48.7%	48.5%	41.7%	49.1%	47.2%
VWL-Theorie	39.7%	33.8%	34.0%	37.7%	36.3%
Statistik / Ökonometrie	42.0%	24.7%	18.8%	12.3%	27.1%
Finanzwissenschaft	18.8%	15.2%	16.7%	14.2%	16.5%
BWL	8.0%	16.0%	14.6%	6.6%	11.8%
Sonstiges	12.1%	16.0%	24.3%	19.8%	17.0%

[a] Mehrfachnennungen möglich.

Tabelle 2-3: Bewertung der Relevanz

1	2	3	4	5	6	7	8	9	10	11	12
				Rang nach Gruppe					Anteil		
	N	Rang	x	Prof	<36	36-45	46-55	55+	4&5	Rang	2000
American Econ Rev	543	1	3.33	1	1	1	3	2	0.52	1	1
J Econ Literature	513	2	3.04	2	6	2	1	1	0.42	2	2
J Political Economy	510	3	2.85	3	4	4	5	3	0.40	3	3
Quarterly J Econ	481	4	2.82	5	2	3	4	6	0.38	4	5
J Econ Perspectives	478	5	2.75	4	11	5	2	4	0.34	5	4
Econ J	495	6	2.61	6	5	6	7	7	0.33	6	7
Rev Econ Studies	491	7	2.40	7	8	8	8	11	0.32	8	10
European Econ Rev	493	8	2.35	10	7	9	9	9	0.22	13	6
Econometrica	504	9	2.33	8	3	7	10	43	0.32	7	8
Econ Letters	509	10	2.17	11	12	11	17	15	0.22	12	13
J Europ Econ Assoc	505	11	2.16	9	10	10	19	20	0.24	11	-
Rev Econ & Stat	461	12	2.10	12	9	12	16	18	0.27	9	21
Persp der Wipol	482	13	1.99	14	30	21	6	5	0.22	14	19
J Public Econ	463	14	1.97	13	13	13	20	27	0.24	10	24
Scandinavian J Econ	497	15	1.86	15	16	15	11	30	0.11	36	23
Intern Econ Rev	468	16	1.86	17	14	16	31	25	0.17	17	20
Am Econ J: Applied Econ	506	17	1.77	20	15	19	30	36	0.19	15	-
German Econ Rev	511	18	1.73	21	29	24	13	13	0.10	43	9
J Econ Behav & Org	496	19	1.70	16	20	18	18	38	0.18	16	36
J Econ Theory	505	20	1.69	18	18	17	27	47	0.15	26	17
RAND J Econ	479	21	1.66	19	19	14	21	89	0.15	27	26
Oxford Econ Papers	467	22	1.61	22	37	22	25	26	0.09	54	27
Brookings Papers	487	23	1.60	25	44	29	23	14	0.15	22	16
Public Choice	483	24	1.60	26	26	23	29	31	0.14	28	30
Kyklos	502	25	1.59	24	57	35	24	8	0.09	51	12
Econ Policy	468	26	1.59	27	36	28	32	16	0.10	44	33
Europ J Pol Economy	506	27	1.57	28	31	30	33	17	0.11	37	32
Jahrb Nat & Stat	493	28	1.53	32	52	54	22	12	0.10	49	14
JITE	485	29	1.52	23	69	42	14	10	0.10	45	15
CESifo Econ Studies	501	30	1.51	40	39	47	26	24	0.10	46	34
J Labor Econ	477	31	1.49	29	22	20	37	72	0.16	20	46
Applied Econ	515	32	1.47	50	21	37	56	44	0.11	39	49
J Intern Econ	486	33	1.46	33	24	44	39	37	0.15	23	35
ifo-Schnelldienst	508	34	1.45	51	64	59	15	19	0.12	32	-
Wirtschaftsdienst	472	35	1.44	41	74	49	12	21	0.15	21	29
Labour Econ	460	36	1.42	44	23	33	49	62	0.15	25	64
J Mon, Cred & Bank	480	37	1.40	34	25	50	34	52	0.16	19	48
J Monetary Econ	458	38	1.38	46	27	45	47	49	0.15	24	41
Economica	485	39	1.38	31	46	38	35	41	0.07	75	31
J Econometrics	479	40	1.37	42	17	26	58	100	0.16	18	61
Econ Theory	468	41	1.35	36	34	36	38	63	0.09	61	44
Ox Bul Econ & Stat	454	42	1.35	37	38	34	42	58	0.11	38	68
J Law & Econ	491	43	1.31	43	62	46	45	34	0.10	48	39
J Econ Dyn & Contr	480	44	1.30	35	28	32	53	86	0.12	31	67
J Finance	480	45	1.26	38	32	31	43	123	0.14	29	51
Empirical Econ	495	46	1.26	56	35	55	51	60	0.10	47	60
Rev Intern Econ	455	47	1.25	59	33	74	55	45	0.10	42	80
Intern J Ind Org	494	48	1.25	39	55	27	46	79	0.12	34	38
J Develop Econ	449	49	1.25	47	41	61	54	48	0.12	35	74
Canadian J Econ	500	50	1.25	45	47	40	62	61	0.07	79	40

1	2	3	4	5	6	7	8	9	10	11	12
				Rang nach Gruppe					Anteil		
	N	Rang	x	Prof	<36	36-45	46-55	55+	4&5	Rang	2000
J Econ (Z Nat-ök)	486	51	1.24	54	79	71	41	22	0.06	94	18
Games & Econ Behav	499	52	1.23	30	45	25	52	91	0.13	30	69
DIW Wochenbericht	505	53	1.21	73	88	84	28	29	0.12	33	-
J Econ Surveys	474	54	1.21	49	60	57	40	50	0.06	87	58
J Public Econ Theory	485	55	1.20	48	56	43	67	57	0.09	60	84
Econ Inquiry	469	56	1.19	53	59	41	59	67	0.05	111	66
J Industrial Econ	461	57	1.16	52	65	39	44	88	0.10	50	50
DIW Vierteljah	495	58	1.13	72	84	97	36	35	0.07	86	45
J Macroecon	470	59	1.11	60	49	64	71	76	0.08	68	75
Ox Rev Econ Pol	479	60	1.11	63	75	67	57	54	0.05	102	59
Finanzarchiv	491	61	1.11	58	102	58	61	46	0.08	64	25
J Law, Econ & Org	453	62	1.10	55	80	56	48	70	0.08	69	77
Rev Worldeconomics	472	63	1.10	68	89	102	50	28	0.07	85	22
Schmollers Jahrbuch	468	64	1.08	83	87	89	82	32	0.09	62	11
Zeit Wirtschaftspol	465	65	1.08	70	110	95	64	23	0.09	56	47
J Bus & Econ Stat	484	66	1.06	57	53	52	80	112	0.10	41	98
J Population Econ	451	67	1.04	71	50	66	83	98	0.09	53	103
J Am Stat Assoc	473	68	1.03	64	43	48	108	125	0.11	40	104
J Urban Econ	455	69	1.03	62	58	51	60	122	0.09	58	86
J Intern Money & Fin	450	70	1.03	74	63	78	76	85	0.08	70	85
J Econ Growth	454	71	1.02	69	68	75	78	65	0.07	71	94
Cambridge J Econ	482	72	1.01	78	81	88	68	56	0.05	101	73
Scot J Pol Economy	456	73	1.01	81	72	73	84	71	0.05	109	93
J Financial Econ	493	74	1.00	76	51	62	72	130	0.09	59	81
Science	489	75	1.00	61	61	70	79	84	0.07	83	-
Econometric J	493	76	0.99	79	40	69	103	119	0.07	73	112
Reg Sc & Urb Econ	475	77	0.99	65	70	53	77	109	0.08	67	78
Rev Indust Org	472	78	0.99	66	67	65	89	87	0.06	92	88
Applied Econ Letters	485	79	0.99	94	42	86	95	95	0.04	115	117
J Econ History	467	80	0.98	86	98	104	75	42	0.09	55	106
Intern Tax & Publ Fin	468	81	0.98	67	78	63	70	90	0.09	52	87
J Evolutionary Econ	447	82	0.98	80	125	96	65	33	0.07	72	72
J Banking & Finance	466	83	0.97	75	66	60	66	134	0.08	65	91
Jahrb Wirtschaftsw	462	84	0.97	88	112	107	91	39	0.07	81	63
J Health Econ	480	85	0.97	87	54	81	105	108	0.09	57	127
Econometric Theory	470	86	0.96	77	48	68	94	132	0.07	77	89
Inter Rev Law & Econ	460	87	0.95	85	92	94	73	66	0.07	84	95
WiSt	508	88	0.91	91	128	103	63	55	0.07	74	28
Europ J Law & Econ	490	89	0.88	89	100	98	69	78	0.05	103	71
App Econ Quarterly	490	90	0.88	104	107	112	107	51	0.04	121	43
ORDO	487	91	0.87	107	138	122	98	40	0.09	63	56
J Env Econ & Manag	486	92	0.87	82	83	83	81	93	0.08	66	92
Regional Studies	449	93	0.87	98	77	77	93	92	0.07	80	109
Southern Econ J	464	94	0.85	84	109	82	102	83	0.02	146	54
J Econ Develop	450	95	0.85	99	90	111	110	69	0.06	93	107
Econ Modelling	488	96	0.84	110	71	101	97	114	0.05	105	110
J Comparative Econ	468	97	0.83	97	96	93	87	102	0.04	117	111
J Risk & Insurance	453	98	0.83	95	76	76	96	137	0.07	76	125
J Regional Science	471	99	0.82	92	103	79	85	101	0.05	106	83
Empirica	479	100	0.82	105	91	92	100	104	0.02	144	70

1	2	3	4	5	6	7	8	9	10	11	12
				Rang nach Gruppe					Anteil		
	N	Rang	x	Prof	<36	36-45	46-55	55+	4&5	Rang	2000
Schw Z Volks & Stat	473	101	0.81	101	137	116	90	53	0.02	142	42
Research Policy	455	102	0.81	102	94	85	88	117	0.06	90	138
WISU	494	103	0.80	103	129	115	86	73	0.07	78	37
Nature	462	104	0.80	93	95	80	99	115	0.06	89	-
J Regulatory Econ	483	105	0.79	90	101	87	106	107	0.05	100	116
J Com Market Studies	453	106	0.77	108	130	108	112	75	0.06	91	128
Rev Income & Wealth	459	107	0.76	100	111	100	115	96	0.03	134	105
J Econ & Mgmt Strat	449	108	0.75	96	97	72	109	142	0.07	82	122
J Mathematical Econ	480	109	0.74	106	86	90	140	121	0.04	118	102
Kredit und Kapital	476	110	0.73	112	122	128	116	77	0.04	123	62
Strct Chg & Econ Dyn	479	111	0.71	113	131	125	101	81	0.04	120	126
Intern J Forecasting	472	112	0.71	120	73	110	118	139	0.06	97	135
Intern Labour Rev	470	113	0.71	117	116	114	124	94	0.03	129	99
Const Pol Economy	488	114	0.71	122	136	124	114	74	0.06	96	97
AStA	476	115	0.71	116	113	91	117	126	0.05	114	96
J Forecasting	475	116	0.70	115	82	106	119	138	0.05	108	129
Econ Record	477	117	0.69	114	118	109	123	110	0.02	137	120
List Forum	452	118	0.69	126	149	130	120	68	0.06	88	65
Aussenwirtschaft	487	119	0.69	125	132	142	130	59	0.04	119	55
J Finan Quant Analy	450	120	0.66	118	85	99	136	143	0.06	95	133
The Manchester School	448	121	0.65	124	126	131	129	97	0.04	124	115
Zeit für Betriebsw	466	122	0.65	111	146	117	74	128	0.06	99	76
Econ Systems	478	123	0.64	133	133	132	141	82	0.05	110	118
Intereconomics	489	124	0.63	135	121	136	92	127	0.04	126	113
J Business	478	125	0.62	119	99	113	113	145	0.03	130	124
Gen Pap Risk & In Th	462	126	0.62	121	105	105	111	148	0.03	131	142
Industrial Relations	447	127	0.62	127	127	123	137	118	0.05	107	134
Expl in Econ Hist	455	128	0.62	130	139	118	143	103	0.05	113	136
Econ The Open-Access	456	129	0.61	132	106	135	125	105	0.03	128	-
Zfbf	474	130	0.61	109	147	119	104	124	0.06	98	79
App Financial Econ	498	131	0.60	137	93	126	133	141	0.04	125	143
Intern J Social Econ	451	132	0.59	139	114	143	132	106	0.02	145	137
J Post-Keynes Econ	466	133	0.59	128	142	150	134	64	0.05	104	114
National Tax J	479	134	0.59	123	123	121	144	129	0.05	112	100
International Organization	486	135	0.58	138	104	138	138	131	0.03	133	-
J Econ Education	476	136	0.57	129	120	129	121	135	0.03	132	149
Leviathan	477	137	0.57	141	148	148	128	80	0.02	136	123
Open Economies Rev	459	138	0.56	131	124	133	126	133	0.02	138	130
Public Finance Rev	474	139	0.56	140	108	134	135	140	0.02	149	-
Cato J	468	140	0.55	134	135	141	122	111	0.04	122	131
J Cultural Econ	479	141	0.53	142	134	145	127	113	0.02	141	132
Jahrb für Regionalw	488	142	0.51	147	144	137	142	116	0.04	127	119
Zeitschrift Umweltpol	481	143	0.50	143	145	149	131	99	0.04	116	108
An d'eco & de statist	488	144	0.49	146	117	120	149	147	0.02	139	140
Inform Econ & Policy	462	145	0.49	145	115	127	145	146	0.02	148	148
Metroecon	464	146	0.45	136	150	147	139	120	0.02	143	146
Australian Econ Rev	494	147	0.45	148	141	144	146	136	0.01	150	141
Land Econ	460	148	0.40	144	140	140	147	144	0.02	140	139
Am J Agric Econ	483	149	0.39	150	119	146	150	149	0.02	135	147
J Accounting & Econ	482	150	0.36	149	143	139	148	150	0.02	147	145

Tabelle 2-4: Bewertung der Reputation

1	2	3	4	5	6	7	8	9	10	11	12	13	14
				Rang nach Gruppe					Anteil				
	N	Rang	x	Prof	<36	36-45	46-55	55+	4&5	Rang	2000	HB	VfS
American Econ Rev	530	1	4.72	1	1	1	1	1	0.93	1	1	1.00	A+
Econometrica	478	2	4.34	2	2	2	2	6	0.84	2	2	1.00	A+
Quarterly J Econ	445	3	4.33	4	4	3	3	3	0.83	3	6	1.00	A+
J Political Economy	480	4	4.32	3	3	4	4	2	0.82	4	3	1.00	A+
J Econ Literature	486	5	3.97	6	7	7	5	4	0.73	6	4	0.20	-
Rev Econ Studies	453	6	3.83	5	6	5	9	7	0.68	7	14	1.00	A+
Econ J	467	7	3.81	7	8	6	7	5	0.73	5	7	0.60	A
Science	432	8	3.65	9	5	9	16	10	0.66	9	-	1.00	-
J Econ Theory	465	9	3.64	8	9	10	6	9	0.66	8	5	0.60	A
Nature	393	10	3.55	10	10	8	10	12	0.64	10	-	1.00	-
J Econ Perspectives	442	11	3.51	12	17	11	8	8	0.57	12	8	0.20	-
Rev Econ & Stat	414	12	3.47	13	12	12	14	11	0.61	11	15	0.60	A
J Finance	396	13	3.40	11	11	13	11	27	0.57	13	9	1.00	A+
J Public Econ	405	14	3.34	15	16	15	12	17	0.55	15	30	0.60	A
J Monetary Econ	381	15	3.28	17	13	17	15	23	0.56	14	11	1.00	A+
European Econ Rev	459	16	3.26	19	15	18	17	14	0.47	20	12	0.60	B+
J Europ Econ Assoc	457	17	3.25	16	14	16	23	15	0.51	17	-	0.60	A
RAND J Econ	424	18	3.23	14	19	14	13	33	0.52	16	25	0.60	A
Intern Econ Rev	407	19	3.16	18	20	20	20	13	0.48	18	16	0.60	A+
J Econometrics	420	20	3.09	20	18	21	18	24	0.48	19	10	0.60	A
J Labor Econ	414	21	3.02	21	23	19	25	34	0.46	21	20	0.60	A
Am Econ J: Applied Econ	461	22	3.02	25	22	24	31	19	0.40	24	-	0.20	-
J Intern Econ	414	23	2.93	27	26	27	27	25	0.40	22	22	0.60	A
J Mon, Cred & Bank	406	24	2.93	26	21	26	19	35	0.39	26	19	0.30	A
Scandinavian J Econ	454	25	2.88	29	29	30	30	18	0.30	31	36	0.20	B+
Games & Econ Behav	441	26	2.87	22	24	23	29	39	0.40	23	35	0.60	A
Econ Letters	469	27	2.86	30	25	32	34	16	0.32	29	24	0.30	B
J Am Stat Assoc	400	28	2.86	23	28	22	26	41	0.39	25	47	0.60	B+
J Econ Behav & Org	440	29	2.84	24	31	28	24	22	0.33	28	28	0.30	B+
J Financial Econ	415	30	2.82	28	27	25	21	57	0.37	27	26	1.00	A
Econ Theory	406	31	2.77	33	32	31	32	28	0.26	35	21	0.30	A
Econometric Theory	404	32	2.76	32	30	29	22	37	0.30	30	17	0.30	A
Public Choice	426	33	2.74	34	35	36	37	21	0.25	39	39	0.20	B
J Law & Econ	420	34	2.67	35	39	34	36	32	0.28	34	18	0.30	B+
Labour Econ	394	35	2.67	38	36	37	40	30	0.26	36	69	0.20	B
J Econ Dyn & Contr	414	36	2.64	31	34	33	33	47	0.28	33	29	0.30	B+
Brookings Papers	426	37	2.61	37	57	38	28	20	0.29	32	13	0.15	-
J Develop Econ	376	38	2.58	36	37	35	45	42	0.25	37	48	0.30	B+
J Macroecon	403	39	2.49	42	38	39	46	60	0.23	42	44	0.15	B
J Health Econ	400	40	2.49	44	33	44	43	71	0.22	43	56	0.60	B+
Oxford Econ Papers	415	41	2.48	41	48	47	39	31	0.17	54	43	0.20	B+
Intern J Ind Org	422	42	2.48	39	43	40	48	43	0.24	40	32	0.30	B+
J Industrial Econ	378	43	2.45	40	52	41	35	63	0.23	41	34	0.30	B+
J Banking & Finance	384	44	2.44	43	40	42	38	74	0.17	51	40	0.30	B
Ox Bul Econ & Stat	380	45	2.41	45	47	45	42	48	0.18	49	71	0.20	B+
J Mathematical Econ	395	46	2.40	46	42	52	41	45	0.20	46	27	0.20	B+
Econometric J	415	47	2.35	48	41	50	52	50	0.21	44	31	0.15	C+
J Econ Growth	373	48	2.35	51	46	43	55	67	0.21	45	53	0.30	A
J Econ History	394	49	2.31	47	56	49	44	62	0.16	57	38	0.20	B
JITE	426	50	2.30	50	61	55	50	29	0.15	61	33	0.10	C+

1	2	3	4	5	6	7	8	9	10	11	12	13	14
				Rang nach Gruppe					Anteil				
	N	Rang	x	Prof	<36	36-45	46-55	55+	4&5	Rang	2000	HB	VfS
J Urban Econ	381	51	2.30	49	50	46	49	69	0.16	58	84	0.30	B+
Rev Intern Econ	376	52	2.29	60	45	60	60	52	0.18	48	78	0.20	C+
Econ Policy	403	53	2.29	56	58	53	61	36	0.15	60	37	0.10	-
Economica	428	54	2.29	54	60	61	47	38	0.18	50	23	0.20	B+
Europ J Pol Economy	452	55	2.28	59	54	59	51	44	0.16	56	49	0.20	B
J Intern Money & Fin	370	56	2.28	58	55	58	54	59	0.17	53	51	0.30	B
J Public Econ Theory	415	57	2.24	57	51	57	57	65	0.16	59	73	0.15	-
Canadian J Econ	449	58	2.23	52	53	56	56	61	0.14	63	41	0.20	B+
J Law, Econ & Org	366	59	2.22	55	67	48	53	68	0.19	47	55	0.30	B+
Applied Econ	469	60	2.20	70	44	66	67	53	0.17	52	52	0.15	C+
J Bus & Econ Stat	402	61	2.19	53	49	51	59	78	0.25	38	63	0.60	A
Kyklos	463	62	2.14	62	70	68	63	26	0.17	55	45	0.15	B
Econ Inquiry	404	63	2.13	61	63	54	65	66	0.10	72	66	0.20	B+
J Risk & Insurance	361	64	2.06	63	62	63	58	83	0.11	67	96	0.15	B
J Population Econ	374	65	2.05	64	59	62	62	101	0.09	78	103	0.20	B+
Rev Indust Org	385	66	2.01	65	64	65	64	73	0.11	68	87	0.15	C+
German Econ Rev	485	67	2.00	67	66	72	72	49	0.10	74	46	0.10	C+
Intern Tax & Publ Fin	394	68	1.94	69	68	71	66	70	0.10	73	75	0.15	C+
Ox Rev Econ Pol	404	69	1.94	74	72	74	75	54	0.10	71	79	0.10	B
J Env Econ & Manag	408	70	1.90	66	75	64	68	81	0.14	62	59	0.30	B+
Reg Sc & Urb Econ	409	71	1.89	68	73	67	69	87	0.10	75	81	0.20	B+
Empirical Econ	427	72	1.88	71	65	84	70	72	0.09	79	72	0.15	C+
Cambridge J Econ	416	73	1.85	75	77	78	76	56	0.11	66	57	0.15	B
J Econ Surveys	396	74	1.83	72	76	70	81	77	0.08	85	61	0.05	B
J Evolutionary Econ	365	75	1.82	73	92	81	71	58	0.07	95	68	0.15	B
Inter Rev Law & Econ	378	76	1.77	84	86	82	77	79	0.08	84	65	0.10	C+
Jahrb Nat & Stat	449	77	1.77	92	81	101	102	40	0.11	69	58	0.05	C+
J Econ Develop	360	78	1.75	83	91	85	83	75	0.08	91	64	0.05	C+
J Econ (Z Nat-ök)	430	79	1.73	89	90	102	94	51	0.08	88	42	0.10	C+
Regional Studies	366	80	1.72	87	93	75	73	91	0.07	94	114	0.20	B
Persp der Wipol	451	81	1.72	95	95	99	96	46	0.08	86	86	0.05	-
Scot J Pol Economy	385	82	1.72	86	87	77	79	98	0.06	106	116	0.15	C+
J Econ & Mgmt Strat	360	83	1.69	76	88	69	78	132	0.10	70	83	0.20	B+
Finanzarchiv	431	84	1.69	79	102	89	98	55	0.09	81	50	0.10	C+
J Comparative Econ	388	85	1.69	80	89	83	82	86	0.08	90	82	0.20	B+
J Regional Science	390	86	1.68	77	96	79	80	80	0.06	111	92	0.15	B
J Finan Quant Analy	352	87	1.68	90	78	73	90	118	0.13	64	76	0.30	B+
J Forecasting	380	88	1.67	81	71	80	87	116	0.09	82	89	0.15	B
Europ J Law & Econ	412	89	1.66	94	85	91	93	82	0.06	105	67	0.10	C+
J Business	383	90	1.65	82	74	76	85	127	0.13	65	62	0.60	-
Am J Agric Econ	387	91	1.65	88	82	86	91	104	0.09	77	93	0.30	B
Econ Modelling	415	92	1.64	97	80	93	88	95	0.06	103	70	0.10	C+
CESifo Econ Studies	448	93	1.63	102	79	107	109	76	0.08	92	121	0.15	-
Applied Econ Letters	425	94	1.62	100	69	98	89	110	0.07	100	113	0.10	C+
Rev Worldeconomics	403	95	1.61	91	109	108	86	64	0.06	102	54	0.10	C+
J Regulatory Econ	390	96	1.57	85	99	87	84	102	0.05	120	120	0.15	B
Southern Econ J	397	97	1.56	78	110	90	95	88	0.07	97	77	0.15	C+
App Financial Econ	415	98	1.54	111	84	106	101	107	0.07	99	111	0.10	-
Research Policy	378	99	1.51	93	104	92	74	117	0.08	89	137	0.30	B
Intern Labour Rev	394	100	1.50	107	98	103	112	97	0.06	109	80	0.10	C+

1	2	3	4	5	6	7	8	9	10	11	12	13	14
				Rang nach Gruppe					Anteil				
	N	Rang	x	Prof	<36	36-45	46-55	55+	4&5	Rang	2000	HB	VfS
Expl in Econ Hist	360	101	1.49	96	124	96	106	85	0.09	80	115	0.15	B+
Empirica	404	102	1.48	105	94	97	105	113	0.05	118	85	0.10	C+
Rev Income & Wealth	383	103	1.47	98	107	94	100	105	0.04	125	110	0.20	B
Intern J Forecasting	391	104	1.46	103	83	104	107	126	0.06	110	105	0.15	B+
Gen Pap Risk & In Th	373	105	1.45	99	100	88	92	143	0.05	119	98	0.05	C+
An d'eco & de statist	399	106	1.41	109	97	100	115	123	0.05	117	107	0.15	C+
Strct Chg & Econ Dyn	390	107	1.39	104	113	111	97	99	0.04	127	126	0.10	C+
J Accounting & Econ	381	108	1.39	101	103	95	99	135	0.08	87	94	0.60	A
Zeit für Betriebsw	387	109	1.39	108	126	114	108	94	0.09	83	91	0.05	-
National Tax J	390	110	1.38	110	105	113	119	114	0.05	123	101	0.15	B+
Industrial Relations	356	111	1.35	113	112	109	111	130	0.04	124	118	0.15	B+
Econ Record	400	112	1.35	106	119	105	103	112	0.06	114	95	0.15	C+
J Com Market Studies	364	113	1.34	115	121	110	110	115	0.05	122	125	0.20	B
Econ Systems	393	114	1.33	119	115	118	117	93	0.05	115	109	0.10	-
J Post-Keynes Econ	389	115	1.30	114	122	126	104	89	0.07	98	117	0.10	C+
International Organization	394	116	1.29	121	101	116	124	124	0.06	108	-	0.60	B
AStA	395	117	1.29	116	118	112	116	122	0.03	133	88	0.05	-
J Econ Education	384	118	1.29	112	106	115	113	133	0.03	134	130	0.10	C+
The Manchester School	363	119	1.27	117	125	117	118	103	0.04	130	128	0.10	C+
Public Finance Rev	385	120	1.25	123	108	121	114	128	0.03	132	-	0.10	-
Schmollers Jahrbuch	404	121	1.25	128	120	122	138	84	0.07	96	74	0.10	-
Zeit Wirtschaftspol	396	122	1.21	129	129	128	133	96	0.06	107	122	0.05	-
ifo-Schnelldienst	468	123	1.19	138	117	137	143	92	0.07	93	-	-	-
Const Pol Economy	411	124	1.19	126	133	123	131	100	0.06	113	104	0.05	-
Zfbf	402	125	1.17	118	142	120	120	121	0.06	104	100	-	-
App Econ Quarterly	431	126	1.15	134	111	134	136	108	0.03	131	123	0.05	
Schw Z Volks & Stat	402	127	1.15	122	143	131	126	90	0.03	141	97	0.05	-
Jahrb Wirtschaftsw	395	128	1.14	133	130	135	134	106	0.07	101	112	--	-
Intern J Social Econ	357	129	1.13	132	116	132	125	137	0.03	139	132	0.05	-
Open Economies Rev	364	130	1.11	124	114	127	128	141	0.01	150	140	0.10	C+
Cato J	377	131	1.08	131	134	136	121	134	0.05	121	124	0.05	-
Kredit und Kapital	394	132	1.07	127	139	124	132	125	0.02	142	102	0.05	-
Australian Econ Rev	421	133	1.07	135	132	133	129	131	0.02	146	119	0.10	C+
J Cultural Econ	388	134	1.07	130	123	130	123	144	0.01	149	135	0.10	C+
Land Econ	362	135	1.06	120	137	119	122	145	0.03	138	134	0.20	B
ORDO	417	136	1.05	143	144	140	140	111	0.09	76	127	--	-
DIW Vierteljah	445	137	1.05	139	127	141	141	119	0.03	135	129	--	-
DIW Wochenbericht	460	138	1.00	144	135	147	144	109	0.06	112	-	--	-
Metroecon	373	139	1.00	125	141	125	130	139	0.02	144	142	0.10	-
Wirtschaftsdienst	429	140	0.99	142	128	138	139	142	0.05	116	131	--	-
Inform Econ & Policy	372	141	0.99	136	131	129	137	148	0.02	145	136	0.15	C+
Aussenwirtschaft	409	142	0.98	140	138	142	145	120	0.02	143	90	0.05	-
Econ The Open-Access	373	143	0.96	137	136	139	135	140	0.02	147	-	0.05	-
Leviathan	400	144	0.96	141	145	143	127	129	0.04	126	147	--	-
Jahrb für Regionalw	414	145	0.86	145	147	144	142	138	0.03	136	138	0.05	-
Intereconomics	410	146	0.83	147	140	146	146	150	0.03	140	146	0.05	-
List Forum	378	147	0.79	149	148	145	147	147	0.04	128	143	--	-
Zeitschrift Umweltpol	403	148	0.77	146	150	150	148	136	0.04	129	139	--	-
WiSt	464	149	0.76	150	146	149	149	149	0.02	148	133	--	-
WISU	445	150	0.72	148	149	148	150	146	0.03	137	144	--	-

Tabelle 2-5: Bewertung der Relevanz, abhängig vom Tätigkeitsgebiet

1	2	3	4	5	6	7	8
		Rang nach Arbeitsschwerpunkt					
	Gesamt	VWL-Politik	VWL-Theorie	Statistik	Fiwi	BWL	Sonstiges
N[a]	n.a.	333	256	191	116	83	120
American Econ Rev	1	1	1	1	2	1	2
J Econ Literature	2	2	3	5	5	3	1
J Political Economy	3	4	4	11	3	2	6
Quarterly J Econ	4	5	2	4	6	6	5
J Econ Perspectives	5	3	8	9	8	9	3
Econ J	6	6	6	7	10	8	4
Rev Econ Studies	7	8	5	8	16	7	24
European Econ Rev	8	7	9	12	9	15	12
Econometrica	9	12	7	3	19	5	11
Econ Letters	10	9	11	10	15	18	25
J Europ Econ Assoc	11	11	10	14	20	16	31
Rev Econ & Stat	12	10	18	2	33	22	20
Persp der Wipol	13	13	34	26	12	28	7
J Public Econ	14	14	17	31	1	52	36
Scandinavian J Econ	15	17	19	22	22	31	34
Intern Econ Rev	16	19	13	21	30	40	61
Am Econ J: Applied Econ	17	16	22	19	29	23	22
German Econ Rev	18	24	33	27	21	39	9
J Econ Behav & Org	19	34	16	44	35	11	14
J Econ Theory	20	37	12	51	32	19	57
RAND J Econ	21	30	15	38	18	14	27
Oxford Econ Papers	22	25	23	30	25	65	30
Brookings Papers	23	15	31	29	42	56	54
Public Choice	24	29	25	76	7	68	13
Kyklos	25	21	47	53	27	48	17
Econ Policy	26	20	39	36	17	72	55
Europ J Pol Economy	27	18	32	63	14	60	37
Jahrb Nat & Stat	28	36	52	28	34	74	8
JITE	29	44	27	90	31	27	21
CESifo Econ Studies	30	27	41	46	28	71	15
J Labor Econ	31	32	36	24	67	36	29
Applied Econ	32	23	50	25	40	33	33
J Intern Econ	33	22	28	42	68	82	96
ifo-Schnelldienst	34	28	62	57	37	70	23
Wirtschaftsdienst	35	26	65	61	26	105	26
Labour Econ	36	31	51	23	61	46	44
J Mon, Cred & Bank	37	33	26	35	82	20	98
J Monetary Econ	38	35	29	34	64	53	97
Economica	39	46	30	43	43	44	45
J Econometrics	40	38	57	6	95	41	52
Econ Theory	41	62	14	74	44	49	71
Ox Bul Econ & Stat	42	42	59	15	90	50	68
J Law & Econ	43	47	48	92	46	25	43
J Econ Dyn & Contr	44	57	21	40	76	47	114
J Finance	45	58	40	41	79	4	87
Empirical Econ	46	41	78	17	81	51	38
Rev Intern Econ	47	39	43	50	56	94	77
Intern J Ind Org	48	51	24	72	55	32	90
J Develop Econ	49	40	44	69	51	124	42
Canadian J Econ	50	48	46	59	36	62	110

[a] Mehrfachnennungen möglich

1	2	3	4	5	6	7	8
		Rang nach Arbeitsschwerpunkt					
	Gesamt	VWL-Politik	VWL-Theorie	Statistik	Fiwi	BWL	Sonstiges
J Econ (Z Nat-ök)	51	64	45	80	59	76	35
Games & Econ Behav	52	85	20	100	38	30	63
DIW Wochenbericht	53	45	103	71	63	106	19
J Econ Surveys	54	54	49	45	71	66	46
J Public Econ Theory	55	61	37	109	13	90	118
Econ Inquiry	56	55	42	48	48	57	66
J Industrial Econ	57	69	35	78	74	29	73
DIW Vierteljah	58	53	75	84	72	108	16
J Macroecon	59	52	38	56	75	114	134
Ox Rev Econ Pol	60	43	67	55	77	84	84
Finanzarchiv	61	63	83	112	11	100	64
J Law, Econ & Org	62	73	54	114	45	34	50
Rev Worldeconomics	63	49	69	65	109	123	41
Schmollers Jahrbuch	64	75	111	49	70	115	18
Zeit Wirtschaftspol	65	50	108	101	53	79	28
J Bus & Econ Stat	66	68	100	16	134	37	92
J Population Econ	67	56	84	37	50	139	95
J Am Stat Assoc	68	78	95	13	120	69	65
J Urban Econ	69	67	63	67	23	107	74
J Intern Money & Fin	70	81	71	64	115	38	106
J Econ Growth	71	59	55	83	57	135	116
Cambridge J Econ	72	65	60	79	93	91	53
Scot J Pol Economy	73	71	70	62	54	93	79
J Financial Econ	74	77	82	60	103	10	113
Science	75	89	61	87	94	43	39
Econometric J	76	70	109	18	110	59	103
Reg Sc & Urb Econ	77	66	73	70	41	88	82
Rev Indust Org	78	76	56	82	85	42	105
Applied Econ Letters	79	60	81	33	83	64	78
J Econ History	80	104	88	111	111	95	10
Intern Tax & Publ Fin	81	101	68	121	4	129	130
J Evolutionary Econ	82	95	53	124	91	111	32
J Banking & Finance	83	92	86	58	113	17	100
Jahrb Wirtschaftsw	84	97	107	94	66	116	48
J Health Econ	85	84	89	54	47	80	81
Econometric Theory	86	98	87	20	106	63	136
Inter Rev Law & Econ	87	99	74	122	52	67	49
WiSt	88	79	98	96	108	86	62
Europ J Law & Econ	89	96	77	117	58	58	59
App Econ Quarterly	90	80	101	75	116	125	69
ORDO	91	94	118	147	80	102	40
J Env Econ & Manag	92	83	85	106	69	99	102
Regional Studies	93	74	99	68	49	118	56
Southern Econ J	94	102	72	110	65	87	76
J Econ Develop	95	93	94	104	78	126	91
Econ Modelling	96	90	76	66	97	96	120
J Comparative Econ	97	72	104	89	101	120	70
J Risk & Insurance	98	128	80	99	60	24	83
J Regional Science	99	87	97	86	73	97	60
Empirica	100	86	102	52	104	101	80

Tabelle 2-6: Bewertung der Reputation, abhängig vom Tätigkeitsgebiet

1	2	3	4	5	6	7	8
		Rang nach Arbeitsschwerpunkt					
	Gesamt	VWL-Politik	VWL-Theorie	Statistik	Fiwi	BWL	Sonstiges
N[a]	n.a.	333	256	191	116	83	120
American Econ Rev	1	1	1	1	1	1	1
Econometrica	2	3	2	2	3	2	2
Quarterly J Econ	3	2	4	3	4	3	3
J Political Economy	4	4	3	4	2	5	5
J Econ Literature	5	5	7	6	6	8	4
Rev Econ Studies	6	7	5	5	8	6	8
Econ J	7	6	6	10	7	13	6
Science	8	8	9	8	10	10	12
J Econ Theory	9	12	8	13	12	9	7
Nature	10	9	10	12	14	7	9
J Econ Perspectives	11	10	13	14	9	14	11
Rev Econ & Stat	12	11	17	7	18	20	10
J Finance	13	16	11	18	15	4	31
J Public Econ	14	14	12	22	5	27	13
J Monetary Econ	15	13	15	15	20	24	23
European Econ Rev	16	15	19	17	13	22	20
J Europ Econ Assoc	17	18	18	16	16	18	21
RAND J Econ	18	17	14	26	11	12	16
Intern Econ Rev	19	19	16	21	23	30	26
J Econometrics	20	20	24	9	24	28	15
J Labor Econ	21	21	21	24	26	19	18
Am Econ J: Applied Econ	22	22	25	28	22	25	14
J Intern Econ	23	24	28	32	29	37	34
J Mon, Cred & Bank	24	23	23	23	34	15	38
Scandinavian J Econ	25	26	30	30	21	32	24
Games & Econ Behav	26	31	20	36	17	21	41
Econ Letters	27	27	26	25	31	31	28
J Am Stat Assoc	28	25	31	11	46	26	27
J Econ Behav & Org	29	35	27	34	30	16	22
J Financial Econ	30	32	35	27	44	11	39
Econ Theory	31	37	22	38	39	34	25
Econometric Theory	32	33	33	20	42	29	32
Public Choice	33	34	32	46	19	49	17
J Law & Econ	34	36	39	52	32	17	19
Labour Econ	35	30	38	33	40	36	37
J Econ Dyn & Contr	36	39	29	37	37	35	61
Brookings Papers	37	29	43	35	55	50	45
J Develop Econ	38	28	36	43	35	58	40
J Macroecon	39	38	37	41	36	40	66
J Health Econ	40	40	44	40	28	38	52
Oxford Econ Papers	41	47	42	49	38	60	33
Intern J Ind Org	42	49	34	45	54	42	54
J Industrial Econ	43	48	40	47	65	33	30
J Banking & Finance	44	43	46	39	51	23	53
Ox Bul Econ & Stat	45	45	58	29	63	52	35
J Mathematical Econ	46	52	41	54	43	44	47
Econometric J	47	46	60	31	68	47	46
J Econ Growth	48	42	45	42	50	80	57
J Econ History	49	54	50	59	53	59	29
JITE	50	56	53	70	47	48	44

[a] Mehrfachnennungen möglich

1	2	3	4	5	6	7	8
		Rang nach Arbeitsschwerpunkt					
	Gesamt	VWL-Politik	VWL-Theorie	Statistik	Fiwi	BWL	Sonstiges
J Urban Econ	51	51	47	48	25	70	51
Rev Intern Econ	52	41	54	51	57	73	55
Econ Policy	53	50	56	56	41	71	65
Economica	54	55	52	58	52	53	48
Europ J Pol Economy	55	44	57	62	45	61	43
J Intern Money & Fin	56	57	59	44	69	51	59
J Public Econ Theory	57	60	48	65	33	64	58
Canadian J Econ	58	58	49	57	48	63	85
J Law, Econ & Org	59	62	55	78	49	41	36
Applied Econ	60	53	63	55	56	65	42
J Bus & Econ Stat	61	61	65	19	102	45	72
Kyklos	62	59	70	76	60	69	49
Econ Inquiry	63	63	51	63	64	66	60
J Risk & Insurance	64	66	61	67	71	55	50
J Population Econ	65	64	64	53	62	87	71
Rev Indust Org	66	67	62	66	76	54	62
German Econ Rev	67	73	73	64	66	67	70
Intern Tax & Publ Fin	68	69	69	88	27	86	86
Ox Rev Econ Pol	69	65	75	72	87	74	67
J Env Econ & Manag	70	70	67	87	67	95	68
Reg Sc & Urb Econ	71	75	74	68	58	79	77
Empirical Econ	72	71	82	50	93	62	74
Cambridge J Econ	73	68	71	79	79	84	64
J Econ Surveys	74	74	72	71	73	81	84
J Evolutionary Econ	75	79	68	101	83	98	63
Inter Rev Law & Econ	76	78	77	99	77	77	73
Jahrb Nat & Stat	77	85	92	75	86	88	69
J Econ Develop	78	76	86	81	84	94	87
J Econ (Z Nat-ök)	79	98	78	97	81	92	75
Regional Studies	80	77	95	74	70	107	56
Persp der Wipol	81	90	107	94	75	97	80
Scot J Pol Economy	82	80	79	86	78	90	81
J Econ & Mgmt Strat	83	89	66	107	96	56	104
Finanzarchiv	84	94	98	104	61	96	90
J Comparative Econ	85	72	90	82	85	104	95
J Regional Science	86	84	88	80	72	72	83
J Finan Quant Analy	87	97	96	69	116	43	108
J Forecasting	88	82	87	60	105	76	107
Europ J Law & Econ	89	88	80	102	74	85	79
J Business	90	100	76	84	113	39	117
Am J Agric Econ	91	83	84	83	97	91	78
Econ Modelling	92	81	91	77	104	89	92
CESifo Econ Studies	93	92	85	103	80	109	88
Applied Econ Letters	94	86	89	73	90	83	91
Rev Worldeconomics	95	87	99	91	108	123	76
J Regulatory Econ	96	91	81	98	95	102	105
Southern Econ J	97	102	83	106	82	100	102
App Financial Econ	98	93	102	93	94	82	103
Research Policy	99	95	94	95	103	75	99
Intern Labour Rev	100	99	100	100	114	103	94

Tabelle 2-7: Veränderung des Rangs der Relevanzbewertung zwischen 2000 und 2011

1	2	3	4	5	6	7	8
	"Gewinner"				"Verlierer"		
	Rang 2011	Rang 2000	Δ		Rang 2011	Rang 2000	Δ
J Health Econ	85	127	42	WISU	103	37	-66
Applied Econ Letters	79	117	38	Aussenwirtschaft	119	55	-64
Econometric J	76	112	36	WiSt	88	28	-60
J Am Stat Assoc	68	104	36	Schw Z Volks & Stat	101	42	-59
J Population Econ	67	103	36	List Forum	118	65	-53
Research Policy	102	138	36	Schmollers Jahrbuch	64	11	-53
Rev Intern Econ	47	80	33	Zfbf	130	79	-51
J Bus & Econ Stat	66	98	32	Kredit und Kapital	110	62	-48
J Public Econ Theory	55	84	29	App Econ Quarterly	90	43	-47
Labour Econ	36	64	28	Zeit für Betriebsw	122	76	-46

Tabelle 2-8: Prozentuale Veränderung der durchschnittlichen Relevanzbewertung zwischen 2000 und 2011

1	2	3	4	5	6	7	8
	"Gewinner"				"Verlierer"		
	Punkte 2011	Punkte 2000	Δ		Punkte 2011	Punkte 2000	Δ
J Econ Education	0.57	0.20	186%	Schmollers Jahrbuch	1.08	1.93	-44%
Research Policy	0.81	0.35	131%	WiSt	0.91	1.46	-38%
J Health Econ	0.97	0.42	130%	WISU	0.80	1.25	-36%
Inform Econ & Policy	0.49	0.22	122%	Rev Worldeconomics	1.10	1.65	-33%
Applied Econ Letters	0.99	0.50	97%	Aussenwirtschaft	0.69	1.00	-31%
App Financial Econ	0.60	0.31	94%	Schw Z Volks & Stat	0.81	1.12	-28%
Gen Pap Risk & In Th	0.62	0.32	94%	Finanzarchiv	1.11	1.53	-27%
Intern J Forecasting	0.71	0.38	88%	J Econ (Z Nat-ök)	1.24	1.69	-26%
J Com Market Studies	0.77	0.41	88%	List Forum	0.69	0.92	-25%
Econometric J	0.99	0.54	84%	Kredit und Kapital	0.73	0.95	-23%

Tabelle 2-9: Veränderung des Rangs der Reputationsbewertung zwischen 2000 und 2011

1	2	3	4	5	6	7	8
	"Gewinner"				"Verlierer"		
	Rang 2011	Rang 2000	Δ		Rang 2011	Rang 2000	Δ
J Population Econ	65	103	38	Aussenwirtschaft	142	90	-52
Research Policy	99	137	38	Schmollers Jahrbuch	121	74	-47
Labour Econ	35	69	34	Rev Worldeconomics	95	54	-41
Regional Studies	80	114	34	J Econ (Z Nat-ök)	79	42	-37
Scot J Pol Economy	82	116	34	Finanzarchiv	84	50	-34
J Urban Econ	51	84	33	Economica	54	23	-31
J Risk & Insurance	64	96	32	Kredit und Kapital	132	102	-30
CESifo Econ Studies	93	121	28	Schw Z Volks & Stat	127	97	-30
Ox Bul Econ & Stat	45	71	26	AStA	117	88	-29
Rev Intern Econ	52	78	26	J Business	90	62	-28

Tabelle 2-10: Prozentuale Veränderung der durchschnittlichen Reputationsbewertung zwischen 2000 und 2011

1	2	3	4	5	6	7	8
	"Gewinner"				"Verlierer"		
	Punkte 2011	Punkte 2000	Δ		Punkte 2011	Punkte 2000	Δ
Labour Econ	2.67	2.29	17%	Aussenwirtschaft	0.98	1.95	-50%
J Public Econ	3.34	2.99	12%	WiSt	0.76	1.45	-48%
J Urban Econ	2.30	2.06	12%	Schmollers Jahrbuch	1.25	2.24	-44%
Rev Econ Studies	3.83	3.45	11%	Kredit und Kapital	1.07	1.86	-42%
J Population Econ	2.05	1.86	10%	Zeitschrift Umweltpol	0.77	1.33	-42%
Research Policy	1.51	1.37	10%	WISU	0.72	1.23	-41%
J Risk & Insurance	2.06	1.90	8%	Schw Z Volks & Stat	1.15	1.89	-39%
Quarterly J Econ	4.33	4.01	8%	Zfbf	1.17	1.88	-38%
J Am Stat Assoc	2.86	2.67	7%	List Forum	0.79	1.24	-37%
Rev Intern Econ	2.29	2.15	6%	Australian Econ Rev	1.07	1.68	-36%

Tabelle 2-11: Spearman-Rangkorrelationskoeffizienten

1	2	3	4	5
	<36	36-45	46-55	55+
<36		0.93	0.82	0.54
36-45	0.97		0.89	0.62
46-55	0.97	0.99		0.81
55+	0.88	0.88	0.89	

Oberer Bereich: Rangkorrelation der Relevanzbewertung.
Unterer Bereich: Rangkorrelation der Reputationsbewertung.

Tabelle 2-12: Spearman-Rangkorrelationskoeffizienten zwischen den Bewertungen von 2000 und 2011

2011 / 2000	<36[a]		36-45[a]		46-55[a]		55-65[a]		65+[a]	
	Rel.	Rep.	Rel.	Rep.	Rel.	Rep.	Rel.	Rep.	Rel.	Rep.
<36	0.82	0.95	0.90	0.96						
36-45			0.77	0.74	0.89	0.73				
46-55					0.84	0.88	0.80	0.90		
55+							0.84[b]	0.88[b]	0.85	0.87

[a] Alle angegeben Korrelationen sind auf dem 1%-Niveau signifikant.

[b] Hierbei handelt es sich um die Korrelation mit der Altersklasse 55+ unserer Umfrage von 2011.

Tabelle 2-13: Gegenüberstellung der Ergebnisse von VfS, Handelsblatt und uns

Journals	Anzahl (VfS)	∅ Punkte	∅ Rang	∅HB
A+	8	3.9	7.8	0.95
A	17	2.9	29.4	0.55
B+	28	2.2	58.3	0.27
B	24	1.9	73.4	0.21
C+	32	1.6	92.1	0.11
Nicht erfasst[a]	37	1.3	115.3	0.11

[a] Nicht erfasste Zeitschriften ohne Berücksichtigung von Science und Nature.

Erklärung über den erbrachten Beitrag

Hiermit erkläre ich, Johannes Muck, dass das Kapitel „What do German Economists Read and Value Today?“ in Zusammenarbeit mit Prof. Dr. Michael Bräuninger und Prof. Dr. Justus Haucap entstanden ist.

Dabei habe ich folgenden inhaltlichen und methodischen Beitrag erbracht:

- Ich war verantwortlich für die Aufbereitung der Daten sowie für die Erstellung der Tabellen
- Ich war verantwortlich für die Konzeption und die Durchführung der Datenanalyse
- Ich war verantwortlich für die Interpretation der Analyseergebnisse und habe an der Entwicklung der daraus resultierenden Implikationen mitgearbeitet
- Ich war verantwortlich für die Erstellung von Abschnitt 3 und habe an der Erstellung der übrigen Abschnitte mitgearbeitet

Unterschrift Koautor 1 (Prof. Dr. Michael Bräuninger): _____

Unterschrift Koautor 2 (Prof. Dr. Justus Haucap): _____

Chapter 3: What Drives the Relevance and Reputation of Economics Journals? An Update from a Survey among Economists[17]

1. Introduction

Probably more than ever, academic careers depend on the reputation of the journals in which the respective scientists publish. Hiring and tenure decisions typically depend, at least to some degree, on publications in reputed outlets, and they also play an important role in the evaluation of research institutes and departments as well as for funding decisions by science funding organizations (see, e.g., Sorzano et al. 2014). At the same time, a number of prominent scientists have voiced concerns whether the most reputed journals really publish the most relevant research (see, e.g., Frey 2005; Frey and Rost 2010). Particularly in economics, a number of critics have argued that technical research excellence tends to drive journals' and scientists' reputation (see, e.g., Ellison 2002) while the research questions' relevance is not adequately reflected in journal reputation. In consequence, critics fear that hiring and funding decisions that are heavily based on the reputation of journal publications may undervalue research relevance (see, e.g., Schläpfer 2010).

This criticism has gained additional prominence in the wake of the great financial and economic crisis which lead to a vivid discussion, among both academic economists themselves as well as within the general public, about the proper role of economists and economics as a science (see, e.g., The Economist 2009a, b, Colander et al. 2009, Krugman 2009, Lucas 2009, Besley and Hennessy 2009, and Dow et al. 2009, to name just a few contributions). One important aspect of this debate has been the concern that the connection between reputation and relevance of publications may be too loose. Put differently, already in 1997, Marc Blaug criticized that "modern economics is sick; economics has increasingly become an intellectual game played for its own sake and not for its practical consequences for understanding the economic world. Economists have converted the subject into a sort of social mathematics in which analytical rigor is everything and practical relevance is nothing" (Blaug 1997, p. 3), something also criticized recently by Piketty (2014) in the introduction to his book. The aim of our paper is now to shed a bit more light on the relationship between reputation and relevance of economic journals. Even though we focus on journals' relevance for the own profession (and not its relevance for economic policy or other purposes), our analysis yields that there are already significant differences in a journal's reputation and its perceived relevance among economists themselves. Hence, we would expect this discrepancy to be even wider among policy makers.

[17] We would like to thank all economists who have participated in our survey. Moreover, we thank Elisabeth Flieger, Susanne Schäfers and Olaf Siegert (all of ZBW – Leibniz-Informationszentrum Wirtschaft) for their excellent support in conducting the survey and assembling the data. For comments and very useful discussions we thank Michael Bräuninger and Florian Heiß.

The remainder of our paper is now organized as follows: Section 2 summarizes related literature and briefly comments on our contribution to the existing literature before section 3 reflects on the factors that determine economic journals' reputation and relevance. Section 4 describes our survey and dataset, and section 5 describes the econometric methodology employed, before we present and discuss the results of our estimations in section 6. Finally, section 7 concludes.

2. Related Literature and own Contribution

Our paper adds to the discussion about the market for economic journals and their reputation and relevance, as we try to measure empirically how economic journals' reputation and their perceived relevance interact. In fact, there are numerous journal rankings nowadays, which aim at measuring a journal's reputation (see, e.g., Kalaitzidakis, Mamuneas and Stengos 2003, Ritzberger 2008, Iyengar and Balijepally 2015) and which are mostly based on some measure of journal citations. And there are also several contributions which discuss the strengths and weaknesses of these rankings (see, e.g., Beed and Beed 1996, Oswald 2007, Frey and Rost 2010)[18]. However, there has been comparatively little empirical analysis of the sources of journal reputation, even though publications in reputed journals are key to academic careers today (see, e.g., Graber, Launov and Wälde 2008). Notable exemptions are papers by Danielson and Delorme (1976), Ellis and Durden (1991), Bräuninger and Haucap (2003) as well as a recent series of papers by Chang, McAleer, and Oxley (2011a, b, c).

The first paper that empirically analyzed the determinants of economic journal reputation is Danielson and Delorme (1976). Their key finding was that American economists had a bias against foreign journals, even including British journals. While volume, age, and specialization did not affect the reputation of non-American journals, volume (measured in pages) was the most important determinant for the reputation of American journals, followed by age, an orientation towards theoretical or statistical economics, and editors coming from top-level universities. Moreover, Ellis and Durden (1991) found that the scientific impact of a journal, as measured by citation frequency, and a journal's past reputation, as reflected in earlier quality rankings, influence economists' perceptions of journal quality. Moreover, they also found a bias towards more theoretical or general journals as well as towards older, more established journals. Bräuninger and Haucap (2003) conducted the only empirical study that directly investigates the interrelationship between economic journals' reputation and their perceived relevance. They found that reputation positively affects perceived relevance and vice versa, but perceived relevance has a much stronger impact on reputation than reputation on perceived relevance. Citation frequency, as measured through the SSCI impact factor, was found to be a key factor for both journal reputation and perceived relevance, even though the effect on journal reputation was nearly twice as large as the effect on relevance. Given citation frequency, specialized journals were considered less relevant and, hence, also less reputed, although the direct effect of specialization on reputation was positive. While German-

[18] The use of these rankings for evaluation purposes has been heavily debated in many scientific disciplines and countries (see, e.g., Albers 2009, Franses 2014, Frey and Osterloh 2014), recently even leading to a boycott of business scholars in Germany (see Berlemann and Haucap 2015).

speaking economists considered domestic journals more relevant, they simultaneously rated them considerably less reputed than foreign journals. Moreover, respondents considered journals without referee process both less relevant and less reputed than refereed journals. In contrast, the number of published articles increased journals' relevance and their reputation. Finally, older journals were more reputed, whereas age hardly affected a journal's relevance.

Finally, Chang, McAleer, and Oxley (2011a, b, c) recently analyzed the interrelationship between the reputation of journals and their authors' reputation. They find that "great authors" lend their reputation to journals, while the reputation effect from journals towards authors is much smaller, at least for established authors. This finding is consistent with Ellison's (2011) observation that authors from top universities such as Harvard enjoy greater reputation effects from being at a top university (i.e., Harvard) than from particular journal publications.

This paper builds on Bräuninger and Haucap (2003) and analyzes the results of a recent survey among German speaking economists (see Bräuninger, Haucap and Muck 2011a, b). In this survey, respondents were asked to rate up to 150 academic journals with respect to, first, the journals' relevance for their work, and, second, respondents' perception of the journals' reputation. Both assessments were to be made on a six-point Likert scale, ranging from 0 (no relevance / reputation) to 5 (very high relevance/reputation). In our analysis we examine the interaction between respondents' rating of journals' relevance and reputation and we investigate which additional factors affect these two evaluations. We also compare our new results with those obtained about ten years ago by Bräuninger and Haucap (2003) in an almost identical survey among German speaking economists. This allows us to draw some conclusions about the cultural change within the academic economics profession and the scientific community of economists within the German Economic Association.

3. Relevance and Reputation of Economic Journals

From a reader's perspective, a scientific article is, like any information product, an experience or even a credence good. The quality of an article is ex ante unknown and can sometimes not even be properly detected without additional cost after consumption, as the recent debate about the research by Carmen Reinhart and Ken Rogoff illustrates (see, e.g., Krugman 2013, Reinhart and Rogoff 2013). Comparable to other experience and credence goods markets (see, e.g., Dullek and Kerschbaumer 2006), various institutions have developed to overcome potential failures in the market for academic journals. The most obvious quality-insuring institution is the peer review process, even though its merits, efficiency, and biases have been debated for quite some time (see, e.g., Laband 1990, Blank 1991, Engers and Gans 1998, Ellison 2002, 2011, Frey 2005, Azar 2005, Ma et al. 2013, Demarest, Freeman and Sugimoto 2014). In addition to peer review, reputation mechanisms can serve as a quality-assuring institution, even though journal quality is certainly a multi-dimensional concept, comprising, among other things, the articles' innovativeness, their relevance, and their rigor of methodology (see, e.g., Beed and Beed 1996). A journal's reputation may result from its authors' reputation (see Chang, McAleer, and Oxley 2011a, b), the reputation of the journal's editors (see, e.g., Danielsen and Delorme 1976, Hodgson and

Rothman 1999), the publisher's brand name (see Bräuninger and Haucap 2003), the journal's age as a proxy for successful survival of the journal (see Ellis and Durden 1991), previous journal rankings (also Ellis and Durden 1991) and, of course, past citations (see Ellis and Durden 1991, Sutter and Kocher 2001, Bräuninger and Haucap 2003, Chang, McAleer, and Oxley 2011a, b). With respect to past citations, a linear impact on reputation can easily be measured by the number of citations per article while a non-linear influence can be captured through the so-called H-index.[19] While citations per article measure the average impact of a particular journal's (average) article, the H-index may be interpreted as measuring the number of "seminal papers" or "landmark articles" that a journal has published. Even if a journal has many uncited articles and, therefore, a low number of average citations per paper, the journal may enjoy a high reputation if it also published many seminal papers at the same time. In fact, since the distribution of citations among journal articles within any given journal is typically heavily skewed with some articles being heavily cited and others being widely ignored (see, e.g., Wall 2009), average citation numbers may only imperfectly capture the sources of a journal's reputation.[20]

Past journal rankings (which often build on past citation measures) may also affect journals' reputation, as previous studies have shown. One reason may be that rankings may be used as a proxy for quality especially for journals which are outside one's own area of expertise. In addition, a journal's place of publication has been found to affect its reputation. For example, Danielsen and Delorme (1976) empirically identified a positive home bias in favor of American journals among American economists, controlling for other factors, while Bräuninger and Haucap (2003) reported a negative home bias against German journals among German speaking economists.

A journal's relevance for the work of academic economists can, in principle, be affected by many of the same factors. Citation measures such as the average number of citations per paper and the H-index clearly indicate that at least some of the journal's articles are relevant at least for the work of some researchers (who have cited them). In general, we conjecture that a journal's perceived relevance for the work of its readers is increasing in these measures. In addition, a journal's perceived relevance should be increasing in the number of articles published, as the likelihood of at least some published article(s) being relevant for the work of a particular researcher should increase in the number of articles published. Furthermore, domestic and German-language journals may be more relevant for the work of German economists, as these journals may put more emphasis on topics of particular interest to the German-speaking community of economists. In addition, we also conjecture that most specialized journals are less relevant than general interest journals for many economists, given the division of labor among economists. However, expectations about the quality of a journal's articles – i.e., the journal's reputation – should, ceteris paribus, not differ between field journals and general interest journals once we control for citation rates and other factors which determine reputation. Similarly, association journals may directly affect relevance, as they are often distributed to all association members. However, we would

[19] The H-index (see Hirsch 2005) is the maximum number n of articles that have been cited at least n times.
[20] Note, however, that journal rankings based on impact factors are remarkably stable even if one removes the journals' most heavily cited articles from the count (see Seiler and Wohlrabe 2014).

not expect a direct effect on article quality (and, hence, journal reputation), even though an indirect effect may exist.

4. Data Description

To study the determinants of journals' relevance and reputation as perceived by their readers we use survey data on the evaluations of 150 economics journals (a copy of our German questionnaire is available in Bräuninger, Haucap, and Muck (2011b, p. 52-56)). The survey was conducted among German-speaking economists in April 2011 and the 150 journals included the most important economics journals listed in international journal rankings as well as most journals published in Germany, Austria, and Switzerland (for a complete list of all journals see Bräuninger, Haucap, and Muck (2011b)). With the exception of nine journals, the journal list coincides with the one used in Bräuninger and Haucap (2001, 2003).[21] To avoid potential ordering effects, the 150 journals were randomly grouped into three blocks (A, B, C) and presented randomly to the participants in one of three different orders (ABC, BCA, CAB), where respondents could decide to either rate the journals in one, two, or all three blocks. For each journal, respondents were asked to indicate (1) how relevant the journal is for their own work and (2) how they assess the journal's reputation. Both assessments were made on a six-point Likert scale, ranging from 0 (no relevance / reputation) to 5 (very high relevance / reputation). Additionally, we asked respondents to provide information about their age, affiliation, academic status, place of work, and current research focus.

The survey was sent via an individualized email-link to all 2991 individual members of the German Economic Association (GEA). Of the 909 respondents who opened the survey, 705 participants evaluated the journals in at least one block while 76 participants evaluated journals in all three blocks. On average, 478 (408) respondents evaluated a journal's relevance (reputation). For our analysis, we defined the dependent variables Relevance (Reputation) as the weighted fraction of respondents evaluating a journal's relevance (reputation) as either four (high) or five (very high). The fractions were weighted using the respondents' age groups, and the weights were set to mirror the actual age distribution of the members of the GEA as of April 2011. We did not use the average evaluation of a journal's relevance or reputation in absolute points since many journals showed only negligible differences in their average evaluations, especially towards the lower end of the scale (for details see Bräuninger, Haucap, and Muck 2011b). For instance, the difference in the average evaluation of relevance between Empirica, ranked 100th according to its relevance, and the Journal of Accounting and Economics, ranked 150th, is only 0.46 points. However, limited variation in our dependent variables negatively affects the precision of the estimation. This is the case because both journal relevance and reputation also serve as independent variables for each other due to the simultaneous relationship

[21] We replaced Australian Journal of Agricultural Economics, Die Weltwirtschaft, Hamburger Jahrbuch für Wirtschafts- und Gesellschaftspolitik, Homo Oeconomicus, Jahrbuch für Neue Politische Ökonomie, Public Finance Quarterly, Public Finance, RWI-Mitteilungen, and Swedish Economic Policy Review, as most of them ceased to exist, by American Economic Journal: Applied Economics, DIW-Wochenbericht, Economics-The Open-Access Journal, ifo Schnelldienst, International Organization, Journal of the European Economic Association, Nature, Public Finance Review, and Science.

between the two. However, the precision of the coefficient estimates (indicated by their variance) decreases if the variance of the independent variables decreases (Wooldridge 2013, p. 52). For the same reason we did not utilize a journal's rank. As illustrated by the previous example, large differences in the ranks of two journals would be based on rather small differences in absolute evaluation points, thereby potentially leading to an overestimation of the effects of our independent variables. Moreover, this approach follows Bräuninger and Haucap (2003) and, therefore, allows us to compare our results to their findings in section 6.5.

We gathered information on various journal characteristics from different data sources as the independent variables of our analysis. From the Social Sciences Edition of the Journal Citation Report (JCR) (see Institute for Scientific Information 2010, 2011), we collected the number of articles published by each journal in 2009 and 2010, which we averaged to create the variable Volume. For the journals not covered by the JCR, we manually counted the number of articles in 2009 and 2010.

We collected a journal's H-index (Hirsch 2005) as well as the average number of Cites/Paper using the software tool Publish-or-Perish (Harzing 2007) which processes information provided by Google Scholar to calculate various bibliometric statistics.

We adopted the journals' Age from Bräuninger and Haucap (2001) and added eleven years and manually gathered the necessary information for the nine journals not included in Bräuninger and Haucap (2001).

Furthermore, we included the journal rating (HB-Rating) from the economics rankings conducted by Handelsblatt, Germany's leading business newspaper (see Handelsblatt 2011) as well as the journal rating published by the German Economic Association in 2008 (Schneider and Ursprung 2008). For its research rankings of German speaking economists and economics departments, the Handelsblatt assigns weights of 1.0, 0.6, 0.3, 0.2, 0.15, 0.1 or 0.05 to each of the more than 1500 journals listed in EconLit (see Handelsblatt 2011), while the 2008 GEA rating only includes 281 journals rated as A+, A, B+, B, or C+ (i.e., five categories). The non-numerical GEA rating was converted into the numerical variable GEA-Rating by assigning a value of 1 to journals rated A+, 0.6 for A-journals, 0.3 for B+ ones, 0.2 for B, and 0.1 for C+. This coding scheme was chosen so that the values for GEA-Rating roughly compare to the ones of HB-Rating. We set the respective values of HB-Rating and GEA-Rating to 0 if a journal was not covered by the rating.

Finally, we created several dummy variables indicating whether a journal is Refereed, whether the majority of its editorial board is German-speaking (Domestic), whether it also publishes articles in German, whether it is published by Elsevier, Springer, or Wiley-Blackwell, whether it is published by an Association, and whether it is a Special (field-) journal, i.e., focusing on special subfields of economics (such as public finance or industrial economics) as opposed to general interest journals.

5. Hypotheses, Econometric Model, and Estimation Strategy

Building on our discussion in section 3, we expect that the variables H-index, Cites/Paper, Volume, Refereed, Domestic, and German affect both a journal's Relevance and its Reputation. At the same time,

we expect a journal's Relevance to depend on its Reputation and vice versa, as reported by Bräuninger and Haucap (2003). Furthermore, we hypothesize that a journal's Relevance increases if it is published by an economic Association, while we expect its Relevance to decrease if it focuses on a Special field of economics (compared to general-interest journals). Regarding journal Reputation, we conjecture this may additionally be affected by its publisher (Elsevier, Springer, or Wiley-Blackwell) as well as by the journal's past ratings in HB-Rating and GEA-Rating, and also its Age (having passed the test of time).

Hence, we arrive at a system of two simultaneous equations, since we expect a journal's Relevance to affect its Reputation and vice versa. More specifically, we estimate the following two equations:

$$(1)\ Relevance = \alpha_0 + \alpha_1 Reputation + \alpha_2 Hindex + \alpha_3 Cites/Paper + \alpha_4 Volume + \alpha_5 Refereed + \alpha_6 Domestic + \alpha_7 German + \alpha_8 Association + \alpha_9 Special$$

and

$$(2)\ Reputation = \beta_0 + \beta_1 Relevance + \beta_2 Hindex + \beta_3 Cites/Paper + \beta_4 Volume + \beta_5 Refereed + \beta_6 Domestic + \beta_7 German + \beta_8 Elsevier + \beta_9 Springer + \beta_{10} WileyBlackwell + \beta_{11} Age + \beta_{12} HB\ Rating + \beta_{13} GEA\ Rating$$

where Elsevier, Springer, Wiley-Blackwell, Age, HB-Rating, and GEA-Rating serve as instruments for Reputation in equation (1) and Association and Special instrument Relevance in equation (2).

Typically, a system of two simultaneous equations with continuous dependent variables is estimated either in a two-step approach using the two-stage least-squares (2SLS) estimator or simultaneously using the three-stage least-squares (3SLS) estimator. Albeit being continuous, the two dependent variables of our analysis are bound to the interval [0,1] since they denote the percentage of respondents rating a journal's relevance (reputation) as either "high" or "very high". However, neither the 2SLS nor the 3SLS estimator ensures that the fitted values of the dependent variables are also limited to the unit interval. Hence, it is not fully appropriate to estimate equations (1) and (2) with either 2SLS or 3SLS, just as the linear probability model is not fully appropriate to estimate models with binary dependent variables (Wooldridge 2013, pp. 238-243).

To properly reflect the limited nature of our dependent variables, we additionally estimate a fractional response model (FRM) which uses a Bernoulli Quasi Maximum Likelihood Estimator and ensures that the fitted values also lie within the unit interval (see Papke and Wooldridge 1996). Moreover, to account for the endogeneity of Relevance and Reputation in the system of two equations, we employ the control function approach suggested by Wooldridge (2010, 2014) which proceeds in three steps. In the first step, each endogenous variable (Reputation in equation (1) and Relevance in equation (2)) is regressed on its instruments and the other independent variables to obtain the fitted residuals. Since both endogenous variables are also limited to the unit interval and do not take on the boundary values of 0 and 1 in our data, we follow Wooldridge's (2010, p. 754) recommendation and use the log-odds transformation

before obtaining the fitted values.[22] In the second step, we estimate equations (1) and (2) separately using a fractional probit model (Ramalho, Ramalho, and Murteira 2011; Ramalho, Ramalho, and Henriques 2010) with the fitted residuals of the respective endogenous variable added as an additional regressor. In the third step, we compute the average marginal effects to facilitate a convenient interpretation of the estimated coefficients.

We also estimated equations (1) and (2) by 2SLS to enable computation of standard tests of instrument exogeneity and instrument strength which are not (yet) available for fractional probit models. We did not estimate the system of two equations simultaneously because the 3SLS estimator is only more efficient than the 2SLS estimator if the homoskedasticity assumption holds (Statalist 2010). However, this assumption is usually violated in the case of fractional response models (Papke and Wooldridge 1996, p. 621).

6. Drivers of Journals' Perceived Relevance and Reputation

6.1 Descriptive Statistics

Table 1 shows the descriptive statistics of the variables used in the analysis both for all 150 journals of the current survey as well as for the subset of journals coinciding with the journals used in the survey of Bräuninger and Haucap (2001, 2003). To facilitate an easy comparison, Table 1 also contains the descriptive statistics from the survey of Bräuninger and Haucap (2001, 2003). On average, 10% of the respondents evaluate a journal's relevance as either high or very high, which is a slight increase as compared to the survey from 2000. At least this particular finding does not appear to support Ellison's (2002, 2011) hypothesis that journals become ever less relevant.

At the same time, the average fraction of respondents evaluating a journal's reputation as high or very high dropped from 25% in 2000 to 19% in 2011. Also note that due to (a) the software developed by Harzing (2007) and (b) new journal ratings we are able to include some more informative (explanatory) variables than Bräuninger and Haucap (2003).

Compared to the survey statistics of 2000, several independent variables remain constant. This is the case for the fraction of refereed journals (92%), the fraction of journals also publishing German articles (13%), the fraction of journals with a predominantly German speaking editorial board (22%), and the age-composition of the 150 journals. The fraction of journals published by an economic association increases by two percentage points to 23%, while the fraction of specialized journals in our list decreases to 61%. Interestingly, the average number of articles published by each journal has increased significantly from about 46 in 2000 to almost 70 articles per year in 2011. This steep increase is, partly due to the fact that we have also included Nature and Science in our current survey. Each of these two journals publishes more than 800 articles per year, which is more than twice as much as the number of articles published by Applied Economics Letters, which has the third highest volume with 331.5 articles

[22] The log-odds transformation for a variable x is defined as log [x/(1-x)].

Table 3-1: Descriptive Statistics

	2010 - All Journals			2010 - Coinciding Journals			2000		
	N	Mean	Std. Dev	N	Mean	Std. Dev	N[a]	Mean	Std. Dev.
Relevance	150	0.10	0.08	141	0.10	0.09	141	0.08	0.09
Reputation	150	0.19	0.21	141	0.19	0.20	141	0.25	0.21
Age	150	51.79	33.03	141	51.79	31.99	141	40.79	31.99
Refereed	150	0.92	0.27	141	0.93	0.26	141	0.92	0.27
Volume	149	69.72	107.58	140	58.17	52.73	141	45.82	35.25
German	150	0.13	0.34	141	0.13	0.33	141	0.13	0.31
Domestic	150	0.22	0.42	141	0.22	0.42	141	0.22	0.42
Association	150	0.23	0.42	141	0.22	0.42	141	0.21	0.41
Special	150	0.61	0.49	141	0.62	0.49	141	0.66	0.48
Elsevier	150	0.22	0.42	141	0.23	0.42	141	0.18	0.39
Springer	150	0.13	0.34	141	0.14	0.35	-	-	-
Wiley-Blackwell[b]	150	0.19	0.39	141	0.20	0.40	141	0.17	0.38
H-index	150	90.23	105.43	141	81.94	61.38	-	-	-
Cites per Paper	150	23.18	42.56	141	18.82	17.49	-	-	-
HB-Rating	150	0.26	0.26	141	0.25	0.25	-	-	-
GEA-Rating	150	0.23	0.26	141	0.24	0.26	-	-	-

[a] Note that we replaced nine journals from our survey in 2000 by new ones.

[b] In 2000, Wiley and Blackwell had not merged yet, only Blackwell was used as a dummy variable.

per year. Once we exclude Nature and Science, the average volume falls to about 59 articles per year. But even if we only consider those journals which were already part of the survey in 2001, the number of articles increases to an average of 58, which still is a significant increase from 46 though.

The three largest publishers of economics journals, Elsevier, Springer, and Wiley-Blackwell, jointly account for 54% of all journals in our list. On average, each journal has approximately 90 articles that have been cited at least 90 times, and each article is cited 23.2 times. For the subset of journals, which were also surveyed in 2001, the respective values are somewhat lower with values of 82 and 18.8, respectively, which, again, can be mainly attributed to the inclusion of Nature and Science in the current survey both of which have very high H-indices and citation scores. The average score of a journal in the Handelsblatt rating is 0.26 and it is 0.23 in the GEA rating.

The correlation coefficients among the independent variables mostly show low to moderate values (see Table 4 in the Appendix). Notable exceptions are the correlations between the variables Refereed, German, and Domestic, taking on values of -0.68, -0.56, and 0.74 respectively. The two citation measures, namely H-index and Cites/Paper, are not only highly correlated with each other (0.92), but also with Volume (0.77 and 0.80) as well as HB-Rating (0.71 and 0.61). Unsurprisingly, HB-Rating and GEA-Rating are also highly correlated, with a coefficient of 0.80.

Figures 1 and 2 show the relationship between the fraction of respondents evaluating a journal's relevance for its readers (Figure 1) or reputation (Figure 2) as "high" or "very high" and its respective evaluation in the journal ranking of the Handelsblatt (left panels) and the GEA (right panels). Figure 1 suggests a positive relationship between the fraction of respondents evaluating a journal as highly relevant and its rating in the journal ranking of the Handelsblatt or the GEA, respectively. Yet, several journals exist which are rated as highly relevant despite receiving relatively low ratings in journal rankings or vice-versa. Similar findings apply to the relationship between journals' reputation and their ratings in journal rankings, albeit to a lesser degree (see Figure 2).[23]

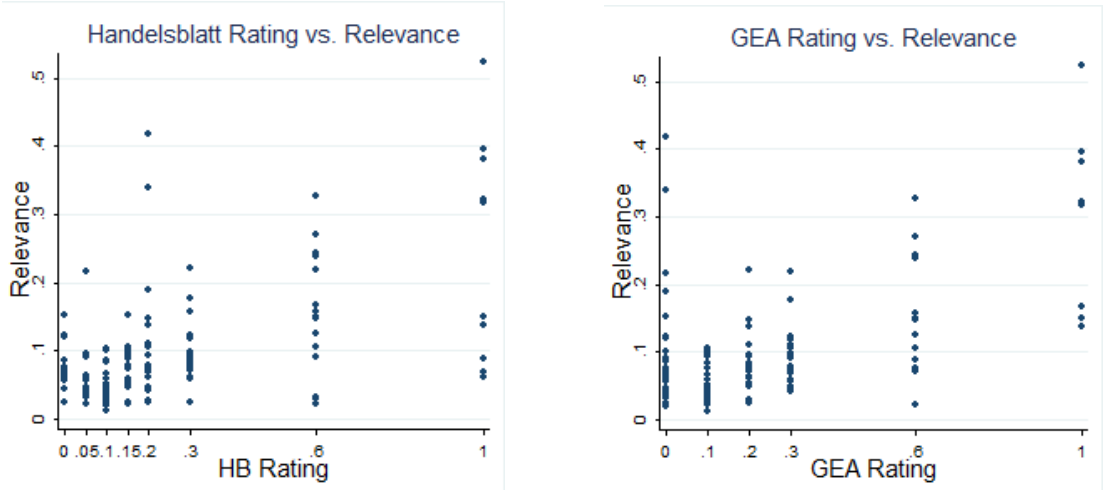


Figure 3-1: Relationship between journals' relevance and ratings in journal rankings

[23] For a more detailed analysis of the interrelationship between respondents' evaluation of journals and journals' rating in the journal rankings of the Handelsblatt and the GEA see Bräuninger, Haucap, and Muck (2011b).

Figure 3-2: Relationship between journals' reputation and rating in journal rankings

Figure 3 gives an overview over how many journals were rated as highly relevant by 0-10%, 11-20%, 21-30%, 31-40%, 41-50% and more than 50% of respondents, whereby the fractions were calculated for both the complete sample as well as for five different age groups (below 36, 36-45, 46-55, 56-65, and above 65). For instance, the first bar in Figure 3 indicates that the number of journals, which are evaluated as "highly relevant" by 0-10% of respondents, is 105 in the complete sample while the second bar indicates that this number increases to 110 in the sample of respondents aged below 36. Figure 4 contains the corresponding analysis for the evaluation of journal reputation. These figures offer two key insights. First of all, most journals are considered highly relevant or highly reputed only by a small fraction of economists. For instance, 134 (105) journals are considered highly relevant (reputed) by no more than 20% of respondents while only 8 (17) journals exist, which are regarded as highly relevant (reputed) by more than 30% (50%) of respondents. Secondly, while the evaluations of respondents in the first three age groups are comparably homogeneous, respondents aged 55 years and older consider more journals as highly relevant or reputed. For example, only 83 (54) journals exist which are considered as highly relevant (reputed) by at most 10% of respondents aged above 65.

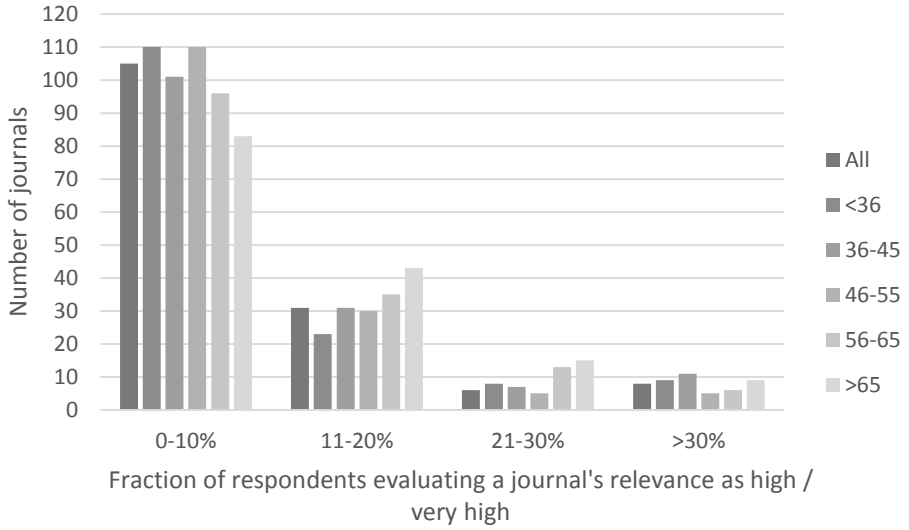


Figure 3-3: Distribution of Relevance Evaluations

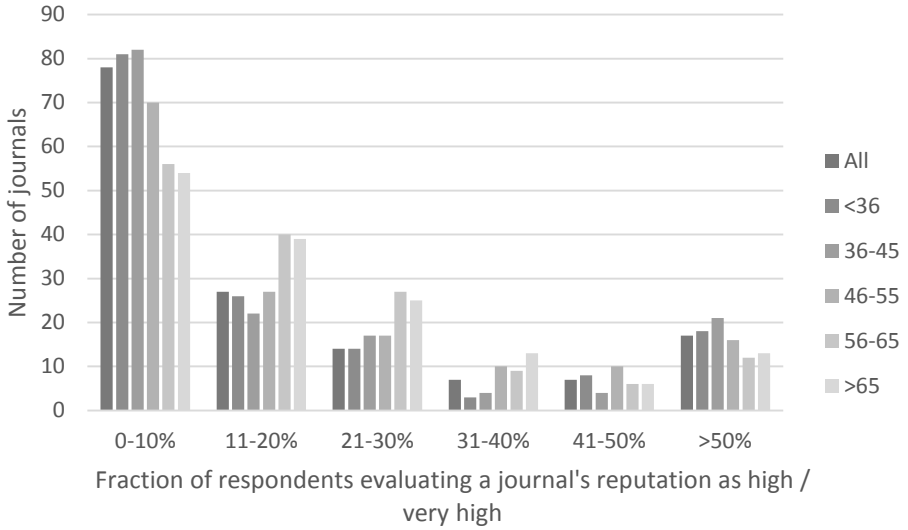


Figure 3-4: Distribution of Reputation Evaluations

6.2 Estimation Results

Estimating equation (1) with 2SLS, the Sargan-Hansen-Test for instrument exogeneity is rejected which indicates that at least one instrument for reputation is endogenous in (1). Careful scrutinizing of the instruments for reputation reveals that the three publisher dummies Elsevier, Springer, and Wiley-Blackwell are the source of instrument endogeneity. After including these three variables as explanatory variables in both equations (1) and (2), the test for instrument exogeneity can no longer be rejected. Hence, the variables Age, HB-Rating, and GEA-Rating can serve as reliable instruments for Reputation.

Table 2 shows the results of both the 2SLS and the fractional probit estimation of equations (1) and (2), where all t-tests are based on heteroskedasticity-robust standard errors. For the FRM models, we report the average marginal effects for the continuous variables and the effect of a discrete change from 0 to 1 for the dummy variables. Both 2SLS models show a very high overall fit. Our models explain 84% of the variation in a journal's relevance and even 93% of the variation in a journal's reputation. Furthermore, the Sargan-Hansen-Test fails to reject the null-hypothesis of instrument exogeneity for both equations with p-values of 0.44 and 0.77, respectively.

However, the F-value of the Kleibergen-Paap rk statistic (Kleibergen and Paap 2006) is only 8.7 for equation (2) while it is 30.3 for equation (1). This indicates that the two instruments for Relevance in (2) might be weak, thereby possibly leading to a weak instruments bias. To test whether this is indeed the case, we used Special as the sole instrument for Relevance and included Association as an independent variable in both equations. As a result, the Kleibergen-Paap rk statistic increases to 16.7, which is well above the conventional rule of thumb of ten for the first-stage F-value (Staiger and Stock 1997), while the significance levels of the variables in equation (1) remain unchanged and only marginal changes occur in the estimated coefficients of both the 2SLS and fractional probit model. Since the estimated coefficients in equation (2) are insensitive to whether or not we additionally include the weak instrument Association, we can be confident that including Association as an instrument does not lead

to a weak instruments bias. Therefore, we decided to keep Association as an instrument in (2) since this leads to an overidentification of the model and enables us to perform tests for instrument exogeneity.

Table 3-2: Estimation Results

	Relevance		Reputation	
	2SLS	FRM	2SLS	FRM
Reputation	0.3946 ***	0.2708 ***		
Relevance			1.3051 ***	0.5586 ***
H-index	-0.0002 **	-0.0001 ***	0.0004 **	0.0003 ***
Cites/Paper	0.0000	-0.0001	-0.0000	-0.0002
Volume	0.0000	0.0000	0.0001	0.0001 ***
Refereed[a]	0.0059	0.0048	0.0105	0.0256
Domestic[a]	-0.0106	-0.0035	0.0050	-0.0059
German[a]	0.0303 *	0.0344 *	-0.0248	-0.0147
Elsevier[a]	0.0129 *	0.0224 ***	-0.0247 *	-0.0143
Springer[a]	0.0184 **	0.0208 **	-0.0325 ***	-0.0373 ***
Wiley-Blackwell[a]	-0.0009	0.0081	-0.0231 *	-0.0193 *
Association[a]	0.0158 *	0.0089		
Special[a]	-0.0323 ***	-0.0258 ***		
Age			-0.0001	-0.0001
HB-Rating			0.1818 **	0.1444 ***
GEA-Rating			0.1321 **	0.1701 ***
Constant	0.0469 ***		-0.0407	
N	149	149	149	149
adj. R^2	0.84		0.93	
p of Hansen's J	0.44		0.77	
Kleibergen-Paap F	30.3		8.7	

* p<0.1, ** p<0.05, *** p<0.01.

[a] For the dummy variables, reported results for the FRM models denote the average effect of a discrete change from 0 to 1.

According to the results from the 2SLS estimation, Reputation has a positive and significant direct effect on Relevance and vice versa. Secondly, H-index has a negative direct effect on Relevance, but a positive direct effect on Reputation. Neither Cites/Paper nor Volume have additional explanatory power once we account for H-index. Thirdly, journals containing German articles are directly considered more relevant, while the journal's reputation remains, ceteris paribus, unaffected. We do not find any additional "home bias" in the sense that journals with a majority of domestic editors would either benefit or suffer from editors being German speaking. Fourthly, journals published by Elsevier, Springer, or an economic association are considered more relevant, but not more reputed. Quite on the contrary, Elsevier, Springer, and Wiley-Backwell journals are, ceteris paribus, considered less reputed. While our survey participants consider specialized journals less relevant, we find higher Handelsblatt and/or GEA ratings to be associated with higher Reputation.

However, due to the simultaneous nature of the two estimation equations, the coefficients listed in Table 2 only measure each exogenous variable's direct effect on the journals' perceived relevance and reputation, holding everything else constant. However, the coefficients do not measure the total effect (including indirect effects) that a variable has on reputation and relevance. Besides their direct effect all variables additionally have an indirect one. For example, H-index has a negative direct effect on Relevance, but also a positive indirect effect, due to its positive influence on Reputation which, in turn, positively affects Relevance. Therefore, we additionally calculate the total effects for each variable by plugging (2) into (1) (and vice versa) and solving the resulting equation for each independent variable to obtain its effect on Relevance and Reputation. The resulting total effects are displayed in Table 3.

Table 3-3: Estimated Total Effects of 2SLS Models

	Relevance		Reputation	
H-index	-0.0002		0.0002	
Cites/Paper	0.0001		0.0000	
Volume	0.0000		0.0001	
Refereed	0.0207		0.0374	*
Domestic	-0.0179		-0.0183	
German	0.0422	**	0.0302	*
Elsevier	0.0066		-0.0160	
Springer	0.0114		-0.0177	
Wiley-Blackwell	-0.0206		-0.0500	*
Association	0.0325	**	0.0424	*
Special	-0.0665	***	-0.0868	***
Age	-0.0001		-0.0002	
HB-Rating	0.1479	**	0.3748	***
GEA-Rating	0.1075	**	0.2724	**

* p<0.1, **p<0.05, *** p<0.01

At first sight, the comparison of the direct effects with the calculated total effects shows that the effects of H-index, Elsevier, and Springer cancel out when accounting for the simultaneous relationship between Relevance and Reputation. The effects of other variables remain statistically significant though. According to Table 3, the fraction of economists rating a respective journal's relevance as high or very high will increase by 4.2 percentage points if a journal also publishes articles in German. Similarly, if a journal is published by an economic association, an additional 3.3 (4.2) percentage points will consider its relevance (reputation) as high or very high. On the other hand, 5.0 percentage points fewer economists rate journals published by Wiley-Blackwell as highly reputed. Furthermore, specialized journals are perceived both less relevant and less reputed, with the fraction of respondents evaluating the relevance (reputation) as high or very high being approximately 6.7 (8.7) percentage points lower than for general interest journals. Interestingly, we find that for both a journal's relevance and its reputation, the total effects of a journal's rating by the Handelsblatt are larger than the effects of the rating by the GEA. If a journal's HB-Rating increases by 0.1 the percentage of economists ascribing a high or very high relevance (reputation) to the respective journal will increase by 1.5 (3.7) percentage

points. However, a comparable increase in GEA-Rating from B to B+ will only lead to 1.1 (2.7) percentage points more economists evaluating the respective journal's relevance (reputation) as high or very high. It is interesting to note, though, that the effects of these two ratings on a journal's reputation are more than twice as large as the effect on perceived journal relevance.

Columns 3 and 5 of Table 2 show the results of the FRM estimations. For the continuous variables, we report average marginal effects whereas for the dummy variables the coefficients denote the effect of a discrete change from 0 to 1. Overall, the results for the FRM estimation mostly confirm our findings from the 2SLS estimation.[24] Noteworthy exceptions are, first, the insignificant effect of Association on Relevance and, secondly, the finding that the effect of GEA-Rating is larger than the effect of the HB-Rating in the FRM estimation. Thirdly, Volume appears to have a significantly positive reputation effect in the FRM estimation, while the effect was insignificant in the 2SLS estimation.

In contrast to the results from the 2SLS model, the estimated effect of the continuous variables on Relevance and Reputation is not constant in the FRM estimation, but rather depends on (1) the value of all other explanatory variables and (2) the current value of the respective variable. This implies that for each continuous variable the average marginal effect reported in columns 3 and 5 of Table 2 also changes with the current level of the respective variable. Therefore, Figures 5 and 6 show the average marginal effects of Reputation on Relevance and vice versa over their sample range. The average marginal effects of the remaining variables can be found in the Appendix. Besides the average marginal effect, each figure additionally contains a histogram of the respective independent variable to relate the magnitude of each marginal effect to the likelihood of its occurrence in our sample. The interpretation of the average marginal effects plotted in Figures 5 and 6 is as follows. Suppose that the current value of Reputation is 0.1, i.e., 10% of all respondents in our sample rate the journal's reputation as high or very high. According to Figure 5, in this situation an increase in Reputation by 1% point will result in a 0.2% point increase in the fraction of economists evaluating the journal's relevance as high or very high. On the other hand, if the journal's current reputation is 0.4, then a 1% point increase in the perceived reputation will lead to a 0.4% point increase in the perceived relevance.

[24] Note that the coefficients reported only represent the direct effect of each independent variable on Relevance or Reputation. However, as already explained in the case of the 2SLS estimation, calculating the total effects would involve plugging equation (1) in equation (2) (and vice versa) and successively solving for each variable. In the context of the FRM model, this implies plugging a normal density function into the exponential part of another normal density function. However, in this paper, we refrained from calculating the total effects for the FRM model for two reasons. First, solving the resulting equations for each variable is analytically not tractable anymore. Second, due to the nonlinear nature of the estimation equation, the total effect of each variable would still depend on the value of all other independent variables which, in turn, impedes a meaningful interpretation of the total effects.

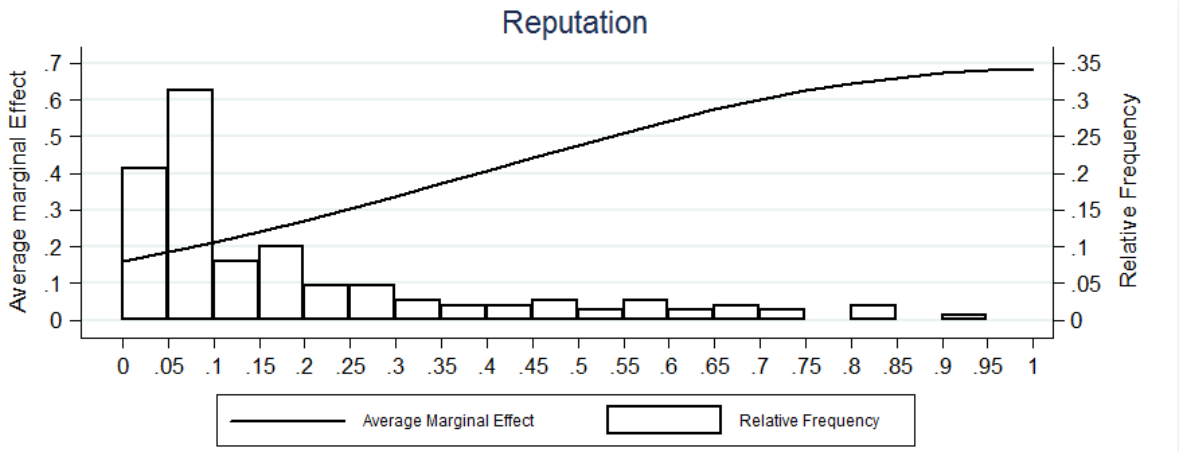


Figure 3-5: Average Marginal Effect of Reputation on Relevance

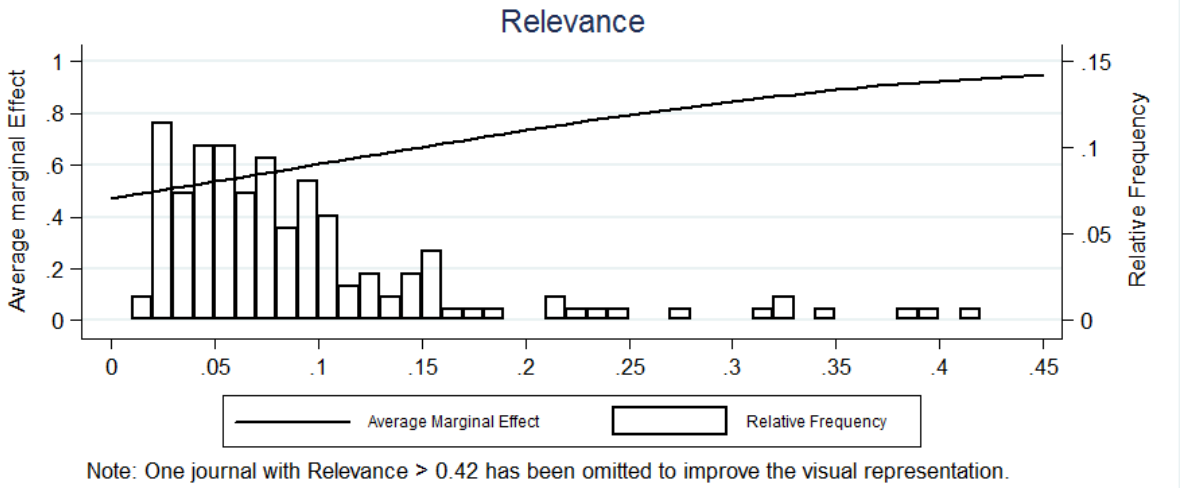


Figure 3-6: Average Marginal Effect of Relevance on Reputation

6.3 Discussion

While some of our findings were to be expected, others are less obvious. Unsurprisingly, journal relevance and reputation reinforce each other. In line with Bräuninger and Haucap (2003) we find that Relevance has a much stronger impact on Reputation than Reputation has on Relevance. Since Bräuninger and Haucap (2003, p. 185) found an even larger difference between the two effects our finding may be regarded as (weak) support for Ellison's (2002, 2011) hypothesis of a declining relevance of journal publications, as Relevance adds less to a journal's reputation than it did ten years ago.

Our finding that specialized field journals are considered less relevant than their general-interest counterparts is also hardly surprising. Since these journals focus on specific fields, such as labor economics or monetary economics, they are less relevant for the work of researchers who specialize in other areas. In a similar vein, it is rather intuitive that journals affiliated with economic associations are, on average, considered more relevant by economists.

In our view, a more interesting result is the complex relationship between various citation measures and Reputation and Relevance. Once we control for a journal's GEA and Handelsblatt rating, neither H-index nor Cites/Paper have an additional (total) effect on Reputation or Relevance. This may be little

surprising as the two ratings are themselves already largely based on citation measures, such as the SSCI impact factor. A more detailed analysis, however, reveals that there are two countervailing forces at work through which H-index affects Reputation and Relevance. While Reputation is positively affected by an increase in the H-index, holding Cites/Paper constant, Relevance is negatively affected.[25]

A plausible explanation for this finding may be that a journal's relevance is more determined by the quality of the average article, which is captured by its rating in the two journal rankings used (GEA and Handelsblatt). Hence, ceteris paribus an increase in the H-index implies an increase in quality variation, but not an increase in average quality which appears to be more important for a journal's relevance. In contrast, a journal's reputation appears to be more dependent on the number of truly seminal landmark papers that receive many cites and not so much on the average article. The fact that Cites/Paper does not have an additional effect on Reputation beyond what is captured by H-index, HB-Rating, and GEA-Rating may not only suggest that a journal's reputation is affected by a comparably small set of heavily-cited landmark papers rather than by a broad basis of articles that receive medium numbers of citations, but may also indicate that the two ratings unfold a stronger effect on perceived reputation than the more precise bibliometric statistics on which journal rankings and ratings are typically based.

Furthermore, the positive impact of German on Relevance indicates that German speaking economists also value German-language publications for their work. Despite receiving a small number of citations per paper and low ratings in journal rankings, they frequently include debates on economic policy issues or country-specific analyses which may only be of interest to economists within the GEA. Yet, contrary to Bräuninger and Haucap (2003), we do not find a negative home bias against German-language journals in terms of their reputation anymore.

We also find that publishers affect journal reputation and perceived relevance. More precisely, we estimate positive direct effects of Elsevier and Springer on Relevance and negative direct effects of Elsevier, Springer, and Wiley-Blackwell on Reputation. Accounting for these countervailing effects, only Wiley-Blackwell's effect on Reputation is statistically significant (and negative).

6.4 Estimation Results for Different Age Groups

To investigate how journals' relevance and reputation depend on respondents' age, we have additionally calculated journals' Relevance and Reputation based on the evaluation of respondents from five different age groups (<36, 36-45, 46-55, 56-65, >65). In doing so, we again resort to the fraction of respondents that evaluate a journal's relevance and/or reputation as high or very high. Tables 5 and 6 in the appendix show the determinants of journals' relevance and reputation for both the 2SLS and the FRM estimations. As before, we report the average marginal effects for the FRM models, whereby the

[25] We conducted some additional tests to explore why German economists consider journals with a high H-index less relevant for their daily work. First, we re-estimated the regression models while excluding Nature and Science, both of which have very high H-Indices while receiving below-average ratings in terms of relevance. Secondly, we also interacted H-index with a dummy variable indicating whether or not the journal primarily focuses on statistics and econometrics to test whether the negative effect of the H-index can be attributed to econometric journals which have high H-Indices due to the publication of methodological landmark articles but which might otherwise not be very relevant for many economists. However, in both cases, the negative coefficient estimate for H-index persisted.

coefficients of the dummy variables denote the effects of a discrete change from zero to one of the respective variable.

For the five 2SLS estimations of journals' perceived relevance (see Table 5), we cannot reject the test of instrument exogeneity at conventional significance levels, and the first stage F-values exceed the critical threshold of 10 in all five estimations. In contrast, the rather low first-stage F-values may indicate that the regression results for Reputation suffer from a weak instruments bias. As before, eliminating Association as an instrument for Relevance, leads to first-stage F-values exceeding the critical value of 10 in four of the five age cohorts in Table 6 with values between 12.2 and 20.5. Only for the 2SLS estimation for economists between 46 and 55 the F-value slightly undercuts the critical threshold of 10 with a value of 9.2. All results remain qualitatively unchanged, though, when using Special as the sole instrument for Relevance in the Reputation regressions. Hence, we are confident that the results reported in Table 6 are not subject to a weak instruments bias.

A first interesting insight from Tables 5 and 6 is that our models better explain the views of respondents aged 45 and younger than the views of respondents aged 46 and above, especially concerning journals' relevance (see Table 5). Moreover, the models are much better in explaining Reputation than Relevance. The finding that the fraction of explained variance decreases with the respondents' age may possibly be explained by a greater degree of homogeneity among younger economists when compared to their older colleagues. This could partly reflect the growing internationalization among younger economists as well as their allegedly less ideological approach, which has been heavily debated within Germany in recent times. Alternatively, older economists' views may have already formed some time ago and, therefore, be less affected by recent ratings and citation patterns.

Secondly, H-index only has a direct impact on both Reputation and Relevance for respondents aged 55 and younger, whereas for respondents above the age of 55 H-index does neither explain Relevance nor Reputation. Similarly, HB-Rating is only (positively) associated with Reputation among respondents aged 65 and younger, while it does appear to explain older economists' views on Reputation. In contrast, GEA-Rating explains Reputation across all age groups. Also note that, while both the GEA-Rating's direct and total effect on Reputation are fairly similar across all age groups, the impact of HB-Rating is declining with age, especially in the FRM regression. The age-specific regressions also reveal that for younger economists HB-Rating has a much stronger impact than GEA-Rating, while for older economists exactly the opposite is true. Hence, the finding that HB-Rating has a larger total impact than GEA-Rating is largely driven by younger economists' perception of journals.

Note that the differences in journal perceptions between economists that are older than 55 and those aged 55 and younger have been noted before by Bräuninger, Haucap, and Muck (2011b) and also by Bräuninger and Haucap (2001, 2003) more than ten years ago (see also Hawkins, Ritter, and Walter 1973). One reason for this rather persistent finding may be changing career concerns, as economists older than 55 are typically on fixed salaries in Germany and very unlikely to be still active in the job market. Another reason may be that younger economists tend to be more internationally oriented than

their older colleagues and that this international orientation is relatively well mirrored in HB-Rating. Somewhat related, we only find significant effects of German on Relevance and Reputation for economists older than 45, but not for economists aged 45 and younger. An explanation may be that older economists become increasingly interested in debates about economic policy (which are, at least partly, reflected in German-language publications), whereas younger economists are more interested in theory and methodology where advancements are typically published in English. Another explanation may be, again, the increasing international orientation among younger economists.

To quantify the overall (direct and indirect) effect of each independent variable, we again calculated the total effect of each variable based on the results of the 2SLS models (see Table 7). The variable German still has a (statistically significant) positive effect on Relevance solely for respondents who are older than 45 years, while we find that journals published by an association are perceived more relevant and more reputed by economists aged 45 and younger and especially by those between 36 and 45 (see Tables 5 and 7). An explanation may be that during this period of academic economists' careers most tenure decisions are made so that exposure to association journals that are widely read may become more important than in later career stages.

The results of the FRM estimations for different age groups confirm the findings from the 2SLS models, by and large.

6.5 Comparison to findings of Bräuninger and Haucap (2003)

A comparison of the estimated direct effects of our study with the findings reported by Bräuninger and Haucap (2003) reveals several interesting differences. First of all, our models are better able to explain respondents' evaluation of journal relevance and reputation than the specifications used by Bräuninger and Haucap (2003). While our models are able to explain 84% and 93% of the variance of Relevance and Reputation, respectively, the corresponding values in the previous study where only 80% and 78%. In part, this may be explained by the fact that we were able to include additional variables like a journal's H-index or its evaluation in the journal rankings of the Handelsblatt and the GEA.

In line with Bräuninger and Haucap (2003), we find that Relevance has a much stronger impact on Reputation than vice-versa. More precisely, a 1% point increase in the fraction of economists who find a journal relevant adds about 1.3%, points to the proportion that attach a high reputation to this journal, while an additional 1% point of economists that attach a high reputation to a journal only leads to an increase of 0.4% points in the fraction of economists who also find that journal highly relevant. Yet, more than ten years ago the difference between the two effects was even larger, as the corresponding figures were 1.95% and 0.2% points (see Bräuninger and Haucap 2003, p. 185). This finding may be regarded as a (weak) support for Ellison's (2002, 2011) hypothesis of declining journal relevance mentioned above, as relevance adds less to a journal's reputation than it did ten years ago.

In our study, a journal's average cites per paper did neither affect Relevance nor Reputation while in the study by Bräuninger and Haucap (2003, p. 185) the SSCI impact factor (which only captures the average

citations received immediately in the two calendar years following a journal's publication) significantly affected Reputation.[26] A possible explanation for these diverging results might be that we additionally included journals' evaluation in two different journal rankings to explain journal reputation. Both of these rankings are (at least partly) based on citation measures which, in turn, might lead to insignificant estimates for Cites/Paper. Interestingly enough, Bräuninger and Haucap (2003, p. 185) found that the impact factor's total effect on Reputation (working through journal relevance) was about twice as high as the effect on Relevance. This compares well with our finding that the two journal ratings' total effect on Reputation is at least twice as high as on Relevance.

Furthermore, we find that refereed journals are perceived as no more relevant and reputed than their non-refereed counterparts whereas Bräuninger and Haucap (2003) reported a significant effect on Reputation. In a similar vein, in our study specialized journals are no longer perceived as more reputed than generalized ones while journals published by an association are now perceived as slightly more relevant.

In our study, an increase in a journal's volume no longer increases the respective journal's relevance for its readers. While for two-thirds of the journals in our survey the average number of articles published per year has increased compared to the survey of Bräuninger and Haucap (2003) the increase in publication output is not distributed evenly between all journals. Rather, journals receiving low ratings in the journal rankings of the Handelsblatt and the GEA increased their volume to a larger extent than top-ranked journals which, in turn, might have deprived Volume of its role as an indicator of journal relevance.

While the estimated positive impact of German on Relevance confirms the previous findings of Bräuninger and Haucap (2003) regarding the relevance of German-language publications for members of the GEA, we do not find a negative home bias against German-language journals in terms of their reputation anymore. Likewise, our findings suggest that journals with a predominantly German editorial board are neither perceived as less reputed nor more relevant. In further contrast to Bräuninger and Haucap (2003), we do not find any effects of a journal's Age on its Reputation anymore either, possibly because we have now been able to use the H-index as an explanatory variable which typically increases with a journal's age. Put differently, in Bräuninger and Haucap (2003) Age may have been a rather crude measure for the number of a journal's landmark articles, which we can now account for more directly by using H-index.

Another difference to the study of Bräuninger and Haucap (2003) is our finding that journals published by Elsevier, Springer, or Wiley-Blackwell are considered as less reputed than other journals while at the same time Elsevier's and Springer's journals are perceived as more relevant.

A comparison of the estimated total effects on journal relevance and reputation with the ones estimated by Bräuninger and Haucap (2003) is not possible since, first, they did not report significance levels for

[26] Note that neither the Handelsblatt- nor the GEA-rating were available when Bräuninger and Haucap conducted their survey. Also the H-index was only invented in 2005 (see Hirsch 2005).

the estimated total effects, and secondly, they used different specifications of the two simultaneous equations. This, in turn, leads to different reduced-form equations which renders a comparison of the estimated total effects meaningless.

Finally, our findings of the estimations for the five age groups differ from those of Bräuninger and Haucap (2003). In the study of 2003, the only difference between the age groups was that the positive effect of a predominantly German editorial board on Relevance was lower for economists aged below 35 and higher for those aged 55 and above (Bräuninger and Haucap 2003, p. 190). Our analysis, on the other hand, revealed a couple of differences between the five different age groups which might be taken as an indication that a generational change occurred within the economist community.

7. Conclusion

Based on a survey of 705 members of the German Economic Association (GEA), we have analyzed the interrelationship between perceived journal reputation and relevance for respondents' work. To this end, we rely on 2SLS and Fractional Response Models (FRM) to estimate a system of two simultaneous equations which relate journal relevance and reputation to various journal characteristics. In accordance with earlier findings by Bräuninger and Haucap (2003) we have found a strong interrelationship between journal reputation and relevance. A journal's perceived relevance has a much stronger impact on the journal's reputation though than reputation on relevance. While a 1% point increase in the fraction of economists who consider a journal's relevance as "high" or "very high" leads to an increase in the fraction of economists who consider the journal highly or very highly reputed by 1.3% points, the corresponding number for the reverse effect is only a 0.4% point increase if we rely on our 2SLS regression analysis. While the numbers for our FRM estimation are somewhat lower, qualitatively the results are similar.

We have also found that past journal ratings conducted by the Handelsblatt and the GEA directly affect journals' reputation among German economists and indirectly also their perceived relevance. However, the effect on reputation is more than twice as large as the effect on perceived relevance. In general, citations appear to have a non-linear impact on perceived journal reputation and relevance. While the number of landmark articles published in a journal, reflected by the H-index, appears to increase journals' reputation, an increase in the H-index even tends to decrease a journal's perceived relevance as long as this is not simultaneously reflected in a higher Handelsblatt or GEA rating.

In addition, our analysis has revealed that Elsevier and Springer have a positive impact on a journal's relevance. However, there is a countervailing effect on reputation, given a journal's relevance. In total, the two effects cancel out so that journals published by Elsevier and Springer are, ceteris paribus, not more reputed or more relevant than other publishers' journals.

We have also found that German speaking economists consider German-language publications, ceteris paribus, more relevant. A more fine-grained analysis of various age groups has revealed that this is largely driven by economists who are older than 45. In contrast, a journal's Handelsblatt rating only

positively influences a journal's reputation for economists aged 55 and younger. While younger economists' views can be better explained by a journal's Handelsblatt rating, a journal's GEA rating has a stronger impact on older economists' views.

Quite generally, we have found significant differences in the views on journal relevance and reputation between different age groups where our regression analysis shows a better fit for the younger survey respondents. One potential reason could be that younger economists might be more homogeneous in their views about their journals than their older colleagues. Another reason may be that older economists' views are less affected by recent citation numbers and patterns. Interestingly, the models are also better in explaining journal reputation than relevance, implying that views about journal reputation may be less heterogeneous than views about journals' relevance.

References

Albers, S. (2009), Misleading Rankings of Research in Business. *German Economic Review*, 3, 352-363.

Azar, O. H. (2005), The Review Process in Economics: Is it Too Fast? *Southern Economic Journal,* 72, 481-491.

Beed, C., Beed, C. (1996), Measuring the Quality of Academic Journals: The Case of Economics. J*ournal of Post-Keynesian Economics,* 18, 369-396.

Berlemann, M., Haucap, J. (2015), Which Factors Drive the Decision to Opt Out of Individual Research Rankings? An Empirical Study of Academic Resistance to Change'. Forthcoming in: *Research Policy*.

Besley, T., Hennessy, P. (2009), *Letter to the Queen*, dated 22 July 2009. Online at: http://www.ft.com/intl/cms/3e3b6ca8-7a08-11de-b86f-00144feabdc0.pdf

Blank, R. M. (1991), The Effects of Double-Blind versus Single-Blind Reviewing: Experimental Evidence from the American Economic Review. *American Economic Review*, 81, 1041-1067.

Blaug, M. (1997), Ugly Currents in Modern Economics, *Policy Options,* 18 (17), September, 3-8.

Bräuninger, M., Haucap, J. (2001), Was Ökonomen lesen und schätzen. *Perspektiven der Wirtschaftspolitik*, 2, 185-210.

Bräuninger, M., Haucap, J. (2003), Reputation and Relevance of Economics Journals. *Kyklos*, 56, 175-198.

Bräuninger, M., Haucap, J., Muck, J. (2011a), Was schätzen und lesen deutschsprachige Ökonomen heute? *Perspektiven der Wirtschaftspolitik,* 12, 339-371.

Bräuninger, M., Haucap, J., Muck, J. (2011b), Was lesen und schätzen Ökonomen im Jahr 2011? *DICE Ordnungspolitische Perspektiven,* 18. Online available at: https://ideas.repec.org/p/zbw/diceop/18.html.

Chang, C.-L., McAleer, M., Oxley, L. (2011a), What Makes a Great Journal in Economics? The Singer, not the Song. *Journal of Economic Surveys,* 25, 326-361.

Chang, C.-L., McAleer, M., Oxley, L. (2011b), What Makes a Great Journal Great in Sciences? Which Came First, the Chicken or the Egg? *Scientometrics,* 87, 17-40.

Chang, C.-L., McAleer, M., Oxley, L. (2011c), Great Expectatrics: Great Papers, Great Journals, Great Econometrics. *Econometric Reviews,* 30, 583-619.

Colander, D., Goldberg, M., Haas, A., Juselius, K., Kirman, A., Lux, T., Sloth, B. (2009), The Financial Crisis and the Systemic Failure of the Economics Profession. *Critical Review,* 21(2), 249-267.

Danielson, A., Delorme, C. D. (1976), Some Empirical Evidence on the Variables Associated with the Ranking of Economics Journals. *Southern Economic Journal,* 43, 1149-1160.

Demarest, B., Freeman, G., Sugimoto. C. R. (2014), The Reviewer in the Mirror: Examining Gendered and Ethnicized Notions of Reciprocity in Peer Review. *Scientometrics,* 101, 717-735.

Dow, S. C., Earl, P. E., Foster, J., Harcourt, G. C., Hodgson, G. M., Metcalfe, J. S., Ormerod, P., Rosewell, B., Sawyer, M. C., Tylecote, A. (2009), The GFC and University Economics Education: An Open Letter to the Queen. J*ournal of Australian Political Economy*, 64, 233-235.

Dulleck, U., Kerschbamer, R. (2006), On Doctors, Mechanics and Computer Specialists: The Economics of Credence Goods. *Journal of Economic Literature,* 44, 5-42.

Ellis, L. V., Durden, G. C. (1991), Why Economists Rank Their Journals the Way They Do. *Journal of Economics and Business,* 43, 265-270.

Ellison, G. (2002), Evolving Standards for Academic Publishing: A q-r-Theory. *Journal of Political Economy*, 110, 994-1034.

Ellison, G. (2011), Is Peer-Review in Decline? *Economic Inquiry*, 49, 635-657.

Engers, M., Gans, J. S. (1998), Why Referees Are Not Paid (Enough). *American Economic Review*, 88, 1341-1349.

Franses, P. H. (2014), Trends in Three Decades of Rankings of Dutch Economists. *Scientometrics,* 98, 1257-1268.

Frey, B. S. (2005), Problems with Publishing: Existing State and Solutions. *European Journal of Law and Economics*, 19, 173-190.

Frey, B. S., Rost, K. (2010), Do Rankings Reflect Research Quality? *Journal of Applied Economics*, 13, 1-38.

Frey, B. S., Osterloh, M. (2014), Ranking Games. Forthcoming in: *Evaluation Review.*

Graber, M., Launov, A., Wälde, L. (2008), Publish or Perish? The Increasing Importance of Publications for Prospective Economics Professors in Austria, Germany and Switzerland. *German Economic Review*, 9, 457-472.

Handelsblatt (2011), *So funktioniert das VWL-Ranking*. Online at: http://www.handelsblatt.com/politik/oekonomie/vwl-ranking/methodik-so-funktioniert-das-vwl-ranking/4575334.html

Harzing, A. W. (2007), *Publish or Perish.* Online at: http://www.harzing.com/pop.htm.

Hawkins, R. G., Ritter, L. S., Walter, I. (1973), What Economists Think of Their Journals. *Journal of Political Economy*, 81, 1017-1032.

Hirsch, J. E. (2005), An Index to Quantify an Individual's Scientific Research Output. *Proceedings of the National Academy of Sciences of the United States of America,* 102 (46), 16569-16572.

Hodgson, G. M., Rothman, H. (1999), The Editors and Authors of Economics Journals: A Case of Institutional Oligopoly? *Economic Journal,* 109, F165-F186.

Institute for Scientific Information (2010), *Journal Citation Report 2009*. Institute for Scientific Information, Philadelphia.

Institute for Scientific Information (2011), *Journal Citation Report 2010*. Institute for Scientific Information, Philadelphia.

Iyengar, K., Balijepally, V. (2015), Ranking Journals Using the Dominance Hierarchy Procedure: An Illustration with IS Journals. *Scientometrics,* 102, 5-23.

Kalaitzidakis, P., Mamuneas, T., Stengos, T. (2003), Rankings of Academic Journals and Institutions in Economics. *Journal of the European Economic Association,* 1, 1346-1366.

Kleibergen, F., Paap, R. (2006), Generalized Reduced Rank Tests Using the Singularvalue Decomposition. *Journal of Econometrics*, 127, 97-126.

Krugman, P. (2009), *How Did Economists Get It So Wrong?,* New York Times Online, 02 September 2009. Online at: http://www.nytimes.com/2009/09/06/magazine/06Economic-t.html.

Krugman, P. (2013), *How the Case for Austerity has Crumbled*, The New York Review of Books, 6 June 2013. Online at: http://www.nybooks.com/articles/archives/2013/jun/06/how-case-austerity-has-crumbled/

Laband, D. N. (1990), Is There Value-Added from the Review Process in Economics? Preliminary Evidence from Authors. *Quarterly Journal of Economics,* 105, 341-353.

Lucas, R. E. (2009), In Defence of the Dismal Science. *The Economist,* 392(8643), 67.

Ma, Z., Pan, Y., Yu, Z., Wang, J., Jia, J., Wu, Y. (2013), A Quantitative Study on the Effectiveness of Peer Review for Academic Journals. *Scientometrics,* 95, 1-13

Oswald, A. J. (2007), An Examination of the Reliability of Prestigious Scholarly Journals: Evidence and Implications for Decision-Makers. *Economica,* 74, 21-31.

Papke, L. W., Wooldridge, J. M. (1996), Econometric Methods for Fractional Response Variables with an Application to 401 (K) Plan Participation Rates. *Journal of Applied Econometrics*, 11, 619-632.

Piketty, T. (2014), *Capital in the Twenty-First Century*. Harvard University Press.

Ramalho, E. A., Ramalho, J. J. S., Murteira, J. M. R. (2011), Alternative Estimating and Testing Empirical Strategies for Fractional Regression Models. *Journal of Economic Surveys*, 25, 19-68.

Ramalho, E. A., Ramalho, J. J. S., Henriques, P. D. (2010), Fractional Regression Models for Second Stage DEA Efficiency Analyses. *Journal of Productivity Analysis*, 34, 239-255.

Reinhart, C., Rogoff, K. (2013), *Open Letter to Paul Krugman*, 25. Mai 2013. Online at: http://www.carmenreinhart.com/letter-to-pk/

Ritzberger, K. (2008), A Ranking of Journals in Economics and Related Fields. *German Economic Review,* 9, 402-430.

Schläpfer, F. (2010), How Much does Journal Reputation Tell us About the Academic Interest and Relevance of Economic Research? *GAIA: Ecological Perspectives for Science & Society*, 19 (2), 140-145.

Schneider, F., Ursprung, H. W. (2008), The 2008 GEA Journal Ranking for the Economics Profession. *German Economic Review,* 9, 532-538.

Seiler, C., Wohlrabe, K. (2014), How Robust are Journal Rankings Based on the Impact Factor? Evidence from the Economic Sciences. *Journal of Informetrics*, 8, 904–911.

Sorzano, C. O. S., Vargas, J., Caffarena-Fernández, G., Iriarte, A. (2014), Comparing Scientific Performance among Equals. *Scientometrics,* 101, 1731-1745.

Staiger, D., Stock, J. H. (1997), Instrumental Variables Regression with Weak Instruments. *Econometrica,* 65, 557-586.

Statalist (2010), *Discussion on "reg3 option –robust-"*. Online at: http://statalist.1588530.n2.nabble.com/reg3-option-robust-td5647547.html.

Sutter, M., Kocher, M. (2001), Tools for Evaluating Research Output: Are Citation-Based Rankings of Economics Journals Stable? *Evaluation Review*, 25, 555-566.

The Economist (2009a), What Went Wrong with Economics? *The Economist*, 392(8640), 16 July 2009, 11-12.

The Economist (2009b), The Other-wordly Philosophers. *The Economist*, 392(8640), 16 July 2009, 65-67.

Wall, H. J. (2009), Don't Get Skewed over by Journal Rankings. *B.E. Journal of Economic Analysis and Policy*, 9 (1), Article 34.

Wooldridge, J. M. (2010), *Econometric Analysis of Cross Section and Panel Data*, 2nd edition, MIT Press, Cambridge MA.

Wooldridge, J. M. (2014), Quasi-Maximum Likelihood Estimation and Testing for Nonlinear Models with Endogenous Explanatory Variables. *Journal of Econometrics*, 182, 226-234.

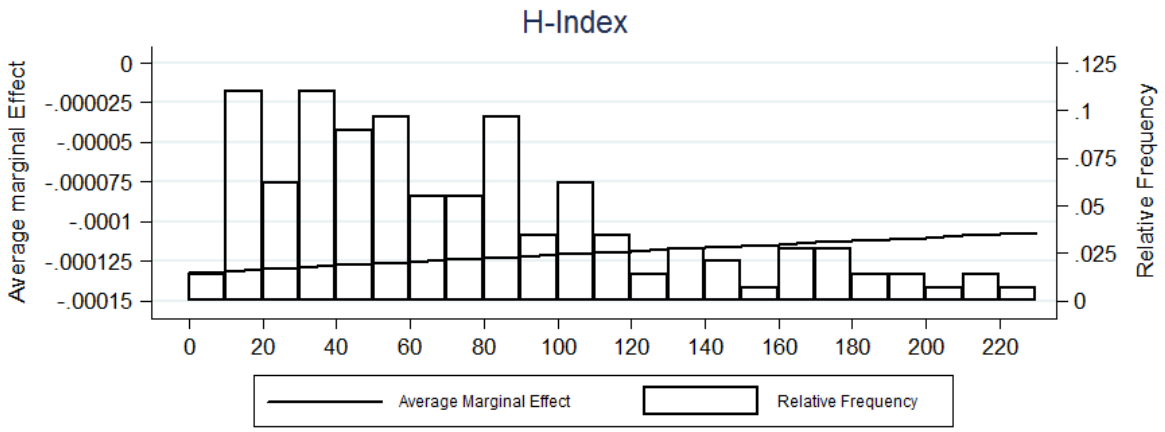
Wooldridge, J. M. (2013) *Introductory Econometrics – A Modern Approach*, 5th edition, South-Western, Florence.

Appendix

Table 3-4: Table of Correlations

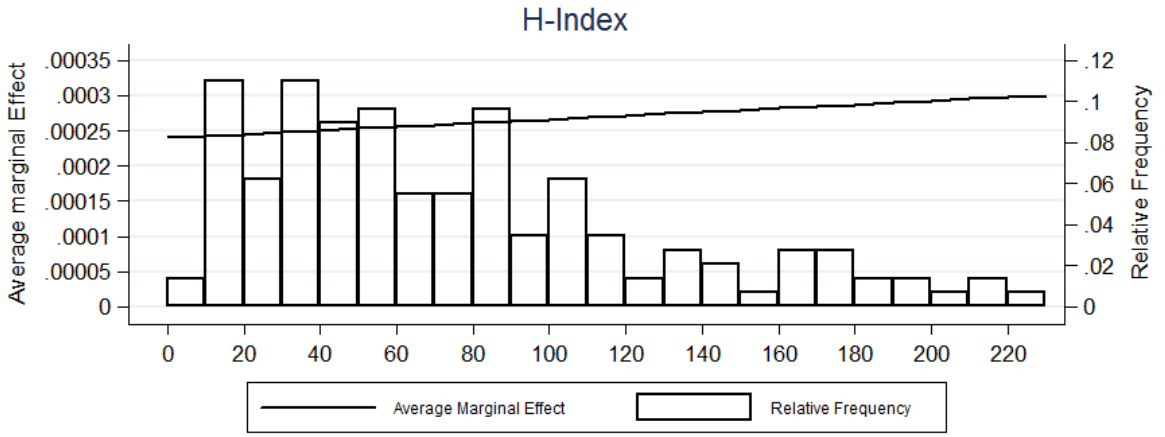
	Rel	Rep	Age	Ref	Volume	German	Domestic	Assoc	Special	Elsevier	Springer	Wiley-B	H-index	Cit/Pap	HB-Rat
Reputation	0.85***														
Age	0.16**	0.21**													
Refereed	0.06	0.21**	-0.01												
Volume	0.07	0.33***	0.19**	0.03											
German	-0.07	-0.26***	0.14*	-0.68***	-0.09										
Domestic	-0.14*	-0.33***	0.30***	-0.56***	-0.15*	0.74***									
Association	0.20**	0.14*	0.08	0.10	-0.09	-0.02	-0.02								
Special	-0.26***	-0.09	-0.27***	0.32***	-0.03	-0.25***	-0.33***	-0.02							
Elsevier	0.03	0.11	-0.28***	0.16*	0.09	-0.21**	-0.28***	-0.17**	0.36***						
Springer	-0.14*	-0.20**	-0.12	-0.03	-0.10	-0.04	0.17**	-0.07	0.16*	-0.21**					
Wiley-Blackw.	-0.04	-0.05	0.02	0.14*	-0.11	-0.14*	-0.13	0.11	-0.17**	-0.25***	-0.19**				
H-index	0.24***	0.59***	0.29***	0.21**	0.77***	-0.26***	-0.32***	0.00	0.05	0.11	-0.15*	-0.03			
Cites/Paper	0.20**	0.51***	0.25***	0.14*	0.80***	-0.18**	-0.22***	-0.01	-0.01	0.02	-0.09	-0.08	0.92***		
HB-Rating	0.57***	0.84***	0.20**	0.28***	0.39***	-0.35***	-0.42***	0.09	0.11	0.21**	-0.19**	-0.06	0.71***	0.61***	
GEA-Rating	0.57***	0.73***	0.06	0.26***	-0.01	-0.34***	-0.41***	0.07	0.13	0.21**	-0.12	0.06	0.31***	0.20***	0.80***

* p<0.1, ** p<0.05, *** p<0.01



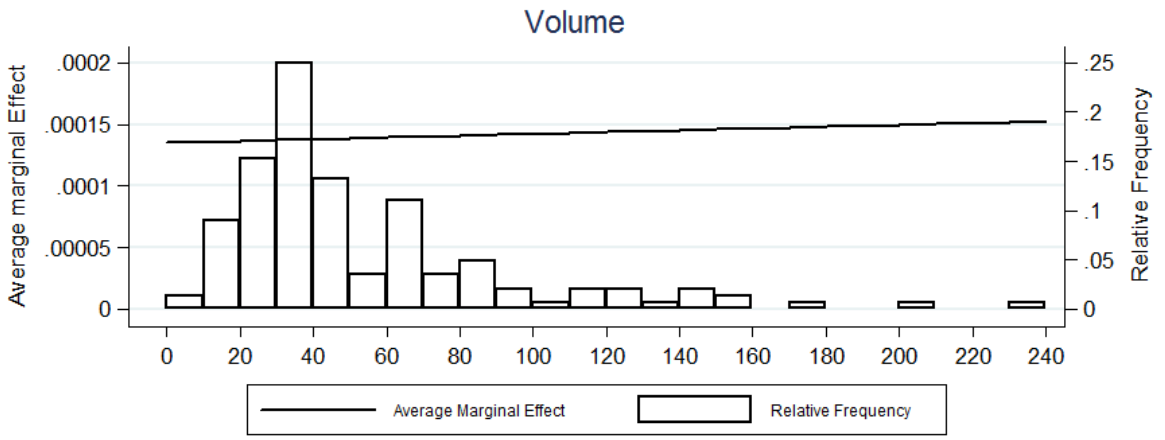
Note: Five journals with H-Index > 230 have been omitted to improve the visual representation.

Figure 3-7: Average Marginal Effect of H-index on Relevance



Note: Five journals with H-Index > 230 have been omitted to improve the visual representation.

Figure 3-8: Average Marginal Effect of H-index on Relevance



Note: Five journals with Volume > 240 have been omitted to improve the visual representation.

Figure 3-9: Average Marginal Effect of Volume on Reputation

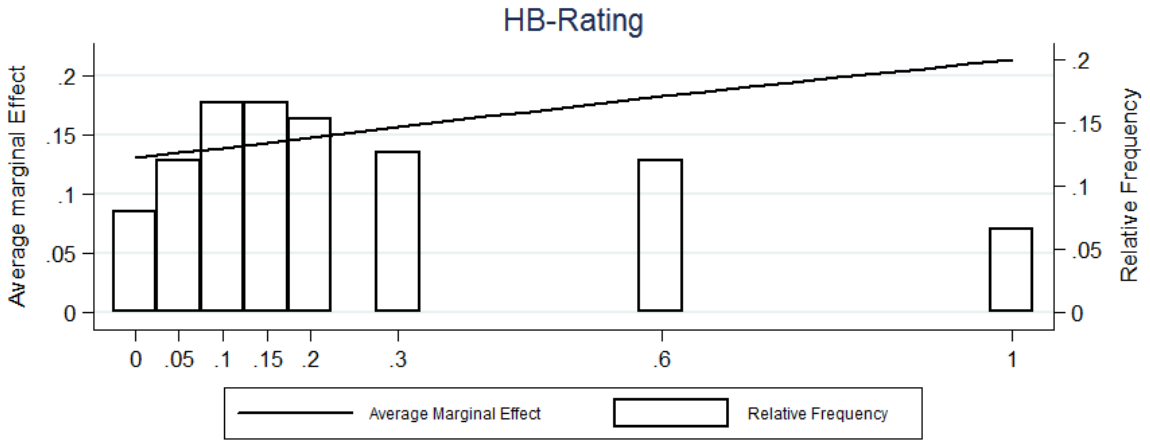


Figure 3-10: Average Marginal Effect of HB-Rating on Reputation

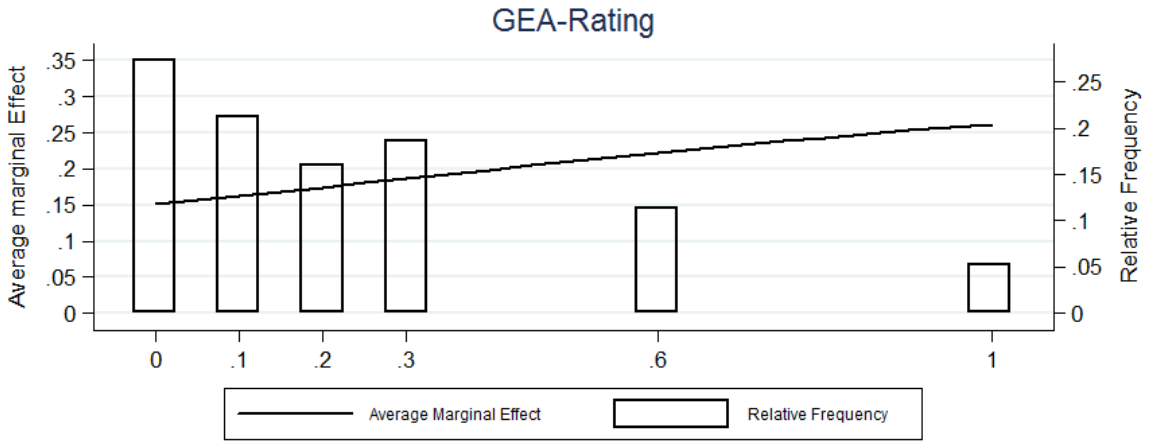


Figure 3-11: Average Marginal Effect of GEA-Rating on Reputation

Table 3-5: Determinants of Relevance for Different Age Groups

	<36		36-45		46-55		56-65		>65	
	2SLS	FRM	2SLS	FRM	2SLS	FRM	2SLS	FRM	2SLS	FRM
Reputation	0.4834 ***	0.2919 ***	0.4208 ***	0.2813 ***	0.2764 ***	0.2189 ***	0.2892 ***	0.3139 ***	0.3543 ***	0.2902 ***
H-index	-0.0004 ***	-0.0002 ***	-0.0002 **	-0.0001 **	-0.0003 **	-0.0002 ***	0.0000	-0.0001	-0.0001	-0.0001
Cites/Paper	0.0000	-0.0001	-0.0001	-0.0002	0.0005 *	0.0003 *	0.0000	-0.0001	-0.0002	-0.0002
Volume	0.0000	0.0001 **	-0.0000	0.0000	-0.0001	-0.0001	-0.0001	-0.0000	0.0000	0.0000
Refereed	0.0076	0.0113	0.0108	0.0175	-0.0085	-0.0118	0.0135	0.0050	0.0095	0.0035
Domestic	-0.0137	-0.0112	-0.0149	-0.0117	-0.0118	-0.0062	-0.0227	-0.0054	0.0068	0.0175
German	0.0082	0.0008	0.0162	0.0206	0.0403 **	0.0489 *	0.0557 **	0.0599 **	0.0657 *	0.0556 *
Elsevier	0.0170 *	0.0266 ***	0.0133	0.0275 ***	0.0092	0.0178 **	0.0152	0.0173	0.0094	0.0243
Springer	0.0075	0.0083	0.0179 *	0.0235 *	0.0236 **	0.0280 **	0.0264 **	0.0332 **	0.0226	0.0207
Wiley-Blackwell	-0.0006	0.0016	0.0017	0.0149 *	0.0002	0.0103	-0.0068	0.0056	-0.0067	0.0051
Association	0.0106	0.0060	0.0262 ***	0.0216 ***	0.0077	0.0024	0.0070	-0.0051	0.0209	0.0195
Special	-0.0236 ***	-0.0211 ***	-0.0271 ***	-0.0199 ***	-0.0257 **	-0.0182 ***	-0.0484 ***	-0.0280 **	-0.0618 ***	-0.0576 ***
Constant	0.0341 ***		0.0382 **		0.0647 ***		0.0673 **		0.0665	
N	149	149	149	149	149	149	149	149	149	149
adj. R^2	0.88		0.85		0.68		0.54		0.60	
p of Hansen's J	0.40		0.51		0.54		0.76		0.23	
Kleibergen-Paap F	41.2		40.6		23.4		11.4		10.7	

* p<0.1, ** p<0.05, *** p<0.01

Table 3-6: Determinants of Reputation for Different Age Groups

	<36		36-45		46-55		56-65		>65	
	2SLS	FRM	2SLS	FRM	2SLS	FRM	2SLS	FRM	2SLS	FRM
Relevance	1.3398 ***	0.5357 ***	1.2169 ***	0.5806 ***	1.7416 ***	0.7547 ***	1.2292 ***	0.7775 ***	1.0703 ***	0.6832 ***
H-index	0.0005 ***	0.0003 **	0.0004 *	0.0002 **	0.0006 ***	0.0004 ***	0.0001	0.0002	0.0003	0.0002
Cites/Paper	-0.0002	-0.0004	0.0002	0.0001	-0.0009 **	-0.0007 **	0.0001	-0.0002	0.0007	0.0004
Volume	0.0001	0.0002 ***	0.0000	0.0001	0.0002 *	0.0002 ***	0.0002 ***	0.0002 ***	-0.0000	-0.0000
Refereed	0.0075	0.0371 **	-0.0021	0.0261	0.0318	0.0159	0.0076	0.0194	0.0251	0.0231
Domestic	0.0209	0.0210	0.0122	-0.0144	-0.0042	-0.0488 **	-0.0062	-0.0070	0.0004	0.0128
German	-0.0034	-0.0399 *	-0.0038	0.0031	-0.0576 *	-0.0575 **	-0.0577 **	-0.0506 **	-0.0378	-0.0161
Elsevier	-0.0329 **	-0.0268 ***	-0.0282 *	-0.0039	-0.0218	-0.0098	-0.0214	-0.0137	-0.0150	-0.0020
Springer	-0.0148	-0.0321 **	-0.0333 **	-0.0244 *	-0.0540 ***	-0.0437 ***	-0.0263	-0.0204	-0.0453 **	-0.0542 ***
Wiley-Blackwell	-0.0170	-0.0339 ***	-0.0267 **	-0.0141	-0.0280	-0.0192	-0.0242	-0.0183	-0.0176	-0.0074
Age	-0.0002	-0.0003 *	-0.0002	-0.0001	-0.0002	-0.0001	0.0003	0.0001	0.0001	0.0002
HB-Rating	0.1674 **	0.1621 ***	0.2515 **	0.1398 ***	0.1824 *	0.1275 **	0.1390 *	0.0762	0.0918	0.0772
GEA-Rating	0.0993 *	0.1501 ***	0.1223 *	0.1795 ***	0.1484 **	0.1817 ***	0.1466 **	0.1537 ***	0.1573 **	0.1505 **
Constant	-0.0419 **		-0.0325		-0.0764		-0.0341		-0.0270	
N	149	149	149	149	149	149	149	149	149	149
adj. R^2	0.93		0.93		0.87		0.81		0.75	
p of Hansen's J	0.94		0.21		0.59		0.92		0.94	
Kleibergen-Paap F	8.3		6.3		5.5		8.6		10.5	

* p<0.1, ** p<0.05, *** p<0.01

Table 3-7: Estimated Total Effects of 2SLS Models for Different Age Groups

	<36		36-45		46-55		56-65		>65	
	Relevance	Reputation	Relevance	Reputation	Relevance	Reputation	Relevance	Reputation	Relevance	Reputation
H-index	-0.0003	0.0002	-0.0002	0.0001	-0.0002	0.0004	0.0000	0.0001	-0.0001	0.0002
Cites/Paper	-0.0001	-0.0003	-0.0000	0.0002	0.0004	-0.0003	0.0000	0.0001	-0.0000	0.0006
Volume	0.0001	0.0003	0.0000	0.0001	-0.0001	0.0001	-0.0001	0.0001	-0.0000	-0.0000
Refereed	0.0318 **	0.0501 *	0.0203	0.0226	0.0006	0.0328	0.0244	0.0377	0.0295	0.0567
Domestic	-0.0101	0.0074	-0.0200	-0.0122	-0.0250	-0.0477	-0.0380	-0.0530	0.0112	0.0125
German	0.0188	0.0218	0.0300	0.0327	0.0470 **	0.0242	0.0605 **	0.0166	0.0844 **	0.0525
Elsevier	0.0032	-0.0286	0.0029	-0.0247	0.0062	-0.0111	0.0140	-0.0042	0.0066	-0.0078
Springer	0.0011	-0.0133	0.0079	-0.0237	0.0167	-0.0250	0.0291 *	0.0094	0.0105	-0.0341
Wiley-Blackwell	-0.0249	-0.0503 *	-0.0196	-0.0506 *	-0.0146	-0.0534 *	-0.0214	-0.0504	-0.0209	-0.0399
Association	0.0301 *	0.0403	0.0537 ***	0.0654 **	0.0148	0.0257	0.0108	0.0133	0.0337	0.0360
Special	-0.0671 ***	-0.0899 ***	-0.0556 ***	-0.0677 ***	-0.0496 ***	-0.0864 ***	-0.0751 ***	-0.0923 ***	-0.0995 ***	-0.1065 ***
Age	-0.0003	-0.0006	-0.0002	-0.0005	-0.0001	-0.0003	0.0001	0.0005	0.0001	0.0002
HB-Rating	0.2297 **	0.4751 ***	0.2169 ***	0.5155 ***	0.0972 **	0.3516 **	0.0624	0.2157 *	0.0524	0.1478
GEA-Rating	0.1362 **	0.2818 **	0.1055 *	0.2507 *	0.0791 **	0.2862 **	0.0658 *	0.2275 **	0.0898	0.2534 **

* p<0.1, ** p<0.05, *** p<0.01

Declaration of Contribution

Hereby I, Johannes Muck, declare that the chapter „What Drives the Relevance and Reputation of Economics Journals“ is co-authored by Prof. Dr. Justus Haucap.

My contributions to this chapter are as follows:

- I was responsible for collecting and consolidating the data
- I was responsible for determining the estimation strategy and conducting the empirical analysis
- I was responsible for interpreting the results of the empirical analysis and for deriving theoretical and practical implications
- I was responsible for the creation of sections 4, 5, and 6 and participated in the creation of the remaining chapters
- I participated in the search for relevant literature

Signature of coauthor 1 (Prof. Dr. Justus Haucap): _____

Chapter 4: Research Evaluation at Universities – Findings of an Explorative Study of Economics and Law Departments (Forschungsevaluation an Universitäten – Ergebnisse einer explorativen Studie rechts- und wirtschaftswissenschaftlicher Fakultäten)[27]

1. Einleitung

Vor dem Hintergrund von Informationsasymmetrien zwischen Prinzipal und Agenten spielen Kontroll- und Anreizsysteme in Unternehmen und anderen Organisationen eine wichtige Rolle. Beispielsweise sammeln Unternehmen im Rahmen des Personalcontrollings Daten über die Leistungen der Mitarbeiter (Weibel et al. 2007, Amalou und Süß 2011) und koppeln zum Teil deren (variable) Vergütungen an diese, um dadurch das Mitarbeiterverhalten zu steuern, oder installieren Kontrollsysteme (z. B. Outputkontrolle) zur Messung der Performanz von Geschäftseinheiten (Govindarajan und Fisher 1990).

Während solche Systeme in Unternehmen seit langem institutionalisiert sind, wurden sie an Hochschulen erst in den letzten ca. 15 Jahren eingeführt. Damit zusammenhängend haben Schlagworte wie Zielvereinbarungen oder leistungsorientierte Mittelvergabe (LoM) Einzug in deutsche Hochschulen gehalten (Bogumil und Heinze 2009). Innerhalb der Hochschulen werden infolgedessen Budgets zunehmend leistungsorientiert verteilt (Jaeger 2009), wodurch eine stärkere Orientierung an erwarteten, vereinbarten oder tatsächlich erbrachten Outputs ermöglicht werden soll.

Damit zielen die Veränderungen auf eine modifizierte Steuerung von Hochschulen, die sich auf zwei Ebenen niederschlägt: (1) Auf der individuellen Ebene beeinflusst sie die persönliche Bezahlung: Im Gegensatz zur C-Besoldung weist die seit 2005 bundesweit geltende W-Besoldung eine Leistungskomponente auf (Trittel et al. 2010). (2) Auf der organisationalen Ebene wird versucht, Hochschulen, Fakultäten und Lehrstühle durch die LoM zu steuern und auf diesem Wege Leistungsanreize zu setzen.

Insgesamt sollen diese Veränderungen dazu beitragen, die Leistungserstellung von Hochschulen, Fakultäten und Wissenschaftlern stärker als in der Vergangenheit an Wirtschaftlichkeitskriterien auszurichten. Dies wird mit der Notwendigkeit der Profilbildung in Forschung und Lehre sowie dem zunehmenden Wettbewerb um Studierende, Wissenschaftler und Drittmittel begründet (Meier 2009, S. 132). Dass damit die Einführung verschiedener Elemente einer leistungsorientierten Steuerung

[27] Die Autoren möchten sich bei Univ.-Prof. Dr. Bernd Günter sowie beim Rektorat der Heinrich-Heine-Universität Düsseldorf, insbesondere Univ.-Prof. Dr. med. Klaus Pfeffer, für die Unterstützung im Rahmen des dem Aufsatz zugrunde liegenden Projekts bedanken. Für hilfreiche Kommentare danken wir den anonymen Gutachtern und dem Herausgeber.

verbunden ist, ist unumstritten. So sind LoM und Leistungsevaluationen an nahezu allen Hochschulen verpflichtend eingeführt worden (Jaeger et al. 2005, S. 12). Leistung kann dabei anhand der Forschungs- und der Lehrleistungen festgestellt werden; besonders stark ist in den letzten Jahren die forschungsbezogene Leistungsmessung in den Blick der (betriebswirtschaftlichen) Literatur gerückt, und es gibt eine kontroverse Diskussion über die Kriterien, anhand derer die forschungsbezogene Leistung auf individueller und organisationaler Ebene gemessen werden kann (Wolf et al. 2005, Fiedler et al. 2008, Dyckhoff et al. 2009, Rassenhövel 2010). Allerdings existieren bislang kaum empirische Erkenntnisse zu der forschungsbezogenen Leistungsmessung in der deutschen Hochschulpraxis. Insbesondere ist bislang unklar, welche Leistungsindikatoren hierfür auf fakultärer Ebene in Deutschland genutzt werden. Erkenntnisse aus der Unternehmenspraxis (Neely et al. 1995) können nur bedingt auf Hochschulen übertragen werden, da diese einige Spezifika aufweisen: Erstens zeichnen sich Hochschulen durch eine Struktur aus, die sich signifikant von der von Unternehmen unterscheidet. Beispielsweise genießen Professoren eine von der Verfassung geschützte Freiheit in Forschung und Lehre, was die Steuerungsmöglichkeiten der Fakultäts- oder Universitätsleitung einschränkt (Bundesverfassungsgericht 2004, Sieweke 2010, S. 166-190). Zweitens sind die Messung und der Vergleich von Leistungen in der Wissenschaft äußerst schwierig, da die Qualität und Quantität neuen Wissens nicht direkt messbar ist, so dass auf Indikatoren zurückgegriffen wird. Diese erfassen die Forschungsleistung jedoch nur approximativ und werden zum Teil stark kritisiert (Frey 2007, Kieser 2010). Drittens zeichnen sich viele Wissenschaftler durch ein hohes Maß an intrinsischer Motivation aus. Kontroll- und Anreizsysteme können jedoch diese intrinsische Motivation verdrängen und damit langfristig die Arbeitsleistung reduzieren (Frey 2007, S. 210-211, Kieser 2010, S. 348).

Vor diesem Hintergrund verfolgt der Beitrag das *Ziel*, einen explorativen Überblick darüber zu gegeben, wie an deutschen Universitäten forschungsbezogene Leistungsmessung erfolgt, welche erhofften Wirkungen damit verbunden sind und welche Faktoren die Einführung von Systemen zur Leistungsmessung beeinflussen. Dazu werden Ergebnisse einer explorativen Studie präsentiert, in der Fakultätsleitungen rechts- und wirtschaftswissenschaftlicher Fakultäten dazu befragt wurden, ob und in welchen Gebieten eine forschungsbezogene Leistungsmessung erfolgt, wie diese ausgestaltet ist und welche Auswirkungen sie hat.

Der Beitrag startet mit einem Überblick über die Grundlagen der Forschungsevaluation. Im Anschluss werden mit Publikationen, Zitationskennzahlen und Drittmitteleinwerbungen die in der Literatur am stärksten diskutierten Leistungsindikatoren beschrieben und kritisch diskutiert, bevor die Ergebnisse der explorativen Studie präsentiert werden. Auf dieser Basis werden abschließend Schlussfolgerungen hinsichtlich der forschungsbezogenen Evaluationspraxis in Deutschland formuliert.

2. Forschungsevaluation an Universitäten

2.1. Präzisierung des Forschungsdefizits und Begründung der Vorgehensweise

Dieser Aufsatz ist explorativ angelegt, d. h. es werden Erkenntnisse über den Stand der forschungsbezogenen Leistungsmessung an wirtschafts- und rechtswissenschaftlichen Fakultäten gewonnen, analysiert und diskutiert. Ein exploratives Vorgehen ist adäquat, wenn über einen Forschungsgegenstand wenig bekannt ist (Kromrey 2009, S. 99). Um den bisherigen Forschungsstand aufzuarbeiten, wurde eine Literaturanalyse durchgeführt. Quelle hierfür waren die Zeitschriftendatenbanken „WISO“ (www.wiso-net.de) sowie „Web of Knowledge“ (www.isiknowledge.com). Diese wurden ausgewählt, da sie wichtige deutsch- und englischsprachige Zeitschriften in Disziplinen wie zum Beispiel Wirtschaftswissenschaften, Naturwissenschaften, Medizin und Geisteswissenschaften abdecken, was eine umfassende Analyse des Forschungsstands ermöglicht. Für die Suche wurden die folgenden Schlagwörter in deutscher und in englischer Sprache gewählt: „Forschungsevaluation“ und „Fakultät*“ („research evaluation“ and „facult*“) sowie „Forschungsleistung“ und „mess*“ und „Fakultät*“ („research performance“ and „measur*“ and „facult*“). Insgesamt konnten nach Ausschluss von Duplikaten 67 Artikel identifiziert werden (WISO: 38; Web of Knowledge: 29).

Ihre Auswertung zeigt, dass in der Literatur bereits eine Auseinandersetzung mit Forschungsevaluation stattgefunden hat. Beispielsweise finden sich Arbeiten zu Indikatoren zur Messung von Forschungsleistungen wie zum Beispiel Zeitschriften-Rankings (Schlinghoff und Backes-Gellner 2002) sowie der Auswirkungen der Forschungsevaluation (Kieser 1998, Münch 2008). Ein Forschungsdefizit konnte jedoch hinsichtlich der Ausgestaltung und Einführung von Systemen zur forschungsbezogenen Leistungsmessung an Fakultäten identifiziert werden. Bislang liegen weder empirische Erkenntnisse über die Ausgestaltung solcher Systeme vor noch lassen sich konzeptionelle Arbeiten finden, die Einflussfaktoren ihrer Einführung diskutieren. Infolgedessen lag keine ausreichende Grundlage zur Aufstellung und Überprüfung von Hypothesen vor, weshalb ein exploratives Vorgehen als geeigneter eingestuft wird als ein explanatives.

2.2. Grundlagen der Forschungsevaluation

Während in den USA, Australien, Großbritannien und den Niederlanden die Evaluation der Forschungsleistungen von Universitäten, Fakultäten und Professoren bereits seit mehreren Jahrzehnten etabliert ist, hat die Debatte in Deutschland erst in den vergangenen ca. 15 Jahren eingesetzt. Zwar lassen sich bereits in den 1980er und den frühen 1990er Jahren vereinzelt Arbeiten finden, die sich mit Forschungsevaluation auseinandersetzen (Heiber 1986, Pommerehne und Renggli 1986, Daniel und Fisch 1990), jedoch hatte insbesondere die Orientierung der Hochschulpolitik am sogenannten New

Public Management eine Steigerung der Relevanz dieses Themas zur Folge (Bogumil und Heinze 2009, S. 7f., Meier und Schimank 2009, S. 43).

Forschungsevaluation umfasst die nachträgliche Bewertung der Leistung einer Universität, einer Fakultät oder eines Forschers hinsichtlich der Entwicklung neuer wissenschaftlicher Erkenntnisse (Frey 2007, S. 207). Sie ist jedoch kein Selbstzweck, sondern dient bestimmten Zielen. Der Wissenschaftsrat gibt beispielsweise als Ziel seiner Forschungsevaluation der Fächer Soziologie und Chemie an, dass die beurteilten Forschungseinrichtungen durch die Ergebnisse der Evaluation bei strategischen Entscheidungen unterstützt werden sollen. Darüber hinaus soll die Forschungsevaluation zu mehr Transparenz in der deutschen Forschungslandschaft führen, wodurch der Wettbewerb zwischen den Einrichtungen gestärkt (Wissenschaftsrat 2007, S. 9) und langfristig die Qualität verbessert werden soll. Daneben wird auch die LoM als Ziel der Forschungsevaluation genannt (Kieser 1998, Jansen et al. 2007); Ressourcen sollen an forschungsstärkere Einrichtungen verteilt werden, da bei diesen von einer effizienteren Nutzung ausgegangen wird (Kieser 1998, Jansen et al. 2007, Kreysing 2008). Zusätzlich werden Agenturprobleme als Grund für die Einführung von Forschungsevaluationen angeführt (Dilger 2001, von Görtz et al. 2010, S. 10, Wilkesmann 2012). Diese umfassen die Unsicherheit des Prinzipals (zum Beispiel Bundesland oder Hochschulleitung), ob der Agent (zum Beispiel Hochschule oder Professor) die Ziele des Prinzipals (zum Beispiel exzellente Forschungsleistungen) oder eigene Ziele verfolgt. Die Forschungsevaluation und die damit verbundene LoM können das Informationsdefizit des Prinzipals reduzieren (zum Beispiel durch Erfassung von Forschungsleistungen) und zusätzlich Anreize für den Agenten schaffen, die Ziele des Prinzipals zu verfolgen (zum Beispiel durch die Zuteilung leistungsorientierter Mittel auf Grundlage von Forschungsleistungen; Kreysing 2008, von Görtz et al. 2010, S. 11).

Auch wenn sich die Forschungsevaluation in Deutschland etabliert hat, wird sie in der wissenschaftlichen Diskussion nicht unkritisch gesehen (vgl. u. a. Kieser 1998, Süß 2006, Frey 2007). Ein grundsätzlicher Kritikpunkt ist, dass Evaluationen Anreize verändern und sich die Evaluierten zukünftig stärker an den Evaluationskriterien ausrichten, da primär das als Leistung zählt, was auch in der Evaluation gemessen wird (Frey 2007, S. 209). Die Befürchtung, intrinsische Motivation könne dadurch verdrängt werden, liegt nahe. So argumentiert *Frey*, dass durch eine regelmäßige Evaluation von Forschungsleistungen die Qualität und Originalität der Forschung sinke, da innovative wissenschaftliche Arbeit intrinsischer Motivation bedürfe, welche durch die Evaluation verdrängt werde (Frey 2007, S. 211). Auch eine Anreizverschiebung wird kritisiert, wenn aufgrund von Evaluationen Forschungsleistungen als wichtiger erachtet werden als Leistungen in der Lehre und Selbstverwaltung (Dilger 2001, S. 138).

Neben diesen kritischen Stimmen gibt es aber auch Personen innerhalb und außerhalb des Wissenschaftsbetriebes, die eine systematische Evaluation der Forschungsleistungen anhand transparenter Kriterien begrüßen, zum einen um dem Problem relativ wirkungsloser Anreize zu

begegnen, zum anderen um Bewertungsverfahren und Entscheidungen über die Allokation von Ressourcen transparenter zu gestalten (vgl. z. B. Bommer und Ursprung 1998, Ursprung 2003).

Unabhängig davon hat sich die Forschungsevaluation zunehmend in der deutschen Hochschullandschaft etabliert. Mittlerweile werden Universitäten (Kieser 1998, Valadkhani und Worthington 2006), Fachbereiche (Litzenberger und Sternberg 2005, Dyckhoff et al. 2009) und einzelne Forscher (Dyckhoff et al. 2005, Rost und Frey 2011) hinsichtlich ihrer Forschungsleistungen evaluiert. Dabei wird überwiegend auf einen Verbund verschiedener Kriterien wie Publikationen, Zitationskennzahlen, Drittmitteleinwerbungen sowie erfolgreiche Promotionen und Habilitationen zurückgegriffen. In der wissenschaftlichen sowie der hochschulpolitischen Diskussion kommt Publikationen, Zitationskennzahlen und Drittmitteleinwerbungen eine besondere Bedeutung zu, weshalb diese Indikatoren im Folgenden betrachtet werden.

2.3. Indikatoren zur Messung der Forschungsleistung

2.3.1. Forschungsevaluation anhand von Publikationen

Publikationen sind als Medien wissenschaftlicher Kommunikation ein wichtiger Indikator zur Messung der Forschungsleistung (vgl. u.a. Wolf et al. 2005, Fiedler et al. 2008). Forscher publizieren Forschungsergebnisse im Wesentlichen aus zwei Gründen: Zum einen sind sie an der Verbreitung ihrer Ergebnisse und der Teilnahme an wissenschaftlichen Diskursen interessiert (Huff 1999, S. 5). Zum anderen tragen Publikationen – in Abhängigkeit vom Publikationsorgan in unterschiedlich starkem Maße – zur Reputation von Wissenschaftlern bei (Haucap et al. 2005, Ellison 2010). *Ellison* argumentiert sogar, dass die primäre Funktion einer wissenschaftlichen Fachzeitschrift heute nicht mehr in der eigentlichen Verbreitung der Forschung bestehe, da die meisten Beiträge bereits lange zuvor in Form von Arbeitspapieren verbreitet werden, sondern darin, Forschungsergebnissen ein Gütesiegel zu verleihen (Ellison 2010).

Obwohl (Nachwuchs-)Forscher nach eigener Aussage weiterhin planen, Ergebnisse in Monografien oder Buchbeiträgen zu veröffentlichen (Fiedler et al. 2006, S. 474), haben zumindest in den Wirtschaftswissenschaften Publikationen in nationalen und internationalen wissenschaftlichen Zeitschriften ein deutlich höheres Gewicht (Fiedler et al. 2008, S. 486). Bei der Evaluation der Publikationsleistung kommt in den Wirtschaftswissenschaften daher Zeitschriften-Rankings wie zum Beispiel dem VHB-JOURQUAL eine große Bedeutung zu, auch wenn das Ranking umstritten ist. Der Ort der Publikation (zum Beispiel in A-, B- oder C-Journalen) dient oftmals als Qualitätssignal für potenzielle Leser. Auch die Forschungsleistung von Fakultäten und Universitäten wird auf Basis von Publikationen ermittelt (vgl. z.B. Wolf et al. 2005). Beispielsweise werden im Rahmen des „UTD Top 100 Business School Research Ranking“ der University of Texas at Dallas (UTD) Publikationen in 24 als international führend eingestuften wirtschaftswissenschaftlichen Zeitschriften gewertet, um

Business Schools hinsichtlich ihrer Forschungsleistung zu vergleichen (vgl. http://jindal.utdallas.edu/the-utd-top-100-business-school-research-rankings/list-of-journals/).

Der Fokus auf Publikationen zur Messung der Forschungsleistung wird in der Literatur jedoch auch kritisiert. Ein Hauptkritikpunkt ist, dass die Anzahl an Publikationen, auch nach einer Gewichtung mit der Reputation der Zeitschrift, in der sie veröffentlicht wurden, nur eine eingeschränkte Aussagekraft über die Qualität der Forschungsleistung hat (Dilger 2000, S. 475, Dilger 2010). Beispielsweise besteht zwischen der Position von Volkswirten im 2008er Handelsblatt-Ranking und den Zitationsdaten aus dem Web of Science nur ein sehr schwacher statistischer Zusammenhang (Schläpfer 2010). Darüber hinaus werden selbst in hochkarätigen Zeitschriften publizierte Aufsätze zum Teil weniger häufig zitiert als ein Aufsatz in weniger renommierten Zeitschriften (Oswald 2007, Bräuniger et al. 2011). Auch innerhalb einer Zeitschrift sind die Bedeutung und Qualität der Beiträge keineswegs homogen, wie Zitationsanalysen illustrieren (Oswald 2007).

Trotz der Kritik an der Nutzung von Publikationen als Indikator zur Evaluation der Forschungsleistung werden sie in der Praxis häufig verwendet. Dabei scheinen sie in der hochschulpolitischen Diskussion jedoch eine geringere Bedeutung zu haben als in der wissenschaftlichen. Ein Indiz dafür ist, dass Publikationen im Rahmen der LoM auf Länderebene nicht berücksichtigt werden (Jaeger und In der Smitten 2009, S. 12, Jaeger und In der Smitten 2010, S. 11), während sie beispielsweise auf Berufungen großen Einfluss haben (Müller-Camen und Salzgeber 2005, S. 277, Schulze et al. 2008).

2.3.2. Forschungsevaluation anhand von Zitationskennzahlen

Zitationskennzahlen sind ein weiterer Ansatz zur Evaluation der Forschungsleistung. Ihrer Nutzung liegt die Annahme zu Grunde, dass die Qualität eines Artikels nur unzureichend durch die Reputation des Publikationsmediums bewertet werden kann, da Qualitätsunterschiede zwischen den in einer Zeitschrift veröffentlichten Artikeln bestehen (Starbuck 2005, Dilger 2010, Schläpfer und Schneider 2010). Um die Qualität einer Publikation festzustellen, wird deshalb die Zitierrate, d.h. die Gesamtzahl der Zitierungen einer Publikation, erhoben, da davon ausgegangen wird, dass „gute“ Publikationen häufiger zitiert werden als „weniger gute“ (Dilger 2000, S. 475, Dyckhoff et al. 2005, S. 351, Dyckhoff und Schmitz 2007). Die Leistung eines Forschers, einer Fakultät oder einer Universität wird dann als gut bewertet, wenn die Publikationen häufig zitiert werden.

In der wissenschaftlichen Praxis variiert der Einfluss von Zitationskennzahlen bei der Evaluation der Forschungsleistung zum Teil erheblich. In Deutschland finden sich hierzu nur wenige Ansätze. Litzenberger und Sternberg evaluieren beispielsweise die Forschungsleistung von soziologischen Instituten an zehn deutschen Universitäten mittels Zitationsdaten aus dem Social Science Citation Index (SSCI; Litzenberger und Sternberg 2005). In Forschungsrankings wie beispielsweise dem Handelsblatt-Ranking oder dem CHE-Ranking in den Sozial- und Wirtschaftswissenschaften haben individuelle Zitationsdaten hingegen kein Gewicht. Auch im Rahmen der LoM zwischen Ländern und Universitäten

werden sie bislang nicht berücksichtigt (Jaeger und In der Smitten 2009, S. 13, Jaeger und In der Smitten 2010, S. 9). Ein anderes Bild zeigt sich in internationalen Wissenschaftsrankings: So gehen Zitationskennzahlen sowohl in das Academic Ranking of World Universities der Shanghai University als auch in das Times Higher Education Supplement (Enserink 2007) und in das RePEc-Ranking von Institutionen und Ökonomen ein (vgl. http://ideas.repec.org/top/top.germany.html).

Jedoch existieren Grenzen von Zitationskennzahlen zur Evaluation der Forschungsleistung, da Zitationskennzahlen durch Selbstzitate, Zitationskartelle, strategisches Zitieren oder auch durch Unterlassungen von Zitaten manipuliert werden können (Kieser 1998, S. 217, Dilger 2000, S. 476). Außerdem hängt die Zahl der Zitationen, die auf einen Artikel entfallen, auch davon ab, wie häufig andere Artikel in der gleichen Ausgabe der Zeitschrift zitiert werden (Hudson 2007). Darüber hinaus erfassen die Kennzahlen nicht, ob eine Arbeit zitiert wird, weil sie als besonders gut oder besonders schlecht eingestuft wird (Frey und Rost 2010, S. 6f), so dass eine hohe Zitierrate nicht eine hohe Qualität implizieren muss. Zusätzlich können Moden dazu führen, dass Arbeiten nur zitiert werden, weil sie vorher bereits in anderen Artikeln zitiert wurden (Frey und Rost 2010, S. 7). Der sogenannte Matthäus-Effekt verstärkt dies; er besagt, dass Arbeiten, unabhängig von ihrer Qualität, häufiger zitiert werden, wenn sie von Forschern verfasst wurden, deren Arbeiten in der Vergangenheit bereits häufig zitiert wurden (Merton 1968, S. 60).

Obwohl Zitationskennzahlen in der Literatur diskutiert sowie in internationalen Rankings als Indikator zur Evaluation der Forschungsleistung genutzt werden, ist ihr direkter Einfluss auf die Forschungsevaluation in Deutschland gering. Sie werden derzeit weder bei einflussreichen Rankings noch im Rahmen der LoM auf Länderebene direkt berücksichtigt (Jaeger und In der Smitten 2010, S. 11).[28] Es findet lediglich eine indirekte Beachtung statt, da die Reputation von Zeitschriften selbst von der Zitierhäufigkeit der dort erschienenen Aufsätze beeinflusst wird.

2.3.3. Forschungsevaluation anhand von Drittmitteleinwerbungen

Drittmitteleinwerbungen stellen einen weiteren Indikator zur Evaluation der Forschungsleistung dar. Nach dem Hochschulfreiheitsgesetz des Landes Nordrhein-Westfalen (§ 71, Abs. 1, S. 1) kann von Drittmitteln gesprochen werden, wenn Forschungsvorhaben „[…] nicht aus den der Hochschule zur Verfügung stehenden Haushaltsmitteln, sondern aus Mitteln Dritter finanziert werden." Sie stammen beispielsweise von der Deutschen Forschungsgemeinschaft (DFG), den Bundes- und Landesministerien, Stiftungen oder aus der Industrie. Dabei sind Drittmittel, anders als Publikationen und Zitationen, eine Input- und keine Outputgröße (Rassenhövel und Dyckhoff 2006, S. 95, Jansen et al. 2007, S. 125). Jedoch werden Drittmittel zum Teil auch als Ergebnis der Forschungsleistung aufgefasst, da Institutionen bei ihrer Vergabe projektbezogene Vorarbeiten berücksichtigen bzw.

[28] Ausnahmen bilden das 2013 erstmals publizierte FAZ-Ökonomenranking, das den H-index der jeweiligen Wissenschaftler berücksichtigt (vgl. Haucap und Thomas 2014), sowie die oben bereits genannten RePEc-Rankings.

Vorarbeiten einen großen Einfluss auf den Erfolg eines Projektantrags nehmen (Rassenhövel und Dyckhoff 2006, S. 96). Bundesländer nutzen die von einer Hochschule eingeworbenen Drittmittelvolumina als Indikator für die Forschungsleistung (Jaeger 2008, S. 92), um leistungsorientierte Mittel an die Hochschulen zu vergeben (Jaeger und In der Smitten 2010). Auch in die Hochschulrankings des CHE sowie in das Förderranking der DFG gehen die eingeworbenen Drittmittel als ein Indikator zur Ermittlung der Forschungsleistung ein (Rassenhövel und Dyckhoff 2006, S. 93).

Jedoch unterliegt die Nutzung von Drittmitteln zur Evaluation der Forschungsleistung Grenzen. So sind Forscher bzw. Institute, die besonders effizient arbeiten und deshalb kaum Drittmittel benötigen, bei der Nutzung von Drittmittelindikatoren benachteiligt (Kieser 1998, S. 216, Rassenhövel 2010, S. 136). Gleiches gilt für Disziplinen wie zum Beispiel die Sozialwissenschaften, in denen die Forschung, anders als zum Beispiel in den Naturwissenschaften, kaum auf (kostspielige) Geräte angewiesen ist (Kieser 1998, S. 216). Ergebnisse empirischer Studien stellen vor diesem Hintergrund die Nutzung von Drittmitteln zur Messung der Forschungsleistung in Frage und zeigen zum Teil sogar die Existenz eines kritischen Schwellenwerts, ab dem zusätzliche Drittmittel den Forschungsoutput reduzieren (Jansen et al. 2007, S. 144).

Dennoch kommt Drittmitteleinwerbungen zur Evaluation der Forschungsleistung in der aktuellen Evaluationspraxis eine hohe Bedeutung zu. Sie sind sowohl in einflussreichen Rankings als auch bei der LoM auf Länderebene ein wesentliches Kriterium zur Bestimmung der Forschungsleistung (Jaeger und In der Smitten 2010, S. 11). Demgegenüber wird die Nutzung von Drittmitteln zur Evaluation der Forschungsleistung in der wissenschaftlichen Literatur nur selten – meist kritisch – diskutiert.

2.4. Implikationen

Der Überblick des Diskussionsstands zur forschungsbezogenen Leistungsevaluation hat erstens verdeutlicht, dass nicht ein Kriterium existiert, das die Forschungsleistung vollumfänglich abbildet. Kriterien wie Publikationen, Zitationen und Drittmitteleinwerbungen messen jeweils lediglich Teilaspekte der Forschungsleistung. Zweitens finden sich zu jedem dieser Kriterien kritische Stimmen, die sich sowohl auf die jeweilige Methodik als auch auf Einschränkungen in der Aussagekraft beziehen. Drittens bestehen zwischen der wissenschaftlichen Diskussion und der Hochschulpraxis auffällige Diskrepanzen, insbesondere hinsichtlich der Nutzung der Kriterien Drittmitteleinwerbungen und Zitationen.

Die Diskrepanz zwischen der wissenschaftlichen Diskussion und der Hochschulpraxis ist der Ausgangspunkt der explorativen Studie. Vor dem Hintergrund des Wissensdefizits hinsichtlich der Verwendung und Bedeutung der Kriterien zur forschungsbezogenen Leistungsmessung stellen sich die Fragen, welche Position Fakultäten diesbezüglich beziehen und wie sie eine forschungsbezogene Leistungsevaluation verwirklichen. Der Fokus auf Fakultäten begründet sich erstens damit, dass sie von

der Hochschulleitung ihre Ressourcen zugewiesen bekommen (Minssen und Wilkesmann 2003, S. 110). Die Hochschulleitungen orientieren sich dabei mehrheitlich an den von den Bundesländern zur LoM an die Hochschulen genutzten Leistungskriterien (Minssen und Wilkesmann 2003, S. 110). Deshalb könnte einerseits vermutet werden, dass Fakultäten die gleichen Kriterien auch für ihre (sofern vorhandene) fakultätsinterne forschungsbezogene Leistungsmessung nutzen, um eine Fehlallokation der Ressourcen zu vermeiden. Andererseits verfügen Fakultäten bei der internen LoM aber über weitgehende Autonomie (Jaeger 2006, S. 57), so dass sie von den auf Universitätsebene genutzten Kriterien abweichen können. Zweitens hat die Erforschung der zur Mittelverteilung auf Fakultätsebene verwendeten Kriterien eine besondere Relevanz für Hochschulforschung und Hochschulmanagement. Lehrstühle erhalten ihre laufenden Mittel in erster Linie von der Fakultät und nicht von der Universität. Um ihre Mittelzuweisungen zu steigern, müssen sie ihr Verhalten daher primär an den von der Fakultät vorgegebenen Kriterien ausrichten. Diese haben deshalb eine Steuerungsfunktion für das Verhalten der Lehrstühle, die letztlich unmittelbarer ist als die Wirkung der von den Hochschulleitungen verwendeten Kriterien. Drittens sind die von Hochschulleitungen angewendeten Kriterien zur forschungsbezogenen Leistungsmessung von Fakultäten bereits untersucht worden (Jaeger et al. 2005), zu den auf Fakultätsebene eingesetzten Evaluationskriterien liegen jedoch keine aus Querschnittstudien resultierenden Erkenntnisse vor. Einzelne Fallstudien (Jaeger 2006) und Untersuchungen in einem Bundesland (Minssen und Wilkesmann 2003) bieten lediglich erste Einblicke. Eine quantitative explorative Analyse der forschungsbezogenen Leistungsevaluation auf Fakultätsebene ist vor diesem Hintergrund erforderlich, um das eingangs konstatierte Forschungsdefizit hinsichtlich des Einsatzes von Leistungsindikatoren zur forschungsbezogenen Leistungsmessung zu reduzieren.

3. Empirische Studie

3.1. Beschreibung der Studie

In der explorativen Studie wurden wirtschafts- und rechtswissenschaftliche Fakultäten untersucht. Die Wirtschaftswissenschaften wurden gewählt, da hier in den letzten Jahren die Forschungsevaluation intensiv diskutiert wurde (Dyckhoff et al. 2009, Dilger 2010). Die Rechtswissenschaft wurde ausgewählt, da 13 Fakultäten ohnehin Wirtschafts- und Rechtswissenschaft umfassen. Darüber hinaus sind rechts- und wirtschaftswissenschaftliche Fakultäten in sich *relativ* homogen, insbesondere im Vergleich zu vielen geisteswissenschaftlichen oder auch mathematisch-naturwissenschaftlichen Fakultäten, die oftmals sehr viele Disziplinen und auch sehr unterschiedliche Studiengänge vereinen. Zusätzlich weist die Rechtswissenschaft einige Besonderheiten auf: So weicht die Publikationskultur in Wirtschafts- und Rechtswissenschaft stark voneinander ab (Moed et al. 2002, S. 508). Außerdem wird in der aktuellen juristischen Diskussion die rechtliche Zulässigkeit einer LoM auf Grundlage von Leistungsevaluationen kontrovers diskutiert (Bundesverfassungsgericht 2004, Sieweke 2010). Dies

könnte sich insbesondere auf die Einführung eines Systems zur forschungsbezogenen Leistungsmessung an rechtswissenschaftlichen Fakultäten auswirken.

Die Durchführung der explorativen Studie verlief in drei Schritten: Im ersten Schritt wurden alle Fakultäten mit wirtschaftswissenschaftlichen und juristischen Fächern an deutschen Universitäten mit Hilfe der Mitgliederlisten des Wirtschafts- und Sozialwissenschaftlichen bzw. Juristen-Fakultätentages identifiziert (Wirtschafts- und Sozialwissenschaftlicher Fakultätentag 2010, Deutscher Juristen-Fakultätentag 2010) und beide Listen um Dopplungen bereinigt. Die Grundgesamtheit umfasste 117 Fakultäten, davon 87 wirtschaftswissenschaftliche (inklusive „Mischfakultäten" wie zum Beispiel wirtschafts- und rechtswissenschaftliche und wirtschafts- und sozialwissenschaftliche Fakultäten) sowie 30 juristische Fakultäten. Im zweiten Schritt wurden die Dekane der 117 Fakultäten zum Stichtag 31.05.2011 identifiziert, denen im dritten Schritt der Fragebogen, der auf Grundlage der Ergebnisse früherer Studien entwickelt wurde (siehe Anhang; Minssen und Wilkesmann 2003, Jaeger et al. 2005, Jaeger 2006), zusammen mit einem personalisierten Anschreiben postalisch zugeschickt wurde. Um die Rücklaufquote zu erhöhen, konnte der Fragebogen alternativ zur postalischen Rücksendung auch online ausgefüllt werden. Er bestand aus drei Teilen. Im ersten Teil wurden Charakteristika der Fakultät wie ihre Bezeichnung, ihr Alter und ihre Größe erhoben. Die Fragen im zweiten Teil zielten auf die Evaluation der Forschungsleistung an der Fakultät ab. Der dritte Teil des Fragebogens wurde nur von Fakultäten ausgefüllt, die bisher kein System zur Evaluation der Forschungsleistung haben; sie wurden gebeten anzugeben, aus welchen Gründen dies der Fall ist und ob die Einführung zukünftig geplant ist.

Die Befragung lief von Juli bis September 2011. Insgesamt wurden 66 Fragebögen zurückgesendet, davon 47 von wirtschaftswissenschaftlichen (inklusive „Mischfakultäten") und 19 von rein juristischen Fakultäten. Dies entspricht einer Rücklaufquote von durchschnittlich 56,4% (wirtschaftswissenschaftliche Fakultäten: 54,0%; juristische Fakultäten: 63,3%). Allerdings waren nicht alle Fragebögen vollständig beantwortet, wodurch die Zahl der Beobachtungen zwischen den Fragen leicht variiert.

3.2. Ergebnisse der Studie

Die Präsentation der Umfrageergebnisse orientiert sich an der Struktur des Fragebogens: Zunächst wird in Abschnitt 3.2.1 ein Überblick über die Charakteristika der teilnehmenden Fakultäten gegeben. In Abschnitt 3.2.2 werden Einflussfaktoren der Einführung eines Systems zur Leistungsmessung analysiert. In Abschnitt 3.2.3 wird erläutert, mit welchen Kriterien die Forschungsleistung gemessen wird. Anschließend wird in Abschnitt 3.2.4 dargelegt, für welche Zwecke die Messung verwendet wird und welche Wirkungen sie entfaltet. Schließlich wird in Abschnitt 3.2.5 untersucht, warum Fakultäten bislang kein System zur Leistungsmessung haben.

3.2.1. Beschreibung der Daten

Fast alle teilnehmenden Fakultäten (97,0%) befinden sich in staatlicher Trägerschaft, lediglich je 1,5% ist in privater bzw. kirchlicher Trägerschaft. Insgesamt sind 37,9% der Fakultäten rein wirtschaftswissenschaftliche (WiWi), 28,8% rein juristische (Jura) und 24,2% Mischfakultäten, d.h. entweder wirtschafts- und sozialwissenschaftliche oder rechts- und wirtschaftswissenschaftliche Fakultäten (WiSo/ReWi). Dazu kommen noch Fakultäten, in denen wirtschaftswissenschaftliche Fächer mit anderen Fächern (z. B. der Informatik) zusammengefasst wurden (9,0%). Ein Drittel der Fakultäten (34,4%) ist höchstens 25 Jahre alt, während knapp ein Fünftel der Fakultäten (21,9%) vor mehr als 50 Jahren gegründet wurde. An 72,7% der Fakultäten sind höchstens 30 Professoren/innen beschäftigt, und die Anzahl der Studierenden liegt in 39,4% der Fakultäten unter 2000 (vgl. Tabelle 1). Die Fakultäten sind in allen 16 Bundesländern verortet, wobei Nordrhein-Westfalen (24,2%) und Baden-Württemberg (15,2%) den höchsten Anteil haben; diese Bundesländer weisen auch absolut gesehen die höchste Zahl an Universitäten auf.

Insgesamt verfügen 40,9% der antwortenden Fakultäten über ein System zur Evaluation der Forschungsleistung. Mehr als die Hälfte (56,0%) der rein wirtschaftswissenschaftlichen Fakultäten evaluiert regelmäßig die Forschungsleistung ihrer Professoren/innen, während dies bei knapp drei Vierteln (73,7%) der rein juristischen Fakultäten sowie bei 62,5% der Mischfakultäten nicht der Fall ist. Elf Fakultäten (40,7%) haben die Forschungsevaluation bereits vor dem Jahr 2005 begonnen. Lediglich drei Fakultäten evaluieren die Forschungsleistung erst seit ein bis zwei Jahren. Insgesamt nimmt die Zahl der Fakultäten, die ein System zur Forschungsevaluation einführen, nur noch degressiv zu.

Tabelle 4-1: Beschreibung des Samples

	N	Fakultätsausrichtung			Alter in Jahren[a]			Zahl Professoren/innen			Zahl Studierende (in Tsd.)		
		WiWi	Jura	WiSo/ ReWi	≤25	25-50	>50	≤30	31-50	>50	≤2	2-4	>4
mit System	27	56%	26%	38%	45%	36%	36%	42%	38%	40%	38%	52%	23%
ohne System	39	44%	74%	63%	55%	64%	64%	58%	62%	60%	62%	48%	77%
Gesamt	-	38%	29%	24%	34%	44%	22%	73%	20%	8%	39%	41%	20%
	66	25	19	16	22	28	14	48	13	5	26	27	13

[a] Zwei Fakultäten machten keine Angaben zu ihrem Alter.

3.2.2. Einflussfaktoren auf die Einführung eines Systems zur forschungsbezogenen Leistungsmessung

Um festzustellen, welche Faktoren das Vorhandensein (bzw. das Fehlen) eines Systems zur Forschungsevaluation beeinflussen, wurde eine Probit-Regression mit der dichotomen abhängigen

Variable „Fakultät evaluiert Forschungsleistungen“ geschätzt (1 = ja; 0 = nein).[29] Die Robustheit der Analyseergebnisse wurde mit einer logistischen Regression überprüft, die bei leicht höheren Signifikanzniveaus zu den gleichen Ergebnissen führte.

Als erklärende Variablen wurden das Alter der Fakultät, die Zahl der Professoren/innen, die Zahl der Studierenden sowie der Fakultätstyp ausgewählt. Die Trägerschaft der Fakultät wurde nicht berücksichtigt, da sich lediglich zwei Fakultäten nicht in staatlicher Trägerschaft befinden. Das Bundesland, in dem die Fakultät angesiedelt ist, wurde ebenfalls nicht berücksichtigt, da für zehn Bundesländer weniger als vier Beobachtungen vorliegen. Bis auf das Alter der Fakultäten handelt es sich bei diesen Variablen um kategoriale Variablen, die vor der Nutzung in einer Regressionsanalyse in Dummy-Variablen zerlegt werden müssen (Wooldridge 2009, S. 233-238).

Aufgrund der hohen Standardabweichung des Alters der Fakultäten wurden diese in die Gruppen „jünger als 25 Jahre“, „zwischen 25 und 50 Jahre alt“ und „älter als 50 Jahre“ aufgeteilt. Diese Abgrenzung ist aus zwei Gründen zweckmäßig: Erstens ist gewährleistet, dass in jeder Altersklasse eine ausreichende Anzahl an Beobachtungen vorhanden ist, so dass die Schätzung der Koeffizienten nicht übermäßig stark von Ausreißern beeinflusst wird. Zweitens ist die Abgrenzung auch aufgrund der historischen Entwicklung der deutschen Hochschullandschaft gerechtfertigt. Fakultäten, die zum Zeitpunkt der Erhebung älter als 50 Jahre waren, bestanden bereits vor der Bildungsexpansion der 1960er und 1970er Jahre. Demgegenüber wurden Fakultäten, die jünger als 25 Jahre sind, erst nach der Bildungsexpansion und (vielfach) infolge der Wiedervereinigung gegründet, so dass die gewählte Einteilung approximativ die Entwicklungsphasen der deutschen Hochschullandschaft widerspiegelt.

Zur Berücksichtigung der Zahl der Professoren/innen sowie der Studierendenzahl wurden die dummy-codierten Variablen „zwischen 31 und 50 Professoren/innen“ und „mehr als 50 Professoren/innen“ bzw. „zwischen 2000 und 4000 Studierende“ sowie „mehr als 4000 Studierende“ in die Regression einbezogen. Folglich stellen Fakultäten mit weniger als 31 Professoren/innen bzw. mit weniger als 2000 Studierenden die Referenzkategorie dar.

Hinsichtlich der Art der Fakultät wurden die Dummy-Variablen „wirtschaftswissenschaftliche Fakultät“ und „juristische Fakultät“ aufgenommen, wodurch Mischfakultäten zusammen mit sonstigen Fakultäten die Referenzkategorie bilden.

Ein mögliches Problem im Rahmen der Schätzung sind etwaige Korrelationen zwischen Fakultäten des gleichen Typs, die auftreten, wenn die Entscheidung für bzw. gegen die Einführung eines Systems zur forschungsbezogenen Leistungsmessung von Faktoren beeinflusst wird, die alle Fakultäten eines Typs gleichermaßen beeinflussen, sich nicht aber auf Fakultäten unterschiedlichen Typs auswirken. Um

[29] Grundsätzlich kann die Analyse auch als logistische Regression durchgeführt werden. Da die Probit-Regression jedoch weiter verbreitet ist (vgl. Wooldridge 2009, S. 577) und Probit- und Logit-Regression in den meisten Fällen zu vergleichbaren Ergebnissen führen (vgl. Gill 2001, S. 33; Greene 2003, S. 667; zu den Ausnahmen siehe Hahn und Soyer 2005), wurde sie für die Analyse ausgewählt.

Verzerrungen der Standardfehler der Regressionskoeffizienten aufgrund dieser gruppeninternen Korrelationen zu vermeiden, wurden in der Schätzung „clustered standard errors“ verwendet (Wooldridge 2002, S. 496-497). Tabelle 2 zeigt neben den Regressionskoeffizienten auch die durchschnittlichen marginalen Effekte der Probit-Regression.

Das Alter der Fakultäten hat keinen signifikanten Einfluss auf die Wahrscheinlichkeit der Einführung eines Systems zur Forschungsevaluation. Hinsichtlich der Größe einer Fakultät zeigt sich, dass die Wahrscheinlichkeit der Existenz eines Systems zur Messung von Forschungsleistungen für Fakultäten mit mehr als 50 Professoren/innen signifikant höher ist als für Fakultäten mit höchstens 30 Professoren/innen ($p = 0,05$, zweiseitiger Test). Bei Fakultäten mit mehr als 4000 Studierenden hingegen ist die Wahrscheinlichkeit, Forschungsleistungen zu evaluieren, signifikant geringer als für Fakultäten mit höchstens 2000 Studierenden ($p = 0,08$, zweiseitiger Test). Zuletzt verdeutlichen die Ergebnisse der Probit-Regression, dass Fakultäten mit ausschließlich wirtschaftswissenschaftlichen Lehrstühlen eine signifikant höhere Wahrscheinlichkeit zur Einführung eines Systems zur forschungsbezogenen Leistungsmessung aufweisen als Mischfakultäten und andere Fakultäten ($p = 0,03$, zweiseitiger Test). Gemäß der durchschnittlichen marginalen Effekte ist die Wahrscheinlichkeit für die Einführung eines Systems zur forschungsbezogenen Leistungsmessung an Fakultäten mit mehr als 50 Professoren/innen (4000 Studierenden) im Durchschnitt um 57% höher (38% geringer) als an Fakultäten mit höchstens 30 Professoren/innen (2000 Studierenden) und an rein wirtschaftswissenschaftlichen Fakultäten im Vergleich zu Mischfakultäten um 42% höher.

Tabelle 4-2: Ergebnisse der Probit-Regression

	Koeffizient (Standardfehler[a])	Durchschnittlicher marginaler Effekt
zwischen 25 und 50 Jahre alt	-0,35 (0,57)	-0,11
älter als 50 Jahre	-0,01 (0,45)	0,00
zwischen 31 und 50 Professoren/innen	1,32 (0,94)	0,35
mehr als 50 Professoren/innen	2,61* (1,34)	0,57
zwischen 2000 und 4000 Studierende	0,20 (0,40)	0,07
mehr als 4000 Studierende	-1,69* (0,96)	-0,38
rein wirtschaftswissenschaftliche Fakultät	1,37** (0,62)	0,42
rein juristische Fakultät	0,52 (0,56)	0,14
Konstante	-1,10* (0,60)	
pseudo-R^2	0,142	
N	64	

[a] Berechnung der Standardfehler unter Berücksichtigung möglicher Korrelationen innerhalb der verschiedenen Fakultätstypen.

* $p \leq 0,1$, ** $p \leq 0,05$, *** $p \leq 0,01$.

3.2.3. Beschreibung der eingesetzten Kriterien

Während von den Bundesländern insbesondere das Drittmittelvolumen als Indikator für die Forschungsleistung von Universitäten eingesetzt wird (vgl. 2.4), verwenden Fakultäten eine Vielzahl an Indikatoren, um die Forschungsleistung der Lehrstühle zu messen (*vgl. Tabelle 3*). Zwar ist auch auf Fakultätsebene die Höhe der eingeworbenen Drittmittel (Mittelwert (MW): 3,5; Skala 1 = keine Bedeutung bis 4 = hohe Bedeutung) das wichtigste Kriterium zur Evaluation der Forschungsleistung, jedoch sind auch Publikationen in internationalen referierten Zeitschriften (MW: 3,3) sowie die Zahl der Promotionen (MW: 3,3) wichtige Kriterien. Auffällig ist die geringe Bedeutung von Zitationskennzahlen; weder die Gesamtzahl der Zitationen (MW: 1,6) noch andere bibliometrische Kennzahlen wie beispielsweise der h-Index (MW: 1,3) sind häufig genutzte Kriterien für die Bestimmung der Forschungsleistung. Zwischen den verschiedenen Fakultätstypen bestehen Unterschiede hinsichtlich der Verbreitung einzelner Kriterien (vgl. Tabelle 3). Rein juristische Fakultäten messen im Rahmen der Forschungsevaluation sonstigen Publikationen sowie der Zahl der Promotionen und Habilitationen eine höhere Bedeutung zu als rein wirtschaftswissenschaftliche Fakultäten sowie Mischfakultäten.[30] Darüber hinaus haben sonstige Publikationen an rein wirtschaftswissenschaftlichen Fakultäten im Vergleich zu Mischfakultäten eine höhere Bedeutung.

Tabelle 4-3: Übersicht über die eingesetzten Kriterien zur Forschungsevaluation

		Bedeutung		Mittelwert (Standardabweichung)			
	N	Keine (=1)	Hohe (=4)	Gesamt	WiWi	Jura	WiSo/ReWi
Eingeworbene Drittmittel	24	4%	58%	3,46 (0,78)	3,31 (0,95)	3,60 (0,55)	3,60 (0,55)
Publikationen (international)	24	13%	67%	3,33 (1,09)	3,43 (0,94)	3,25 (1,50)	3,40 (1,34)
Zahl Promotionen	24	0%	50%	3,25 (0,85)	3,23 (0,83)	3,80 (0,45)	2,60 (0,89)
Zahl Habilitationen	24	13%	46%	3,00 (1,10)	2,77 (1,24)	3,80 (0,45)	2,60 (0,89)
Publikationen (national)	24	17%	46%	2,96 (1,16)	3,00 (1,11)	3,25 (1,50)	2,80 (1,30)
Publikationen (sonstige)	24	25%	21%	2,50 (1,10)	2,57 (1,09)	3,50 (0,58)	1,60 (0,89)
Erhaltene Auszeichnungen / Preise etc.	24	58%	13%	1,88 (1,15)	1,93 (1,21)	1,75 (1,50)	1,60 (0,89)
Zitationen gesamt	23	65%	9%	1,57 (0,95)	1,54 (0,97)	1,75 (1,50)	1,40 (0,55)
Andere bibliometrische Kennzahlen	23	74%	0%	1,35 (0,65)	1,38 (0,65)	1,50 (1,00)	1,20 (0,45)

[30] Aufgrund der geringen Zahl an rein juristischen und Mischfakultäten mit System zur Forschungsevaluation (jeweils N=5) wird bei der Unterscheidung nach Fakultätstypen auf die Durchführung von t-Tests verzichtet.

Hinsichtlich des Indikators „eingeworbene Drittmittel“ folgen die Fakultäten weitgehend der Empfehlung der DFG und berücksichtigen Drittmittel bei der Forschungsevaluation nur dann in voller Höhe, wenn diese nach einem anspruchsvollen „peer review“ Verfahren vergeben wurden. Dieses Kriterium trifft auf die meisten öffentlichen Drittmittelgeber zu, während es bei Drittmitteln aus der Privatwirtschaft seltener erfüllt ist (Deutsche Forschungsgemeinschaft 2004, S. 11-13). Jedoch sind zum Teil auch Abstufungen hinsichtlich der Bedeutung öffentlicher Geldgeber für die Forschungsevaluation erkennbar. Drittmittel der DFG sowie der EU werden von je 92,0% der Fakultäten (WiWi: je 85,7%, Jura: je 100%, Mischfakultäten: je 100%) herangezogen. Gelder des Bundesministeriums für Bildung und Forschung (BMBF) von 84,0% (WiWi: 85,7%, Jura: 80,0%, Mischfakultäten: 80,0%), Drittmittel anderer Bundesministerien, von Landesministerien sowie der Thyssen- bzw. VW-Stiftung von je 80,0% (WiWi: je 78,6%, Jura: 80,0%, 100%, 80,0%, Mischfakultäten: 80,0%, 60,0%, 80,0%). Industriemittel werden von immerhin 72,0% der Fakultäten (WiWi: 71,4%, Jura: 80,0%, Mischfakultäten: 60,0%) zur Evaluation der Forschungsleistung herangezogen, obwohl sie in der Regel nicht in einem Begutachtungsverfahren vergeben werden, während Mittel des DAAD nur von 64,0% der Fakultäten berücksichtigt werden (WiWi: 71,4%, Jura: 60,0%, Mischfakultäten: 40,0%). Durchschnittlich stützt sich die Forschungsevaluation auf 6,6 Drittmittelarten, wobei rein wirtschaftswissenschaftliche Fakultäten durchschnittlich 6,4, rein juristische Fakultäten 7,6 und Mischfakultäten 6,2 Drittmittelarten heranziehen. Lediglich eine Fakultät zieht ausschließlich Drittmittel der DFG und EU zur Beurteilung der Forschungsleistung heran.

Weiterhin nehmen 28,0% der Fakultäten, darunter 15,4% der rein wirtschaftswissenschaftlichen, 40,0% der rein juristischen und die Hälfte der Mischfakultäten, eine qualitative Unterscheidung hinsichtlich der Herkunft von Drittmitteln vor. Sie gewichten Drittmittel von öffentlichen Geldgebern oder Stiftungen höher als Industriemittel, womit einer Empfehlung der DFG entsprochen wird (Deutsche Forschungsgemeinschaft 2004, S. 15). Jedoch zeigen sich auch zwischen den öffentlichen Geldgebern teils deutliche Unterschiede in der Gewichtung der Drittmittel. Dies kann am Beispiel zweier Fakultäten verdeutlicht werden, die detaillierte Auskünfte gemacht haben. Die erste Fakultät gewichtet Drittmittel der DFG sowie der VW-Stiftung mit dem Faktor 2,5, so dass ein eingeworbener Euro von diesen Institutionen bei der Forschungsevaluation 2,5 Euro entspricht. Drittmittel der EU, des BMBF sowie von anderen Stiftungen werden mit dem Faktor 1,25 gewichtet, während Mittel aus der Privatwirtschaft mit dem Faktor 1,0 in die Forschungsevaluation eingehen. Auch die zweite Fakultät erkennt Drittmitteln der DFG einen besonderen Wert zu; sie gehen zu 100% in die Forschungsevaluation ein, während Drittmittel von allen übrigen öffentlichen und privaten Geldgebern mit lediglich 50% ihrer Gesamthöhe berücksichtigt werden.

Eine ähnliche Abstufung ist bei Publikationen zu erkennen. Insgesamt verwenden 46,2% der Fakultäten Rankings bzw. Ratings, um die Qualität von Zeitschriftenpublikationen zu ermitteln, wobei 57,1% der rein wirtschaftswissenschaftlichen und zwei Drittel der Mischfakultäten jedoch keine der fünf Jura-

Fakultäten angeben, ein solches Ranking zu nutzen. Ein Drittel der Fakultäten (WiWi: 50,0%, Mischfakultäten: 33,3%) nutzt das VHB-JOURQUAL-Ranking zur Qualitätsbestimmung, während 22,2% der Fakultäten (WiWi: 35.7%, Mischfakultäten: 16,7%) auf das Handelsblattranking (sowohl für die Betriebs- als auch für die Volkswirtschaftslehre) zurückgreifen. 18,5% der Fakultäten (WiWi: 28,6%, Mischfakultäten: 16,7%) ziehen beide Rankings heran. Die Verwendung von Rankings hat zur Folge, dass Zeitschriftenartikel bei der Forschungsevaluation mit unterschiedlichen Gewichtungen berücksichtigt werden. Beispielsweise gab eine Fakultät an, dass Artikel, die in einer Zeitschrift der Kategorie A+ veröffentlicht wurden, mit dem Faktor zehn gewichtet werden, während Zeitschriften der Kategorie A mit dem Faktor fünf, der Kategorie B mit dem Faktor 2,5, der Kategorie C mit dem Faktor 1,5 sowie der Kategorie D mit dem Faktor 0,75 in die Forschungsevaluation eingehen. Eine andere Fakultät vergibt für Publikationen in A+ Zeitschriften 100 Punkte, während Artikel in Zeitschriften der Kategorie A 50 Punkte, der Kategorie B 25 Punkte sowie der Kategorie C und D jeweils zehn Punkte erhalten. Beide Fakultäten differenzieren ferner zwischen Zeitschriftenpublikationen und anderen Publikationen. Während Monografien in der ersten Fakultät mit dem Faktor vier gewichtet werden und sich dadurch nur unwesentlich von einer Publikation in einer in der Kategorie A gerankten Zeitschrift unterscheiden (Faktor fünf), werden sie bei der zweiten Fakultät nicht gewertet. Ähnlich verfahren die Fakultäten mit Beiträgen in Sammelbänden.

3.2.4. Verwendung und Auswirkungen der forschungsbezogenen Leistungsmessung

Wie frühere Studien zeigen, werden Systeme zur forschungsbezogenen Leistungsmessung auf universitärer Ebene insbesondere für die LoM verwendet (Heinze 2002, S. 22, Hornbostel 2006, S. 221). Die Ergebnisse der vorliegenden Studie zeigen, dass dies auch auf fakultärer Ebene zutrifft. 87,5% aller Fakultäten bzw. 85,7% der rein wirtschaftswissenschaftlichen, alle rein juristischen und 80,0% der Mischfakultäten verwenden die Ergebnisse der forschungsbezogenen Leistungsmessung für die LoM innerhalb der Fakultät. Weitere Anwendungsbereiche sind die Evaluation von Juniorprofessoren/innen (alle: 37,5%, WiWi: 28,6%, Jura: 0%, Mischfakultäten: 80,0%), Bleibe- und Berufungsverhandlungen (alle: 29,2% bzw. 20,8%, WiWi: 21,4% bzw. 14,3%, Jura: jeweils 0%, Mischfakultäten: 60,0% bzw. 40,0%) sowie die Evaluation von Bewerbern im Rahmen von Berufungen (alle: 25,0%, WiWi: 14,3%, Jura: 0%, Mischfakultäten: 60,0%). Kaum Verwendung findet sie zum fakultätsinternen Vergleich verschiedener Lehrstühle (alle: 12,5%, WiWi: 21,4%, Jura: 0%, Mischfakultäten: 0%) sowie zur Vergabe interner Boni oder Auszeichnungen (alle: 12,5% bzw. 8,3%, WiWi: je 14,3%, Jura: 25,0% bzw. 0%, Mischfakultäten: je 0%).

Hinsichtlich des Volumens, das auf Grundlage der forschungsbezogenen Leistungsmessung an die Lehrstühle verteilt wird, zeigt sich, dass bei zwei Dritteln der Fakultäten (66,7%) bis zu 250.000 Euro vergeben werden, während lediglich 9,5% der Fakultäten mehr als eine Million Euro auf Basis der Evaluationsergebnisse an die Lehrstühle verteilen. Eine nach Fakultätstypen differenzierte Betrachtung zeigt, dass 76,9% der rein wirtschaftswissenschaftlichen, die Hälfte der rein juristischen und 60,0% der

Mischfakultäten höchstens 250.000 Euro leistungsorientiert vergeben. Da die absolute Höhe der verteilten Mittel mit hoher Wahrscheinlichkeit auch von der Größe der Fakultät abhängt, wurde ebenfalls der relative Anteil der leistungsorientiert vergebenen Mittel gemessen am Gesamtbudget der Fakultät abgefragt. Bei 50,0% der Fakultäten beträgt dieser Anteil höchstens 10% des Gesamtbudgets der Fakultät, wobei dies an 41,7% der rein wirtschaftswissenschaftlichen, zwei Dritteln der rein juristischen und 60,0% der Mischfakultäten der Fall ist. Lediglich 18,2% der Fakultäten (WiWi: 25,0%, Jura: 0%, Mischfakultäten: 20,0%) vergeben mehr als 30% ihres jährlichen Gesamtbudgets auf Grundlage der Ergebnisse der forschungsbezogenen Leistungsbewertung.

Die Auswirkungen forschungsbezogener Leistungsmessung sehen die befragten Dekane in Forschung, Drittmitteleinwerbung, Publikationen und Lehre. Am stärksten sind sie hinsichtlich der Publikationsorientierung der Lehrstühle (MW: 3,8; Skala 1 = deutlich verringert bis 5 = deutlich erhöht), der Drittmittelorientierung (MW: 3,7) und der generellen Forschungsorientierung (MW: 3,6). Durchschnittlich keine bedeutenden Auswirkungen hatte die Einführung hingegen auf die Lehrorientierung (MW: 3,2). Rein wirtschaftswissenschaftliche und Mischfakultäten schätzen die Auswirkungen der Forschungsevaluation positiver ein als rein juristische Fakultäten. Während rein wirtschaftswissenschaftliche und Mischfakultäten sowohl bei der Forschungs- als auch der Publikationsorientierung durchaus Steigerungen sehen (MW WiWi: 3,7 bzw. 4,2; Mischfakultäten: 3,8 bzw. 3,6), geben rein juristische Fakultäten an, keine Veränderungen in diesen Bereichen festzustellen (MW je 3,0). Lediglich bei der Drittmittelorientierung sehen alle drei Fakultätstypen positive Auswirkungen (MW WiWi: 3,6; Jura: 3,5; Mischfakultäten: 3,8). Demgegenüber geben rein juristische Fakultäten im Schnitt eine Verschlechterung der Lehrorientierung an (MW: 2,5), während sowohl rein wirtschaftswissenschaftliche als auch Mischfakultäten diese als weitgehend unverändert ansehen (MW WiWi: 3,4; Mischfakultäten: 3,3).

Zuletzt wurden die Dekane nach der generellen Zufriedenheit mit ihrem fakultätsinternen System zur forschungsbezogenen Leistungsmessung befragt. Sie äußern überwiegend Zufriedenheit mit ihrem System. Auf einer fünfstufigen Likert-Skala (1 = gar nicht zufrieden, 5 = sehr zufrieden) wurde durchschnittlich ein Wert von 3,4 angegeben. Insgesamt 48,0% der Fakultäten sind „sehr zufrieden“ bzw. „zufrieden“ mit ihrem derzeitigen System, 40,0% sind zumindest „teilweise zufrieden“. Rein wirtschaftswissenschaftliche Fakultäten äußern die höchste Zufriedenheit mit ihrem System zur Forschungsevaluation (MW: 3,6), gefolgt von Mischfakultäten (MW: 3,4) und rein juristischen Fakultäten (MW: 2,8). Zufrieden oder sehr zufrieden mit ihrem System sind 64,3% der rein wirtschaftswissenschaftlichen und 40,0% der Mischfakultäten, aber lediglich ein Fünftel der rein juristischen Fakultäten.

3.2.5. Hinderungsgründe forschungsbezogener Leistungsevaluation

Der Fragebogen richtete sich auch an Fakultäten, die zum Zeitpunkt der Befragung nicht über ein System zur forschungsbezogenen Leistungsmessung verfügten, was auf 39 Fakultäten zutraf. Zwei Drittel dieser Fakultäten planen aktuell keine Einführung (WiWi: 81,8%, Jura: 57,1%, Mischfakultäten: 70,0%). Als wichtigster Hinderungsgrund wird die Befürchtung genannt, dass ein System zur forschungsbezogenen Leistungsmessung zu einer einseitigen Fokussierung auf die zur Beurteilung verwendeten Kriterien führt (MW: 3,3; Skala 1 = trifft überhaupt nicht zu bis 4 trifft voll und ganz zu). Weitere Hinderungsgründe sind die fehlende Notwendigkeit für ein solches System (MW: 3,1), der Mangel an geeigneten Kriterien zur Erfassung der Forschungsleistung (MW: 3,1) sowie ein zu hoher Aufwand bei der Erfassung der Leistungen (MW: 3,0). Der interne Widerstand innerhalb der Fakultät (MW: 1,4) hat laut Aussage der Dekane hingegen keinen wesentlichen Einfluss auf die Entscheidung, ein System zur forschungsbezogenen Leistungsmessung nicht einzuführen. Rein juristische Fakultäten messen den Hinderungsgründen „fehlende Notwendigkeit", „keine geeigneten Kriterien" und „zu einseitige Konzentration" eine deutlich höhere Bedeutung zu (MW 3,5, 3,6 bzw. 3,6) als rein wirtschaftswissenschaftliche Fakultäten (MW: 2,9, 3,0 bzw. 3,2) oder Mischfäkultäten (MW: 2,7, 2,7 bzw. 3,0). Weniger stark ausgeprägt hingegen sind die Unterschiede hinsichtlich der Hinderungsgründe „am internen Widerstand gescheitert" bzw. „zu hoher Aufwand" (MW WiWi: 1,4 bzw. 2,9; Jura: 1,4 bzw. 3,2; Mischfakultäten: 1,5 bzw. 2,6).

4. Schlussfolgerungen

Die Untersuchung gibt Aufschluss über Einflussfaktoren der Einführung von Systemen zur forschungsbezogenen Leistungsmessung, die genutzten Performanzindikatoren, die Auswirkungen der Einführung auf die Forschungs- und Lehrorientierung innerhalb der Fakultäten sowie die Gründe, die aus Sicht einiger Fakultäten gegen die Einführung dieser Systeme sprechen. Als wesentliches Ergebnis kann festgehalten werden, dass (1) Drittmittel, Publikationen und Promotionen in den untersuchten Fakultäten die wichtigsten Kriterien zur Evaluation der Forschungsleistung sind. (2) Die Fakultäten berücksichtigen Drittmittel verschiedener Quellen, wobei teilweise eine Höhergewichtung solcher Drittmittel erfolgt, die von der DFG oder der EU eingeworben wurden. (3) Die im Rahmen der Forschungsevaluation berücksichtigten Publikationen werden in den meisten Fällen unter Zuhilfenahme von Zeitschriftenrankings gewichtet. (4) Haupteinsatzgebiet der Forschungsevaluation ist die LoM.

Durch die Studie wurden Unterschiede hinsichtlich der Bedeutung der Kriterien zur Evaluation der Forschungsleistung zwischen den verschiedenen Fakultätstypen festgestellt.[31] Rein juristische Fakultäten messen der Zahl der Promotionen und Habilitationen eine höhere Bedeutung bei als rein

[31] Aufgrund der geringen Fallzahl der rein juristischen Fakultäten (n = 5) müssen diese Ergebnisse allerdings mit Vorsicht interpretiert werden.

wirtschaftswissenschaftliche Fakultäten. Eine Erklärung hierfür könnte im Ansehen von Promotionen und Habilitationen in der Rechtswissenschaft liegen. Beispielsweise ist die Promotionsintensität, d.h. der Anteil an Studierenden, die nach ihrem Studium erfolgreich promovieren, in der Rechtswissenschaft fast doppelt so hoch wie in den Wirtschaftswissenschaften (Hauss et al. 2012, S. 30). Darüber hinaus haben auch sonstige Publikationen eine höhere Bedeutung. Dies kann durch die besondere Publikationskultur erklärt werden. So ist in weiten Teilen der Rechtswissenschaft - anders als in den Wirtschaftswissenschaften - kein Trend zu Publikationen in (englischsprachigen) „peer reviewed" Fachzeitschriften sowie zur Einführung von Zeitschriftenrankings erkennbar; stattdessen besitzen Publikationen wie z. B. Monographien und Gesetzeskommentare weiterhin einen (sehr) hohen Stellenwert.

Darüber hinaus verdeutlichte die Analyse drei Faktoren, die die Einführung eines Systems zur forschungsbezogenen Leistungsmessung beeinflussen: (1) Fakultäten mit mehr als 50 Professoren/innen haben signifikant häufiger Systeme zur forschungsbezogenen Leistungsmessung eingeführt als Fakultäten mit weniger als 30 Professoren/innen. Eine Erklärung dafür ist, dass bei einer großen Zahl an Professuren ein formaler Verteilungsmechanismus nötig ist, wenn man eine Verteilung pro Kopf vermeiden möchte. Organisationstheoretisch lässt sich dieser Befund durch den zunehmenden Kontrollverlust begründen, der aus der steigenden Organisationsgröße resultiert (Williamson 1967, Ouchi 1977, S. 110). Für die Fakultätsleitung (Prinzipal) sinkt damit die Möglichkeit, die Leistungen der Professoren/innen (Agenten) durch (informelle) Kontrollsysteme zu überprüfen. Zudem sind in größeren Fakultäten die Möglichkeiten und Anreize einer gegenseitigen Kontrolle der Professoren/innen geringer (Kandel und Lazear 1992, S. 812f). Um den Kontrollverlust zu reduzieren, bietet sich für Fakultätsleitungen die Einführung formaler Systeme zur forschungsbezogenen Leistungsmessung an (von Görtz et al. 2010, S. 10-11). Darüber hinaus können diese Systeme den Gruppendruck erhöhen, da sie die intrafakultäre Transparenz im Hinblick auf die Forschungsleistung vergrößern, was – personalökonomisch argumentiert – wiederum zu besseren Leistungen führen kann (Mohnen et al. 2008). (2) Fakultäten mit mehr als 4000 Studierenden haben seltener ein System zur forschungsbezogenen Leistungsmessung eingeführt. In solchen Fakultäten haben Leistungen in der Lehre gegebenenfalls eine höhere Bedeutung als Forschungsleistungen (Jaeger 2006, S. 25), weshalb die Einführung eines Systems zur forschungsbezogenen Leistungsmessung für diese Fakultäten eine geringere Relevanz aufweist. (3) Zuletzt zeigt sich im Vergleich zu den übrigen Fakultäten ein höherer Verbreitungsgrad von Systemen zur forschungsbezogenen Leistungsmessung in Fakultäten mit ausschließlich wirtschaftswissenschaftlichen Fächern. Dies könnte durch die größere fachliche Homogenität rein wirtschaftswissenschaftlicher Fakultäten erklärt werden, da Fachspezifika die Anwendbarkeit von Performanzindikatoren einschränken können (Jaeger 2006, S. 32), was sich negativ auf die Einführung eines Systems zur forschungsbezogenen Leistungsmessung auswirken kann. Allerdings wäre auf Grundlage dieser Argumentation zu erwarten, dass rein juristische Fakultäten

ebenfalls signifikant häufiger ein System zur forschungsbezogenen Leistungsmessung eingeführt haben als Mischfakultäten. Dieser Effekt konnte jedoch nicht identifiziert werden. Eine Erklärung für dieses Ergebnis könnte die möglicherweise höhere Affinität von Wirtschaftswissenschaftlern zur Leistungsmessung sein, die z. B. in der häufigen Bezugnahme auf die Prinzipal-Agenten-Theorie in der wirtschaftswissenschaftlichen Forschung deutlich wird (Muth und Süß 2006). Auf dieser Grundlage ist die prinzipielle Vorteilhaftigkeit von Leistungsmessung und leistungsorientierter Ressourcenvergabe im wirtschaftswissenschaftlichen Denken fest etabliert und wird zunehmend auch für den Hochschulbereich diskutiert (Dyckhoff et al. 2009). Demgegenüber werden bei Juristen die Leistungsmessung und LoM im Hochschulbereich zum Teil sehr kritisch gesehen (Sieweke 2010, S. 173-188). Der höhere Verbreitungsgrad von Systemen zur forschungsbezogenen Leistungsmessung an wirtschaftswissenschaftlichen Fakultäten könnte somit Ausdruck der größeren Akzeptanz der Leistungsmessung sowie der LoM unter Wirtschaftswissenschaftlern sein. Dies erklärt auch, weshalb rein juristische Fakultäten, die noch keine Leistungsmessung eingeführt haben, häufiger angeben, dass sie keine Notwendigkeit dafür sehen.

Insgesamt verdeutlicht die Studie die Diskrepanz zwischen der wissenschaftlichen Diskussion und der Hochschulpraxis hinsichtlich der Performanzindikatoren Drittmitteleinwerbungen und Zitationskennzahlen. Während letztere in der Literatur viel diskutiert werden, spielen sie in der Praxis weder bei der LoM von den Bundesländern an die Universitäten (Jaeger und In der Smitten 2009) noch bei der Mittelvergabe von der Hochschulleitung an die Fakultäten (Jaeger et al. 2005, S. 21) eine große Rolle; stattdessen sind Drittmitteleinwerbungen das dominierende Kriterium, obwohl sie im wissenschaftlichen Diskurs kaum Beachtung finden. Als Ursache dafür lässt sich vermuten, dass Fakultäten gezielt die zur Evaluation der Forschungsleistung genutzten Kriterien an denen der Hochschulleitung ausrichten, um die Fakultätsmitglieder zu einer besseren Performanz in diesen Kriterien zu motivieren, was wiederum zu einem höheren Anteil der Fakultät an den leistungsorientiert vergebenen Mitteln führen würde. Zusätzlich kann die Diskrepanz auch durch den relativ geringen Aufwand für die Erhebung von Daten bezüglich Drittmitteleinwerbungen erklärt werden. Diese Daten liegen in aller Regel in der Hochschulverwaltung vor und können Fakultäten bzw. einzelnen Lehrstühlen zugeordnet werden. Bei Zitationskennzahlen ist der Aufwand hingegen höher, da die Daten für jeden Wissenschaftler einzeln erfasst werden müssen. Zudem wird in der wissenschaftlichen Diskussion vielfach auf Probleme bei der Nutzung von Zitationskennzahlen hingewiesen (Merton 1968 S. 60, Kieser 1998, S. 217, Dilger 2000, S. 476, Frey und Rost 2010, S. 6f.). Zwar wird auch auf Grenzen des Indikators Drittmitteleinwerbungen hingewiesen (Kieser 1998, S. 216, Jansen et al. 2007, Rassenhövel 2010, S. 136), jedoch zeigen Studien die gute Nutzbarkeit dieses Indikators (Hornbostel 2001, S. 150-154), was seine Akzeptanz auf Fakultätsebene gefördert haben könnte.

Die Grenzen der vorliegenden Studie bilden den Ausgangspunkt für zukünftige Forschung. Eine erste Grenze ist die fehlende Berücksichtigung politischer Rahmenbedingungen. So haben die

Landesregierungen durch Hochschulgesetze und die von ihnen zur Mittelverteilung an die Universitäten genutzten Kriterien einen erheblichen Einfluss auf die Hochschulen. Dieser konnte bei der Probit-Regression aufgrund geringer Fallzahlen für einige Bundesländer nicht berücksichtigt werden. Diese sollte in zukünftigen Arbeiten berücksichtigt werden, um Aussagen über ihren Einfluss sowohl bei der Einführung als auch bei der Ausgestaltung von Systemen zur forschungsbezogenen Leistungsmessung auf Fakultätsebene treffen zu können. Darüber hinaus kann auf Grundlage der Studie keine Aussage über den Einfluss der Professoren/innen einer Fakultät auf die Einführung und Ausgestaltung von Systemen zur forschungsbezogenen Leistungsmessung getroffen werden. So könnten beispielsweise ihr durchschnittliches Alter, ihre Einstellung zur Forschungsevaluation und/oder ihre Forschungsausrichtung (stärker national bzw. international ausgerichtet) die Einführung beeinflussen. Zuletzt liegt eine Grenze der Studie in der Verallgemeinerbarkeit der Ergebnisse. Da der Fokus auf juristischen und wirtschaftswissenschaftlichen Fakultäten lag, können keine Aussagen über die Verbreitung und Ausgestaltung von Systemen zur forschungsbezogenen Leistungsmessung beispielsweise in naturwissenschaftlichen, medizinischen oder geisteswissenschaftlichen Fakultäten getroffen werden. Zukünftige Arbeiten könnten hier ansetzen und die Verbreitung und Ausgestaltung dieser Systeme in verschiedenen Fakultäten untersuchen, um mögliche fächerübergreifende Gemeinsamkeiten und Unterschiede herauszuarbeiten.

Literatur

Amalou, L. und Süß, S. (2011), 25 Jahre alt und (noch) nicht erwachsen? Personalcontrolling auf der Suche nach Identität. In: Kajüter, Peter/Mindermann, Torsten/Winkler, Carsten (Hrsg.), *Controlling und Rechnungslegung,* Stuttgart, S. 49-70.

Bogumil, J. und Heinze, R. G. (2009), Einleitung. In: Bogumil, Jörg/Heinze, Rolf G. (Hrsg.), *Neue Steuerung von Hochschulen – Eine Zwischenbilanz*, Berlin, S. 7-12.

Bommer, R. und Ursprung, H. W. (1998), Spieglein, Spieglein an der Wand: Eine publikationsanalytische Erfassung von Forschungsleistungen volkswirtschaftlicher Fachbereiche in Deutschland, Österreich und der Schweiz. *Zeitschrift für Wirtschafts- und Sozialwissenschaften*, 118, 1-28.

Bräuninger, M., Haucap, J. und Muck, J. (2011), Was lesen und schätzen Ökonomen im Jahr 2011? *Perspektiven der Wirtschaftspolitik*, 12, S. 339-371.

Bundesverfassungsgericht (2004), 1 BvR 911/00 vom 26.10.2004

Daniel, H.-D. und Fisch, R. (1990), Research Performance Evaluation in the German University Sector. *Scientometrics*, 19, 349-361.

Deutsche Forschungsgemeinschaft (2004), *Empfehlungen zu einer „Leistungsorientierten Mittelvergabe" (LOM) an den Medizinischen Fakultäten*. Stellungnahme der Senatskommission für Klinische Forschung der Deutschen Forschungsgemeinschaft, Bonn.

Deutscher Juristen-Fakultätentag (2010), *Mitglieder des Deutschen Juristen-Fakultätentages*. Zugriff am 11.05.2011 unter http://www.djft.de/

Dilger, A. (2000), Plädoyer für einen Sozialwissenschaftlichen Zitationsindex. *Die Betriebswirtschaft*, 60, 473-484.

Dilger, A. (2001), Was lehrt die Prinzipal-Agenten-Theorie für die Anreizgestaltung in Hochschulen? *Zeitschrift für Personalforschung*, 15, 132-148.

Dilger, A. (2010), Rankings von Zeitschriften und Personen in der BWL. *Zeitschrift für Management*, 5, 91-102.

Dyckhoff, H., Rassenhövel, S. und Sandfort, K. (2009), Empirische Produktionsfunktion betriebswirtschaftlicher Forschung: Eine Analyse der Daten des Centrums für Hochschulentwicklung. *zfbf*, 61, 22-56.

Dyckhoff, H. und Schmitz, C. (2007), Forschungsleistungsmessung mittels SSCI oder SCI-X? Internationale Sichtbarkeit und Wahrnehmung der Betriebswirtschaftslehre von 1990-2004. *Die Betriebswirtschaft*, 67, 638-662.

Dyckhoff, H., Thieme, A. und Schmitz, C. (2005), Die Wahrnehmung deutschsprachiger Hochschullehrer für Betriebswirtschaft in der internationalen Forschung. Eine Pilotstudie zu Zitationsverhalten und möglichen Einflussfaktoren. *Die Betriebswirtschaft*, 65, 350-372.

Ellison, G. (2010), Is Peer Review in Decline? *Economic Inquiry*, 49, 635-657.

Enserink, M. (2007), Who Ranks the University Rankers? *Science*, 317, 1026-1028.

Fiedler, M., Welpe, I. M. und Picot, A. (2006), Terra Incognita. Forschungsleistungen und Qualifizierungswege des deutschsprachigen Hochschullehrernachwuchses für Betriebswirtschaftslehre. *Die Betriebswirtschaft*, 66, 464-486.

Fiedler, M., Welpe, I. M., Lindlbauer, K. und Sattler, K. (2008), Denn wer da hat, dem wird gegeben: Publikationsproduktivität des BWL-Hochschullehrernachwuchses und deren wissenschaftlicher Betreuer. *Zeitschrift für Betriebswirtschaft*, 78, 477-508.

Frey, B. (2007), Evaluierungen, Evaluierungen … Evaluitis. *Perspektiven der Wirtschaftspolitik*, 8, 207-220.

Frey, B. und Rost, K. (2010), Do Rankings Reflect Research Quality? *Journal of Applied Economics*, 13, 1-38.

Gill, J. (2001), *Generalized Linear Models: A Unified Approach*, Thousand Oaks.

Govindarajan, V. und Fisher, J. (1990), Strategy, Control Systems, and Resource Sharing: Effects on Business-Unit Performance. *Academy of Management Journal*, 33, 259-285.

Greene, W. H. (2003), *Econometric Analysis*, 5. Aufl., Upper Saddle River.

Hahn, E. D. und Soyer, R. (2005), *Probit and Logit Models: Differences in the Multivariate Realm*. Zugriff am 03.12.2011 unter http://home.gwu.edu/~soyer/mv1h.pdf

Haucap, J., Hartwich, T. und Uhde, A. (2005), Besonderheiten und Wettbewerbsprobleme des Marktes für wissenschaftliche Fachzeitschriften. *Vierteljahrshefte zur Wirtschaftsforschung*, 74, 84-107.

Haucap, J. und Thomas, T. (2014), Wissenschaftliche Politikberatung: Erreicht der Rat von Ökonomen Politik und Öffentlichkeit? *Wirtschaftsdienst*, 94, 180-186.

Hauss, K., Kaulisch, M., Zinnbauer, M., Tesch, J., Fräßdorf, A., Hinze, S. und Hornbostel, S. (2012), Promovierende im Profil: Wege, Strukturen und Rahmenbedingungen von Promotionen in Deutschland. *iFQ-Working Paper* Nr. 13.

Heiber, H. (1986), Messung universitärer Forschungsleistungen mit Hilfe der Zitatenanalyse. In Fisch, Rudolf/Daniel, Hans-Dieter (Hrsg.), *Messung und Förderung von Forschungsleistungen*, Konstanz, S. 135-149.

Heinze, T. (2002), Evaluation von Forschungsleistungen. Konzeptionelle Überlegungen und Situationsbeschreibung für Deutschland. *Wissenschaftsmanagement*, 8, 14-22.

Hornbostel, S. (2001), Die Hochschulen auf dem Weg in die Audit Society. Über Forschung, Drittmittel, Wettbewerb und Transparenz. In: Stölting, Erhard/Schimank, Uwe (Hrsg.), *Die Krise der Universitäten*, Levithan Sonderheft 20/2001, Wiesbaden, S 139-158.

Hornbostel, S. (2006), Leistungsmessung in der Forschung. Von der Qualitätssicherung der Lehre zur Qualitätsentwicklung als Prinzip der Hochschulsteuerung. In: Hochschulrektorenkonferenz (Hrsg.), *Beiträge zur Hochschulpolitik* 1/2006, Bonn, S. 219-228.

Hudson, J. (2007), Be Known by the Company You Keep: Citations – Quality or Chance? *Scientometrics*, 71, 231-238.

Huff, A. S. (1999), *Writing for Scholarly Publication*, Thousand Oaks.

Jaeger, M. (2006), Leistungsorientierte Budgetierung: Analyse der Umsetzung an ausgewählten Universitäten und Fakultäten/Fachbereichen. *HIS Kurz-Information* A 1/2006, Hannover.

Jaeger, M. (2008), Wie wirksam sind leistungsorientierte Budgetierungsverfahren an deutschen Hochschulen? *Zeitschrift für Hochschulentwicklung*, 3, 89-104.

Jaeger, M. (2009), Steuerung durch Anreizsysteme an Hochschulen. In: Bogumil, Jörg/Heinze, Rolf (Hrsg.), *Neue Steuerung von Hochschulen*, Berlin, S. 45-65.

Jaeger, M. und In der Smitten, S. (2009), Evaluation der leistungsbezogenen Mittelvergabe an die Berliner Hochschulen. *HIS: Forum Hochschule* 1/2009, Hannover.

Jaeger M. und In der Smitten, S. (2010), Evaluation der leistungsbezogenen Mittelvergabe an die Hochschulen in Mecklenburg-Vorpommern. *HIS: Forum Hochschule* 4/2010, Hannover.

Jaeger, M., Leszczensky, M., Orr, D. und Schwarzenberger, A. (2005), Formelgebundene Mittelvergabe und Zielvereinbarungen als Instrumente der Budgetierung an deutschen Universitäten: Ergebnisse einer bundesweiten Befragung. *HIS Kurz-Information A* 13/2005, Hannover.

Jansen, D., Wald, A., Franke, K., Schmoch, U. und Schubert, T. (2007), Drittmittel als Performanzindikator der wissenschaftlichen Forschung – Zum Einfluss von Rahmenbedingungen auf Forschungsleistungen. *Kölner Zeitschrift für Soziologie und Sozialpsychologie*, 59, 125-149.

Kandel, E. und Lazear, E. P. (1992), Peer Pressure and Partnerships. *Journal of Political Economy*, 100, 801-817.

Kieser, A. (1998), Going Dutch – Was lehren niederländische Erfahrungen mit der Evaluation universitärer Forschung? *Die Betriebswirtschaft*, 58, 208-224.

Kieser, A. (2010), Unternehmen Wissenschaft? *Leviathan*, 38, 347-367.

Kreysing, M. (2008), Forschungsförderung mittels leistungsorientierter Mittelvergabe. *Zeitschrift für Hochschulentwicklung*, 3. 19-28.

Kromrey, H. (2009), *Empirische Sozialforschung*, Stuttgart

Litzenberger, T. und Sternberg, R. (2005), Die Forschungsleistung der Soziologie an zehn deutschen Universitäten. Ein bibliometrischer Vergleich auf Basis des Social Science Citation Index (SSCI). *Soziologie*, 34, 174-190.

Meier, F. (2009), *Die Universität als Akteur. Zum institutionellen Wandel der Hochschulorganisation*, Wiesbaden.

Meier, F. und Schimank, U. (2009), Matthäus schlägt Humboldt? New Public Management und die Einheit von Forschung und Lehre. *Beiträge zur Hochschulforschun*g, 31, 42-61.

Merton, R. K. (1968), The Matthew Effect in Science. *Science*, 159, 56-63.

Minssen, H. und Wilkesmann, U. (2003), Folgen der indikatorisierten Mittelzuweisung in nordrhein-westfälischen Hochschulen. *Beiträge zur Hochschulforschung*, 25, 106-128.

Moed, H. F., Luwel, M. und Nederhof, A. J. (2002), Towards Research Performance in the Humanities. *Library Trends*, 50, 498-520.

Mohnen, A., Pokorny, K. und Sliwka, D. (2008), Transparency, Inequity Aversion, and the Dynamics of Peer Pressure in Teams: Theory and evidence. *Journal of Labor Economics*, 26, 693-720.

Müller-Camen, M. und Salzgeber, S. (2005), Changes in Academic Work and the Chair Regime: The Case of German Business Administration Academics. *Organization Studies*, 26, 271-290.

Münch, R. (2008), Stratifikation durch Evaluation: Mechanismen der Konstruktion von Statushierarchien in der Forschung. *Zeitschrift für Soziologie*, 37. Jg., S. 60-80.

Muth, I. und Süß, S. (2006), Homogenisierung der anreizbezogenen Managementforschung? Eine Analyse auf Grundlage des Soziologischen Neo-Institutionalismus. *Zeitschrift für Management*, 1, 168-199.

Neely, A., Gregory, M. und Platts, K. (1995), Performance Measurement System Design: A Literature Review and Research Agenda. *International Journal of Operations & Production Management*, 15, 80-116.

Ouchi, W. G. (1977), The Relationship Between Organizational Structure and Organizational Control. *Administrative Science Quarterly*, 22, 95-113.

Oswald, A. J. (2007), An Examination of the Reliability of Prestigious Scholarly Journals: Evidence and Implications for Decision-Makers. *Economica*, 74, 21-31.

Pommerehne, W. W. und Renggli, M. F. P. (1986), Die Messung universitärer Forschungsleistungen am Beispiel der Wirtschaftswissenschaften. In: Fisch, Rudolf/Daniel, Hans-Dieter (Hrsg.), *Messung und Förderung von Forschungsleistungen*, Konstanz, S. 89-134.

Rassenhövel, S. (2010), *Performancemessung im Hochschulbereich. Theoretische Grundlagen und empirische Befund*e, Wiesbaden.

Rassenhövel, S. und Dyckhoff, H. (2006), Die Relevanz von Drittmittelindikatoren bei der Beurteilung der Forschungsleistung im Hochschulbereich. In: Zelewski, Stephan/Akca, Naciye (Hrsg.), *Fortschritt in den Wirtschaftswissenschaften – Wissenschaftstheoretische Grundlagen und exemplarische Anwendungen*, Wiesbaden, S. 85-112.

Rost, K. und Frey, B. (2011), Quantitative and Qualitative Rankings of Scholars. *sbr*, 63, 63-91.

Schläpfer, F. (2010), How Much Does Journal Reputation Tell us about the Academic Interest and Relevance of Economic Research? Empirical Analysis and Implications for Environmental Economic Research. *GAIA – Ecological Perspectives for Science and Society*, 19, 140-145.

Schläpfer, F. und Schneider, F. (2010), Messung der akademischen Forschungsleistung in den Wirtschaftswissenschaften: Reputation vs. Zitierhäufigkeiten. *Perspektiven der Wirtschaftspolitik*, 11, 325-339.

Schlinghoff, A. und Backes-Gellner, U. (2002), Publikationsindikatoren und die Stabilität wirtschaftswissenschaftlicher Zeitschriftenrankings. *zfbf*, 54, 343-362.

Schulze, G., Warning, S. und Wiermann, C. (2008), What and How Long Does it Take to Get Tenure? The Case of Economics and Business Administration in Austria, Germany, and Switzerland. *German Economic Review*, 9, 473-505.

Sieweke, S. (2010), *Managementstrukturen und outputorientierte Finanzierung im Hochschulbereich. Zum Instrumentarium des Neuen Steuerungsmodells im Hinblick auf Wissenschaftsfreiheit und Hochschulautonomie*, Baden-Baden.

Starbuck, W. H. (2005), How Much Better are the Most-Prestigious Journals? The Statistics of Academic Publishing. *Organization Science*, 16, 180-200.

Süß, S. (2006), Wandel der Forschung und dysfunktionale Effekte des zunehmenden Wettbewerbs um wissenschaftliche Reputation. *Die Hochschule – Journal für Wissenschaft und Bildung*, 15, 84-97.

Trittel, N., Schmidt, W., Müller, A. und Meyer, T. (2010), *Leistungsentgelt in den Kommunen*, Berlin.

Ursprung, H. W. (2003), Schneewittchen im Land der Klapperschlangen: Evaluation eines Evaluators. *Perspektiven der Wirtschaftspolitik*, 4, 177-189.

Valadkhani, A. und Worthington, A. (2006), Ranking and Clustering Australian University Research Performance, 1998-2002. *Journal of Higher Education Policy and Management*, 28, 189-210.

von Görtz, R., Heidler, R. und Jansen, D. (2010), Chancen für neue Forschungslinien? Leistungsorientierte Mittelvergabe und „ergebnisoffene“ Forschung. *Beiträge zur Hochschulforschung*, 32, 8-32.

Weibel, A., Rost, K. und Osterloh, M. (2007), Gewollte und ungewollte Anreizwirkungen von variablen Löhnen: Disziplinierung der Agenten oder Crowding-Out? *Zfbf,* 59, 1029-1054.

Wilkesmann, U. (2012), Auf dem Weg vom Gelehrten zum abhängig Beschäftigten? Zwei deutschlandweite Surveys zur Lehrmotivation von Professoren. In: Wilkesmann, Uwe/Schmid, Christian J. (Hrsg.), *Hochschule als Organisation*, Wiesbaden, S. 363-381.

Williamson, O. E. (1967), Hierarchical Control and Optimum Firm Size. *Journal of Political Economy*, 75, 123-138.

Wirtschafts- und Sozialwissenschaftlicher Fakultätentag (2010), *Mitgliedsfakultäten*, Zugriff am 10.05.2011 unter http://www.fakultaetentag.de/test_WISOFT/mitglieder.html

Wissenschaftsrat (2007), *Forschungsleistungen deutscher Universitäten und außeruniversitärer Einrichtungen in der Chemie,* Köln.

Wolf, J., Rohn, A. S. und Macharzina, K. (2005), Institution und Forschungsproduktivität. Befunde und Interpretationen aus der deutschsprachigen Betriebswirtschaftslehre. *Die Betriebswirtschaft*, 65, 62-77.

Wooldridge, J. M. (2002), *Econometric Analysis of Cross Section and Panel Data*, Cambridge.

Wooldridge, J. M. (2009), *Introductory Econometrics*, 4. Aufl., Florence.

Anhang: Zur Befragung verwendeter Fragebogen

Allgemeine Fragen zu Ihrer Fakultät

1. Bitte nennen Sie uns die Bezeichnung Ihrer Fakultät

2. In welchem Bundesland liegt Ihre Universität?

3. Befindet sich Ihre Universität in staatlicher oder privater Trägerschaft?

   ☐ staatlich ☐ privat ☐ sonstige:

4. In welchem Jahr wurde Ihre Fakultät gegründet?

5. Wie viele Professuren umfasst Ihre Fakultät (ohne Juniorprofessuren)?

   ☐ bis 20 ☐ 31-40 ☐ 51-60
   ☐ 21-30 ☐ 41-50 ☐ > 60

6. Wie viele Studierende waren im Sommersemester 2011 in den Studiengängen Ihrer Fakultät eingeschrieben?

   ☐ bis 1.000 ☐ 2.000-3.000 ☐ 4.000-5.000
   ☐ 1.000-2.000 ☐ 3.000-4.000 ☐ > 5.000

Fragen zur Beurteilung der Forschungsleistung an Ihrer Fakultät

7. Wird an Ihrer Fakultät die Forschungsleistung von Professoren / Lehrstühlen regelmäßig beurteilt?

   ☐ Ja (weiter mit Frage 8) ☐ Nein (weiter mit Frage 21)

8. Wie lange gibt es an Ihrer Fakultät bereits ein System zur regelmäßigen Beurteilung der Forschungsleistung?

   ☐ weniger als 1 Jahr ☐ 3-4 Jahre ☐ > 6 Jahre
   ☐ 1-2 Jahre ☐ 5-6 Jahre

9. Welche Bedeutung haben folgende Kriterien im Rahmen der regelmäßigen Beurteilung der Forschungsleistung an Ihrer Fakultät?

	keine Bedeutung	geringe Bedeutung	mittlere Bedeutung	hohe Bedeutung
Höhe der eingeworbenen Drittmittel, die zur Beurteilung der Forschungsleistung herangezogen	☐	☐	☐	☐
Anzahl der Publikationen in nationalen referierten Zeitschriften	☐	☐	☐	☐
Anzahl der Publikationen in internationalen referierten Zeitschriften	☐	☐	☐	☐
Anzahl anderer Publikationen	☐	☐	☐	☐
Gesamtzahl der Zitationen pro Professor / Lehrstuhl	☐	☐	☐	☐
Andere bibliometrische Kennzahlen, z. B. h-Index, g-Index etc.	☐	☐	☐	☐
Anzahl der erfolgreichen Promotionen pro Jahr	☐	☐	☐	☐
Anzahl der erfolgreichen Habilitationen pro Jahr	☐	☐	☐	☐
Erhaltene Auszeichnungen, Preise, Stipendien etc.	☐	☐	☐	☐
andere, und zwar:	☐	☐	☐	☐

10. Falls mehrere Kriterien zur regelmäßigen Beurteilung der Forschungsleistung an Ihrer Fakultät herangezogen werden: Wie werden diese Kriterien miteinander verknüpft?
    - ☐ Aus den genannten Kriterien wird eine Liste mit K.O.-Kriterien erstellt (Ausschluss-Methode)
    - ☐ Aus den genannten Kriterien wird ein (Forschungs-)Profil erstellt (Profil-Methode)
    - ☐ Die genannten Kriterien werden gewichtet und zu einer Kennzahl zusammengefasst (Scoring-Methode)
    - ☐ Andere, und zwar:

11. Verwenden Sie im Rahmen der Beurteilung der Forschungsleistung an Ihrer Fakultät Zeitschriften-Rankings?
    - ☐ Ja, und zwar folgende:
    - ☐ Nein

12. Welche der nachfolgenden Drittmittel werden an Ihrer Fakultät im Rahmen der regelmäßigen Beurteilung der Forschungsleistung berücksichtigt (Mehrfachnennungen möglich)?
    - ☐ Drittmittel werden zur Beurteilung der Forschungsleistung nicht herangezogen
    - ☐ Drittmittel der Deutschen Forschungsgemeinschaft
    - ☐ Drittmittel der Europäischen Union
    - ☐ Drittmittel des Bundesministeriums für Bildung und Forschung
    - ☐ Drittmittel anderer Bundesministerien
    - ☐ Drittmittel von Landesministerien
    - ☐ Drittmittel der Thyssen- und/oder VW-Stiftung
    - ☐ Drittmittel anderer Stiftungen, und zwar v.a.:
    - ☐ Drittmittel privater Unternehmen
    - ☐ Drittmittel des Deutschen Akademischen Austausch Dienstes
    - ☐ andere, und zwar:

13. Werden die Drittmittel aus den verschiedenen Quellen in irgendeiner Weise gewichtet?
    - ☐ Ja, und zwar folgendermaßen:
    - ☐ Nein

14. Für welche Zwecke wird das System zur regelmäßigen Beurteilung der Forschungsleistung an Ihrer Fakultät eingesetzt (Mehrfachnennungen möglich)?
    - ☐ Leistungsorientierte Mittelvergabe innerhalb der Fakultät
    - ☐ Vergabe interner Boni
    - ☐ Vergabe interner Auszeichnungen
    - ☐ Bleibeverhandlungen
    - ☐ Berufungsverhandlungen
    - ☐ Evaluation von Bewerbern im Rahmen von Berufungsverfahren
    - ☐ Evaluation von Juniorprofessoren
    - ☐ Benchmarking verschiedener Lehrstühle innerhalb der Fakultät
    - ☐ andere, und zwar:

15. Wird das System zur regelmäßigen Beurteilung der Forschungsleistung auf alle Bereiche Ihrer Fakultäten gleich angewendet?
    - ☐ Ja, es gibt keine fakultätsinterne Differenzierung
    - ☐ Nein, innerhalb der Fakultät ergeben sich folgende Unterschiede:

16. Wie hoch ist die Summe der Mittel, die innerhalb Ihrer Fakultät insgesamt leistungsorientiert vergeben wird?
    - ☐ es werden keine Mittel leistungsorientiert vergeben
    - ☐ bis 50.000 Euro
    - ☐ 50.000-100.000 Euro
    - ☐ 100.000-250.000 Euro
    - ☐ 250.000-500.000 Euro
    - ☐ 500.000-750.000 Euro
    - ☐ 750.000-1.000.000 Euro
    - ☐ > 1.000.000 Euro

17. Gemessen an der Mittelzuweisung, die Ihre Fakultät von der Universitätsleitung erhält: Wie hoch ist der Anteil der Mittel, der innerhalb Ihrer Fakultät leistungsorientiert vergeben wird?
    - ☐ 1-5%
    - ☐ 6-10%
    - ☐ 11-20%
    - ☐ 21-30%
    - ☐ > 30%

18. Wie bewerten Sie die Wirkung des Systems zur regelmäßigen Beurteilung der Forschungsleistung an Ihrer Fakultät?

	deutlich verringert		unver-ändert		deutlich erhöht
Forschungsorientierung	☐	☐	☐	☐	☐
Drittmittelorientierung	☐	☐	☐	☐	☐
Publikationsorientierung	☐	☐	☐	☐	☐
Lehrorientierung	☐	☐	☐	☐	☐
Andere, und zwar:	☐	☐	☐	☐	☐

19. Wie zufrieden sind Sie mit dem derzeitigen System zur regelmäßigen Beurteilung der Forschungsleistung an Ihrer Fakultät?

gar nicht zufrieden		teilweise zufrieden		sehr zufrieden
☐	☐	☐	☐	☐

20. Welche Verbesserungen könnten Sie sich vorstellen?

Füllen Sie bitte die folgenden drei Fragen nur aus, wenn an Ihrer Fakultät <u>kein</u> System zur regelmäßigen Beurteilung der Forschungsleistung existiert!

21. Ist es geplant, an Ihrer Fakultät ein System zur regelmäßigen Beurteilung der Forschungsleistung einzuführen?
    - ☐ Ja, und zwar innerhalb der nächsten ___Jahre
    - ☐ Ja, jedoch steht noch kein Zeitpunkt fest.
    - ☐ Nein

22. Was sind aus Ihrer Sicht die Gründe, die gegen die Einführung eines Systems zur regelmäßigen Beurteilung der Forschungsleistung an Ihrer Fakultät sprechen?

	trifft überhaupt nicht			trifft voll und ganz zu
Die Notwendigkeit hat sich für unsere Fakultät bislang noch nicht gestellt.	☐	☐	☐	☐
Die Notwendigkeit wurde bereits angesprochen. Die Umsetzung ist jedoch an internem Widerstand gescheitert.	☐	☐	☐	☐
Es existieren bislang keine geeigneten Kriterien zur Beurteilung der Forschungsleistung.	☐	☐	☐	☐
Die Beurteilung der Forschungsleistung ist mit einem zu hohen Aufwand verbunden.	☐	☐	☐	☐
Die Beurteilung der Forschungsleistung führt zu einer einseitigen Konzentration auf die verwendeten Kriterien; andere wichtige Aspekte werden dabei vernachlässigt.	☐	☐	☐	☐

23. Wie sollte Ihrer Meinung nach ein System zur regelmäßigen Beurteilung der Forschungsleistung ausgestaltet sein?

24. Haben Sie noch Anmerkungen / Kommentare zu unserer Studie?

Erklärung über den erbrachten Beitrag

Hiermit erkläre ich, Johannes Muck, dass das Kapitel „Research Evaluation at Universities – Findings of an Explorative Study of Economics and Law Departments“ in Zusammenarbeit mit Jun. Prof. Dr. Jost Sieweke, Prof. Dr. Stefan Süß und Prof. Dr. Just Haucap entstanden ist.

Dabei habe ich folgenden inhaltlichen und methodischen Beitrag erbracht:

- Ich war verantwortlich für die Konzeption des in der Umfrage verwendeten Fragebogens
- Ich war verantwortlich für die Aufbereitung der Daten
- Ich war verantwortlich für die Konzeption und Durchführung der Datenanalyse
- Ich war verantwortlich für die Interpretation der Analyseergebnisse und habe an der Entwicklung der daraus resultierenden Implikationen mitgearbeitet
- Ich war verantwortlich für die Erstellung von Abschnitt 3 und habe an der Erstellung der übrigen Abschnitte mitgearbeitet

Unterschrift Koautor 1 (Jun. Prof. Dr. Jost Sieweke): _____

Unterschrift Koautor 2 (Prof. Dr. Stefan Süß): _____

Unterschrift Koautor 3 (Prof. Dr. Justus Haucap): _____

PART B:
MOBILE TELECOMMUNICATIONS

Chapter 5: First Mover Advantages in Mobile Telecommunications: Evidence from OECD Countries[32]

1. Introduction

Do market pioneers, i.e., firms that enter a market first, have a first mover advantage (FMA) vis-à-vis followers, i.e., later entering competitors? Numerous studies in economics and both management and marketing research have investigated whether pioneering firms enjoy FMAs over followers (see e.g. Ethiray and Zhu 2008, Carson et al. 2007, Frynas et al. 2006). The majority of these studies find empirical support for the existence of FMAs, which enable pioneering firms to set prices above competitive levels and thus gain excessive profits (Dewenter and Haucap 2008). The topic of FMAs is especially important because recent studies on market share dynamics provide strong evidence that market leadership often persists for a long time, much longer than standard economic theory predicts (see, e.g., Sutton 2007).

Since FMAs affect the cost position of firms, they are particularly important in regulated industries such as mobile telecommunications, where national regulation authorities (NRAs) regulate termination rates based on some (estimated) measure of operators' costs. If pioneering operators enjoy a superior cost position vis-à-vis later entering competitors due to FMAs, symmetric regulation of the termination rates of pioneers and followers allows the former to earn additional profits (Dewenter 2007). This, in turn, further strengthens the competitive position of pioneers. Ultimately, this might impede the development of competition among mobile network operators, thereby thwarting the regulation authorities' objective of stimulating competition. Hence, the existence of FMAs in mobile telecommunication would support the policy of NRAs to implement an asymmetric regulation of pioneers and followers, to provide a level playing field for all market participants.

In recent years, several empirical studies have explored whether FMAs for market pioneers exist in the mobile telecommunications industry. The majority of these studies use linear models to investigate whether being the first to enter the market for mobile telecommunications exerts a positive influence on market shares, which would indicate the presence of FMAs. However, the linear representation of operators' market shares does not resemble the empirical observation that market shares in fact follow a nonlinear pattern: while market shares of pioneers follow a negative decreasing course, those of followers tend to follow a positive, but decreasing one. This holds true regardless of whether there are one, two, three, or four firms entering the market after the pioneer, as can be inferred from Figure 1,

[32] We thank Pedro Pereira and the participants at the 38th annual conference of the European Association for Research in Industrial Economics as well as Jason Whalley and the participants at the 2nd PhD Seminar of the International Telecommunications Society for valuable comments on earlier versions of the paper.

which displays the course of market shares in four OECD countries, namely Iceland, Hungary, Germany, and Australia, for the period January 1990 to March 2008.

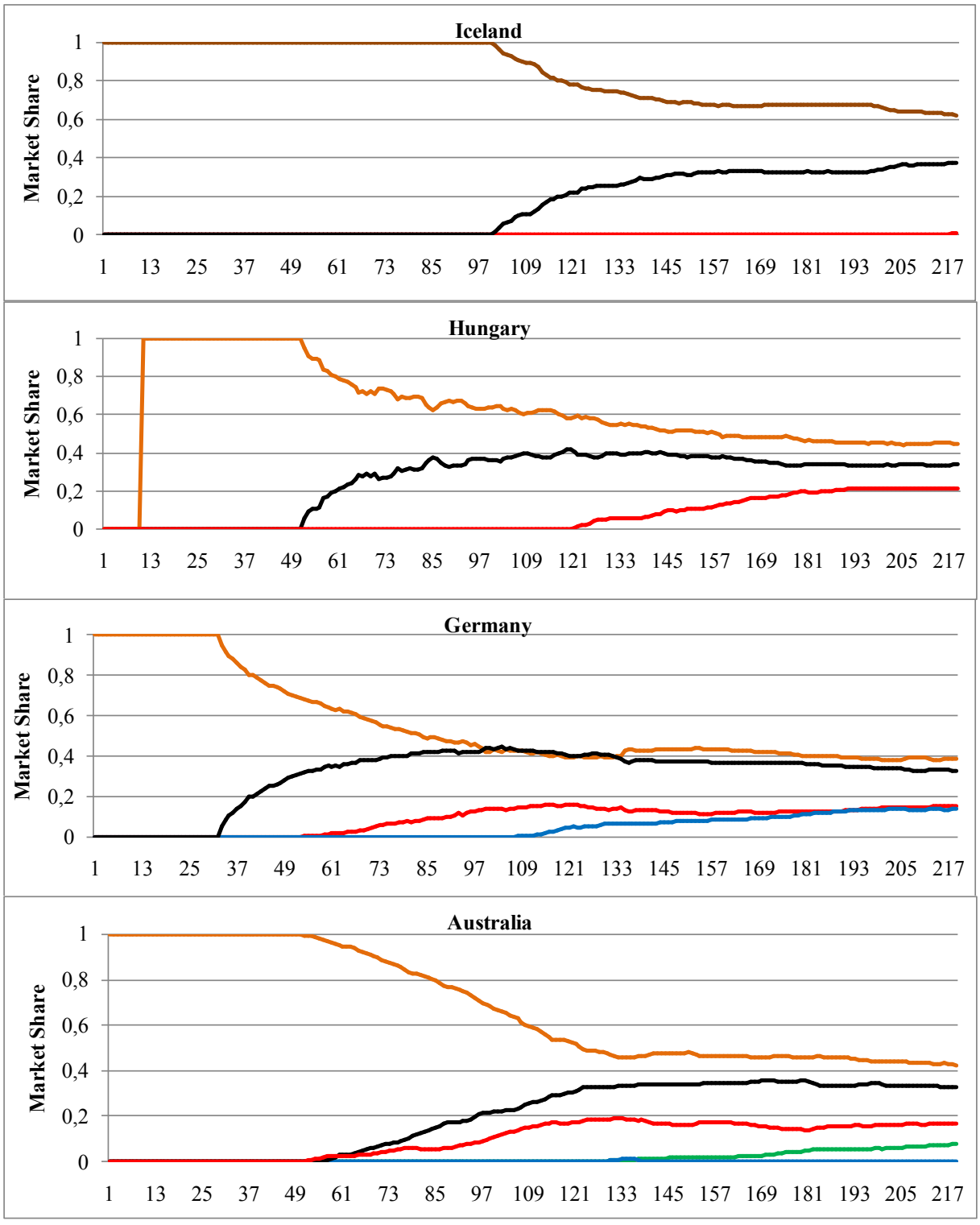


Figure 5-1: Market shares of mobile network operators in selected countries

Hence, it seems to be more appropriate to study FMAs in mobile telecommunications using a nonlinear econometric specification for the number of subscribers or market shares.

To the best of our knowledge, there exist only two empirical studies on FMAs in mobile telecommunications that explicitly account for the non-linear nature of operators' market shares. These are the studies of Dewenter and Haucap (2008), who studied 14 European countries for the period 1990 to 2005, and the study of Bijwaard et al. (2008), who used data on 16 European countries from 1990 to 2006.

In our study, we aim to further ground and extend the previous findings on FMAs in the mobile telecommunications industry by estimating an extended version of the nonlinear model used by Bijwaard et al. (2008) using data on 90 followers from 33 OECD countries covering the period from January 1990 to March 2008. Furthermore, by drawing on studies from the economics, management, and marketing literature, we are the first to provide a comprehensive overview of the empirical research on FMAs in mobile telecommunications.

The remainder of this article is structured as follows: in section two we review the existing literature on FMAs in mobile telecommunications. In section three we explore different sources of FMAs in mobile telecommunications and describe briefly why this market is particularly well suited for analyzing the existence of FMAs. In section four we specify our econometric model and derive testable hypotheses, before we state and interpret the results of our nonlinear least squares estimation in section five. We discuss possible limitations of our study and outline avenues for further research in section six.

2. Empirical Research on FMAs in Mobile Telecommunications

Table 1 gives an overview over the existing empirical studies on FMAs in the mobile telecommunications industry. In addition to the authors' names and the publication year, the table also contains information on the type of model employed, the independent and dependent variables included, the time period, countries, and number of network operators covered by the study, and the core findings with respect to the existence of FMAs.

Table 5-1: Review of empirical studies on FMAs in mobile telecommunications

	Model			Data			
	Model-type	Explanatory variables	Dependent Variables	Period	Countries	No. of Firms	Core findings with respect to FMAs
zu Knyphausen-Aufseß, Krys, & Schneider 2002	case study	n.a.	n.a.	1994-2001	Greece, Germany	2	- The third entrant in the Greek mobile market, Cosmote, enjoyed a late mover advantage by successfully exploiting the inertia of its competitors - By introducing a radically simplified tariff scheme, offering postpaid rather than prepaid services, targeting of the mass market, and capitalizing on the resources of its parent, OTE, Cosmote became market leader within only three years
Kim & Kwon, 2003	multiple discrete-choice	- Age - Monthly payment - Monthly income - Network size - Price level	Mobile carrier selection	1999	Korea	5	- Consumers are more likely to choose larger networks - Older consumers are more likely to choose the pioneer
Gerpott, 2005	correlation analysis	- Time in market - Market share	- Market share - EBITDA	1992-2004	16	54	- Significant positive correlation between time in market and market share - Significant positive correlation between market share and EBITDA
Rieck, 2005	linear regression	- Time elapsed since entry of GSM / GPRS / MMS pioneer - Time since January 1990 - ARPU - Churn rate - Market share - Operational revenue - Number of employees - GDP per capita - Operator migrated from TDMA or CDMA	Tobin's q	2002	20	30	- Entering the GSM market early has a positive effect on performance - Entering the MMS market early has a negative effect on performance - ARPU and market share have a positive effect on performance
Sung, 2005	System of three linear regressions	- Market share - EBITDA - ARPM - Former state monopolist - Time in market - Number of operators - Frequency band used - Majority of shares held by a global operator - Penetration rate - Number portability - Number of subscribers - Population density	- Market share - EBITDA - ARPM	1998-2003	27 OECD countries	94	- Market share has positive impact on ARPM - ARPM has positive impact of EBITDA - EBITDA has positive impact on market share - Former state monopolists have higher market share - Time in market has positive impact on market share and EBITDA - Number of operators has negative impact on market share and ARPM - Operators owned by a globally active carrier have higher EBITDA - Mobile number portability has negative impact on ARPM - Number of subscribers has negative impact on ARPM - Penetration rate has positive impact on EBITDA - Population density has negative impact on ARPM

Table 5-1 (continued)

	Model			Data			
	Model-type	Explanatory variables	Dependent Variables	Period	Countries	No. of Firms	Core findings with respect to FMAs

Gerpott & Jakopin, 2006	linear regression	- Market entry through cooperation with already active network operator
		- Market entry through acquisition of shares of already active network operator
		- Market entry through foundation of new network operator
		- Degree to which entry is part of an internationalization strategy
		- Entry order
		- Time elapsed since entry of pioneer
		- 13 firm- and market-related control variables, among others:
		  - Penetration rate
		  - Number of active operators
			Stock market reaction	1989-2004	16	29	- Entry through cooperation with/acquisition of shares of existing operators is inferior to entry through foundation of new operator
							- Entry order has negative effect on stock market reaction
							- Lead time of the pioneer has positive effect on stock market reaction
							- Penetration rate has no effect on stock market reaction
							- Number of active operators has no effect on stock market reaction

Atiyas & Dogan, 2007	case study	n.a.	n.a.	1994-2004	Turkey	4	- The long period of duopoly in the Turkish market created significant first- mover advantages for the two pioneering network operators - Regulatory mistakes further strengthened the position of the two pioneers
Fernández & Usero, 2007	log-linearized regression	- Entry order - Time in market - Market growth - Market concentration - Market has two pioneers - Number portability - Pre-entry experience	Erosion of pioneer's market share	1993-2005	EU, Norway, Switzerland	61	- Easier to gain market share from pioneer for early entrants - Easier to gain market share from pioneer if only one pioneer in the market - More difficult to gain market share from pioneer with pre-entry experience in markets with two pioneers - Easier to gain market share from pioneer if number portability is possible - Easier to gain market share from pioneer if market is growing - More difficult to gain market share from pioneer if market is concentrated
Bijwaard, Janssen, & Maasland, 2008	- non-linear regression - linear regressions	- Penetration rate at market entry - Market concentration at market entry - Market growth - Market concentration	Market share	1990-2006	16 European countries	45	Core results of the non-linear model: - A follower's long-run market share is negatively influenced by the penetration rate and market concentration at market entry - A follower's speed of convergence is influenced positively by market growth and negatively affected by the market concentration Core results of the linear models: - Market growth and market concentration have a positive impact on followers' market share
Dewenter and Haucap 2008	non-linear regression	- Lagged number of subscribers	Growth in number of subscribers	1990-2005	14 European countries	n.a.	- The convergence of market shares of pioneers and followers is slower in countries that liberalized their market rather late

Table 5-1 (continued)

	Model			Data			
	Model-type	Explanatory variables	Dependent Variables	Period	Countries	No. of Firms	Core findings with respect to FMAs
Fernández & Usero, 2009	linear regression	- Heterogeneity in competitive conduct - Number of differentiation actions - Number of price actions - Market growth - Lead time of pioneer - Penetration rate - Market concentration - Pre-entry experience - Lagged market share	Gain in market share	1997-2000	EU, Norway, Switzerland	51	- Heterogeneity of competitive conduct positively affects gain in market share - Pioneers gain market share by using differentiation actions - Followers gain market share by using price actions - Market growth positively affects gain in market share - Penetration rate negatively affects gain in market share - Market concentration negatively affects gain in market share
Usero & Fernández, 2009	linear regression	- Relative product innovation activity - Relative marketing activity - Relative legal activity - Lead time of pioneer - Entry order - Penetration rate - Market growth - Lagged market share of pioneer	Erosion of pioneer's market share	1997-2000	EU, Norway, Switzerland (excluding Sweden and Luxem-bourg)	49	- If followers issue more legal actions relative to the pioneer they can erode the pioneer's market share - The higher the pioneer's market share in the previous period, the easier it is to erode for the follower - The longer the pioneer's lead-time, the more difficult it is to erode his market share
Tözer, 2010	case study	n.a.	n.a.	1994-2009	Turkey	4	- The dominant pioneer, Turkcell, strengthened its position by strategically delaying regulatory measures (roaming agreements, termination rates, and mobile number portability) and by exploiting tariff-mediated network effects
Lanzolla, Gómez, & Maícas, 2010	linear regression	- Entry order - Market growth - Dummy for UMTS introduction - Former state monopolist - Number of active operators - Interactions between entry order and market growth / UMTS dummy	EBITDA	1998-2007	19 EU countries	65	- Pioneers are more profitable than followers - Market growth has negative effect on profitability - Negative effect of market growth is smaller for pioneers - Introduction of UMTS has negative (positive) effect on profitability of pioneers (followers) - Former state monopolists have higher profitability - Number of operators has negative effect on profitability
Gómez & Maícas, 2011	linear regressions	- Entry Order - Switching costs - Number of active operators - Per capita income	-Market share - EBITDA	1998-2007	19 EU countries	69	- Pioneers have higher market share and profitability - Number of active operators has negative effect on market share and profitability - Switching costs have a positive effect on market share and profitability
Karabag & Berggren 2011	case study	n.a.	n.a.	1994-2009	Turkey	4	- Instead of structural factors, superior management and marketing skills paired with mistakes of competitors enabled the dominant pioneer, Turkcell, to defend and strengthen its dominant position

Table 5-1 (continued)

	Model			Data			
	Model-type	Explanatory variables	Dependent Variables	Period	Countries	No. of Firms	Core findings with respect to FMAs
Eggers, Grajek, & Kretschmer, 2012	two-step linear regression approach	- Average monthly minutes of use - Number of subscribers to a given operator as share of population - Company fixed effect - Lagged average monthly minutes of use - Lagged number of subscribers to a given operator as share of population - Average revenue per minute of a given operator - Average revenue per minute of competitors - Price of local fixed-line connection - Number of subscribers to competitors as share of population - Number of fixed-line subscribers as share of population - GDP per capita - Share of prepaid consumers in own customer base - Pre-entry experience in same technology - Pre-entry experience in the focal market - Operator is pioneer in 2G - Country launched 2G before 1995	- Average monthly minutes of use - Number of subscribers to a given operator as share of population - Company fixed effect	1998-2004	30	90	- Early entry helps firms with pre-entry experience in the same technology to attract high-usage consumers - Firms with pre-entry experience in the focal market (i.e., incumbent fixed-line operator or 1G operators) achieve higher market shares - Early entrants without pre-entry experience in the same technology achieve higher market shares than entrants with such pre-entry experience
Jakopin & Klein, 2012	linear regressions	- Entry order - Time elapsed since entry of pioneer - Former fixed-line monopolist - ARPU of operator - Price level of operator - Share of revenue from data services - Number of subscribers - GDP	- Market share - EBITDA	2004-2006	49	191	- Pioneers have higher market shares and profitability than later entering operators - Former fixed-line monopolists have higher market share and profitability

By and large, the studies on FMAs in mobile telecommunications support the notion that pioneering network operators enjoy an advantage over their later entering competitors, usually through higher market shares and/or profits. However, as already stated above, the majority of these studies use linear regression models to explain market share dynamics of pioneers and followers. The only two exceptions are the studies of Dewenter and Haucap (2008) and of Bijwaard et al. (2008) which explicitly use a non-linear econometric specification to model network operators' market shares. Since these studies are most closely related to our work, we will describe them in more detail below.

In a regression based on a dynamic growth model in the spirit of Barro and Sala-i-Martin (1991), Dewenter and Haucap (2008) investigate market share dynamics of network operators in 14 EU countries. More specifically, they estimate the following model:

(1) $\ln\left(\frac{y_{it}}{y_{it-1}}\right) = a_i - bln(y_{it-1}) + u_{it}$

where y_{it} denotes operator i's market share in period t, u_{it} denotes a random error term, and a_i and b are the parameters to be estimated. The parameter b in this model can be interpreted as the speed of convergence of operators' market shares to a long-run level. Estimating this model for a sample of 14 European countries for the period 1990-2005, Dewenter and Haucap (2008) find that the convergence of market shares of pioneers and followers is slower in countries that liberalized their market rather late.

In a similar vein, Bijwaard et al. (2008) use a dynamic model derived from Kalyanaram and Urban (1992) to analyze FMAs in 16 European countries. In their study, the market shares of followers are represented by:

(2) $m_{it} = \gamma_i(1 - e^{-\beta_i t})$

where m_{it} denotes operator i's market share in period t, γ_i represents operator i's long-run market share, which each operator approaches with a specific speed of convergence, denoted as β_i. Furthermore, γ_i and β_i are modeled as:

(3) $\gamma_i = e^{\alpha_1 p_i + \alpha_2 p_i^2 + \alpha_3 HHI_i + c_i}$

(4) $\beta_i = \beta_1 + \beta_2 HHI_{it} + \beta_3 \Delta p_{it}$

whereby p_i and HHI_i are the penetration rate and the market concentration at the time of market entry of operator i, HHI_{it} is the market concentration in operator i's market at time t, and Δp_{it} is the change in the penetration rate in i's market since the time of i's entry. Concerning the existence of first mover advantages, these scholars find that for followers "[…] it is best to enter as early as possible, i.e., it is not optimal to wait with an entry decision" (p. 254) which indicates the presence of first mover advantages for market pioneers.

However, the studies of Dewenter and Haucap and Bijwaard et al. are limited with respect to their internal and external validity. Dewenter and Haucap use the lagged values of market shares to explain the change in market shares in logarithms, without incorporating additional control variables. Bijwaard

et al. apply a more elaborate model but their analysis suffers from the fact that, for the period January 1998 to May 2006, it is based on monthly data on market shares and penetration rates, whereas, for the years 1990 to 1997, it relies on annual data which the authors interpolate to monthly data. Moreover, both studies concentrate on the existence of FMAs in European countries. Hence, the question of whether their findings extend to mobile telecommunications markets outside Europe remains unanswered. In our study we address some of these shortcomings by building on the non-linear model proposed by Bijwaard et al. (2008) and refining their analysis in three ways: First, we use a more flexible econometric specification, which is more responsive to fundamental changes in the market structure. Second, our analysis uses a richer data set containing monthly data on market shares and penetration rates from January 1990 to March 2008. Third, we base our estimation on the analysis of the 34 OECD countries, thereby extending the findings of FMAs to countries outside Europe.

3. Sources of First Mover Advantages in Mobile Telecommunication Markets

From a theoretical perspective, FMAs in mobile telecommunications can stem primarily from three sources (Dewenter and Haucap 2008, Foros and Steen 2008): technology-induced cost advantages of the pioneer; demand-side induced disadvantages of followers; and tariff-mediated positive network effects benefitting pioneers.

3.1. Technology-Induced Cost Advantages of Pioneers

A first reason for pioneering network operators to enjoy a cost advantage over followers is the existence of economies of scale (Gruber 2005, Foreman and Beauvais 1999). Owing to the large proportion of fixed costs in setting up and operating a mobile telecommunication network, pioneers can have substantially lower average cost per user as compared to followers if they are able to attract a large customer base before subsequent entry occurs. Moreover, a large customer base enables pioneers to faster realize cost reductions, due to learning effects, which further increase the cost differential between first movers and followers (Whang 1995, Lieberman 1989, Sutton 1991).

Besides economies of scale, economies of scope can be a second reason for pioneers' cost advantage over followers. In many countries the incumbent fixed-line operator first entered the market for mobile telecommunications (Jakopin and Klein 2012, see Gruber 2005, p. 15-21 for some examples). In this case, the mobile network operator can use part of the infrastructure of its parent fixed-line operator, e.g. leased lines or buildings on which transmitters can be built, which will result in significantly lower network operation costs (Dewenter and Haucap 2008). Furthermore, the mobile subsidiary of a fixed-line incumbent can also capitalize on the existing distribution network and established brand name of its parent. For example, as zu Knyphausen-Aufseß et al. (2002) report, the Greek mobile network

operator Cosmote,[33] whose parent company is the Greek fixed-line incumbent OTE, was able to gain a significant competitive advantage by offering its services through the 470 OTE distribution outlets and by capitalizing "especially on the brand awareness and reputation of its parent company" (p. 219). This line of argument is also corroborated by the findings of Jakopin and Klein (2012), Lanzolla et al. (2010), and Sung (2005), who submit that mobile network operators that are former fixed-line incumbents have a significantly higher market share and EBITDA than their competitors.

Thirdly, cost advantages for pioneers in mobile telecommunications arise because of the different technologies employed by pioneers and followers to operate their networks. In the early days of mobile telecommunications, pioneers mainly operated their network in the 900 MHz spectrum, since this spectrum was first assigned for mobile telephony usage. Followers, on the other hand, often operated in the 1800 MHz spectrum (see e.g. Hausman 2002, p. 568). While this may have changed over time due to the auctioning of additional licenses, it nevertheless provided pioneers with an initial cost advantage. This cost advantage accrues since transmitters of a 900 MHz network have a greater coverage than those of an 1800 MHz network. As Gerpott (2005) reports, a transmitter operating in the 900 MHz spectrum can cover an area that is 2.3 to 2.8 times larger than that of a transmitter using the 1800 MHz spectrum. Consequently, a 900 MHz network can be operated with a smaller number of transmitters, which, in turn, leads to significant cost reductions for first movers (Gruber 2005). This cost advantage is further amplified by the fact that the prices or rents for locations where transmitters can be built have been increasing constantly over recent years, making it more expensive for later-entering network operators to roll out their network (Kruse, Haucap, and Dewenter 2004, p. 81)

3.2. Demand-Side Induced Disadvantages of Followers

Typically, newly introduced products attract those customers with the highest willingness to pay (Kruse, Haucap, and Dewenter 2004). As Gruber (2005, p. 38) points out, in the case of mobile telecommunications, pioneers primarily "[…] penetrated the segment of high-spending, price insensitive users", enabling them to realize high average revenues per user (ARPU). Hence, when followers enter the market they are only able to attract the mass-market customers with a medium or low willingness to pay, which results in a lower ARPU.

A second demand-side induced disadvantage of followers stems from users' uncertainty about the quality of service of followers. The product 'mobile telephony' can be considered as an experience good (Nelson, 1970), since users can assess important product characteristics, first and foremost network coverage, only ex-post, i.e., after they have subscribed to an operator's network (Dewenter and Haucap 2008). Nevertheless, the coverage of the mobile network appears to be one of the most important factors influencing a user's decision to join a particular network (Gruber 2005). Hence, from a user's point of view, joining a follower's network is a somewhat risky decision. Accordingly, users will only switch

[33] Although Cosmote is the third entrant in the Greek mobile telecommunications market rather than a pioneer, it nevertheless exemplifies the fact that mobile subsidiaries of a fixed-line incumbent can benefit to a large extent from their parents' assets.

their network provider if they are compensated by a risk premium, e.g. in the form of subsidized handsets or lower tariffs. However, due to the lower willingness to pay of its customers, a follower's scope for undercutting the price of the pioneer is limited, making it difficult for them to gain users from the pioneer. Instead, followers might find it easier to enlarge their customer base by penetrating new user segments.

3.3. Tariff-Mediated Positive Network Effects

Positive network effects arise if a user's valuation of a product increases as the total number of its users increases (Shy 2001, p. 3). In mobile telecommunications, tariff-mediated network effects are of particular importance since they can be endogenously created by network operators through the design of their tariff structure (Laffont, Rey, and Tirole 1998, see Harbord and Pagnozzi 2010 and chapter 6 for an overview of the literature on on-net/off-net differentiation). Tariff-mediated network effects occur if operators differentiate between on-net and off-net calls, i.e., calls to the own network (on-net calls) are cheaper than calls to a competitor's network (off-net calls). If calls are placed randomly, which is a common assumption in the literature on on-net/off-net differentiation, the probability of making a (cheaper) on-net call is equal to the network's market share. Hence, the utility a user derives from being subscribed to a certain network, ceteris paribus, increases with the number of other users subscribed to the same network, since the average cost per call decreases with the relative size of the network. Therefore, users have a strong incentive to join the largest network in order to minimize their bill and maximize their benefit from tariff-mediated network effects. Since pioneers in mobile telecommunications tend to have higher market shares than followers (Gerpott 2005, Sung 2005, Gómez and Maícas 2011, Jakopin and Klein 2012) tariff-mediated network effects are highest for users subscribed to the pioneering network, thereby creating tariff-mediated FMAs.

3.4. Suitability of Mobile Telecommunications Markets for Studying First Mover Advantages

In addition to the strong theoretical arguments supporting the existence of FMAs, the market for mobile telecommunications is also particularly well suited to the analysis of the existence of FMAs: three important conceptual issues concerning the measurement of FMAs discussed in the extant literature, namely endogeneity of the entry decision, definition of the first mover, and bias towards surviving firms, do not apply to mobile telecommunications.

A first concern usually raised in the context of the analysis of FMAs is that in most models market entry is assumed to be exogenous, whereas, in reality, it is reasonable to depict entry as an endogenous decision, driven by characteristics of the market and of the entrant (Lieberman and Montgomery 1988, 1998). However, in mobile telecommunications, market entry is not determined endogenously by characteristics of the market, but exogenously, through a decision of the national regulator to offer additional licenses for network operation (Sarkar et al. 1999, Bijwaard et al. 2008, Fernández and Usero

2009). The assumption of exogenously determined market entry in mobile telecommunications is also tested by Eggers et al. (2011). More specifically, they test whether those entrants that acquired their license for network operation through a transparent awarding process, like for instance an auction, are more efficient than entrants that acquired their license through a beauty contest or by allotment of the national government. The basic assumption underlying this test is that the more transparent the awarding process, the more likely it is that the most efficient operator will obtain the license. Eggers et al. (2011, p. 16) report that there are "no statistically significant differences between early movers depending on the license awarding method," which the authors interpret as evidence for the exogeneity of market entry in mobile telecommunications.

Secondly, when analyzing FMAs, it is often difficult to unambiguously identify the true market pioneer. Golder and Tellis (1993), for example, point out that in many analyses of FMAs the firms labeled as pioneer were in fact followers, while the true pioneers remained unidentified. This problem may occur if a firm leaves the market too quickly to be observed. In the context of mobile telecommunications, this problem does not arise because every company willing to enter the market and operate a network, first needs to acquire a license. Hence, each active operator and the starting date of its operations are easily observable. Thus, all relevant network operators and the order of their entry can be undoubtedly identified, thereby ensuring that firms first entering the market are correctly labeled as pioneers.

The bias of some frequently used data sets to include only surviving first movers is a third problem associated with the analysis of FMAs (Golder and Tellis 1993, Day and Freedman 1990). If the data set contains only surviving companies, the analysis of FMAs is likely to overstate the true effect of being the pioneer in a market. However, this problem does not apply to mobile telecommunications. Due to the formal requirements for market entry, data sets on mobile network operators can be expected to comprise a complete set of all relevant mobile network operators, even if they left the market shortly after their entry. Hence, analyses based on these data sets will not show a "survival bias".

4. Econometric Model

To explore the existence of FMAs in mobile telecommunications, we rely on an extended version of the dynamic growth model proposed by Bijwaard et al. (2008). The core assumption of this model is that for each follower there exists a long-run market share that operators approach with an individual speed of convergence.

In line with Bijwaard et al. (2008), we assume that the market share of follower i at time t can be expressed as

(5) $ms_{it} = \gamma_i\left(1 - e^{-\beta_{it}t}\right)$

with γ_i denoting follower i's long-run market share and β_{it} denoting follower i's rate of convergence to the long-run market share in period t. In principle, it would also be possible to use an alternative econometric specification, e.g. a root function or the functional form developed in Kalyanaram and

Urban (1992), to model the empirically observable positive decreasing course of followers' market shares. However, we decided to use the specification of Bijwaard et al. since their model allows for an explicit definition of the factors influencing the two key parameters of a dynamic growth model: namely the long-run market share (steady state) and the rate of convergence.

With respect to γ_i and β_i, we hypothesize that both solely depend on characteristics of the market and not on firm-specific determinants, like for example marketing expenses or product quality. We define the long-run market share, γ_i, as

$$(6)\ \gamma_i = e^{\alpha_1 pen_i + \alpha_2 pen_i^2 + \alpha_3 HHI_i + \alpha_4 num\_of\_op_i + \alpha_5 num\_of\_op_{it} + \alpha_6 country_i}$$

where PEN_I denotes the penetration rate of the market at the time of market entry of company i, calculated as the total number of mobile subscribers divided by the country's total population; HHI_I denotes the Herfindahl-Hirschman index at the time of market entry of company i; $NUM\_OF\_OP_I$ contains the number of already active network operators (including the pioneer) in the market at the time of market entry of follower i; $NUM\_OF\_OP_{IT}$ denotes the number of active network operators at time t; and $COUNTRY_I$ denotes a series of country dummies.

Although the number of already active operators at the time of market entry is closely related to the HHI at the time of entry, we nevertheless include both variables in our specification for the long-run market share γ_i. This is due to the fact that a certain HHI can be achieved by different combinations of market shares and numbers of firms. For the sake of illustration, consider a simple example where an operator plans to enter a market with an HHI of 0.68. An entrant's odds of successfully entering the market are likely to depend on whether this market concentration is the result of a duopolistic market structure with market shares of 20% and 80%, or whether there is an oligopolistic market structure with 5 active operators having market shares of 2.5%, 2.5%, 3%, 10%, and 82%. Hence, the two variables capture different aspects of the competitive situation at the time of market entry and should therefore be included in the specification for γ_i.

Moreover, we extend Bijwaard et al.'s specification for γ_i and also include the number of currently active network operators in period t in (6). In its original specification, a follower's long-run market share was determined exclusively by characteristics of the market at the time of market entry. Hence, whatever happens after market entry would not affect a follower's estimated long-run market share. However, this assumption is particularly unrealistic if the number of active operators changes after the entry of operator i. For instance, the subsequent entry of an additional network operator most likely affects the long-run market shares of the other network operators in the market. By additionally including the number of currently active operators in period t, we allow the long-run market share to react to such changes in the market structure, thereby achieving a more realistic representation of reality and a higher fit to the data.

Although including additional dynamic elements in the specification for the long-run market share might appear to be a promising avenue for increasing the model fit, we only include the current number of

active operators as a dynamic element in equation (6). This is due to the fact that the basic idea of our econometric model is the existence of a stable long-run market share for each follower in the market. Together, these long-run market shares represent a long-run market equilibrium. Including several dynamic elements in equation (6) would lead to continuously changing predictions for the long-run market shares of each follower, thereby contradicting the key idea of stability inherent in our econometric model.

Furthermore, we define the rate of convergence to the long-run market share, β_{it}, as

$$(7)\ \beta_{it} = \beta_0 + \beta_1 HHI_{it} + \beta_2 num\_of\_op_{it} + \beta_3 del\_pen_{it}$$

with HHI_{IT} denoting the Herfindahl-Hirschman index in the market at period t, $NUM\_OF\_OP_{IT}$ denoting the number of active operators in the market at time t, and DEL_PEN_{IT} denoting the change in the penetration rate since market entry of follower i up to period t.

Plugging (6) and (7) into (5) leads to the following estimation equation:

$$(8)\ ms_{it} = \left(e^{\alpha_1 pen_i + \alpha_2 pen_i^2 + \alpha_3 HHI_i + \alpha_4 num\_of\_op_i + \alpha_5 num\_of\_op_{it} + \alpha_6 country_i}\right) * (1 - e^{-(\beta_0 + \beta_1 HHI_{it} + \beta_2 num\_of\_op_{it} + \beta_3 del\_pen_{it})t}).$$

Table 2 provides a list of all variables used in our econometric model together with their definition and operationalization.

Table 5-2: Variables of the econometric model

Variable	Definition	Operationalization
ms_{it}	*market share of follower i at time t*	-
γ_i	*follower i's long-run market share*	-
PEN_I	penetration rate at time of entry of entrant i	(total number of mobile customers/country's population) in the month prior to market entry
HHI_I	market concentration at time of entry of follower i	Herfindahl-Hirschman index in the month prior to market entry
$NUM\_OF\_OP_I$	number of already active operators at time of entry of follower i	total number of active operators (including pioneer(s)) in the month prior to market entry
$NUM\_OF\_OP_{IT}$	current number of active operators	total number of active operators at time t
β_{it}	*rate of convergence to the long-run market share*	-
HHI_{IT}	current market concentration	Herfindahl-Hirschman index at time t
$NUM\_OF\_OP_{IT}$	current number of active operators	total number of active operators at time t
DEL_PEN_{IT}	change in penetration rate since market entry	(penetration rate in t - penetration rate in the month of entry)
t	time index	t=1 in the month of market entry, where market entry is defined as the month in which the operator first shows a non-zero market share

From our model we derive seven hypotheses which can be tested empirically. First of all, we hypothesize that the penetration rate at the time of entry exerts an inverted u-shaped effect on the long-run market share of a mobile network operator. This implies that, in terms of the penetration rate, there is an optimal level of market penetration that, ceteris paribus, maximizes a follower's long-run market share. If, at the time of entry, market penetration is still very low, the diffusion of mobile telephony is still in its infancy, as only the relatively small segment of "innovators" (Rogers 1962) has already subscribed to a mobile network. Hence, large investments are necessary to promote the new technology and to tap new customer segments. Due to the high market risk associated with entry in this stage of the market, a potential entrant is likely to make costly mistakes and to be leap-frogged by later-entering competitors. Taken together, entering a market when the penetration rate is still very low might ultimately lead to a lower long-run market share. If, on the other hand, the penetration rate at the time of entry is already high, so that the diffusion curve has almost reached its saturation level, most of the users potentially interested in subscribing to a mobile network have already adopted the technology.

Thus, in order to increase their customer base, new entrants have to rely on gaining customers from their competitors. This impedes followers from quickly building up a large customer base, eventually leading to a lower long-run market share. If, however, the penetration rate is at a medium level where the diffusion of the new technology starts to accelerate, sufficient investments in promoting the new technology have already been undertaken while, at the same time, the number of potential users who have not yet subscribed to a network is still large. Hence, a company entering the market at this stage to build up its own network can focus on convincing new users to subscribe to its network without having to gain customers from its competitors and investing heavily in market development.

This leads us to propose:

H1: There exists an optimal penetration rate that maximizes a follower's long-run market share, implying that $\alpha_1 > 0$ *and* $\alpha_2 < 0$.

Secondly, we postulate that the market concentration at the time of market entry, measured by the HHI, positively influences a follower's long-run market share. A company entering a highly concentrated market faces a situation in which the distribution of market shares is highly unequal, usually with one dominant firm serving a large fraction of the market. In this situation, an entrant is likely to face strong resistance to entry, mainly from this one dominant player in the market. Building on the theory of fringe competition (see Hirshleifer et al. 2005, p. 231), it is reasonable to assume that it is easier for an entrant to identify potential customers that have either thus far not been served at all or only been served by inferior products, if he mainly has to deal with one big competitor. If, however, an entrant faces multiple strong competitors, the available product space and customer segments are probably already exhaustively occupied by the already active network operators so that it is very challenging for late entering followers to build up a large customer base in the long-run.

Hence, we propose:

H2: The higher the market concentration at the time of market entry, the higher a follower's long-run market share will be, implying that $\alpha_3>0$.

As already stated, besides the market concentration at the time of market entry, we also included the number of active network operators at the time of market entry, since each variable captures a different aspect of the competitive environment at the time of market entry. Concerning the effect of the number of already active operators at the time of market entry, we assume that, at a fixed level of market concentration, it is easier to enter a market with a smaller number of already active operators. In this case, it is easier for an entrant to identify niches in the product space that are still unoccupied by competitors. Hence, a follower will find it easier to gain a foothold in the market and attract subscribers, eventually leading to a higher long-run market share.

Likewise, we expect the number of currently active operators in a market to unfold a negative effect on a follower's long-run market share. Drawing on the standard model of Cournot-competition where in equilibrium the market shares are inversely related to the number of firms in the market, we expect the number of currently active operators to exhibit a negative effect on a follower's long-run market share. Besides, by definition, the long-run market shares of the already active operators must be reduced if an additional network operator enters the market with a non-zero market share, since all long-run market shares must sum up to one.[34]

Besides, the empirical literature on FMAs in mobile telecommunications also supports the notion that the number of active operators negatively affects followers' market shares (Sung 2005, Gómez and Maícas 2011).

This leads us to propose:

H3: The higher the number of already active network operators at the time of market entry, the smaller a follower's long-run market share will be, implying that $\alpha_4<0$.

H4: The higher the number of currently active operators in a market, the lower a follower's long-run market share will be, implying that $\alpha_5<0$.

While the concentration at the time of market entry is assumed to exert a positive influence on a follower's long-run market share, we hypothesize that the current market concentration will negatively affect a follower's rate of convergence to the long-run market share. Especially in the case when the already active operators price differentiate between on-net and off-net calls, consumers have strong incentives to subscribe to the larger networks of the already active operators, due to the existence of tariff-mediated network effects, instead of subscribing to the smaller network of a new entrant. The more concentrated the market is, the stronger these network effects, since high market concentration in the

[34] Note that we only include followers in our analysis and, hence, we do not include pioneers in our estimation. Therefore, it would in theory be possible for the long-run market shares of the followers to remain constant, even if an additional operator enters the market. This would be the case if the entrant exclusively attracts customers from the pioneer. However, since this is a purely hypothetical scenario, we do not give it further consideration.

mobile telecommunications industry mostly implies that the market is dominated by one or two very large networks. Hence, upon entering a concentrated market, followers will initially find it very hard to attract consumers and to increase their market share, as subscribers to their networks enjoy only lower tariff-mediated network effects. This, in turn, negatively affects followers' rate of convergence to the long-run market share.

This argument is also supported by the study of Fernández and Usero (2007) who report that followers find it difficult to grow their market share relative to the pioneer if the market is concentrated. Furthermore, Fernández and Usero (2009) submit that market concentration has a negative effect on the market share growth of mobile network operators.

Hence, we posit:

H5: The higher the current market concentration, the lower a follower's rate of convergence to the long-run market share will be, implying that $\beta_1<0$.

Likewise, we expect the number of currently active operators in a market to negatively affect a follower's rate of convergence to the long-run market share. Typically, the number of active firms in a market is taken as a proxy for the intensity of competition. If there is intense competition among the mobile network operators in a market, it is more difficult for a single firm to increase its market share at the expense of its competitors. Hence, intense competition will negatively affect the convergence rate of all operators that are active in the market. As already mentioned above, empirical findings from the studies of Sung (2005) and Gómez and Maícas (2011) show that the number of active operators negatively affects followers' market shares and therefore also their market share growth. If the number of active operators is interpreted as the entry order (which is a valid assumption in the absence of market exits or mergers), additional empirical support for the detrimental effect on followers' market share growth is provided by the studies of Fernández and Usero (2007), Gómez and Maícas (2011), and Jakopin and Klein (2012).

Therefore, we argue:

H6: The higher the number of currently active operators in a market, the lower a follower's rate of convergence towards the long-run market share will be, implying that $\beta_2<0$.

If pioneering network operators enjoy an FMA as compared to their competitors, they should find it easier than their competitors to attract consumers who newly enter the market for mobile telecommunications. Accordingly, we expect the change in penetration rate since market entry to exert a negative influence on a follower's rate of convergence. Typically, changes in the penetration rate reflect market growth and increasing market volume (in terms of number of subscribers). If FMAs exist in mobile telecommunications, pioneers will be able to attract a large fraction of all users who subscribe to the network for the first time, which, in turn, will slow down a follower's growth in market share.

This leads us to postulate:

H7: The higher the change in the penetration rate since market entry, the lower a follower's rate of convergence to the long-run market share will be, implying that $\beta_3<0$.

Table 3 summarizes our hypotheses concerning the determinants of a follower's long-run market share and rate of convergence to the long-run market share.

Table 5-3: Summary of proposed hypotheses

		Variable	Proposed Effect
long-run market share			
	H1	Penetration rate at market entry	inverted u-shaped
	H2	HHI at market entry	positive
	H3	Number of active operators at market entry	negative
	H4	Current number of active operators	negative
rate of convergence			
	H5	Current HHI	negative
	H6	Current number of active operators	negative
	H7	Change in penetration rate since entry	negative

5. Empirical Analysis and Discussion

5.1. Description of the Data Used

To analyze the existence of FMAs in mobile telecommunications we use data from 34 OECD countries covering the period from January 1990 to March 2008.[35] The data set contains penetration rates, market concentration, and market shares of 173 network operators that operate their own mobile networks. The subscriber base of mobile virtual network operators (MVNOs) is added to the respective network a given MVNO relies on for providing its service. The data was recorded on a monthly basis for the entire observation period. We excluded the USA from our analysis due to the unique manner in which the Federal Communications Commission (FCC) awarded licenses for mobile network operation (Parker and Röller 1997). With the introduction of mobile telephone services in the US, the FCC divided the country into 305 non-overlapping regional markets and issued two licenses for network operation in each market. Although, over time, some of these 305 regional duopolies may have become integrated markets, it is unreasonable to treat the USA as a single market for mobile telecommunications. Since our data set does not account for the fragmented market structure of the USA, we refrained from using the data for the US in our estimation.[36]

Prior to the analysis, we corrected the data set for mergers of mobile network operators. This is crucial for our analysis, because otherwise discrete jumps in the market share of one firm would occur if two or more operators merge to a single firm. This, in turn, would negatively influence estimation results.

[35] We are grateful to Informa UK Ltd. for provision of the data.
[36] As a check for robustness, we also estimated our model including the data for the USA which, however, led to similar results.

The same holds true if the merging firms form a new operator, which, if ignored, would then be treated as an operator newly entering the market. To identify possible mergers, we searched the data set for discrete jumps in the market share of more than 5%. While this allowed us to identify a total of 12 mergers (detailed information available upon request), we are aware of the fact that we might miss those mergers that result in a change in market shares of less than 5%. However, we believe that this will not significantly affect our estimation results, since changes in market shares in the range of 5% also occur in the data set due to competitive forces.

In principle, there are three possible approaches to deal with the merger of two or more companies. Firstly, it would be possible to ignore the merger. However, as explained previously, this might be detrimental to our estimation results. Secondly, we could simply delete the merged operator, but this has the drawback that we would lose all post-merger information in our analysis. The third approach to deal with mergers among network operators is to sum the market shares of the merging operators for the pre-merger period. While this implies losing the within-fluctuation of market shares of the merging operators in the pre-merger period, summation of market shares still preserves the information from the post-merger period. After weighing the pros and cons of each approach, we decided on summing the market shares of the merging operators for the pre-merger period, since this approach preserves as much information as possible while avoiding merger-induced jumps in market shares.

Furthermore, we also identified the pioneering network operator in each country and excluded it from the data set, since our analysis focuses on the market shares of followers. We considered all those operators as pioneers that either were the first to show a non-zero market share in a specific country or already had a non-zero market share in the first month of observation.

After correcting for mergers and deleting the pioneers, our data set contained 90 followers from 33 OECD countries. On average, a follower is observed for 109.7 months. Table 4 contains additional information on the distribution of followers across the 33 countries.

The diffusion pattern of mobile telecommunication, expressed by the development of the penetration rates, varies among the countries in our data set, as can be inferred from Figure 2. While some countries, for instance Canada, Iceland, Norway, and Sweden, already show comparably high penetration rates in the range of 3-4% at the beginning of our data set, other countries, primarily from Eastern Europe, show substantial lags in penetration rates. However, during the observation period, most countries manage to catch up so that the average penetration rate at the end of our sample (in March 2008) is 111%, with Canada showing the lowest value for the penetration rate (61%) and Israel showing the highest value (149%).

Table 5-4: Distribution of followers across countries

	Maximum number of active operators	observation period (t)		
		min.	avg.	max.
Australia	5	14	114.5	178
Austria	5	59	102.7	136
Belgium	3	109	124.0	139
Canada	7	126	143.0	160
Chile	4	16	124.8	208
Czech Republic	4	11	81.7	137
Denmark	5	54	120.0	184
Estonia	4	9	99.3	158
Finland	4	118	151.0	184
France	3	142	142.0	142
Germany	4	114	155.7	187
Greece	4	61	90.5	120
Hungary	3	100	134.0	168
Iceland	3	4	61.5	119
Ireland	4	31	83.3	133
Israel	4	111	143.7	160
Italy	4	29	86.8	148
Japan	5	1	83.5	166
Korea	6	90	114.0	126
Luxembourg	3	35	77.0	119
Mexico	10	88	126.8	178
Netherlands	5	110	130.5	151
New Zealand	2	175	175.0	175
Norway	3	12	93.5	175
Poland	4	13	96.3	139
Portugal	3	115	149.5	184
Slovak Republic	3	14	74.5	135
Slovenia	3	6	56.7	109
Spain	4	16	92.3	150
Sweden	6	3	95.2	184
Switzerland	4	34	84.0	112
Turkey	4	85	140.3	169
UK	5	61	134.3	175

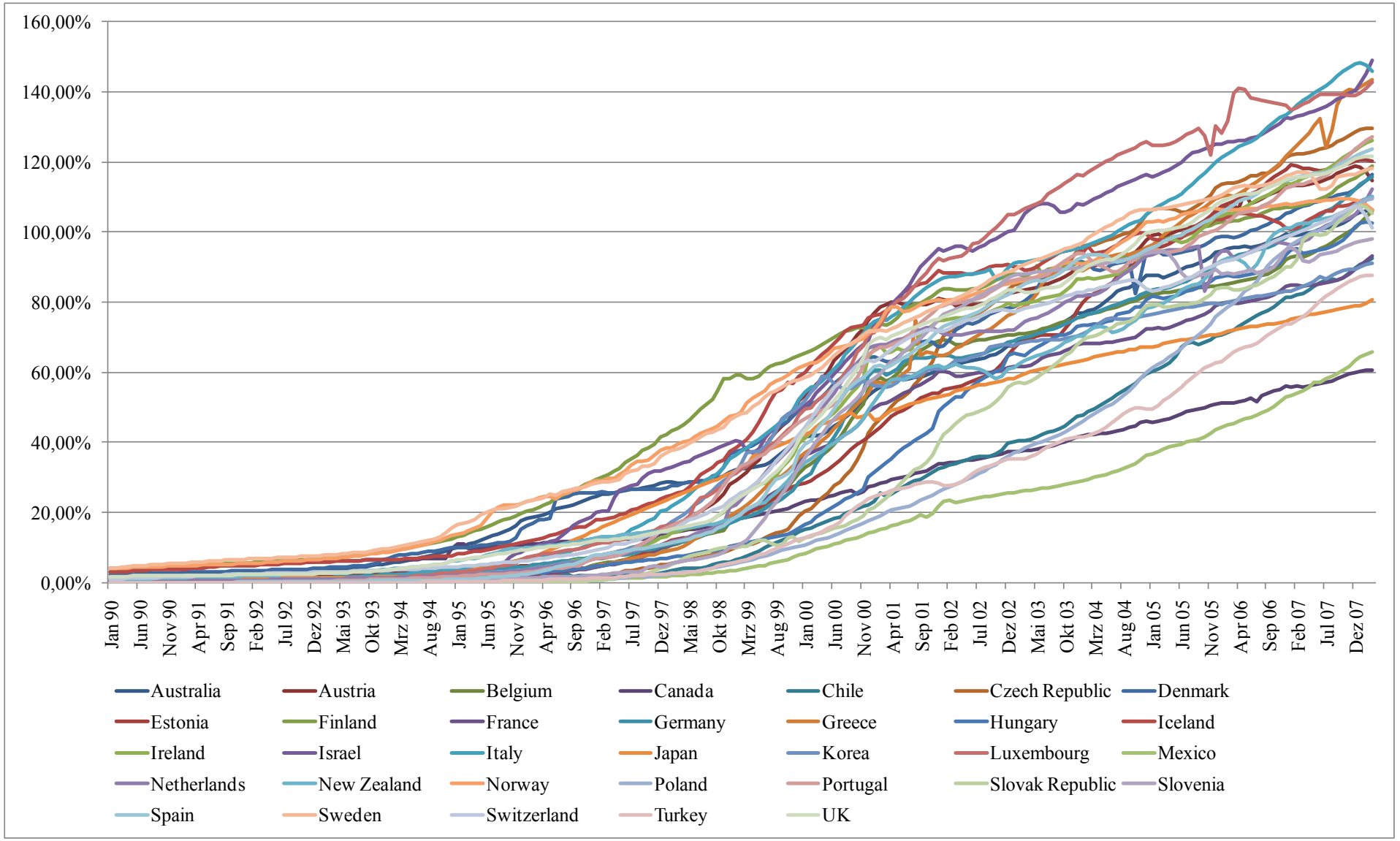


Figure 5-2: Penetration rates of 33 OECD countries

5.2. Operationalization of Variables

For each operator, we defined the time of market entry as the first month in which the respective operator shows a non-zero market share in the data set. Furthermore, we operationalized the values of the penetration rate and the HHI at market entry as the respective values from the month prior to market entry. The number of active operators at market entry comprises all operators observed in the data set at the month of market entry, including the pioneer(s) but excluding the entering firm. We computed the change in penetration rate since market entry as the difference between the current penetration rate in the respective month and the penetration rate in the month of entry (note that this is not the penetration rate at market entry).

5.3. Estimation Results

Prior to the estimation of our model with nonlinear least squares (NLS), two problems must be solved. These are, first, the endogeneity problem arising from the simultaneity of market shares, penetration rates, and market concentration; and, second, the identification of suitable starting values for the NLS routine.

In our analysis, we use both the penetration rate and the market concentration to explain the market shares of followers. This raises the concern that our analysis might suffer from an endogeneity-bias due the fact that a follower's market share also influences, at least partially, the penetration rate, as well as the concentration in the respective market. In order to solve this simultaneity problem, we used the lagged values for the current market concentration (HHI_{IT}), current number of active operators ($NUM\_OF\_OP_{IT}$), and the change in penetration rate since market entry (DEL_PEN_{IT}). Since our data set comprises monthly data, we decided to use a lag length of 12 months in our estimation to obtain unbiased results.[37]

A second problem that must be solved prior to the estimation is the definition of suitable starting values. Due to the iterative optimization nature of the NLS routine, the algorithm needs a set of starting values for all estimation parameters. Since there is no generally agreed rule for identifying the best set of starting values (Davidson and MacKinnon 2004, p. 232-233, Greene 2008, p. 294), we tested three different specifications. First, we used the estimation results from Bijwaard et al. (2008) as starting values, with the values for the country dummies set to -1. Second, we set the absolute value of all starting values to 1, but with the signs according to the results of Bijwaard et al., while in the third specification we set all starting values to 1. While specifications one and two lead to similar results, the number of iterations until convergence of the estimation differed. Specification one converged after 58 iterations, whereas specification two needed 72 iterations. For specification three, the NLS routine did not compute estimations for the variables defining a follower's rate of convergence; therefore it was dismissed. Since

[37] We also estimated our model with a lag length of six months and without lags, but this did not change our results.

the number of iterations until convergence can be interpreted as a measure of goodness of fit (Ratkowsky 1990, p. 21-23), we decided to use specification one in our estimation.

In total, 8,827 observations were entered into the estimation, which resulted in an adjusted R^2 of 0.9213. Due to the use of lags, only the observations for 83 followers were entered into the estimation. The coefficient estimates, as well as the corresponding heteroscedasticity-robust standard errors and p-values are displayed in Table 5. Note that, in order to enhance readability, Table 5 only incorporates the unweighted mean of the coefficient estimates for the country dummies and their standard error. The complete set of estimates for the country dummies is listed in Table 6 in the appendix.

Table 5-5: Estimation results

	Coefficient	Robust Std. Error	p-value
long-run market share			
penetration rate at market entry	1.366	0.176	0.000
penetration rate at market entry squared	-3.053	0.218	0.000
HHI at market entry	0.807	0.074	0.000
number of active operators at market entry	-0.296	0.023	0.000
current number of active operators	-0.075	0.006	0.000
country dummy (average)[a]	-1.228	0.304	-
rate of convergence			
current HHI	-0.101	0.006	0.000
current number of active operators	-0.004	0.000	0.000
change in penetration rate since entry	-0.046	0.002	0.000
t	0.125	0.006	0.000

[a]computed as the nonweighted average of all 33 coefficients.

As can be inferred from Table 5, all variables are highly significant at the 1% level. As with other nonlinear models, e.g. binary choice models such as logit and probit, the coefficients of a nonlinear least squares estimation can only be interpreted in terms of their sign but not their magnitude. In principle, this problem could be solved by computing the marginal effects of the variables. However, in the present analysis, computation of marginal effects would not be very informative, as our model includes 33 country dummies.[38] Hence, the main focus of our analysis is on the sign of the coefficients, because these coincide with the sign of the marginal effects.

In line with H1, the penetration rate at the time of market entry has a positive but decreasing effect on a follower's long-run market share. In addition, the market concentration at the time of market entry,

[38]In nonlinear models, the marginal effect of one variable also depends on the values of all other variables. Hence, marginal effects are typically calculated by fixing the remaining variables at their mean. In our case, fixing the 34 country variables at their mean would not lead to meaningful results.

measured by the HHI, inflicts a positive effect on the long-run market share, thereby providing support for H2. As proposed by H3 and H4, both the number of already active firms at market entry and the number of currently active operators negatively influence the long-run market share of followers. Besides, all country dummies are estimated to have a significant negative effect on the long-run market share.

Moreover, the results of our empirical analysis confirm H5 and H6 with the current market concentration, again measured by the HHI, as well as the current number of active operators negatively affecting a follower's rate of convergence to the long-run market share. Likewise, the change in market penetration since entry has a decreasing effect on the rate of convergence, supporting H7. Finally, we observe that the market shares of followers tend to increase over time, as indicated by a significant positive coefficient estimate for t.

In order to test the sensitivity of our results to changes in the specification of our econometric model, we performed several robustness checks, none of which led to any changes in the sign or significance level of the estimated coefficients. As a first check, we varied the length of the lags on the variables HHI_{IT}, $NUM\_OF\_OP_{IT}$, and DEL_PEN_{IT} and estimated our model using a lag length of six months and without lags. As a second check, we varied our approach for dealing with the identified mergers during the observation period. We estimated our model using a data set in which we deleted the merged operator after the merger and a data set in which we ignored the mergers altogether. Finally, we also included the USA in our estimation as a third check for robustness, which also did not influence our results.

To illustrate the high model fit, Figure 3 shows the actual and predicted market shares of followers in selected countries, namely Iceland, Hungary, Germany, and Australia. These four countries were selected for two reasons. First, these countries are rather heterogeneous, for instance with respect to topography, culture, or population density. Second, the number of followers varies among these four countries. While in Iceland, for almost the entire observation period only one follower was active in the market (and, hence, a duopoly existed), in Hungary, two followers entered the market. The German mobile market has seen the entry of three followers over time, while in Australia a total of four followers began operations although, according to our data, one operator was active for only 14 months. Note that the predicted values shown in the four graphs are based on the model without lags, because otherwise it would not have been possible to compute the predicted values for the first 12 months after market entry. The actual market shares of each operator are represented by bold lines, whereas the predicted market shares are represented by dotted lines.

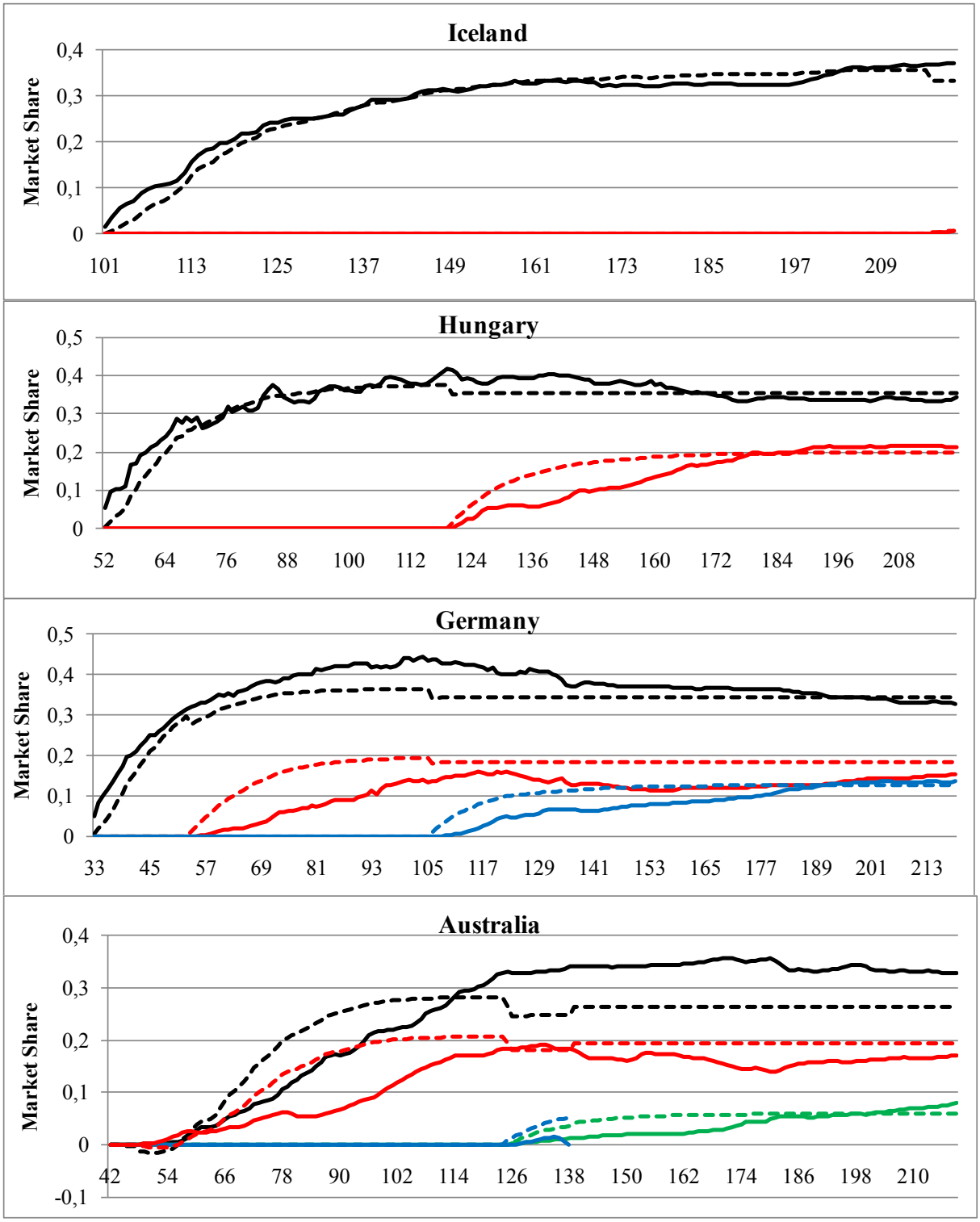


Figure 5-3: Actual and predicted market shares of followers in selected countries (actual market share bold; predicted market share dotted line)

The four graphs provide two interesting insights. First, the graphs demonstrate that our econometric model fits the actual course of the market shares fairly well, irrespective of how many followers are active in the country. In particular, the predicted long-run market share of each follower decreases whenever additional entry occurs, and increases if an operator leaves the market. Second, Figure 3 demonstrates that those followers that entered the market earlier usually also have higher market shares than the later entering ones. Hence, it seems that the inverted u-shaped effect of the penetration rate is

strictly dominated by the negative effect of the number of already active operators at the time of market entry: although the first followers in most countries entered at very low penetration rates, they nevertheless gained higher market shares than those that entered the market at a later stage.

5.4. Discussion

From our analysis of 90 mobile network operators from 33 OECD countries for the period January 1990 to March 2008, three key insights into the nature of FMAs in mobile telecommunications can be inferred.

A first interesting conclusion emerging from our analysis is that the change in penetration rate since market entry negatively affects a follower's rate of convergence to the long-run market share. This result contradicts the findings of previous studies in the mobile telecommunications industry. In their study on central European countries, Fernández and Usero (2007, 2009) report that market growth increases followers' ability to erode pioneers' market shares and to gain market share themselves. While the coefficient estimates for the variable capturing market growth are only significant at the 10% level, the deviating results may be due the fact that Fernández and Usero use linear models, which are not able to adequately account for the nonlinear course of followers' market shares. Furthermore, studying 16 European countries, Bijwaard et al. (2008) find that the change in penetration rate since market entry has a positive effect on followers' rate of convergence. Nevertheless Bijwaard et al. conclude that "there is clear evidence of early mover advantage, mainly caused by the influence of the penetration rate" (2008, p. 246), which in our view is a contradiction to their finding that market growth is beneficial for followers. If the market is growing, i.e., the penetration rate increases as new subscribers enter the market, FMAs should enable pioneers to attract a disproportionately large fraction of the newly entering subscribers, which would, in turn, negatively affect followers' market share growth. Since our finding of a negative effect of the change in the penetration rate since market entry on followers' rate of convergence also holds when we re-estimate Bijward et al.'s original specification, the discordance in results may be attributed to Bijward et al.'s interpolation of the data for the period 1990-1997.

In our view, the finding that market growth, represented by change in the penetration rate since market entry, negatively affects followers' rate of convergence to the long-run market share strongly suggests that FMAs exist in the mobile telecommunications industry. As can be inferred from Figure 2, the penetration rates in almost all OECD countries were monotonically increasing during the period of 1990 to 2008. Large changes in the penetration rate are thus typically the result of a rapidly expanding market. Hence, the negative impact of changes in the penetration rate on a follower's rate of convergence implies that a growing market puts followers at a disadvantage as compared to the pioneer. This can be explained by the existence of FMAs that enable pioneering network operators to attract a large fraction of those users who subscribe to a mobile network for the first time. As a result, the fraction of new customers that followers are able to attract is reduced, which then decelerates their market share growth.

Second, our results show that the penetration rate at the time of market entry has an inverted u-shaped effect on a follower's long-run market share. This result is in contrast to the findings of Bijwaard et al.

(2008), who report that the penetration rate at the time of market entry has a negative, nonlinear impact on followers' market shares. However, analogous to our findings for the change in the penetration rate since market entry, the inverted u-shaped effect still holds if we re-estimate Bijwaard et al.'s original specification. Hence, the differing findings might be attributed to differences in the granularity of the data for the period 1990-1997.

However, we also find that this inverted u-shaped effect is dominated by the negative effect of the number of already active operators at the time of market entry. As a consequence, the first followers in almost all countries have higher long-run market shares than the later ones, although they usually entered the market at low penetration rates.

Together with our finding that large changes in the penetration rate negatively affect followers' growth in market shares, our results imply that it is doubly beneficial for followers to delay market entry until the penetration rate has reached medium levels. According to Figure 2, the diffusion process of mobile telecommunication services roughly follows an S-shaped pattern. At low levels of the penetration rate, growth rates are high; however, as soon as the penetration rate reaches medium levels the diffusion curve reaches its inflexion point and growth rates decrease. Hence, if market entry occurs after the inflexion point of the diffusion curve, this will on the one hand maximize the positive effect on a follower's long run market share (due to the inverted u-shaped effect of the penetration rate at market entry) and, on the other hand, attenuate the negative effect of market growth on a follower's convergence rate due to the lower growth in penetration rates.

In essence, our results suggest that there exist two windows of opportunity (Schilling 2002, Christensen et al. 1998) during which entering mobile telecommunication markets seems particularly promising: either entering the market as the first mobile network operator or entering the market when the penetration rate has reached medium levels. Obviously, in the case of mobile telecommunications, network operators are not able to decide on the timing of market entry, as this is tied to the decision of the national government to issue licenses for network operation. Accordingly, our findings indicate that national governments should wait until the penetration rate has reached a medium level, i.e., after the inflexion point of the diffusion curve, before deciding on whether to issue an additional license for mobile network operation. By doing so, the national governments can provide followers with an optimal starting position and support them in their attempt to gain a foothold in the market.

Third, we observe that although the market concentration, measured by the HHI, and the intensity of competition, measured by the number of active operators, are closely related concepts, they nevertheless have different effects on the market shares of followers. While the intensity of competition reduces both a follower's long-run market share and rate of convergence to the long-run market share, the effect of the concentration rate on market shares is ambiguous. On the one hand, a high market concentration enables followers to ultimately gain a higher long-run market share, but on the other hand, high market concentration decreases followers' rate of convergence, i.e., slows down their growth in market shares.

Hence, it is easier for followers to successfully enter the market and build up a large customer base if the market is highly concentrated. However, this requires the followers to exhibit a high degree of perseverance, since market share growth will be slower in highly concentrated markets. Hence, our findings suggest that followers in mobile telecommunications markets should not feel discouraged by initial slow growth rates of their market shares, as these are not necessarily linked to unsuccessful market entry.

6. Conclusion

In this paper, we explore the existence of FMAs in mobile telecommunications by estimating an extended version of the model developed by Bijwaard et al. (2008). The core assumption of this model is that there exists a stable long-run market equilibrium, which is represented by operator-specific long-run market shares. Operators approach their long-run market share with an individual rate of convergence. By extending the model of Bijwaard et al., we allow the long-run market share to react to major changes in the market structure in the form of market entry and exit.

We derive seven empirically testable hypotheses from our econometric model. Specifically, regarding a follower's long-run market share, we propose, that, first, the penetration rate at the time of market entry has an inverted u-shaped effect (H1). Second, we propose that the market concentration at market entry, measured by the HHI, has a positive effect (H2). Third, we expect the number of already active operators at the time of entry and the number of currently active operators to have a negative effect (H3 and H4). Furthermore, with respect to a follower's rate of convergence to the long-run market share, we hypothesize that, fifth, the current market concentration, measured by the HHI, has a negative effect (H5). Sixth, we postulate that the number of currently active operators has a negative effect (H6) and, seventh, we argue that the change in the penetration rate since market entry has a negative effect (H7).

We test our hypotheses using data on penetration rates, market concentration, number of active operators, and market shares of 90 followers from 33 OECD countries (excluding USA) on a monthly basis for the period January 1990 to March 2008. The results of the nonlinear least squares estimation confirm all seven hypotheses and show that, on average, the market shares of followers increase over time.

With an adjusted R^2 of 0.92, our model shows a high fit to the data, which is confirmed by visual inspection of the actual and predicted market shares of followers in Iceland, Hungary, Germany, and Australia.

Based on our results, three conclusions can be drawn. First, we find that a fast growing market, expressed by large changes in the penetration rate since market entry, significantly slows down a follower's convergence to the long-run market share. In our view, this is a strong indication for the existence of FMAs, which enable pioneers to attract a large fraction of users newly entering the market, thereby slowing down followers' growth in market shares. Second, we find that the number of active operators

exerts a negative effect on both the long-run market share and rate of convergence to the long-run market share of followers, whereas the market concentration increases the long-run market share but decreases the rate of convergence. Hence, our results suggest that it is beneficial for followers to enter a more concentrated market, since this results in a higher long-run market share, although with the detriment of slower growth in market shares. Third, the market penetration exerts an inverted u-shaped effect on followers' long-run market share. This implies that, ceteris paribus, there exists an optimal level of market penetration which maximizes a follower's long-run market share. However, the inverted u-shaped effect of the penetration rate is strictly dominated by the negative effect of the number of already active operators in the market: in almost all countries under investigation the first follower gained higher market shares than those that entered later. Nevertheless, this finding might be useful for national governments in deciding when to issue additional licenses for mobile network operation.

We contribute to the literature on FMAs in mobile telecommunications by refining the analysis of Bijwaard et al. (2008) in three respects: First, we use a richer data set, containing a higher resolution with respect to the time dimension and covering a longer observation period. Second, we expand their analysis of first mover advantages in mobile telecommunications to countries outside Europe by using data on all OECD countries (except for the USA). As a third contribution, we extend their econometric model so that a follower's long-run market share reacts to subsequent market entry and exit. In addition to that, we contribute to the literature on FMAs by being the first to provide a comprehensive overview over the empirical findings concerning the existence of FMAs in the mobile telecommunications industry. Furthermore, we add to the recent literature on the optimal design of the mobile telecommunications industry. Li and Lyons (2012), for instance, investigate the determinants influencing the speed of market penetration in mobile telecommunications. Their analysis of 30 countries for the period 1991 to 2006 reveals that the speed of market penetration is highest for a pentopoly, i.e., governments should optimally issue five licenses for network operation. We further extent the insights of Li and Lyons by showing that there exists not only an optimal number of licenses issued by the government but also an optimal time for issuing them – when the penetration rate has reached a medium level, i.e., after the inflexion point of the diffusion curve.

Moreover, our study is also relevant for practitioners concerned with the regulation of mobile network operators. Our findings may serve as guidance for national governments in their decision on when to issue additional licenses for mobile network operation. We also provide evidence for the presence of FMAs in mobile telecommunications, and hence our results support the asymmetric regulation of pioneering network operators and followers, to provide a level playing field for all market participants.

Several limitations of our study open up avenues for further research. First, despite the fact that our data set in principle exhibits an unbalanced panel structure of 90 operators for a period of 219 months, we did not exploit the panel structure in our analysis. This was because employing panel methods in the context of nonlinear regression models is extremely difficult and subject to numerous pitfalls (Wooldridge 2002, Greene 2008). However, future research may find it worthwhile to re-estimate our

model using panel methods. Then it would be possible to control for operator-specific unobserved effects, which, in turn, would enhance the explanatory power of our model. Alternatively, it would also be possible to refrain from estimating the model using a one-shot approach and instead apply a two-step estimation strategy in the spirit of Eggers et al. (2012). In the first step, the long-run market shares and the rates of convergence could be estimated directly for each follower. In the second step, the estimated long-run market shares and rates of convergence would then be used as the dependent variables in two separate regressions according to equations (6) and (7). A second limitation of our model stems from the fact that market shares are modeled as solely depending on characteristics of the market, without taking into account the actions of the operators. In a sense, our model conveys a deterministic view with respect to the development of the market shares of followers, since their long-run market share is determined to a large extent by market characteristics at the time of market entry. Therefore a promising starting point for further research might be to incorporate operator-specific actions of the market participants, e.g. marketing expenses or product quality, into the model. To this end, our model could be combined with elements of the model in Kalyanaram and Urban (1992).

The analysis of FMAs in mobile telecommunications is important for national regulatory authorities to adequately design the regulatory regime and to achieve their goal of stimulating competition. We hope our findings will help to deepen our knowledge on the nature of FMAs in mobile telecommunication and will stimulate further research in this area.

References

Atiyas, I., Dogan, P. (2007), When Good Intentions are not Enough: Sequential Entry and Competition in the Turkish Mobile Industry. *Telecommunications Policy*, 31, 502-523.

Barro, R. J., Sala-i-Martin, X. (1991), Convergence Across States and Regions. *Brookings Papers on Economic Activity*, 1, 107-182.

Bijwaard, G. E., Janssen, M. C. W., Maasland, E. (2008), Early Mover Advantages: an Empirical Analysis of European Mobile Phone Markets. *Telecommunications Policy*, 32, 246-261.

Carson, S. J., Jewell, R. D., Joiner, C. (2007), Prototypicality Advantages for Pioneers Over Me-Too Brands: the Role of Evolving Product Designs. *Journal of the Academy of Marketing Science*, 35, 172-183.

Christensen, C. M., Suárez, F. F., Utterback, J. M. (1998), Strategies for Survival in Fast-Changing Industries. *Management Science*, 44, 207-220.

Davidson, R., MacKinnon, J. G. 2004. *Econometric Theory and Methods*. New York: Oxford University Press.

Day, G. S., Freedman, J. S. (1990), Burnout or Fadeout: the Risks of Early Entry into High Technology Markets. In: M. W. Lawless, L. R. & Gomez-Meija (eds.): *Strategic Management in High Technology Firms*. Greenwich: Jai Press.

Dewenter, R. (2007), First Mover Advantages in Mobile Telecommunications: the Swiss Case. In: L. Benzini, P. Geoffron (eds.): *A Collection of Essays on Competition and Regulation with Asymmetries in Mobile Markets.* Paris: Quantifica Publishing.

Eggers, J. P., Grajek, M., Kretschmer, T. (2011), First Mover Advantages in the Mobile Telecommunications Industry: A Consumer-Centric Perspective. *ESMT Working Paper* 11-03.

Eggers, J. P., Grajek, M., Kretschmer, T. (2012), Performance Implications of Core and Complementary Pre-Entry Experience. *ESMT Working Paper* 11-03 R(2).

Ethiraj, S. K., Zhu, D. H. (2008), Performance Effects of Imitative Entry. *Strategic Management Journal*, 29, 797-817.

Fernández, Z., Usero, B. (2007), The Erosion of Pioneer Advantage in the European Mobile Telecommunications Industry. *Service Business*, 1, 195-210.

Fernández, Z., Usero, B. (2009), Competitive Behavior in the European Mobile Telecommunications Industry: Pioneers vs. Followers. *Telecommunications Policy*, 33, 339-347.

Foreman, R. D., Beauvais, E. (1999), Scale Economies in Cellular Telephony: Size Matters. *Journal of Regulatory Economics*, 16, 297–306.

Foros, O., Steen, F. (2008), *Do First-Mover Advantages Call for Asymmetric Regulation in the Norwegian Mobile Market?* http://www.nettvett.no/ikbViewer/Content/108743/Tele2%20Bilag%204%20-%20offentlig.pdf.

Frynas, J., Mellahi, K., Pigman, G. (2006), First Mover Advantages in International Business and Firm-Specific Political Resources. *Strategic Management Journal*, 27, 321-345.

Gerpott, T. J. (2005), Vergabe zusätzlicher Frequenzen in den E-GSM Bändern im deutschen Mobilfunkmarkt. *Kommunikation und Recht*, 8, 503-511.

Gerpott, T. J., Jakopin, N. M. (2006), Aktienmarktreaktionen auf internationale Markterschließungsmaßnahmen von Mobilfunknetzbetreibern. *Zeitschrift für Betriebswirtschaft*, 76, 1067-1103.

Golder, P. N., Tellis, G. J. (1993), Pioneer Advantage: Marketing Logic or Marketing Legend? *Journal Marketing Research*, 30, 158-170.

Gómez, J., Maícas, J. P. (2011), Do Switching Costs Mediate the Relationship Between Entry Timing and Performance? *Strategic Management Journal*, 32, 1251-1269.

Greene, W. H. (2008), *Econometric Analysis*. Upper Saddle River: Prentice Hall.

Gruber, H. (2005), *The Economics of Mobile Telecommunications*. New York: Cambridge University Press.

Harbord, D., Pagnozzi, M. (2010), Network-Based Price Discrimination and ‚Bill-and-Keep' vs. 'Cost-Based' Regulation of Mobile Termination Rates. *Review of Network Economics*, 1, Article 1.

Dewenter, R., Haucap, J. (2008), First Mover Vorteile im Mobilfunk: Wettbewerbsökonomische und regulierungspolitische Implikationen am Beispiel der Schweiz. In M. Grusevaja, C. Wonke, U. Hösel, M.H. Dunn (Eds.): Quo Vadis Wirtschaftspolitik? Ausgewählte Aspekte der aktuellen Diskussion, Festschrift für Norbert Eickhof. Frankfurt: Peter Lang Verlag.

Hausman, J. (2002), Mobile Telephone, in Cave, M. E., Majumdar, S. K., & Vogelsang, I. (eds.) *Handbook of Telecommunications Economics*. Oxford: Elsevier: 564-641.

Hirshleifer, J., Glazer, A., Hirshleifer, D. (2005), *Price Theory and Applications: Decisions, Markets, and Information*. Cambridge: Cambridge University Press.

Jakopin, N.M., Klein, A. (2012), First-Mover and Incumbency Advantages in Mobile Telecommunications. *Journal of Business Research*, 65, 362-370.

Kalyanaram, G., Urban, G. L. (1992), Dynamic Effects of the Order of Entry on Market Share, Trial Penetration, and Repeat Purchases for Frequently Purchased Consumer Goods. *Marketing Science*, 11, 235-250.

Karabag, S. F., Berggren, C. (2011), Mobile Communications in Turkey: From First Mover Advantages to Management Capabilities. *Info*, 13, 72-84.

Kim, H.-S., Kwon, N. (2003), The Advantage of Network Size in Acquiring New Subscribers: a Conditional Logit Analysis of the Korean Mobile Telephony Market. *Information Economics and Policy*, 15, 17-33.

Kruse, J., Haucap, J., Dewenter, R. (2004), *Wettbewerb im Mobilfunk in Österreich*. Baden-Baden: Nomos-Verlag.

Laffont, J.-J., Rey, P., Tirole, J. (1998), Network Competition: II. Price Discrimination. *RAND Journal of Economics,* 29, 38-56.

Lanzolla, G., Gómez, J., Maícas, J. P. (2010), Order of Market Entry, Market and Technological Evolution and Firm Competitive Performance. *Paper prepared for the Imperial College London Business School Summer Conference 2010*. http://www2.druid.dk/conferences/viewpaper.php?id=501664&cf=43 .

Li, Y., Lyons, B. (2012), Market Structure, Regulation and the Speed of Mobile Network Penetration. *International Journal of Industrial Organization*, 30, 697-707.

Lieberman, M. B. (1989), The Learning Curve, Technology Barriers to Entry and Competitive Survival in the Chemical Processing Industries. *Strategic Management Journal*, 10, 431-447.

Lieberman, M. B., Montgomery, D. B. (1988), First-Mover Advantages. *Strategic Management Journal*, 9, 41-58.

Lieberman, M. B., Montgomery, D. B. (1998), First-Mover (Dis)Advantages: Retrospective and Link with the Resource Based View. *Strategic Management Journal*, 19, 1111-1125.

Muck, J. (2012), The Effect of On-net/Off-net Differentiation and Heterogeneous Consumers on Network Size in Mobile Telecommunications – An Agent-Based Approach. *Paper prepared for the 23rd European Regional Conference of the International Telecommunications Society.* https://www.econstor.eu/dspace/bitstream/10419/60355/1/720272475.pdf

Nelson, P. (1970), Information and Consumer Behavior. *Journal of Political Economy*, 78, 311-329.

Parker, P. M., Röller, L.-H. (1997), Collusive Conduct in Duopolies: Multimarket Contact and Cross-Ownership in the Mobile Telephone Industry. *RAND Journal of Economics*, 28, 304-322.

Ratkowsky, D. (1990), *Handbook of Nonlinear Regression.* New York, Basel: Dekker.

Riek, O. (2005), *The Impact of Service Innovation on Corporate Performance: an Investigation into the Mobile Telecommunications Service Industry*. http://www.dbresearch.eu/PROD/DBR_INTERNET_DE-PROD/PROD0000000000187583.pdf.

Rogers, E. (1962), *Diffusion of Innovations.* New York: The Free Press.

Sarkar, M. B., Cavusgil, S. T., Aulakh, P. S. (1999), International Expansion of Telecommunication Carriers: the Influence of Market Structure, Network Characteristics, and Entry Imperfections. *Journal of International Business Studies*, 30, 361-381.

Schilling, M. A. (2002) Success and Failure in Winner-Take-All Markets: the Impact of Learning Orientation, Timing and Network Externalities. *Academy of. Management Journal*, 45, 387-398.

Shy, O. (2001), *The Economics of Network Industries*. Cambridge: Cambridge University Press.

Sung, N. (2005), The Determinants of Market Share for Mobile Telecommunications Operators. *Paper prepared for the 16th European Regional Conference of the International Telecommunications Society*. http://www.itseurope.org/ITS%20CONF/porto05/papers/Sung.pdf.

Sutton, J. (1991), *Sunk Costs and Market Structure*. Cambridge: MIT Press.

Sutton, J. (2007), Market Share Dynamics and the "Persistence of Leadership Debate". *American Economic Review*, 97, 222-241.

Tözer, A. (2010), Assessment of First Comer Advantages and Network Effects; the Case of Turkish GSM Market. P*aper prepared for the 21st European Regional Conference of the International Telecommunications Society*. http://ideas.repec.org/p/zbw/itse10/35.html.

Usero, B., Fernández, Z. (2009), First Come, First Served: How Market and Non-Market Actions Influence Pioneer Market Share. *Journal of Business Research*, 62, 1139-1145.

Whang, S. (1995), Market Provision of Custom Software: Learning Effects and Low Balling. *Management Science*, 41, 1343-1352.

Wooldridge, J. M. (2002.). *Econometric Analysis of Cross Section and Panel Data*. Cambridge: MIT Press.

zu Knyphausen-Aufseß, D., Krys, C., Schweizer, L. (2002), Attacker's Advantage in a Homogeneous Market: the Case of GSM. *International Journal of Media Management*, 5, 212-224.

Appendix

Table 5-6: Estimation results for country dummies

	Coefficient	Robust Std. Error	p-value
Australia	-1.571	0.108	0.000
Austria	-1.244	0.101	0.000
Belgium	-1.432	0.098	0.000
Canada	-1.030	0.105	0.000
Chile	-0.913	0.092	0.000
Czech Republic	-1.163	0.095	0.000
Denmark	-1.397	0.098	0.000
Estonia	-1.591	0.100	0.000
Finland	-1.510	0.102	0.000
France	-1.461	0.085	0.000
Germany	-1.283	0.095	0.000
Greece	-0.540	0.088	0.000
Hungary	-1.315	0.094	0.000
Iceland	-1.474	0.113	0.000
Ireland	-1.248	0.101	0.000
Israel	-1.283	0.124	0.000
Italy	-1.363	0.101	0.000
Japan	-1.040	0.101	0.000
Korea	-0.583	0.144	0.000
Luxembourg	-1.236	0.110	0.000
Mexico	-0.704	0.207	0.001
Netherlands	-1.359	0.098	0.000
New Zealand	-1.251	0.099	0.000
Norway	-1.588	0.101	0.000
Poland	-1.118	0.096	0.000
Portugal	-1.232	0.095	0.000
Slovak Republic	-0.877	0.094	0.000
Slovenia	-1.498	0.111	0.000
Spain	-1.464	0.097	0.000
Sweden	-1.128	0.139	0.000
Switzerland	-1.848	0.115	0.000
Turkey	-0.761	0.096	0.000
UK	-1.015	0.092	0.000

Declaration of Contribution

Hereby I, Johannes Muck, declare that the chapter „First Mover Advantages in Mobile Telecommunications: Evidence from OECD Countries“ is co-authored by Dr. Ulrich Heimeshoff.

My contributions to this chapter are as follows:

- I participated in the process of data collection and was responsible for consolidating the data
- I was responsible for determining the estimation strategy and conducting the empirical analysis
- I was responsible for interpreting the results of the empirical analysis and for deriving theoretical and practical implications
- I was responsible for the creation of sections 1 to 6
- I was responsible for the search for relevant literature

Signature of coauthor 1 (Dr. Ulrich Heimeshoff): _____

Chapter 6: Tariff-mediated Network Effects With Incompletely Informed Consumers[39]

1. Introduction

Over the past decades, telecommunications markets around the globe have been liberalized with the consequence that in modern economies typically several mobile telecommunications networks coexist. Since subscribers expect to be able to make both on-net calls (which originate and terminate on the same network) as well as off-net calls (which originate and terminate on different networks) networks are interconnected (Peitz 2003, p.734, Berger 2005, p. 2, Gabrielsen and Vagstad 2008, p. 100). Typically, network operators charge each other for terminating a call originating from a rival's network. These access charges directly increase operators' costs for off-net calls and, thereby, increase the tariffs for off-net calls (Blonski 2002, p. 96, Peitz 2003, p. 732, Hoernig 2008, p. 9, Gabrielsen and Vagstad 2008, p. 5, Cabral 2011, p. 103, Lopez and Rey 2012, p. 1). Accordingly, access charges are one reason why network operators often price discriminate between on-net and off-net calls ("on-net/off-net differentiation"), whereby on-net calls are cheaper than off-net calls.

On-net/off-net differentiation generates tariff-mediated network effects (Laffont, Rey, and Tirole 1998b, p. 39). Under the standard assumption of a "balanced" or "uniform" calling pattern (Laffont, Rey, and Tirole 1998b, Armstrong 1998, Hoernig, Bourreau, and Cambini 2014), i.e., calls are placed randomly, the probability that a subscriber to network A makes an on-net call equals A's market share. Hence, the higher A's market share, the higher subscribers' probability of making a cheaper on-net call and, therefore, the lower the expected costs of a call which ultimately translates into a higher utility of being subscribed to network A. Accordingly, rational consumers striving to maximize their utility by minimizing their telephone bill have an incentive to join the largest network. Tariff-mediated network effects are particularly important if network sizes are asymmetric, i.e., if a large incumbent network competes with one or several smaller entrants. In this case, tariff-mediated network effects exacerbate the already superior competitive position that large incumbent networks enjoy, for instance, due to cost advantages (for instance, because of economies of scale) or higher network quality (for instance, broader network coverage) (Peitz 2003, p. 735).

Inspired by the seminal articles of Armstrong (1998) and Laffont, Rey, and Tirole (1998a, 1998b), numerous scholars have investigated the competitive effect of tariff-mediated network effects (for a summary see Harbord and Pagnozzi 2010). One key result of this abundant literature is that on-net/off-

[39] I am grateful for helpful comments from Michael Roos, Anna Klabunde, and the participants of the 2013 Annual Conference of the German Economic Association, the 40th Annual Conference of the European Association for Research in Industrial Economics, the 19th Biennial Conference of the International Telecommunications Society, and the 23rd European Regional Conference of the International Telecommunications Society. Computational support and infrastructure was provided by the ‚Zentrum für Informations – und Medientechnologie' (University Computer Centre) at the Heinrich – Heine – University of Duesseldorf (Germany).

net differentiation benefits large networks and harms small ones. In their survey of the theoretical literature Harbord and Pagnozzi summarize that on-net/off-net differentiation "can be used strategically by incumbent operators to either prevent entry or to reduce competition from new entrants into their markets" (2010, p. 7).

This unanimously agreed-upon result is somewhat puzzling given the mixed empirical observations regarding the effect of on-net/off-net differentiation on small networks. On the one hand, evidence from the French mobile telecommunications industry corroborates the findings of the extant literature. In December 2012, the French Competition Authority announced that the two largest network operators, Orange, and SFR, had been found guilty of abusing their dominant position in the market for mobile telecommunications by engaging in "excessive rate differentiation between 'on-net' calls (made within their own network) and 'off-net' calls (to a rival network)" (Autorité de la concurrence 2012, p. 1). The on-net/off-net differentiation practiced by Orange and SFR led to a "freezing [of] the market by drawing consumers to the two biggest networks" and acted to "weaken the third operator - Bouygues Télécom - which had to strike back by launching offerings that significantly increased its costs" (Autorité de la concurrence 2012, p. 1) so that ultimately "there was a great danger of Bouyges being driven out of the market" (Autorité de la concurrence 2012, p. 3). The fine for Orange's and SFR's anti-competitive conduct was set to €183 million.

On the other hand, evidence from the German and Austrian mobile telecommunication markets challenge the prevailing paradigm that on-net/off-net differentiation is harmful for small networks. In 2007 Germany's second smallest-network operator, E-Plus, filed a complaint with the European Commission that the on-net/off-net differentiation practiced by Germany's two largest network operators, T-Mobile and Vodafone, put E-Plus at an unfair competitive disadvantage due to its smaller market share (KPN 2007). The German Federal Cartel Office, entrusted with the investigation of KPN's complaint, found insufficient evidence of anti-competitive effects of on-net/off-net differentiation and therefore stopped its investigation in 2009 (Haucap, Heimeshoff, and Stühmeier 2011, Haucap and Heimeshoff 2011, German Federal Cartel Office 2010). Even more surprisingly, in the Austrian mobile telecommunications market, the first competitor of incumbent A1 Telekom Austria, T-Mobile Austria (formerly max.mobil), successfully introduced a calling plan with substantial on-net/off-net differentiation shortly after its market entry to gain a competitive advantage over A1 (pressetext.com 1999). Contrary to the standard theory which predicts that consumers would have no incentive to subscribe to the small network of T-Mobile Austria, this strategy proved very successful and led to the rapid growth of T-Mobile Austria (wirtschaftsblatt.at 2012, p. 1). With a market share of 31% in 2012, T-Mobile has become Austria's second largest mobile network operator after A1 Telekom Austria which has a market share of 42%.

A possible explanation for the divergence between the theoretical findings and the empirical observations could be that some of the assumptions of the theoretical models are not met in real-world telecommunications markets. In particular, two assumptions appear to be crucial for tariff-mediated

network effects to occur. These are, first, the assumption of a uniform calling pattern which implies that consumers know (at least in expectation) whom they will be calling, and which ensures that the number of calls to a network is proportional to its market share. Secondly, the assumption of fully informed consumers guarantees that consumers know (at least in expectation) the networks of their callees.

Recently, first attempts have been made to relax the assumption of a uniform calling pattern by studying models which use more realistic calling patterns (Kamiński and Latek 2008, 2010). Yet, relaxing the assumption of a uniform calling pattern by introducing real-word call graph topologies also suffers from severe shortcomings. This approach implicitly assumes that at the time a consumer decides to subscribe to a particular network she can either perfectly foresee her future calling pattern or perfectly infer it from her past behavior – both of which are quite unrealistic assumptions. Hence, assuming a balanced calling pattern which links calling probabilities to market shares appears to be a reasonable approximation.

However, to the best of my knowledge, the assumption that consumers have full information about the market shares of all networks has not yet been challenged in the existing literature. This gap is surprising given the fact that there exists a large body of literature which argues that consumers ex-ante lack information about important market parameters which they can acquire by costly search. Following the seminal work of Stigler (1961), numerous scholars have investigated the consequences of costly information acquisition (for an overview of the recent literature see Baye, Morgan, and Scholten 2006; for recent advances in this literature see Janssen and Parakhonyak 2013, 2014). The key premise of the literature on search costs is that consumers are uninformed about prices and have to incur costs to obtain this information. As a result, a certain fraction of utility-maximizing consumers decide to remain only partially informed because of prohibitively high search costs.

This paper aims at challenging the assumption of fully informed consumers by combining the literature on tariff-mediated network effects with the literature on search costs. By combining these two previously separated literature streams, I aim at answering the following research question: *Do tariff-mediated network effects still unfold detrimental effects for small networks if (at least some) consumers are imperfectly informed about the true market shares of the networks?*

To answer this question, I study an agent-based simulation model of a mobile telecommunications market with two asymmetric networks and three types of consumers with unit demand who differ with respect to their search costs. Fully informed consumers (FICs) have non-positive search costs (i.e., search costs are either negative or zero) and, accordingly, are perfectly informed about the true market shares of both networks. Partially informed consumers (PICs) have moderate search costs and, therefore, are assumed to observe market shares within a circular sensing field. Finally, locally informed consumers (LICs) have high search costs and are assumed to be able to only observe their immediate neighbors. Consumers maximize their expected utility by subscribing to the network with the lowest expected costs for a call which they calculate based on the market shares they observe.

The remainder of this paper is structured as follows. In section two, I briefly review the theoretical literature on tariff-mediated network effects as well as the literature on search costs. In section three, I describe the methodology used and the setup of the simulation model. Section four discusses how the model was analyzed and section five presents the results of the baseline model. Section six presents the results of two extensions of the baseline model while section seven discusses the results. Chapter eight summarizes and concludes the paper.

2. Tariff-Mediated Network Effects and Costly Information Acquisition

2.1. Tariff-Mediated Network Effects

The literature on on-net/off-net differentiation has two different foci. While some scholars study how on-net/off-net differentiation affects competition among network operators in a market, others explore networks' incentives to use access charges as a device for facilitating collusion. In the following review of the extant literature I will focus on the competitive effect of on-net/off-net differentiation and in particular on the effect of on-net/off-net differentiation on the viability of small networks. In doing so, I do not distinguish between studies which solely derive equilibrium results with respect to the access charges set by networks and those which also derive the equilibrium on-net/off-net pricing structure. This is due to the fact that access charges are typically assumed to raise off-net tariffs (see, for instance, Blonski 2002, p. 96, Peitz 2003, p. 732, Hoernig 2008, p. 9, Gabrielsen and Vagstad 2008, p. 5, Cabral 2011, p. 103, Lopez and Rey 2012, p. 1)

The first paper which theoretically explores the competitive effect of on-net/off-net differentiation is the seminal work of Laffont, Rey, and Tirole (1998b, henceforth LRT). They study a Hotelling duopoly in which networks set reciprocal access charges and price discriminate between on-net and off-net calls. One insight of their analysis is that "a full-coverage incumbent can squeeze a small-coverage entrant by insisting on a high access price. The high access charge translates into high off-net prices, creating a de facto lack of interconnection" which, in turn, raises "serious anticompetitive concerns under price discrimination" (Laffont, Rey, and Tirole 1998b, p. 40-41).

Using the same setup, Gans and King (2001) find that with asymmetric access charges, the network setting the higher access charge can increase its market share at the expense of its rival (Gans and King 2001, p. 417). This might be the case if, for instance, one network has a higher bargaining power vis-á-vis its competitors, possibly due to higher initial market shares caused by an incumbency advantage.

Blonski (2002) studies a duopoly market with (exogenous or endogenous) network externalities in which consumers are assumed to be heterogeneous with regards to their taste for the network good. Assuming that network effects are exogenous, he notes that "it is realistic to assume that there is only one equilibrium […] namely the incumbent remaining monopolist" (Blonski 2002, p. 103). Moreover, with

endogenous network externalities (whose origin is not explored further), he finds that under linear pricing only corner equilibria exist with the incumbent being more likely to corner the market (Blonski 2002, p. 106). Although under nonlinear pricing shared-market equilibria also exist, the incumbent's prevalence remains if access charges are sufficiently high. Based on these results Blonski concludes that "network externalities represent a force towards uniformity and therefore towards monopoly" (2002, p. 109).

In his review of the European legislation concerning the interconnection between telecommunications network operators, Peitz posits that by setting high access charges incumbents can deter entry and retain their dominant position (2003, p. 730). Furthermore, "in an infant market […] cost-based access prices maintain the asymmetry between operators" (Peitz 2003, p. 737).

Cambini and Valletti (2003) build on the LRT framework and study the effect of reciprocal access charges on networks' investment incentives. However, their study does not pertain to the competitive effect of on-net/off-net differentiation since they explicitly consider only symmetric equilibria (Cambini and Valletti 2003, p. 3).

Another extension of the LRT setup is the model by Jeon, Laffont, and Tirole (2004) who study a Hotelling duopoly with call externalities, i.e., consumers also derive utility from being called. Their key result is that a connectivity breakdown can occur, i.e., networks charge excessively high tariffs for off-net calls so that consumers only make on-net calls, irrespective of whether or not networks levy a reception charge. As a result, consumers on the rival's network do not receive utility from being called by subscribers to the rival network. However, Jeon, Laffont, and Tirole only consider the case of symmetric networks so the question of whether their results extend to the case of asymmetric networks remains unanswered.

Elliot (2004) provides an early review and extension of the literature on on-net/off-net differentiation by means of an Excel-based simulation model. He shows that "it is possible for the larger network to increase its market share if it can force up reciprocal access charges" while also pointing out that "it is almost certainly more cost effective for the dominant firm to cut retail prices than to force up reciprocal access charges" (Elliot 2004, p. 26).

A further simulation study is provided by Cricelli, Di Pillo, Levialdi, and Gastaldi (2004). They consider a triopoly with one fixed network and two mobile networks (an incumbent and an entrant) which are differentiated á la Hotelling. The two mobile networks price differentiate between mobile-to-mobile on-net and off-net calls. Their analysis shows that the incumbent mobile network can increase its market share by price discriminating between on-net and off-net calls. Therefore, the authors conclude that "this price discrimination strategy presents a threat for the other carriers, especially for the smallest ones" (Cricelli, Di Pillo, Levialdi, and Gastaldi 2004, p. 197).

In two related papers, Berger (2004, 2005) studies the model of LRT with call externalities. By means of a graphical analysis, he posits that symmetric equilibria only exist if networks are sufficiently

differentiated (Berger 2004, p. 14). Moreover, in the case of asymmetric market shares, "it is optimal for network i to deter any off-net call" (Berger 2005, p. 6) if its market share is sufficiently high which, apparently, would harm the smaller network.

Another series of articles on on-net/off-net differentiation is provided by Hoernig (2007, 2008, 2009). Building on the model of LRT with call externalities and explicitly allowing for asymmetric networks, Hoernig shows that the larger network has an incentive to "limit off-net calls in order to make the smaller network less attractive" (2007, p. 185). Moreover, he explicitly studies the larger network's incentive for predatory pricing and concludes that large on-net/off-net differentials can indicate such anti-competitive conduct (Hoernig 2007, p. 185). The starting point of Hoernig's (2008) study is the assertion that on-net/off-net differentiation "creates inefficiencies and disadvantages for small networks" (Hoernig 2008, p. 1). Subsequently, he analyzes the effectiveness of different regulatory measures for alleviating market share asymmetries. These measures include limiting on-net/off-net differentials, limiting off-net margins, lowering access charges, and allowing for asymmetric access charges. A key insight is the conclusion that the effect of the regulatory measures under consideration on total welfare is ambiguous and depends on the characteristics of demand. Hoernig (2009) extends the findings of his study from 2007 to the case of N networks with asymmetric costs.

Calzada and Valletti (2008) analyze an oligopolistic market with logit demand in which firms compete in prices or utilities, set reciprocal industry-wide access charges, and face the threat of additional entry. Calzada and Valleti show that, if allowed to, incumbents will set higher access charges for entrants than for other incumbents thereby foreclosing the market (2008, p. 1234). However, even with non-discriminatory access charges, incumbents "may decide to use the access charge to deter entry completely" (Calzada and Valletti 2008, p. 1243). While their results are contingent on the extent of the fixed cost of entry, they are robust to the introduction of asymmetric calling patterns, i.e., consumers call some of their peers (their calling club) more frequently than others.

The consequences of calling clubs is also explored in the work of Gabrielsen and Vagstad (2008) who study a non-differentiated duopoly in which both networks have zero marginal cost and offer two-part tariffs with on-net/off-net differentiation. Consumers do not receive utility from receiving calls, have unit demand, incur exogenous switching costs, and are members of non-overlapping calling clubs. Initially, all members of a calling club are subscribed to the same network. Gabrielsen and Vagstad conclude that "a markup on access and resulting price discrimination between on- and off-net calls creates endogenous switching costs and thereby reduces competition between networks" (2008, p. 111).

In a similar vein, Geoffron and Wang (2008) study an extension of the LRT framework with call externalities and linear tariffs in which the second network enjoys an incumbency advantage and consumers are members of calling clubs. The starting point of their analysis is the observation that large or incumbent networks can strategically use access charges to gain a competitive advantage over entrant networks (Geoffron and Wang 2008, p. 60). These scholars then set out to explore the effectiveness of

different regulatory measures in alleviating the entrant's disadvantage. They find that regulators should decrease the access charge of the incumbent network rather than increase the access charge of the entrant. From this they conclude that an "appropriate asymmetric regulation may contribute to balancing market shares and, in such a way, compensate for first-mover advantages" (Geoffron and Wang 2008, p. 58).

The analysis of Stennek and Tangerås (2008) builds on a non-differentiated duopoly without call externalities in which networks charge linear tariffs. Absent any regulatory intervention, an incumbent will monopolize the market with the help of three related actions: First, by setting prohibitively high access charges for calls terminating in his network; second, by charging very low off-net tariffs; and third, by paying a very low access charge for calls terminating on the rival's network (Stennek and Tangerås 2008, p. 14). To restore competition, regulators should mandate the interconnection of both networks at reciprocal access charges and should ban on-net/off-net differentiation.

The first agent-based model which explicitly accounts for on-net/off-net differentiation is provided by Schade, Frey, and Mahmoud (2009). They study a mobile telecommunications market with four network operators and a total of 30 different mobile contracts, both pre- and post-paid. Furthermore, with respect to mobile usage intensity, the model accommodates three different consumer types ("infrequent callers," "average callers," and "frequent callers"). When studying which pricing strategy a new entrant should adopt to maximize his probability of successful market entry, Schade, Frey, and Mahmoud find that "a new provider has to accept a considerable cut in prices to successfully establish on the market" and that a "low off-net fee for prepaid contracts has a higher chance of success than a low fee for landline calls" or a cut in the on-net fees (Schade, Frey, and Mahmoud 2009, p. 296).

Cabral (2011) studies a dynamic oligopoly market with a constant fluctuation of consumers. More specifically, in each period one consumer dies and is replaced ("birth"). Having chosen their network after birth, consumers are not allowed to switch anymore. Furthermore, they derive positive utility from the presence of other subscribers on their network. However the source of these positive network effects is not explored explicitly. Cabral demonstrates that "if network effects are sufficiently strong, then the larger network tends to increase in its size" (2011, p. 84) and that "high markups of termination charges over marginal cost imply greater market dominance and possibly the switch from a unimodal to a bimodal stationary distribution of market shares" (2011, p. 104).

The case of an asymmetric Hotelling duopoly with two-part tariffs and switching costs in which initially all consumers are subscribed to the incumbent network is studied by López and Rey (2012). They submit that an incumbent network can use tariff-mediated network effects to "keep the entrant out of the market and still charge monopoly prices by setting a large enough mark-up (or subsidy) on the access charges even if access charges are reciprocal" (López and Rey 2012, p. 4). Hence, the authors conclude that on-net/off-net differentiation "is a key factor in foreclosing competition" (López and Rey 2012, p. 5).

Hoernig, Inderst, and Valletti (2014) study a model with nonuniform calling-patterns in which the probability of calling a specific consumer decreases in the distance between the caller and the callee on the Hotelling line. These scholars show that "if calling patterns are sufficiently concentrated […] profit maximizing access charges are set above cost because sustaining high off-net prices becomes relatively more important than suppressing network effects" (Hoernig, Inderst, and Valletti 2014, p. 172).

The first study to investigate the competitive effects of on-net/off-net differentiation in the context of calls between fixed and mobile networks is the work of Hoernig, Bourreau, and Cambini (2014). Their model comprises one fixed and two mobile network operators, whereby the fixed line operator and one mobile network are integrated and customers of the fixed and mobile networks, respectively, do not overlap. Consumers derive utility from receiving calls, and mobile networks set nonlinear prices. In equilibrium "FTM [fixed-to-mobile] calls to the rival mobile network are priced significantly above marginal cost, while those to the integrated mobile network are priced below cost" which, in turn, "creates an additional disadvantage for the non-integrated mobile network, in terms of market shares and profits, and even magnifies any prior asymmetries" (Hoernig, Borreau, and Cambini 2014, p. 59). Since it is typically the mobile network incumbents which are integrated with the fixed line operator (Hoernig, Burreau, and Cambini 2014, p. 58), the pricing structure of the integrated network especially harms small network operators.

In summary, the theoretical literature on tariff-mediated network effects by and large shows that on-net/off-net differentiation can strategically be used to harm smaller networks. This is also echoed in Harbord and Pagnozzi's review of the literature on on-net/off-net differentiation who conclude that "tariff-mediated network effects create barriers to entry" (2010, p. 6) and that "high mobile-to-mobile termination charges, coupled with high charges for off-net calls, can be used strategically by incumbent operators to either prevent entry or reduce competition from new entrants into their market" (2010, p. 7).

2.2. Costly Information Acquisition

Research on the consequences of costly information acquisition by consumers started in 1961 with Stigler's seminal paper 'The Economics of Information.' The key premise underlying the stream of literature kindled by Stigler's work is that consumers ex-ante lack information about prices charged by individual firms. In order to obtain this information, consumers have to costly search for prices. Possible sources of search costs are, for instance, "the material cost of time and travel involved" or "behavioural biases such as status quo bias or choice overload" (Fletcher 2013, p. 108). Since a comprehensive review of the literature on search costs is beyond the scope of this paper, I focus on those papers which closely follow the research agenda outlined by Stigler and which analyze the impact of costly information acquisition on equilibrium prices charged by firms. For a comprehensive review of the recent theoretical and empirical literature on search costs see Baye, Morgan, and Scholten (2006).

A standard assumption in this literature is that consumers differ with respect to the extent of their search costs. In particular, this literature distinguishes between two basic types of consumers. On the one hand, a fraction μ of consumers is assumed to have non-positive search costs (i.e., search costs are either negative or zero) to account for the empirical observation "that there is a non-negligible measure of consumers who seem to derive enjoyment form shopping [i.e., searching for prices] itself" (Stahl 1989, p. 701). Accordingly, these consumers, typically labeled "shoppers," always obtain full information about all prices in a market. On the other hand, the remaining fraction 1- μ of "non-shoppers" have positive search costs which are either assumed to be homogeneous among consumers (see, e.g., Burdett and Judd 1983, Stahl 1989, Janssen and Non 2008, Janssen and Parakhonyak 2013, 2014, Astorne-Figari and Yankelevich 2014), or drawn from some distribution function (see, e.g., Braverman 1980, Rob 1985, Stiglitz 1987, Stahl 1996, Chandra and Tappata 2011). Typically, search costs are assumed to be high enough so that it is optimal for non-shoppers to search only a fraction of all prices in the market and, hence, remain only partially informed. In fact, some consumers may even decide to "remain uninformed, as they prefer to avoid search costs" (Chandra and Tappata 2011, p. 681).

With respect to the extent of consumers' prior information, Stahl (1996) distinguishes between models following the 'Stackelberg paradigm,' under which "consumers know the 'market distribution' of actual prices being charged but do not know which store is charging which price," and models adhering to the 'Nash paradigm,' under which "consumers have no information (before search) about the market distribution M(p)" (Stahl 1996, p. 244-245). Moreover, Stahl posits that "the Nash paradigm is the preferred modeling choice" (1996, p. 246).

Furthermore, the literature on search costs also differs according to the process of consumer search. More specifically, consumers are either assumed to search sequentially or use a fixed sample size search strategy. In sequential search models, consumers search the first firm provided that their valuation for the good exceeds the search costs. After learning the price charged by the first firm, consumers decide whether to buy or continue searching. Consumers keep on searching if and only if the expected gain from additional search exceeds the cost of search. Based on this optimization behavior, it is possible to calculate a reservation price r such that if the price at a firm is lower than r, consumers buy at the firm and otherwise they keep on searching. This implies that consumers always buy at the firm last visited (unless they have searched all firms). Sequential consumer search is only viable under the Stackelberg paradigm since consumers are required to know (or have an estimate of) the probability distribution of the prices charged to be able to form an expectation about the probability of finding a lower price than the one currently observed. On the other hand, if consumers use a fixed sample size search strategy, they ex-ante decide to visit a fixed number of firms to obtain price quotes. After having visited each firm in their sample, consumers buy from the firm with the lowest price. The two crucial assumptions underlying this search strategy are that, first, consumers have perfect recall of all prices observed and that, second, prices remain fixed between the time of search and the time of purchase. Although most theoretical models assume that consumers search sequentially, empirical evidence from a recent study

of De Los Santos, Hortaçsu, and Wildenbeest (2012) suggests that this assumption is invalid. These scholars use data on the actual browsing behavior of more than 150,000 internet users to analyze search behavior in the market for online books. They formulate three hypotheses which allow them to test whether the observed search behavior is consistent with sequential or fixed sample size search strategy. In all three tests, their data does not support the null hypothesis of sequential search and, hence, the authors conclude that "the fixed sample size search strategy outperforms the sequential search model in terms of explaining observed search behavior" (De Los Santos, Hortaçsu, and Wildenbeest 2012, p. 2979).

The major theme of this literature stream is whether costly information acquisition can explain the persistent price dispersion observed in many markets. (Stahl 1996, p. 260, Carlton and Perloff 2005, p. 445). Price dispersion occurs if price differentials between firms exist which are not rooted in differing product characteristics or transportation costs. Accordingly, there exists an abundant literature studying whether and under which conditions costly consumer search leads to a market equilibrium with dispersed prices. Recently, scholars have begun to enrich standard models of search behavior (Wollinsky 1986, Stahl 1989) by allowing for firms offering price matching guarantees (Janssen and Parakhonyak 2013), costly revisits of firms (Janssen and Parakhonyak 2014), or asymmetric price sampling by consumers (Astorne-Figari and Yankelevich 2014).

The key insight from this literature stream is that under quite general conditions, costly information acquisition by consumers leads to equilibrium prices being consistently above marginal costs as long as the fraction of shoppers does not exceed a certain threshold. Moreover, costly search might also induce firms to randomize over prices in equilibrium which, in turn, leads to price dispersion. Therefore, as Stahl concludes, "costly information acquisition almost surely implies a departure from the first-best setting" (1996, p. 259) and, accordingly, a welfare loss.

3. A Computational Model of Tariff-Mediated Network Effects with Incompletely Informed Consumers

To study the competitive effects of tariff-mediated network effects with costly information acquisition for consumers, I employ an agent-based simulation model. Two key features of agent-based simulations make this methodology particularly useful for answering the research question. First of all, agents in the model are autonomous, i.e., act according to individual rules and objectives. Secondly, agents are heterogeneous regarding their characteristics and decision rules. This allows for an investigation of different types of consumers who differ with respect to their search costs without necessarily imposing simplifying assumptions on the distribution of search costs, such as, for instance, that search costs are identical or uniformly distributed among consumers. Moreover, modeling autonomous agents allows me to study models which are characterized by complex interactions and feedback loops among consumers' behavior. These interactions and feedback loops, in turn, lead to emergent system-level

behavior, "that is, properties arising from the interactions of the agents that cannot be deduced simply by aggregating the properties of the agents." (Axelrod and Tesfatsion 2006, p. 1649). Being able to study models which allow for interactions and feedback loops is particularly important in the context of a consumer's decision to subscribe to a telecommunication network. This decision strongly depends on the market shares of the networks which, in turn, depend on other consumers' decisions to join a particular network which, again, depends on other consumers' decision and so on.

The description of the model proceeds in four steps. First, I describe the key features of the telecommunications market modeled before explaining the characteristics and behavior of consumers in the second step. The third step comprises an explanation of how the model is initialized and, finally, in the fourth step I describe the scheduling of the simulation.

3.1. The Market

The market for telecommunications is modeled as a rectangular grid of 1,000 (50x20) cells with each cell accommodating exactly one consumer. The grid is toroidal, i.e., the world wraps both horizontally and vertically so that each consumer has exactly eight neighbors. Telecommunication services are provided by two network operators offering linear tariffs and price discriminating between on-net and off-net calls. Networks sizes are assumed to be asymmetric with a large incumbent network A facing competition from a small entrant B. Furthermore, in line with standard models of tariff-mediated network effects (see, e.g., LRT 1998b), I assume full market participation so that each consumer is subscribed to exactly one network in every period.

The representation of the market as a two-dimensional grid is open to different interpretations. First of all, the market could be interpreted spatially, where the Euclidean distance between two consumers represents the spatial distance between the two. Alternatively, the two-dimensional grid can also be interpreted as a social space where individuals differ along two social dimensions. An example for such a social space would be the so-called Sinus-Milieus, which classify consumers into ten different social groups along two basic dimensions (SINUS Markt -und Sozialforschung GmbH 2011, p. 14). These are, first, "basic values," indicating whether an individual is primarily oriented toward "tradition," "modernization and individualization," or "re-orientation," and, second, "social class," indicating whether an individual belongs to the "lower," "middle," or "higher" class.

3.2. The Consumers

The models studied in the literature on search costs assume that consumers' decision to buy a good depends on their *actual* expenditure for the good, i.e., on the quantity to be purchased and on firms' prices. In contrast, the literature on tariff-mediated network effects postulates that the decision to subscribe to a telecommunications network is contingent on the *expected* expenditures for the good which depend on consumers' forecast of their future demand and the actual prices set by the firms. To facilitate this forecast, it is typically assumed that calling patterns are uniform, i.e., that the probability

of calling a specific network equals its market share. Accordingly, in search models consumers face only one source of uncertainty, namely the prices charged by firms, whereas in the present model, in principal two different sources of uncertainty exist. Similar to search cost models, consumers could lack knowledge of the prices charged by each network. However, additionally consumers might lack information about networks' market shares and, hence, the probabilities of calling each network. While it would in principle be possible to allow for both sources of uncertainty simultaneously, it seems advisable to only consider one source of uncertainty at a time in order to establish a clear between the type of uncertainty and the outcome of the model.

I assume that consumers in the model are perfectly informed of the tariffs charged by each network, while they have to search for information regarding networks' market shares. This decision is based on the observation that the advertising of prices is ubiquitous in telecommunications markets, as exemplified, for instance, by the overwhelming success of T-Mobile Austria's famous "Ein-Schilling-Tariff" (see pressetext.com 1999). Since advertising can be considered a substitute for consumer search (Perloff and Salop 1986, p. 187, Janssen and Non 2008, p. 355), it seems reasonable to assume that consumers are informed of the prices charged by different telecommunication networks. On the other hand, information about networks' market shares is not readily available to consumers via advertising or other sources. Hence, I assume that consumers have to search costly for networks' market shares. An alternative argumentation would be that the costs of searching for tariffs charged by networks are negligible compared to the costs which consumers incur when searching for networks' market shares.

In the model, a central agency selling perfect information about networks' market shares does not exist. Therefore, in order to obtain information about networks' market shares, consumers have to approach other consumers and ask them about their current network subscription. This assumption roughly parallels the setup in standard search models where consumers have to visit a firm to learn about its price. For each visit consumers incur constant costs which are assumed to be independent of the distance traveled. Hence, the number of other consumers visited by a specific consumer depends on the realization of her search costs.

In line with Stahl who postulates that "it is important to have a model that can accommodate an atom of shoppers" (1996, p. 146), I assume that a fraction α of consumers are shoppers with non-positive search costs. As a result, they always approach all other consumers and, hence, become 'fully informed consumers' (FICs). To get a more fine-grained picture of the influence of costly information acquisition on the competitive effect of tariff-mediated network effects, I allow the fraction $1-\alpha$ of non-shoppers to differ with respect to the extent of search costs. More specifically, I assume that a fraction $\beta \leq 1-\alpha$ has moderate search costs, whereas the remaining $\gamma = 1 - \alpha - \beta$ consumers have high search costs.

In line with the empirical findings of De Los Santos, Hortaçsu, and Wildenbeest (2012) consumers in the model use a fixed sample size search strategy to collect information about networks' market shares. I do not explicitly model how consumers' search costs translate into an optimal sample size for fixed

sample size search. Instead, I assume that the moderate extent of search costs allows the fraction β of consumers to approach other consumers within a specific radius which is decreasing in the search costs. This assumption establishes a clear link between consumers' search cost and the radius of their sensing field. Since these consumers only observe a fraction of the market, I label them 'partially informed consumers' (PICs). Finally, I assume that the remaining fraction γ of consumers with high search costs find it optimal to only infer market shares from their immediate eight neighbors, which makes them 'locally informed consumers' (LICs).

Both partially and locally informed consumers use the observed market shares as estimates for firms' true market shares. This assumption parallels the model of Perloff and Salop (1986) in which consumers form an estimate of firms' prices which is based on, among other factors, their observation of prices (see also Carlton and Perloff 2005, p. 464).

The modeling of consumers' search behavior implies that FICs and LICs span a continuum of different levels of information on firms' market shares. PICs are located within this continuum and their exact position depends on their sensing radius. As their radius increases, they approach FICs in behavior, while they converge to the behavior of LICs as their sensing radius decreases. Figure 1 further illustrates the relationship between the sensing radius of PICs and percentage of market observed.

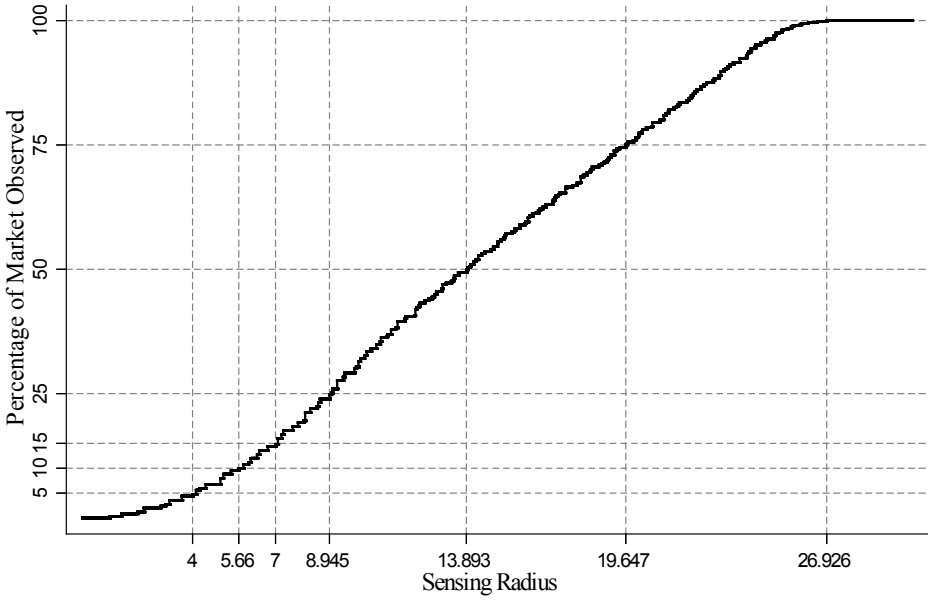


Figure 6-1: Effect of sensing radius on percentage of market observed

This flexible specification allows for an investigation of the consequences of different levels of information among consumers on the competitive effect of tariff-mediated network effects.

Following Stahl, I assume that "consumers are effectively identical except for search costs" (1989, p. 701). Each consumer strives to be subscribed to the network offering the highest expected utility. The expected utility of consumer i from being subscribed to network j in period t is given by:

(1) $U_{ijt} = v_{0i} - E(c_{ijt})$,

that is, the expected utility is given by a baseline utility derived from being able to communicate over the network net of the expected cost of a call to a random consumer. The baseline utility is assumed to be large enough so that consumers always subscribe to one of the two networks (Calzada and Valletti 2008, p. 1227, Cabral 2011, p. 88, López and Rey 2012, p. 6). Note that the specification of the utility function contains three implicit assumptions about consumers' behavior. First, I assume that consumers have unit demand, which is a common assumption in models of costly consumer search (see, for instance, Rob 1985, Janssen and Non 2008, Janssen and Parakhonyak 2013, Astorne-Figari and Yankelevich 2014) but has also been used in the literature on on-net/off-net differentiation (Gabrielsen and Vagstad 2008, p. 103). Second, I assume that consumers are myopic, i.e., when deciding which network to subscribe to, consumers do not take the behavior of other consumers into account. This assumption is in line with Cabral who observes that "many of the existing models of network effects assume that consumers are short-lived, myopic, or naïve" (2011, p. 95; see also Gabrielsen and Vagstad 2008, p. 104). The third assumption is that the baseline utility is identical for both networks for a given consumer while it may differ between consumers. Accordingly, the only source of differentiation between the two networks are the tariffs for on-net and off-net calls, respectively. The reason for this seemingly strong assumption is that the present study focuses on the competitive effect of price differentiation rather than on the effect of (horizontal or vertical) product differentiation. Moreover, this assumption is in line with the observation of Gabrielsen and Vagstad (2008, p. 102) that "the extent of product differentiation among different mobile network operators is minimal" (see also Stennek and Tangerås 2008, p. 2). However, this assumption is not overly restrictive as differences in product quality, which would be reflected by different v_{0i}, can also be interpreted as an additional cost incurred by subscribers of the network with inferior quality.

In essence, the utility function in (1) implies that consumers minimize their (expected) telephone bill by subscribing to the network which offers the lowest expected cost of a random call. Furthermore, the expected cost of a call is given by:

(2) $E(c_{ijt}) = marketshare_{ijt} * p_{jt}^{onnet} + (1 - marketshare_{ijt}) * p_{jt}^{offnet}$,

where marketshare_{ijt} denotes consumer i's observation of network j's market share in period t and p_{jt}^{onnet} and p_{jt}^{offnet} denote network j's tariffs for on-net and off-net calls in period t, respectively. Note that two consumers may have a different observation of network j's market share at time t depending on their search costs as well as on their location in the market.

This specification implies that, for each network, there exists a critical market share above which a consumer wants to be subscribed to the respective network. For network A the critical market share is given by:

(3) $E(c_{iAt}) < E(c_{iBt})$

which holds whenever

(4) $marketshare_{iAt} > \frac{p_{Bt}^{onnet} - p_{At}^{offnet}}{\left(p_{At}^{onnet} - p_{At}^{offnet}\right) + \left(p_{Bt}^{onnet} - p_{Bt}^{offnet}\right)}$

Typically, the denominator in (4) is negative since networks price on-net calls below off-net calls. If this is the case, an analysis of the effect of tariff-mediated network effects is only interesting if network B's tariff for on-net calls is below A's tariff for off-net calls because otherwise the right-hand side of the inequality is negative and, hence, consumers always join network A regardless of its market share. The analogous result holds for network B. Moreover, equation (4) shows that network A's critical market share increases in its tariffs and decreases in network B's tariffs.

3.3. Initialization of the Market (t=0)

The initialization of the simulation in t=0 proceeds in three steps. First, the computer creates 1,000 consumers and scatters them across the grid so that each cell accommodates exactly one consumer. In the second step, each consumer is randomly assigned to one of the three types (FIC, PIC, or LIC) based on pre-defined shares. In the third step, membership to networks A and B is distributed based on the market shares pre-defined by the modeler. The distribution is such that clusters of subscribers to network B occur, with the number of clusters being pre-defined by the modeler. The initial clustering of subscribers to the smaller network is in line with Möbius (2011, p. 16) and mirrors the empirical findings of Karacuka, Çatik, and Haucap (2013). These scholars report that in the Turkish mobile telecommunications market regional market shares of mobile networks differ considerably. While the incumbent network operator Turkcell has a dominant position in the densely populated area of Marmara, "surprisingly, the smallest operator, Avea, is the market leader in postpaid services in eastern and south eastern parts of Turkey, and Avea has a share very close to Turkcell in the postpaid market in the Black Sea region" (Karacuka, Çatik, and Haucap 2013, p. 337). Furthermore, Karacuka, Çatik, and Haucap report that Turkish network operators also differ with respect to the social characteristics of their customers. Avea, for instance, is the operator of choice among young consumers (Karacuka, Çatik, and Haucap 2013, p. 343). Hence, these findings corroborate the assumption of a clusterwise distribution of membership to the smaller network regardless of whether the two dimensional grid is interpreted as a geographic or social space. As a side note, this assumption is also reasonable from a technical point of view. If membership to both networks was assigned randomly, then market shares observed by both PICs and LICs would in expectation be equal to the true market share observed by FICs. Hence, with random assignment of network membership, all three types of consumers would behave similarly.

Figure 2 shows an exemplary state of the market after completed initialization. Red cells are occupied by subscribers to network A, while blue cells accommodate subscribers to network B. Membership to network B is distributed in ten clusters. FICs are represented by a dot, PICs by an x, and LICs by a triangle.

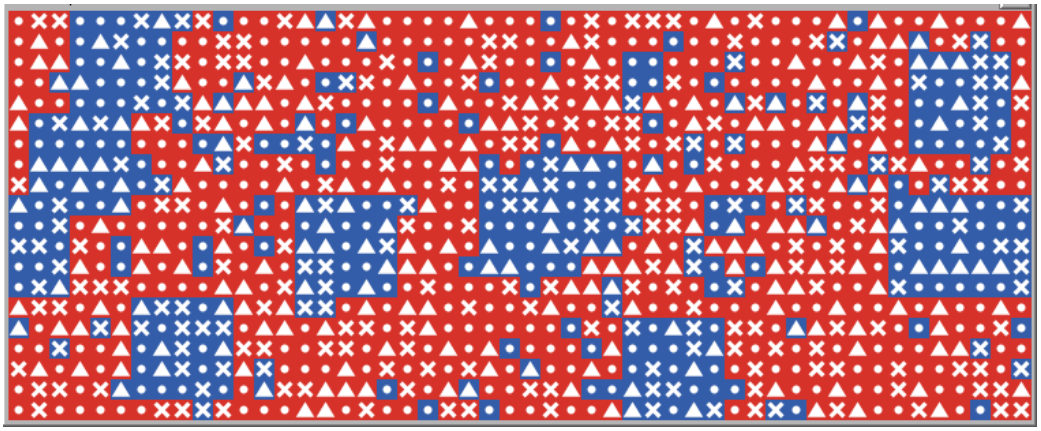


Figure 6-2: Exemplary state of the market after successful initialization

3.4. The Scheduling (t=1 to 999)

In the simulation model, time is represented discretely, i.e., time passes in steps. The length of one time step is not explicitly defined. However, it is shorter than the average subscription duration because in each time period only a fraction of subscribers is allowed to decide about whether to stay with the current network or switch to the competitor. This assumption compares to the dynamic model of Cabral (2011). Although in his model, subscribers are not allowed to switch their network after initial subscription, in each period one random consumer dies and is replaced. Technically, this is equivalent to allowing one consumer per period to decide on switching her network. Moreover, allowing only a fraction of all consumers to switch their network in each period mirrors the fact that, in reality, consumers' contract lengths are heterogeneous and not synchronized. Following Cabral (2011, p. 102), I set the maximum simulation length to 1,000 periods. However, the simulation prematurely stops after one of the networks has successfully cornered the market.

Table 6-1: Scheduling of the model

1. Initialization	1.1. Create and distribute 1,000 consumers
	1.2. Assign consumer types randomly
	1.3. Assign network membership clusterwise
2. Simulation	2.1. Draw random sample of consumers allowed to decide on network membership
	2.2. Selected consumers update observed market shares • FICs observe true market shares • PICs observe market shares within circular sensing field • LICs observe market shares among their eight neighbors
	2.3. Selected consumers calculate expected utility for both networks, based on equations (1) and (2)
	2.4. Selected consumers switch to competitor if expected utility from competing network is higher
3. Observation	Update plot of true market shares of both networks

In each period, four actions are executed successively. First, the computer draws a random sample of consumers who are allowed to decide on their network membership. Second, all consumers of this sample update their observed market shares of both networks using their respective behavioral rule. Since I assume full market participation, the market share of network B is simply one minus the market share of network A. Third, all selected consumers calculate the expected utility derived from both networks, while in the fourth step, each consumer of the sample subscribes to the network offering the higher expected utility. As a tie-breaking rule, consumers stay with their current network operator if the expected utilities for both networks are equal. Finally, in the fifth step, a plot is updated which keeps track of the true market shares of A and B. Table 1summarizes the initialization and scheduling of the model.

4. Description of the Experimental Setup

Table 2 gives an overview of the variables used in the model. To analyze agent-based models, Railsback and Grimm (2012) recommend identifying the key variables which are likely to have the greatest impact on the model outcome and systematically varying these variables to understand the model's behavior. However, it is important to keep in mind that the number of possible parameter combinations which have to be simulated increases exponentially. For instance, adding a variable with three levels to an analysis which already contains five variables with three levels each increases the number of necessary simulations from $3^5 = 243$ to $3^6 = 729$.

Table 6-2: Overview of variables

Name	Type	Levels used in analysis
Market shares at end of simulation	Dependent	n.a.
Fraction of fully informed consumers	Independent	0%, 20%, 40%, 60%, 80%, 100%
Fraction of partially informed consumers	Independent	0%, 20%, 40%, 60%, 80%, 100%
Fraction of locally informed consumers	Independent	0%, 20%, 40%, 60%, 80%, 100%
Initial market share of network A	Control	65%, 75%, 85%, 95%
Sensing radius of partially informed consumers	Control	4, 5.66, 7, 8.945, 13.893, 19.647
Number of clusters	Control	1, 5, 10
Number of consumers	Fixed	1000
Maximum simulation length	Fixed	1000
Probability of network selection	Fixed	5%
On-net price network A	Fixed	0.5
Off-net price network A	Fixed	1
On-net price network B	Fixed	0.25
Off-net price network B	Fixed	1

To keep the model computationally tractable, I decided to keep the size of the market and the length of the simulation constant since these two variables do not significantly affect the model outcome. Increasing the size of the market does not affect the behavior of fully informed consumers, decreases

the fraction of the market observed by PICs which is equivalent to a reduction of their sensing radius, and makes LICs' inference about the market shares of A and B even less precise. Setting the maximum simulation length to 1,000 periods ensures that the system will achieve a market equilibrium or steady state before the simulation terminates. Moreover, I fixed the tariffs for off-net calls of networks A and B to 1 and the tariffs for on-net calls to 0.5 and 0.25, respectively. Variation of the tariffs for on-net and off-net calls affects the critical market share of network A below (above) which consumers will choose network B (A) (see equation (4)). Given these tariffs, consumers join network B if their observed market share of network A is below 60%. However, a change in tariffs implies a change in the critical market share and, therefore, necessitates an adjustment of the values of network A's initial market share which, in turn, complicates a comparison of the different simulation runs. Hence, I decided to keep tariffs constant to assure that all simulations can be run on the same parameter space. However, in the second extension of the model (see chapter 6.2) I allow for active price setting by networks.

To investigate the effects of on-net/off-net differentiation on the market shares of small networks, I systematically vary the remaining six variables of the model, whereby the main focus is on how differing fractions of FICs, PICs, and LICs affect the model outcome. I vary these fractions in six equidistant steps of 20%, of course assuring that the three shares sum to one. As control variables, I systematically permute the initial market share of A (and hence of B), the sensing radius of partially informed consumers, and the number of (and hence the size of) clusters of subscribers to network B. For network A's market share, I choose four equidistant steps starting from 65% to ensure that tariff-mediated network effects still favor the larger network A. The values for PICs' sensing radius were chosen such that they observe 5%, 10%, 15%, 25%, 50%, and 75% of the market, respectively. The number of clusters was set somewhat arbitrarily to 1, 5, and 10, respectively.

In total, the combination of all values for each of the six variables results in 1,152 possible parameter combinations, taking into account that the shares of consumer types sum to one and that the sensing radius need not be varied if the share of PICs is 0%. Despite this vast parameter space, I decided to use a full factorial design for the analysis of the model to be able to detect nonlinearities in the model's response surface. By using fractional factorial designs, such as Plackett-Burman designs (Plackett and Burman 1946) or Latin Hypercubes (Siebertz, van Bebber, and Hochkirchen 2010, p. 159-190) it is not possible to estimate higher-order nonlinearities (Siebertz, van Bebber, and Hochkirchen 2010, p. 25-56) or it might even be the case that nonlinear regions in the response surface of the model are overlooked if exactly those parameter combinations leading to nonlinear behavior are skipped.

In order to minimize the influence of stochastic elements of the model, such as the random initialization of the market or the order in which consumers are selected to decide on network membership, I simulated each parameter combination 500 times. Although it is possible to observe both equilibrium and off-equilibrium behavior in an agent-based simulation, the focus of this paper is on the model's equilibrium or steady state given a specific combination of parameters. Hence, for each parameter combination and each repetition, I only analyze the market shares of networks A and B in the last period and the average

number of times in which a consumer switches her network. The final data set consists of the average of these two statistics over the 500 repetitions as well as the average simulation length for each of the 1,152 parameter combinations.

5. Simulation Results

As described in the previous section, I simulated each parameter combination 500 times to ensure that stochastic elements in the model do not affect the simulation results. Accordingly, the results reported below are based on the averaged dataset, i.e., for each parameter combination the results are averaged over the 500 repetitions.

To check whether 500 repetitions are sufficient to ensure that stochastic elements in the model do not affect the analysis, the experimental error variance should be calculated (Lorscheid, Heine, and Meyer 2012, p. 33). The experimental error variance is a measure of the variability in the model's response variable(s) which arises if the model is run repeatedly using the same parameter settings (Lorscheid, Heine, and Meyer 2012, p. 33). As a measure of the experimental error variance, Lorscheid, Heine, and Meyer suggest using the coefficient of variation, which is defined as

(5) $c_v = \frac{s}{\mu}$

where s denotes the standard deviation of a response variable and μ denotes its arithmetic mean (Hendricks and Robey 1936). The necessary number of repetitions is given by the point where c_v no longer changes with an increasing number of repetitions.

Figure 3 shows the experimental error variance after 50, 100, 150, 200, 250, 300, 350, 400, 450, and 500 repetitions for 20 different parameter combinations which showed the highest coefficient of variation in network A's market share after 500 repetitions and, accordingly, represent those combinations which are most sensitive to random influences.

As Figure 3 illustrates, in 15 parameter combinations the coefficient of variation stabilizes after 400 to 450 repetitions. The explanation for the increasing coefficient of variation for the remaining five parameter combinations is of a statistical nature. In four parameter combinations network A corners the market in all but one repetition, while for the fifth parameter combination A corners the market 498 times. Due to the fact that with an increasing number of repetitions the mean market share decreases faster than the standard deviation, these rare events lead to an increasing coefficient of variation. However, since the events that impede the coefficient of variation from stabilizing are so rare, even significant increases in the number of repetitions for all parameter combinations would not lead to a significant increase in the amount of information available. Therefore, I decided to not increase the number of repetitions per parameter combination further.

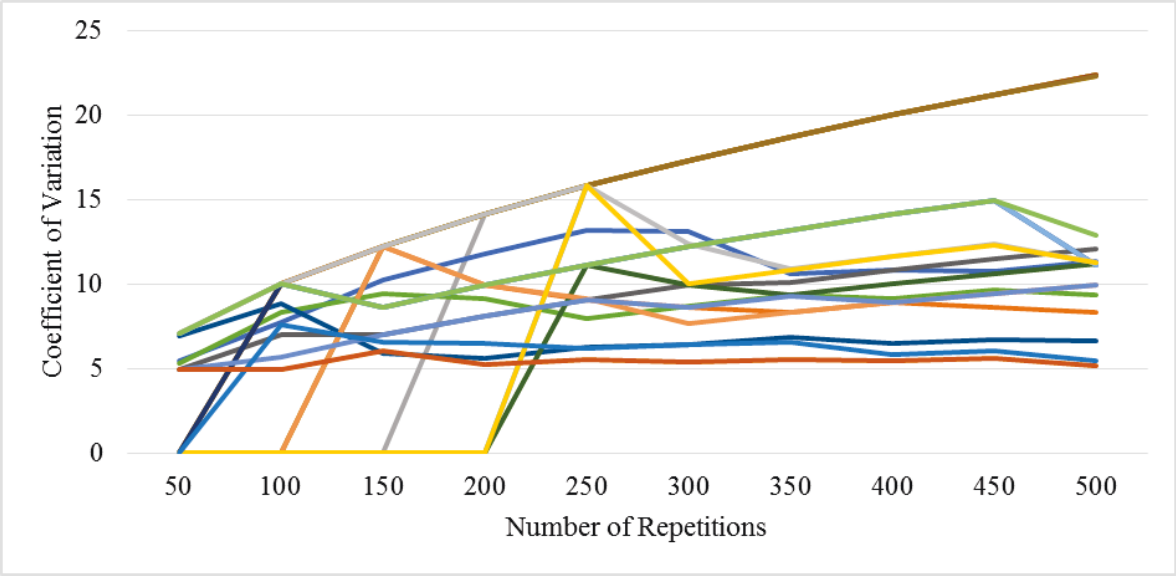


Figure 6-3: Development of Coefficient of Variation

5.1. Descriptive Statistics

Table 3 summarizes the descriptive statistics of the results. On average, consumers switch their network 0.26 times during one simulation run. In extreme cases, the market either shows hardly any dynamics, with consumers switching only 0.01 times, or turns out to be very turbulent, with all consumers switching their network once. Furthermore, on average, a simulation run stops after 266 periods since one of the networks corners the market. However, for 24 parameter combinations the market never converges to a corner equilibrium so that all 999 periods are simulated in all 500 repetitions. The mean market share of network A at the end of a simulation run is 0.88. Over all parameter combinations, network A increases its initial market share with a probability of 89%, i.e., in 445 repetitions, while the corresponding probability for network B is 11%. Furthermore, network A corners the market with a probability of 80%, i.e., in about 400 repetitions, while network B corners the market with a probability of 9%.

The fact that the probabilities of increasing the initial market share and of cornering the market are pretty close implies that for most parameter combinations market share growth is monotonic, i.e., if a network increases its initial market share it typically also corners the market.

Table 6-3: Descriptive statistics

	Mean	Std. Dev.	Min.	Max.
No. of network switches per consumer	0.26	0.23	0.01	1.00
Simulation length	266.24	270.74	85.78	999.00
Final market share of network A	0.88	0.29	0.00	1.00
Probability of A increasing its market share	0.89	0.30	0.00	1.00
Probability of B increasing its market share	0.11	0.30	0.00	1.00
Probability of A cornering the market	0.80	0.36	0.00	1.00
Probability of B cornering the market	0.09	0.27	0.00	1.00

However, these statistics can only provide a first rough understanding of the simulation results since they are based on the average of 500 repetitions for all parameter combinations. Therefore, Table 4 shows the number of parameter combinations in which the number of runs in which either network increases its initial market share exceeds a certain threshold.

In 1,026 out of 1,152 parameter combinations, network A increases its market share in at least 250 out of 500 repetitions, whereas for network B this is only the case in 126 parameter combinations. In 898 (65) parameter combinations, all 500 repetitions result in network A (B) increasing its initial market share.

The corresponding analysis for corner equilibria is displayed in Table 5. In 932 out of 1,152 parameter combinations, network A corners the market in at least half of all repetitions, while in still 675 combinations, A always corners the market. For network B, the corresponding figures are 102 and 48, respectively. This analysis again shows that if one of the networks increases its initial market share it most likely also corners the market.

Table 6-4: Frequency of market share growth

		Number of parameter combinations in which…	
		...network A increases its initial market share in at least…	...network B increases its initial market share in at least…
250	repetitions	1026	126
300		1022	123
350		1013	115
400		1003	110
450		980	102
500		898	65

Table 6-5: Frequency of monopolization

		Number of parameter combinations in which…	
		...network A corners the market in at least…	...network B corners the market in at least…
250	repetitions	932	102
300		912	98
350		887	89
400		866	83
450		818	75
500		675	48

Table 6-6: Matrix of one-way and two-way effects

		FIC						PIC						LIC						Initial Market Share				Sensing Radius						Number of Clusters		
		0.00	0.20	0.40	0.60	0.80	1.00	0.00	0.20	0.40	0.60	0.80	1.00	0.00	0.20	0.40	0.60	0.80	1.00	0.65	0.75	0.85	0.95	4.00	5.66	7.00	8.95	13.89	19.65	1	5	10
FIC	0.00	0.67																														
	0.20		0.96																													
	0.40			1.00																												
	0.60				1.00																											
	0.80					1.00																										
	1.00						1.00																									
PIC	0.00	0.79	0.94	1.00	1.00	1.00	1.00	0.95																								
	0.20	0.68	0.98	1.00	1.00	1.00			0.93																							
	0.40	0.67	0.97	1.00	1.00					0.91																						
	0.60	0.66	0.96	1.00							0.87																					
	0.80	0.66	0.94									0.80																				
	1.00	0.66											0.66																			
LIC	0.00	0.66	0.94	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	0.66	0.92																		
	0.20	0.66	0.96	1.00	1.00	1.00		1.00	1.00	1.00	0.96	0.66			0.91																	
	0.40	0.66	0.97	1.00	1.00			1.00	1.00	0.97	0.66					0.88																
	0.60	0.67	0.98	1.00				1.00	0.98	0.67							0.83															
	0.80	0.68	0.94					0.94	0.68									0.71														
	1.00	0.79						0.79											0.79													
Initial Market Share	0.65	0.19	0.87	1.00	1.00	1.00	1.00	0.90	0.82	0.77	0.68	0.48	0.17	0.80	0.77	0.71	0.59	0.29	0.54	0.70												
	0.75	0.54	0.97	1.00	1.00	1.00	1.00	0.94	0.91	0.88	0.83	0.74	0.54	0.90	0.88	0.84	0.77	0.62	0.73		0.84											
	0.85	0.94	1.00	1.00	1.00	1.00	1.00	0.98	0.99	0.99	0.98	0.96	0.93	0.99	0.98	0.98	0.98	0.95	0.90			0.98										
	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99				1.00									
Sensing Radius	4.00	0.48	0.96	1.00	1.00	1.00			0.92	0.87	0.80	0.69	0.42	0.87	0.84	0.80	0.73	0.62		0.64	0.71	0.91	1.00	0.82									
	5.66	0.58	0.95	1.00	1.00	1.00			0.91	0.88	0.84	0.75	0.59	0.90	0.88	0.84	0.76	0.60		0.63	0.77	0.98	1.00		0.85								
	7.00	0.63	0.95	1.00	1.00	1.00			0.92	0.89	0.86	0.78	0.64	0.91	0.90	0.86	0.79	0.61		0.64	0.82	0.99	1.00			0.86							
	8.95	0.66	0.95	1.00	1.00	1.00			0.92	0.91	0.87	0.80	0.67	0.92	0.90	0.88	0.82	0.64		0.65	0.85	1.00	1.00				0.87						
	13.89	0.74	0.96	1.00	1.00	1.00			0.94	0.93	0.90	0.84	0.74	0.93	0.93	0.91	0.87	0.72		0.73	0.88	1.00	1.00					0.90				
	19.65	0.90	0.98	1.00	1.00	1.00			0.97	0.98	0.96	0.93	0.91	0.97	0.97	0.97	0.95	0.86		0.85	0.99	1.00	1.00						0.96			
Number of Clusters	1	0.53	0.92	1.00	1.00	1.00	1.00	0.95	0.90	0.87	0.80	0.68	0.49	0.88	0.86	0.82	0.76	0.62	0.80	0.63	0.73	0.95	1.00	0.77	0.80	0.81	0.81	0.81	0.90	0.83		
	5	0.72	0.97	1.00	1.00	1.00	1.00	0.96	0.94	0.92	0.89	0.83	0.71	0.94	0.92	0.90	0.86	0.75	0.79	0.72	0.89	0.99	1.00	0.83	0.86	0.88	0.90	0.93	0.99		0.90	
	10	0.76	0.98	1.00	1.00	1.00	1.00	0.96	0.95	0.94	0.92	0.87	0.77	0.95	0.94	0.92	0.89	0.78	0.78	0.76	0.92	1.00	1.00	0.84	0.88	0.90	0.92	0.96	1.00			0.92

To investigate the effect of the independent variables, Lorscheid, Heine, and Meyer (2012, p. 38) recommend the use of an effect matrix which contains the main effects as well as all possible pairwise interactions between all levels of the independent variables. In Table 6, the values on the main diagonal denote the unconditional mean of the final market share of network A for each level of all independent variables. Furthermore, for all levels of the independent variables, the mean of the final market of network A conditional on the level of another independent variable is shown in the lower triangle matrix.

Across all parameter combinations in which the share of FICs is 0, the average market share of network A at the end of the simulation is 67%. However, A's market share drastically increases to an average of 96% if the share of FICs is 20%. If at least 40% of all consumers are fully informed, network A always corners the market. In contrast to that, network A's final market share (almost) monotonically decreases with an increase in the fraction of PICs (LICs). On average, network A's market share is 66% across all parameter combinations in which all consumers are partially informed, while A's average market is 79% if all consumers are locally informed. Not surprisingly, an increase in A's initial market share also leads to an increase in its final market share. Moreover, the sensing radius of PICs also has a positive effect on A's final market share which increases from 82% for a sensing radius of 4 to an average of 96% if the radius is 19.65. Finally, if the number of clusters of network B at t=0 increases from 1 to 10, network A's average market share increases from 83% to 92%.

Furthermore, Table 6 shows that if the fraction of FICs is at least 40%, network A always corners the market irrespective of the levels of the other independent variables. If the fraction of FICs is at most 20%, A's market share in most cases decreases with an increase in the fraction of PICs or LICs, while it increases with an increase in A's initial market share, PICs' sensing radius, or the number of clusters. The interaction effects between the share of PICs and the share of LICs show that network A always corners the market if the combined fraction of PICs and LICs is below 80%. For all levels of the fraction of PICs, A's final market share monotonically increases in A's initial market share. Besides, for a given fraction of PICs, network A's market share increases with either an increase in the sensing radius or in the number of clusters, albeit these effects gain in strength with an increase in the fraction of PICs. The same pattern can be observed for the fraction of LICs, albeit with one exception: If all consumers are locally informed, an increase in the number of clusters from 1 to 10 slightly lowers A's average market share from 80% to 78%. For values of A's initial market share of 85% or above, A almost always corners the market, irrespective of the values of the other independent variables. An increase in PICs' sensing radius or in the number of clusters increases the positive effect of A's initial market share on A's final market share and this positive effect is larger for higher values of the initial market share. The number of clusters have only a minor positive influence on the effect of the sensing radius on A's final market share.

Overall, Table 6 also shows that for some combinations, network A faces a substantial loss in market shares to an average of less than 50%. This is the case in the following seven combinations: (1) FIC = 0% and initial market share = 65%; (2) FIC = 0% and sensing radius = 4; (3) PIC = 80% and initial

market share = 65%; (4) PIC = 100% and initial market share = 65%; (5) PIC = 100% and sensing radius = 4; (6) PIC = 100% and number of clusters = 1; and (7) LIC = 80% and initial market share = 65%.

However, since Table 6 only illustrates the main effects and two-way interactions, the preceding analysis only conveys a partial picture of the effects of the independent variables on network A's final market share. A more comprehensive picture is provided by the graphical analysis in the following section.

5.2. Graphical Analysis

Figure 4 shows the averaged results for all 1,152 parameter combinations in a matrix of four-dimensional scatter plots (Mazza 2009, p. 50-51). The rows of the matrix denote the six different levels of the fraction of FICs used in the simulation, while the columns denote the six different levels of the fraction of PICs. Since the sum of FICs and PICs cannot exceed 1, only the lower triangle of the matrix is filled. Apart from the first column, each cell contains a four-dimensional scatter plot. In each plot, the x-axis represents the number of clusters, the y-axis represents the sensing radius of PICs, and the z-axis represents network A's initial market share. Since I used a full factorial design for the simulation, each plot contains a total of 72 parameter combinations, each represented by a bullet. In the plots in the first column the sensing radius is missing as an additional dimension since the fraction of PICs is zero for that column. The value of the dependent variable is depicted by the color of the bullets. The dependent variable in the plots is defined as the ratio of the actual change in network A's market share to the maximum possible change, i.e.,

$$(6)\ change = \begin{cases} \frac{marketshare_{end} - marketshare_{intial}}{1 - marketshare_{initial}} & if\ marketshare_{end} \geq marketshare_{initial} \\ \frac{marketshare_{end} - marketshare_{intial}}{marketshare_{initial}} & if\ marketshare_{end} < marketshare_{intial} \end{cases}$$

Accordingly, the value of the dependent variable is bound on the interval [-1;1]. A value of 1 implies that network A realized 100% of its growth potential, i.e., cornered the market. On the other hand, a value of -1 implies that A realized 100% of its possible shrinkage or, put differently, network B realized 100% of its growth potential. Values close to zero can have two different meanings. They occur either if networks A and B take turns in cornering the market or if predominantly market sharing equilibria occur in the respective parameter combination so that neither network realizes its full growth potential. By using the ratio of the actual change and the maximum possible change in A's market share instead of the mean market share, all graphs are immediately comparable. When using the mean market share instead, a value of 80% would imply an *increase* in A's market share if its initial share was 75% but a *decrease* if its initial share was 85%. When using the ratio between actual change and maximum possible change, the respective values would be +0.2 in the former case and -0.06 in the latter.

The scatter plots in Figure 4 illustrate that network A always realizes 100% of its maximum growth potential, i.e., corners the market, if the fraction of FICs is at least 40%. Furthermore, even if the fraction of FICs is below 40%, network A always corners the market if its initial market share exceeds a certain threshold, whereby this threshold varies between 75% and 95%, depending on the value of the other

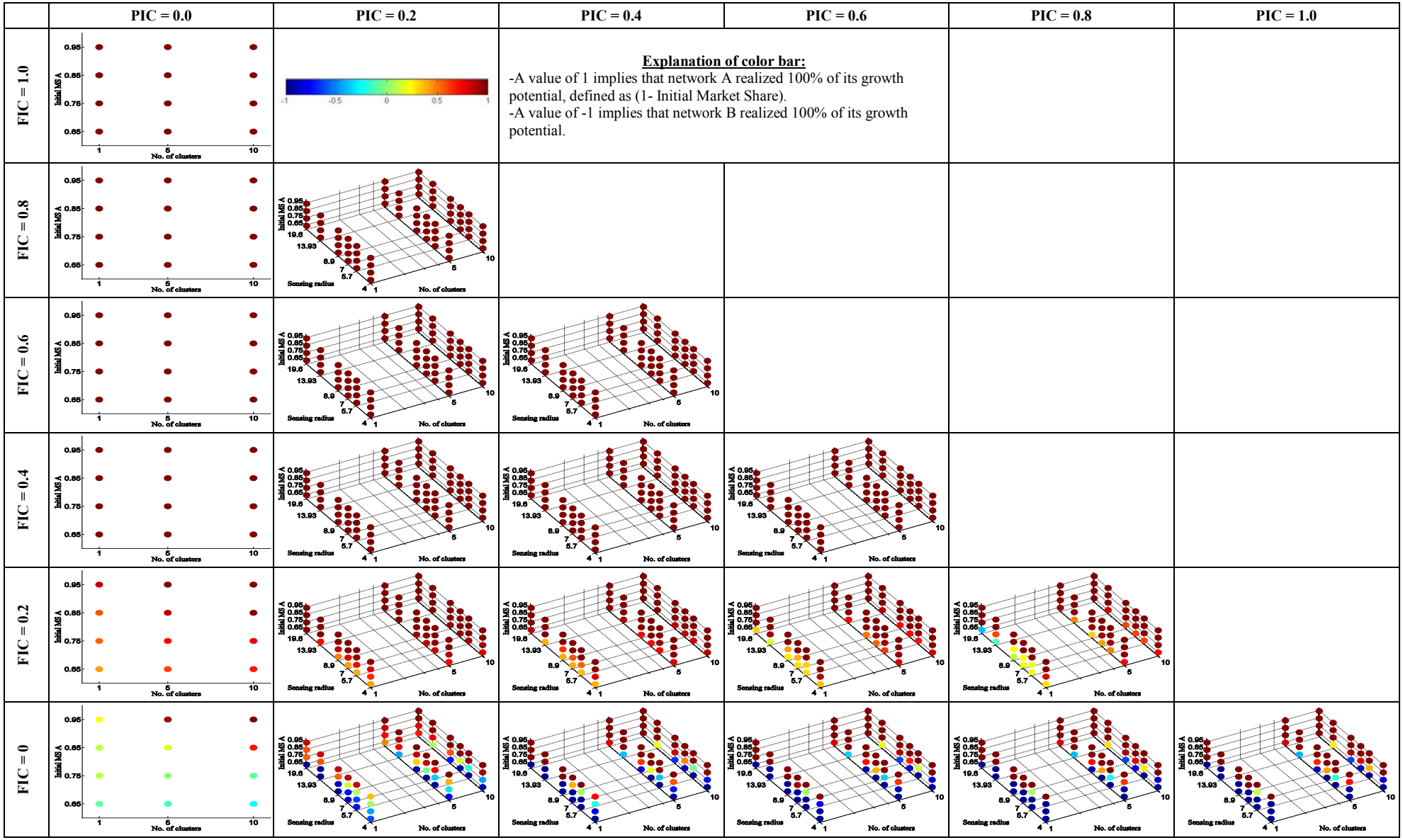


Figure 6-4: Graphical representation of simulation results

variables. If the fraction of FICs is at most 20%, Figure 4 illustrates that, generally, network A's fraction of realized growth potential decreases with an increasing fraction of PICs or LICs but increases if either A's initial market, the number of clusters, or PICs' sensing radius increases. Furthermore, network B's odds of increasing its market share drastically increase if the fraction of FICs decreases from 20% to 0%, regardless of whether this decrease leads to an increase in the fraction of PICs or LICs.

More specifically, if the fraction of FICs is 20%, network A's initial market share is below 75% (in some cases below 85%), and the number of clusters is 1 (in some cases 5 or 1), in most cases market sharing equilibria emerge. For instance, if the fraction of FICs and PICs is 20% each, network A's initial market share is 65%, and only one cluster exists, the mean ratio of the number of runs in which A corners the market to the number of runs in which B corners the market (henceforth called *monopolization ratio*) over the six different radii is 96 : 0. This means that over these six parameter combinations, network A monopolizes the market in 96 out of 500 runs on average, while network B never monopolizes the market. If, ceteris paribus, the fraction of PICs gradually increases to 80%, the average monopolization ratio takes on the values 111 : 1 (PIC = 40%), 52 : 14 (PIC = 60%) and 16 : 64 (PIC = 80%). If the fraction of FICs is 20%, network B can only increase its market share substantially if four conditions are fulfilled simultaneously: First, the fraction of PICs is 80%; second, initially only one cluster of subscribers to network B exists; third, the initial market share of network A does not exceed 65%; and fourth, PICs observe 50% or 75% of the market, i.e., the sensing radius is either 13.893 or 19.647.

If no consumer is fully informed, network B realizes a large fraction of its growth potential or even corners the market over a wide range of parameter combinations. If, for instance, the fraction of PICs is 60% or higher, network A's initial market share is 65%, and only one cluster exists, the average monopolization ratio is 0 : 500, i.e., B always corners the market in all 500 repetitions, regardless of PICs' sensing radius. If, ceteris paribus, the fraction of PICs decreases to 40% or 20%, the average monopolization ratios are still 0 : 434 and 0 : 250, respectively. An increase in the number of clusters changes the monopolization ratio in favor of network A. As an example, consider the case in which the fraction of PICs is 60% and network A's initial market share is 65%. A change in the number of clusters from 1 to 5 or 10 changes the monopolization ratio from 0 : 500 to 106 : 394 or 153 : 345, respectively. But even if network A's initial market share is 75%, network B can increase its market share and may even corner the market if the number of clusters is small enough and/or the fraction of PICs is large enough. Network B can corner the market even if network A has an initial market share of 85%, provided that initially only one cluster exists, PICs' sensing radius is only 4 and the fraction of PICs exceeds 40%.

5.3. Regression Results

To further explore how the fraction of consumer types, PICs' sensing radius, network A's initial market share, and the number of initial clusters affect the market shares of both networks, I estimated five different regressions (see Table 7) in which the dependent variable is network A's final market share, as before averaged over the 500 repetitions for each parameter combination.

Model I only contains the levels of the independent variables. Since the fractions of the three different consumer types sum to one and including all three variables would lead to perfect multicollinearity, I decided to exclude the fraction of FICs from the regression. Hence, the coefficients for the fraction of PICs and LICs denote the effect of increasing the fraction of PICs or LICs at the expense of the fraction of FICs. In line with the analysis of the preceding sections, the results indicate that network A's final market share decreases if either the fraction of PICs or the fraction of LICs increases. On the other hand, PICs' sensing radius, network A's initial market share, and the number of clusters positively affect A's final market share. However, the low R^2 of 0.37 suggests that this simple linear model misses out on important nonlinearities and/or interactions in the model's behavior.

Table 6-7: Regression results

	(I)	(II)	(III)	(IV)	(V)
PIC	-0.50 ***	-0.25 **	-3.90 ***	-0.83	-0.83 ***
LIC	-0.43 ***	-0.32 ***	-3.27 ***	-1.76 ***	-1.76 ***
Radius	0.01 ***	0.00	0.00 *	-0.01 *	-0.01 ***
Initial MS	1.02 ***	5.86 ***	-1.77 ***	3.52 ***	3.52 ***
Clusters	0.01 ***	0.03 ***	0.00	0.02 ***	0.02 ***
PIC^2		-0.23 **		-2.95 ***	-2.95 ***
LIC^2		-0.16 *		-1.57 ***	-1.57 ***
$Radius^2$		0.00 *		0.00	0.00 ***
$(Initial\ MS)^2$		-3.02 ***		-3.02 ***	-3.02 ***
$Clusters^2$		0.00 **		0.00 ***	0.00 ***
PIC x LIC			-0.41 ***	1.20 *	1.20 ***
PIC x Radius			0.01 ***	0.02	0.02 ***
PIC x (Initial MS)			4.01 ***	1.77 ***	1.77 ***
PIC x Clusters			0.03 ***	0.00	0.00 ***
LIC x (Initial MS)			3.69 ***	2.77 ***	2.77 ***
PIC^2 x LIC				-2.96 ***	-2.96 ***
PIC^2 x Radius				0.00	0.00
PIC^2 x Clusters				0.02	0.02 ***
PIC^2 x (Initial MS)				2.27 ***	2.27 ***
LIC^2 x PIC				-2.97 ***	-2.97 ***
LIC^2 x (Initial MS)				1.27 **	1.27 ***
Constant	0.28 ***	-1.66 ***	2.59 ***	0.02	0.02
N	1152	1152	1152	1152	576000
R-sq	0.37	0.40	0.56	0.66	0.59
adj. R-sq	0.37	0.39	0.55	0.65	0.59

* p<0.1, ** p<0.05, *** p<0.01

Therefore, models II and III introduce squares and interaction terms, respectively. The decision as to which interactions to include in model III was based on the fact that PICs' sensing radius and the number of clusters is only relevant for the behavior of PICs, while network A's initial market share is relevant to both PICs and LICs. According to model II, the fraction of PICs, the fraction of LICs, and network A's initial market share have an inverted u-shaped effect on network A's final market share. In contrast, the number of clusters exerts a u-shaped effect on A's final market share, while PICs' sensing radius does not seem to have a nonlinear effect. The results for Model III suggest that the negative effect of the fraction of PICs (LICs) on A's final market share is larger the larger the fraction of LICs (PICs) or, put differently, the lower the fraction of FICs. Besides, the influence of the fraction of PICs decreases in, first, an increase in PICs' sensing radius; second, an increase in A's initial market share; and, third, an increase in the number of clusters. Similarly, the effect of the fraction of LICs is lower the higher A's initial market share.

Due to the presence of both statistically significant nonlinearities and interactions, model IV combines both the squared and the interaction terms. Despite the fact that a combination of squares and interactions significantly complicates the interpretation of the regression coefficients, model IV is the preferred specification since it offers by far the highest adjusted R^2. Overall, model IV explains 66% of the variance in network A's final market share. However, in model IV several coefficients are insignificant. A possible explanation for that could be the moderate sample size of 1,152 in conjunction with the very high multicollinearity present in model IV: While the maximum variance inflation factor (VIF) is 895.45, the mean VIF is 330.14. Since the problem of multicollinearity vanishes in very large samples, I reestimated model IV using the dataset which contains the original simulation data prior to averaging, i.e., 500 observations for each parameter combination. The results for model V demonstrate that the increase in sample size to 576,000 successfully mitigates the problem of multicollinearity as all coefficients except for the interaction between PIC^2 and Radius and the Constant are now statistically different from zero. While all coefficient estimates remain the same, the R^2 slightly decreases to 0.59. This is not very surprising since the original dataset contains much more randomness than the averaged dataset which, in turn, makes it more difficult to explain changes in the dependent variable.

The fraction of PICs and the fraction of LICs continue to have an inverted U-shaped effect which implies that the marginal effect is a downward-sloping line which intersects the x-axis at some point. Figure 5 shows how the course of the marginal effect of the fraction of PICs is affected by the fraction of LICs (upper-left panel), the sensing radius (upper-right panel), network A's initial market share (lower-left panel), and the number of clusters (lower-right panel).

The fraction of LICs as well as network A's initial market share have a strong effect on both the intercept and the slope of the marginal effect of the fraction of PICs. While an increase in the fraction of LICs decreases the intercept and increases the absolute value of the slope of the marginal effect, the reverse is true for an increase in network A's initial market share. On the other hand, PICs' sensing radius increases the intercept slightly but hardly affects the slope of the marginal effect, whereas the number

of clusters does not change the intercept but decreases the absolute value of the slope. Also note that in many cases the marginal effect is already negative if the fraction of PICs is at least 20% while it is negative in all cases as soon as the fraction of PICs reaches 40%.

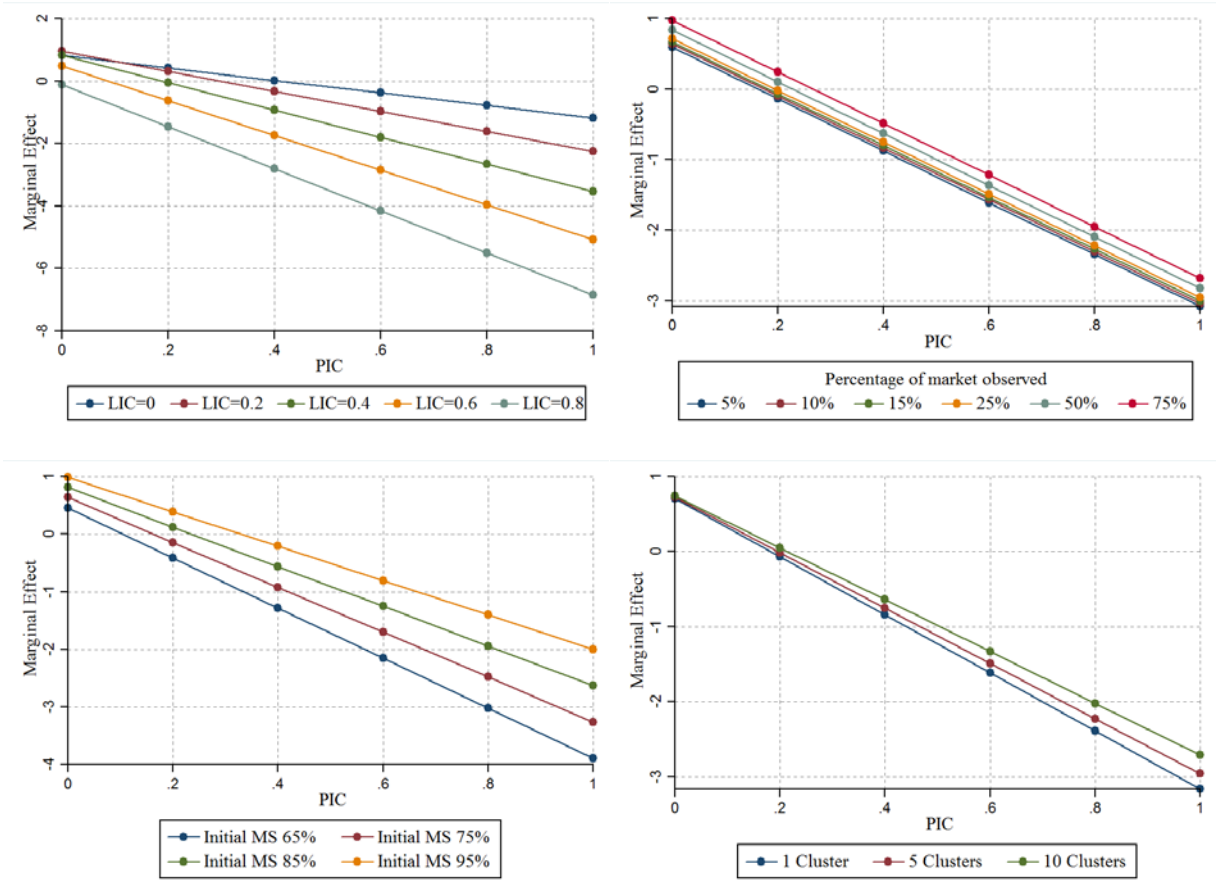


Figure 6-5: Marginal effect of PIC conditional on the other independent variables

Figure 6 contains the marginal effect of the fraction of LICs for different fractions of PICs (left panel) and different values for network A's initial market share (right panel). An increase in the fraction of PICs decreases the intercept and increases the absolute value of the slope of the marginal effect of the fraction of LICs. Network A's initial market share increases the slope of the marginal effect but hardly

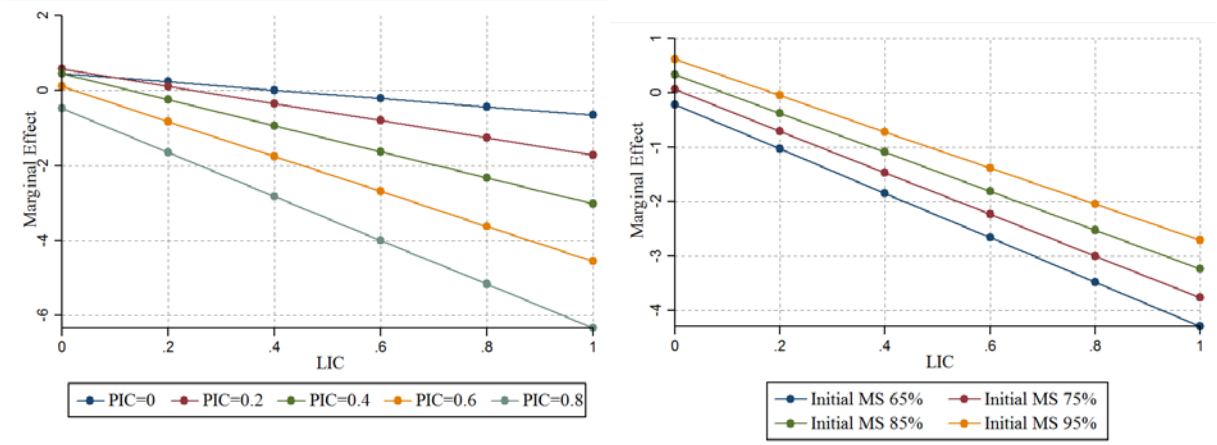


Figure 6-6: Marginal effect of LIC conditional on PIC and Initial MS

affects its slope. Moreover, the marginal effect becomes negative in all cases as soon as the fraction of LICs is at least 40%.

To further quantify the effect of the independent variables on network A's final market share, Table 8 shows the estimated average marginal effects for models I to IV. The results for model IV imply that if the fraction of PICs increases by 10% points, on average network A's final market share decreases by 6.7% points, while a similar increase in the fraction of LICs leads to a decrease of A's final market share of 6.3% points on average. Furthermore, if PICs' sensing radius increases by 1 or if the number of clusters increases by 1, A's average market share increase is estimated to be a 1% point. Finally, a 10% points increase in network A's market share increases A's final market share, on average, also by 10% points.

Table 6-8: Average marginal effects for models I to IV

	(I)	(II)	(III)	(IV)
PIC	-0.50 ***	-0.45 ***	-0.55 ***	-0.67 ***
LIC	-0.43 ***	-0.41 ***	-0.50 ***	-0.63 ***
Radius	0.01 ***	0.01 ***	0.01 ***	0.01 ***
Initial MS	1.02 ***	1.02 ***	1.02 ***	1.02 ***
Clusters	0.01 ***	0.01 ***	0.01 ***	0.01 ***

* p<0.1, ** p<0.05, *** p<0.01

To check how sensitive the estimated regression coefficients are to the random initialization of the market and to other random elements in the model, I repeatedly estimated model IV, while using only the simulation results of one repetition for each parameter combination at a time. As a result, I obtained 500 coefficient estimates for each independent variable. Table 9 shows the mean, 95% confidence interval, as well as the minimum and maximum estimate for each coefficient and the R^2. Overall, the standard deviation of the estimated coefficients is quite low: For 18 out of 22 regressors, the ratio of the mean to the standard deviation is greater than 2. Additionally, the 95% confidence intervals of all variables do not enclose 0, i.e., they do not contain a sign switch. Moreover, the R^2 shows only a very low standard deviation and ranges within the quite narrow interval [0.56;0.62]. Taken together, this suggests that the regression results are robust to random elements in the model.

Table 6-9: Descriptive statistics of the estimates of the repeated regressions

	Mean	Std. Error	95% Conf. Interval		Min.	Max.
PIC	-0.83	0.25	-0.85	-0.81	-1.73	-0.06
LIC	-1.76	0.21	-1.78	-1.74	-2.37	-1.24
Radius	-0.01	0.00	-0.01	-0.01	-0.02	0.00
Initial MS	3.52	0.43	3.48	3.56	2.20	4.83
Clusters	0.02	0.00	0.02	0.02	0.01	0.03
PIC^2	-2.94	0.29	-2.97	-2.92	-3.82	-1.77
LIC^2	-1.57	0.30	-1.60	-1.54	-2.38	-0.62
$Radius^2$	0.00	0.00	0.00	0.00	0.00	0.00
$(Initial\ MS)^2$	-3.02	0.27	-3.04	-3.00	-3.91	-2.25
$Clusters^2$	0.00	0.00	0.00	0.00	0.00	0.00
PIC x LIC	1.20	0.29	1.17	1.22	0.38	2.11
PIC x Radius	0.02	0.01	0.02	0.02	0.00	0.05
PIC x (Initial MS)	1.77	0.32	1.74	1.80	0.74	2.67
PIC x Clusters	0.00	0.01	0.00	0.00	-0.02	0.03
LIC x (Initial MS)	2.77	0.24	2.75	2.79	2.14	3.43
PIC^2 x LIC	-2.96	0.35	-2.99	-2.93	-4.22	-1.94
PIC^2 x Radius	0.00	0.01	0.00	0.00	-0.02	0.02
PIC^2 x Clusters	0.02	0.01	0.02	0.02	-0.01	0.05
PIC^2 x (Initial MS)	2.27	0.37	2.23	2.30	1.07	3.42
LIC^2 x PIC	-2.97	0.29	-2.99	-2.94	-3.68	-2.10
LIC^2 x (Initial MS)	1.27	0.33	1.24	1.30	0.24	2.19
Constant	0.02	0.17	0.00	0.03	-0.45	0.57
R^2	0.59	0.01	0.59	0.59	0.56	0.62

6. Extensions of the Baseline Model: Calling Clubs and Active Price Setting by Networks

6.1. Incorporating Calling Clubs

Evidence from empirical studies suggests that the network membership of close friends and family members has a great influence on consumers' decision to join a specific network (Birke and Swann 2006, Calzada and Valletti 2008, Gabrielsen and Vagstand 2008). Therefore, the first extension of the model tests whether the existence of so-called calling clubs affects the results of the baseline model. To this end, consumers in the model consecutively befriend with x random other consumers. As a result, each consumer has at least x friends, the expected mean number of friends is 2x, and the expected modus

is 2x-1. Figure 7 shows the resulting distribution of the number of friends among all consumers for x = 10.

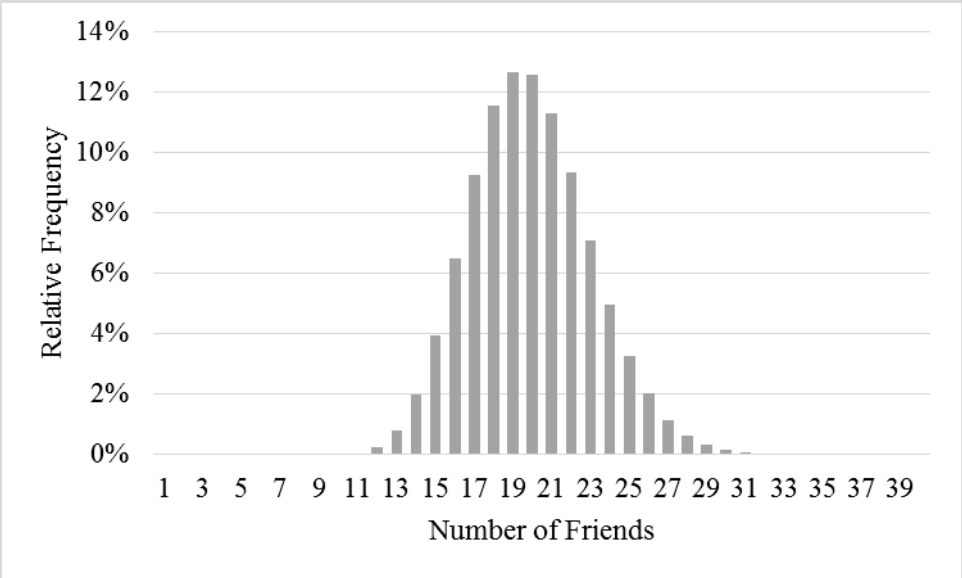


Figure 6-7: Distribution of the number of friends for x = 10

Irrespective of their type, all consumers know which network their friends are subscribed to. This assumption is in line with the literature on costly consumer search which argues that friends can serve as a costless source of information (Janssen and Parakhonyak 2013, p. 3, Perloff and Salop 1986, p. 187, Carlton and Perloff 2005, p. 463). Moreover, following Geoffron and Wang (2008, p. 63), Calzada and Valletti (2008, p. 1240), and Gabrielsen and Vagstad (2008, p. 104), I assume that consumers call one of their friends with probability q and a random stranger with probability (1-q). Accordingly, the expected cost of a call to a random consumer in the model with calling clubs is denoted by (recall that consumers have unit demand):

(7) $E\left(c_{ijt}\right) = q(E\left(c_{ijt}^{friends}\right)) + (1-q)(E\left(c_{ijt}^{strangers}\right))$

Furthermore, the expected costs for calls to friends and strangers are given by:

(8) $E\left(c_{ijt}^{friends}\right) = marketshare_{ijt}^{friends} * p_{jt}^{onnet} + \left(1 - marketshare_{ijt}^{friends}\right) * p_{jt}^{offnet}$

and

(9) $E\left(c_{ijt}^{strangers}\right) = marketshare_{ijt}^{strangers} * p_{jt}^{onnet} + \left(1 - marketshare_{ijt}^{strangers}\right) * p_{jt}^{offnet}$,

respectively.

For the simulation of the extended model I chose values of 5 and 10 for the minimum number of friends. Furthermore, for the probability of calling a friend, q, the values 50%, 75%, and 95% were used, which is in line with Gabrielsen and Vagstad (2008, p. 104) who assume that the probability of calling friends is at least 50% as well as with Möbius (2011, p. 8) who postulates that the probability is 75% (see also Fischer 1992, p. 226). Similar to the baseline model, I used a full factorial design for the simulation

which included eight variables and a total of 6,912 parameter combinations, each of which was again simulated 500 times to mitigate the effect of random elements.

Table 10 gives an overview of the descriptive statistics of the results for the extended model with calling clubs. Compared to the baseline model, the average number of network switches remains at 0.26, albeit with a slightly lower standard deviation of 0.21. More interestingly, with an average simulation length of 122 periods, the extended model converges to a corner equilibrium more than twice as fast as the baseline model. Furthermore, the maximum average simulation length is below 999 which implies that in the extended model no parameter combination was simulated for 999 periods in all 500 repetitions, i.e., corner equilibria occur in each parameter combination. Across all parameter combinations, network A's final market share increases to an average of 95% and also shows less variability with a standard deviation of 0.14. Likewise, the average probability that network A corners the market also increases across all parameter combinations. In the extended model, A corners the market in 475 out of 500 repetitions, i.e., with a probability of 95%. In contrast, the probability of network B cornering the market decreases to 4%. In line with the baseline model, the probability that a network increases its market share closely resembles the respective probability of cornering the market. Hence, also in the extended model, growth in market share typically leads to a corner equilibrium.

Table 6-10: Descriptive statistics of the model with calling clubs

	Mean	Std. Dev.	Min.	Max.
No. of networks switches per consumer	0.26	0.21	0.05	0.89
Simulation length	121.83	35.13	84.25	399.08
Final market share of network A	0.95	0.14	0.01	1.00
Probability of A increasing its market share	0.95	0.14	0.01	1.00
Probability of B increasing its market share	0.05	0.14	0.00	0.99
Probability of A cornering the market	0.95	0.15	0.01	1.00
Probability of B cornering the market	0.04	0.14	0.00	0.99

Table 11 illustrates that the number of parameter combinations in which network A increases its initial market share in a significant number of repetitions substantially increases for the model with calling clubs. In 6,628 of 6,912 (96%) parameter combinations, network A increases its initial market share in at least 250 of 500 repetitions. In still 5,540 (80%) parameter combinations, network A increases its market share in all 500 repetitions. On the other hand, no parameter combination exists in which network B always increases its market share, and only 288 combinations (4%) exist in which B increases its market share in at least 250 repetitions.

Almost the same holds for the number of parameter combinations in which either network corners the market (see Table 12). While in 6,607 (5,540) combinations network A corners the market in at least 250 (500) repetitions, this is the case for network B in 283 and 0 parameter combinations, respectively. A comparison of Tables 11 and 12 again demonstrates that there are only very few parameter

combinations in which either network increases its market share without cornering the market. Hence, shared-market equilibria become less likely if calling clubs exist.

Table 6-11: Frequency of market share growth for the model with calling clubs

		Number of parameter combinations in which…	
		...network A increases its initial market share in at least…	...network B increases its initial market share in at least…
250	repetitions	6628	288
300		6524	176
350		6427	55
400		6332	7
450		6245	4
500		5540	0

Table 6-12: Frequency of monopolization for the model with calling clubs

		Number of parameter combinations in which…	
		...network A corners the market in at least…	...network B corners the market in at least…
250	repetitions	6607	283
300		6506	166
350		6424	48
400		6332	7
450		6244	4
500		5540	0

Appendix C graphically illustrates the results for the extended model with calling clubs. Since the extended model contains two additional variables, the number of friends and the probability of calling a friend, with two and three levels, respectively, Appendix C contains six different graphs each of which shows the simulation results for a specific combination of number of friends and probability of calling a friend.

If the minimum number of friends is 5 and consumers call friends and strangers with equal probability (see Figure 11), network A always corners the market if the fraction of FICs is at least 40%. The same holds for all parameter combinations in which the fraction of FICs is 20% and network A's initial market share is above 65%. Network B has a small probability of cornering the market if the fraction of FICs is 20% and A's initial market share is 65%. For example, if the number of clusters is 1, the average monopolization ratios range between 443 : 56 (PIC = 0%) and 458 : 42 (PIC = 80%). If, however, no consumers are fully informed, network B corners the market in most cases if the following three conditions are fulfilled simultaneously: First, network A's initial market share is 65%; second, initially

only one cluster of subscribers to network B exists; and, third, PICs observe at most 50% of the market, i.e., the sensing radius does not exceed 13.893.

If the probability of calling a friend increases to 75%, i.e., friends become more important relative to strangers, network A still always corners the market if its initial market share is above 65% (see Figure 12). Yet, if A's initial market share is 65%, network B is generally more likely to corner the market. In fact, both networks take turns in cornering the market whereby the probability that network A corners the market decreases if the fraction of LICs increases at the expense of the fraction of FICs. Furthermore, it increases (decreases) if the fraction of PICs increases at the expense of the fraction LICs (FICs). Besides, network A is more likely to corner the market if the number of clusters or PICs' sensing radius increases. To further illustrate these effects, consider the following examples. For instance, if the fraction of LICs is 0%, the fraction of PICs is 20%, and the number of clusters is 1, the average monopolization ratio over the six different radii is 405 : 95. This ratio decreases to 323 : 176 and 172 : 322 if the fraction of LICs increases to 40% and 80% while the fraction of FICs decrease accordingly. If, instead, the fraction of FICs is fixed at 20% and the number of clusters is 1, the average monopolization ratios become 214 : 280 if the fraction of PICs is 0%, 287 : 210 if the fraction of PICs is 40%, and 331 : 168 if the fraction of PICs is 80%. If the fraction of PICs increases while the fraction of LICs is fixed to 20%, the respective ratios are: 388 : 111, 341 : 158, and 255 : 242. Setting the fraction of FICs to 20% and the fraction of PICs to 40% leads to average monopolization ratios of 287 : 210 (1 cluster), 319 : 180 (5 clusters), and 342 : 156 (10 clusters), or alternatively, if the ratios are averaged over the number of clusters, they become 288 : 209 (radius = 4), 311 : 186 (radius = 8.945), and 351 : 147 (radius = 19.647).

Almost the same results apply if the probability of calling a friend further increases to 95% (see Figure 13). Increasing the fraction of LICs or PICs at the expense of the fraction of FICs decreases the probability that network A corners the market, while increasing the number of clusters or PICs' sensing radius increases the probability. However, the effect of increasing the fraction of PICs at the expense of the fraction of LICs now depends on the number of clusters: If initially only one cluster exists, increasing the fraction of PICs decreases the probability that A corners the market, while the reverse is true if the number of clusters is either 5 or 10. For instance, if the number of clusters is 1, the fraction of FICs is 20%, and the fraction of PICs increases from 0.2 to 0.8, the average monopolization ratio decreases from 165 : 322 to 152 : 335. For the case of 10 clusters and 20% FICs, the average monopolization ratios are 176 : 308 (PIC = 0.2) and 226 : 261 (PIC = 0.8).

For all parameter combinations in which the minimum number of friends is 10 and the probability of calling a friend is 50% (see Figure 14), network B has a sizeable probability of cornering the market only if the following five conditions hold: First, the fraction of FICs is 0; second, the fraction of PICs is at least 60%; third, network A's initial market share is 65%; fourth, the number of clusters is 1; and fifth, the sensing radius is neither too small nor too large. For instance, in the parameter combination FIC = 0%, PIC = 80%, initial market share = 65%, clusters = 1, and sensing radius = 13.93, network B corners

the market in 216 out of 500 repetitions, while A corners the market in the remaining 284 repetitions. If, ceteris paribus, the fraction of PICs increases to 100%, B (A) corners the market in 444 (56) repetitions.

If the probability of calling a friend increases to 75% or 95% (see Figures 15 and 16), network A virtually always corners the market. The average monopolization ratio across all parameter combinations in which consumers call a friend with 75% probability is 499.5 : 0.5 and slightly decreases to 496 : 4 if the probability increases to 95%.

Table 6-13: Regression results of model with calling clubs

	(I)		(II)		(III)		(IV)		(V)	
PIC	-0.05	***	-0.18	***	-0.08	***	-0.09	***	-0.26	***
LIC	-0.06	***	-0.23	***	-0.11	***	-0.08	***	-0.31	***
Radius	0.00	***	0.00	***	0.00	***	0.00		0.00	***
Initial MS > 65%	0.18	***	-0.11	***	0.18	***	0.18	***	-0.11	***
Clusters	0.00	***	0.01	***	0.00	***	0.00	***	0.01	***
Friends = 10	0.08	***	0.33	***	-0.13	***	0.08	***	0.11	***
Weight of friends	-0.13	***	-0.52	***	-0.26	***	-0.14	***	-0.66	***
PIC x (Initial MS > 65%)			0.18	***					0.18	***
LIC x (Initial MS > 65%)			0.23	***					0.23	***
Radius x (Initial MS > 65%)			0.00	***					0.00	***
Clusters x (Initial MS > 65%)			-0.01	***					-0.01	***
(Friends = 10) x (Initial MS > 65%)			-0.33	***	-0.33	***			-0.33	***
Weight of friends x (Initial MS > 65%)			0.52	***			0.52	***	0.52	***
PIC x (Friends = 10)					0.06	***			0.06	***
LIC x (Friends = 10)					0.10	***			0.10	***
Radius x (Friends = 10)					0.00	***			0.00	***
Clusters x (Friends = 10)					0.00	***			0.00	***
Weight of friends x (Friends = 10)					0.25	***	0.25	***	0.25	***
PIC x Weight of friends							0.06	*	0.06	**
LIC x Weight of friends							0.03		0.03	*
Radius x Weight of friends							0.00		0.00	
Clusters x Weight of friends							0.00	*	0.00	***
Constant	0.89	***	1.11	***	1.00	***	0.90	***	1.22	***
N	6912		6912		6912		6912		6912	
R^2	0.42		0.78		0.69		0.53		0.81	
adjusted R^2	0.42		0.78		0.69		0.52		0.81	

* p<0.1, ** p<0.05, *** p<0.01

Table 13 shows the regression results for the extended model with calling clubs. In contrast to the baseline model, the independent variables do not have significant quadratic effects on the dependent variable (results available upon request). Instead, the preceding graphical analysis suggests that the

effects of the fraction of PICs and LICs, the sensing radius, and the number of clusters depend on three factors: First, whether or not network A's initial market share is above 65%, second, whether the minimum number of friends is 5 or 10; and third, the probability of calling a friend. Therefore, in models II, III, and IV the independent variables are interacted with a dummy indicating whether network A's initial market share is above 65%, a dummy indicating whether the minimum number of friends is 10, and the probability of calling a friend, respectively. Since all interactions except for two in model IV are statistically significant, model V contains the full set of interactions. Achieving the highest adjusted R^2, model V is also the preferred specification.

In line with the results from the graphical analysis, model II shows that the main effects of the independent variables are completely neutralized by their respective interactions with the dummy variables indicating whether A's initial market share is above 65%. This implies that the independent variables do not affect network A's final market share if its initial market share is above 65%. Almost the same holds true for the results from model III, albeit with one exception: The coefficient for the dummy indicating whether A's initial market share is above 65% switches its sign, depending on whether the minimum number of friends is 5 or 10. In the former case, the effect on A's final market share is positive, while in the latter it is negative, albeit of comparable magnitude. In model IV, the interaction effects are not large enough to offset the main effects or to cause a switch in the effect sign.

To facilitate the interpretation of the results of model V, which contains the full set of interactions, Figure 8 illustrates the marginal effects of the fraction of PICs (left panel) and LICs (right panel), depending on the probability of calling a friend for different values of A's initial market share and the minimum number of friends.

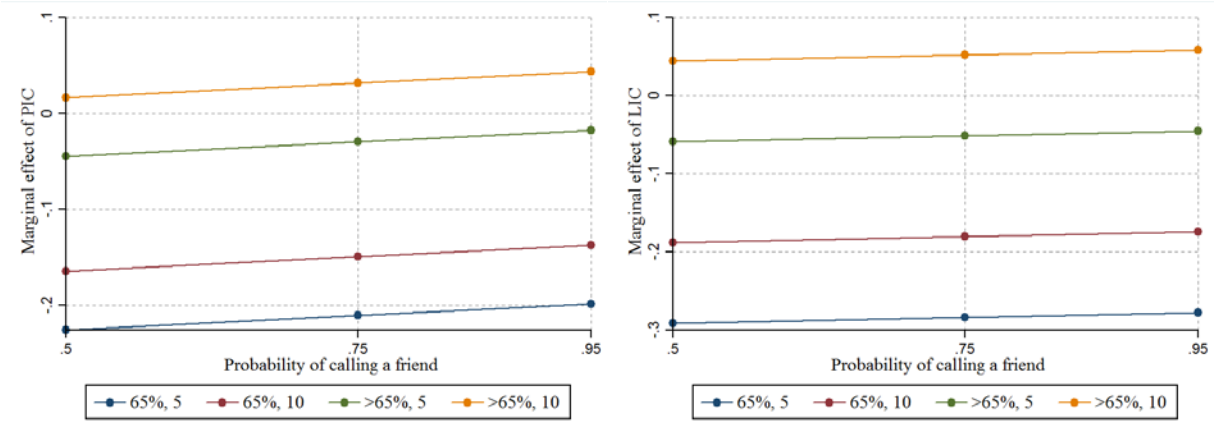


Figure 6-8: Marginal effects of PIC and LIC for model with calling clubs

The marginal effects of the fraction of PICs and the fraction of LICs are negative as long as network A's initial market share is 65% and/or the minimum number of friends is 5. Moreover, the probability of calling a friend slightly increases both marginal effects. On the other hand, the marginal effect of PICs' sensing radius is very small and positive unless network A's initial market share is larger than 65% and the minimum number of friends is 10. The marginal effect of the number of clusters is also

quite small, decreases in the probability of calling a friend, and is also positive except for the case when A's initial market share is larger than 65% and the minimum number of friends is 10.

The average marginal effects of all seven independent variables are shown in Table 14.

Table 6-14: Average marginal effects for model with calling clubs

	(I)		(II)		(III)		(IV)		(V)	
PIC	-0.05	***	-0.05	***	-0.05	***	-0.05	***	-0.05	***
LIC	-0.06	***	-0.06	***	-0.06	***	-0.06	***	-0.06	***
Radius	0.00	***	0.00	***	0.00	***	0.00	***	0.00	***
Initial MS > 65%	0.18	***	0.18	***	0.18	***	0.18	***	0.18	***
Clusters	0.00	***	0.00	***	0.00	***	0.00	***	0.00	***
Friends = 10	0.08	***	0.08	***	0.08	***	0.08	***	0.08	***
Weight of friends	-0.13	***	-0.13	***	-0.13	***	-0.13	***	-0.13	***

* p<0.1, ** p<0.05, *** p<0.01

At first sight, it might be surprising that the marginal effects are identical for all models. However, the explanation for that is rather straightforward. Due to the full factorial design of the simulation, all independent variables are uncorrelated with each other. Furthermore, since model I does not account for any interaction effects, these are lumped into the coefficients of the main effects. On the other hand, this is not the case for models II to V which explicitly account for different kinds of interaction effects. However, by calculating the average marginal effects for models II to V, both the main effects and the interaction effects are again "lumped together," which leads to the very same results as model I due to the strict independence of all variables.

According to the estimated average marginal effects, network A's final market share decreases by 0.5 (0.6) % points if the fraction of PICs (LICs) increases by 10% points. Furthermore, if A's initial market share is above 65%, its final market share is on average 18% points higher and if the minimum number of friends increases from 5 to 10, the average increase in A's final market share is 8% points. A 25% points increase in the probability of calling a friend decreases A's final market share by 3% points. Finally, the results in Table 14 suggest that the effects of PICs' sensing radius and the number of clusters are negligible in the extended model with calling clubs.

6.2. Active Price Setting by Networks

In both the baseline model as well as in the model with calling clubs, both networks were not allowed to react to changes in their market shares by adjusting their tariffs for on-net and off-net calls. While the assumption of fixed tariffs ensures that the study of the effects of costly information acquisition by consumers is not blurred by supply-side effects, i.e., the price setting behavior of networks, this restrictive assumption heavily weakens the empirical relevance of the study. In order to test whether the

previous results generalize to the case of active networks who aim at increasing their profits by adjusting their prices, the second extension of the model allows for active price setting behavior of both networks.

Similar to consumers, both networks are assumed to lack perfect information about all market conditions. In particular, I assume that networks lack information on consumers' individual search costs (while they may know the fraction of FICs, PICs, and LICs in the population of consumers). Accordingly, networks in the model are not able to explicitly maximize their profits by setting tariffs, since this would require perfect knowledge of each consumer's type and each consumer's immediate environment. Instead, both networks try to estimate the consequences of different pricing strategies in order to implement the strategy associated with the highest expected profit.

When deciding on changing their tariffs, I assume that both operators can choose among five generic strategies (see Figure 9).

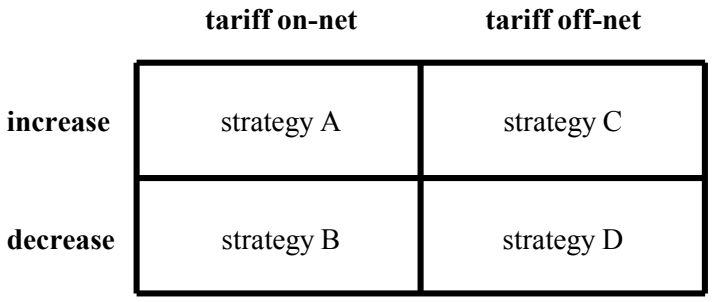


Figure 6-9: Price setting strategies of networks

Each network can either increase its tariff for on-net calls (strategy A) or decrease it (strategy B), or increase or decrease its tariffs for off-net calls (strategies C and D, respectively). Of course, networks can also decide to keep their prices unchanged (strategy E). To keep the model computationally trackable, networks are not allowed to combine several strategies. However, this assumption is not particularly restrictive since every change in one tariff (on-net or off-net) can profit-neutrally be substituted by an appropriate change in the other tariff (see Appendix B for details).

Despite their lack of full information on consumers' search costs, both networks nevertheless aim at increasing their profit by implementing the strategy resulting in the highest expected profit. To evaluate the effectiveness of the five pricing strategies, networks use a variant of a recursive algorithm (Łatek, Axtell, and Kamińsky 2009). The basic idea of a recursive algorithm is that an agent simulates the outcome of an action by anticipating certain actions of all other agents who, themselves, may anticipate certain action of all other agents, and so on. How many iterations of anticipated actions are simulated is described by the concept of n-th order rationality (Michihiro 1997). For n = 0, an agent simulates the consequences of an action under the assumption that all other agents do not change their current behavior (Łatek, Axtell, and Kamińsky 2009, p. 458). On the other hand, for n = 1, an agent simulates the consequences of an action given an explicitly defined set of actions for all other agents, while for n = 2

each action of all other agents is again contingent on the actions chosen by all other agents (Łatek, Axtell, and Kamińsky 2009, p. 457).

To simplify the computation, I assume that both networks use the simplest possible variant of the recursive algorithm in which n is set to 0. Hence, for each of the four strategies, both networks calculate the expected profit under the assumption that the rival network will not change its tariffs. If, instead, n was set to 1, the number of strategies that each network would have to simulate would quadruple which, in turn, would result in a significant increase in computation time. Since this paper is primarily interested in the consequences of costly search on the consumer side rather than in the price setting behavior of firms, I decided to keep the computational burden stemming from the price setting behavior of networks at a minimum by setting n = 0.

Both networks implement the recursive algorithm by executing six consecutive actions. First, each network draws a random sample of its subscribers as well as a random sample of subscribers to the rival network. For simplicity, both sample sizes are assumed to be equal and fixed. If the market share of one network is too small so that the targeted sample size exceeds the number of available consumers, all available consumers are sampled. Second, for each of the five strategies, consumers in both samples indicate their decision (switch or stay) should the respective strategy be implemented. Note that each strategy has four possible outcomes: Consumers already subscribed to the network can decide to either renew their subscription or switch to the rival network, and subscribers to the rival network can either switch to the network or renew their subscription to the rival. In the third step, for each strategy networks calculate the fraction of subscribers in the first sample who indicated that they would leave the network as well as the fraction of consumers in the second sample who indicated they would join the network. Step four involves an extrapolation of the findings from the two samples to the whole population. To illustrate the process of extrapolation, consider the following numerical example. Assume network A has a market share of 60% and that in each period 5% of all consumers are allowed to switch their network. Assume further that in A's first sample 50% of its subscribers indicated that they would join the rival network if strategy C was implemented. In this case, network A expects 50% of its total subscribers would leave if they were allowed to decide on their network membership in the next period, i.e., it expects that it would lose 600*0.5*0.05=15 consumers. Likewise, if 30% of consumers in A's second sample indicate that they would join network A under strategy C, then A expects to gain 400*0.3*0.05=6 consumers. In step five, each network calculates the balance of joining and leaving consumers and the resulting potential market share for each strategy. In the final step, for each strategy the expected profits are calculated based on the potential market shares using the following formula:

$$(10)\ \Pi_{jts} = 1000 * marketshare_{jts}(marketshare_{jts} * p_{jts}^{onnet} + \left(1 - marketshare_{jts}\right) * p_{jts}^{offnet}),$$

where $marketshare_{jts}$ denotes the expected market share for network j in period t when implementing strategy s, p_{jts}^{onnet} and p_{jts}^{offnet} denote network j's tariffs for on-net and off-net calls in period t under strategy s respectively, and networks' cost are normalized to zero.

Following Calvo (1983) I assume that networks' tariffs are sticky, i.e., in every period firms are allowed to change their prices with an exogenously determined probability $\lambda < 1$. For the analysis of the extended model, I fixed λ at 5% so that, in expectation, whenever a consumer is allowed to decide about her network membership, both networks have changed their tariffs once. Furthermore, to avoid the occurrence of negative prices, I assume that networks change their prices by a constant fraction which I fixed at 5% for the analysis. Finally, I decided to set the two sample sizes of the recursive algorithm to 50 for both networks, i.e., I assume that both networks rely on the same amount of market intelligence when estimating the consequences of each strategy. In total, this results in 8,064 different parameter combinations (1,152 combinations without and 6,912 combinations with calling clubs) each of which was simulated 500 times to mitigate the effect of random elements in the model.

Table 15 gives an overview of the descriptive statistics for the model with active price setting behavior by both networks, both for the case without calling clubs and with calling clubs.

Table 6-15: Descriptive statistics for the model with active price setting by networks

	Without calling clubs				With calling clubs			
	Mean	Std. Dev.	Min.	Max.	Mean	Std. Dev.	Min.	Max.
No. of networks switches per consumer	0.29	0.22	0.05	0.94	0.26	0.21	0.05	0.81
Simulation length	198	145	86	827	118	25	85	212
Final market share of network A	0.93	0.15	0.04	1.00	0.95	0.12	0.43	1.00
Prob. of A increasing its market share	0.92	0.16	0.04	1.00	0.95	0.12	0.43	1.00
Prob. of B increasing its market share	0.08	0.16	0.00	0.96	0.05	0.12	0.00	0.57
Prob. of A cornering the market	0.92	0.17	0.04	1.00	0.95	0.12	0.43	1.00
Prob. of B cornering the market	0.06	0.13	0.00	0.96	0.05	0.12	0.00	0.57
A's on-net tariff in final period	0.79	0.23	0.51	2.38	0.67	0.02	0.59	0.73
A's off-net tariff in final period	1.31	1.00	1.00	8.21	1.03	0.08	1.00	1.45
B's on-net tariff in final period	0.25	0.01	0.25	0.32	0.25	0.01	0.25	0.29
B's off-net tariff in final period	1.85	1.15	1.18	8.80	1.33	0.06	1.23	1.56

Compared to the baseline model, consumers switch slightly more frequently (0.29 times on average) in the model with active networks. On the other hand, with a value of 198, the average simulation run takes 68 periods less to converge to a corner equilibrium and no parameter combination exists which is simulated for all 1,000 periods in all 500 repetitions. This implies that in contrast to the baseline model, corner equilibria exist in all parameter combinations even if no calling clubs exist. On average, network A's final market share is 93%, which is a slight increase compared to the baseline model, while, simultaneously, the standard deviation of A's average market share almost bisects. Similarly, A's probability of increasing its market share rises to 92%, while the respective value for network B decreases to 8%. Besides, on average, network A (B) has a 92% (6%) probability of cornering the market in each simulation run. Hence, the finding that whenever a network increases its initial market share it typically also corners the market continues to hold in the second extension of the model. Finally, Table 15 shows that, on average, network A increases both its on-net and its off-net tariff to 0.79 and 1.31,

respectively, whereas B only increases its off-net tariff to 1.85 while the on-net tariff remains at 0.25, on average. Moreover, both networks never find it profitable to decrease their tariffs below the respective initial values. With respect to the extent of on-net/off-net differentiation, the results show that, except for 74 parameter combinations, network A always prices on-net calls below off-net calls, while network B does so in all 1,152 combinations. Finally, only 95 (0) parameter combinations exist in which A's (B's) on-net/off-net differential is smaller than 0.1.

If calling clubs are included in the model with active price setting by networks, consumers switch 0.26 times on average during a simulation run with a mean duration of 118 periods. These values are roughly equivalent to the ones from the model with calling clubs but without active price setting behavior. Quite surprisingly, the descriptive statistics of the remaining variables, i.e., for network A's final market share and the probabilities of networks A and B to increase their market share or to corner the market, are also almost identical to the statistics from the first extension. Besides, network A's (B's) tariff for on-net and off-net calls are, on average, 0.79 and 1.31 (0.25 and 1.85), respectively, which is slightly lower than in the case without calling clubs. However, even in the case with calling clubs, both networks never find it profitable to decrease their tariffs below their initial values, and in all parameter combinations both networks price on-net calls below off-net calls. The minimum on-net/off-net differential is 0.29 for network A and 0.98 for network B.

Table 6-16: Frequency of market share growth for model with active price setting by networks

		Number of parameter combinations in which…			
		...network A increases its initial market share in at least…		...network B increases its initial market share in at least…	
		without calling clubs	with calling clubs	without calling clubs	with calling clubs
250	repetitions	1087	6873	66	44
300		1072	6590	40	0
350		1060	6422	11	0
400		1040	6244	6	0
450		930	5827	2	0
500		366	4380	0	0

Compared to the baseline model, the number of parameter combinations in which network A increases its initial market share in at least 250 repetitions slightly increases to 1,087 in the model with active price setting by networks, whereas the number of parameter combinations in which A increases its share in all 500 repetitions more than bisects to a value of 366 (see Table 16). On the other hand, the number of parameter combinations in which network B increases its market share in at least 250 repetitions almost bisects to 66, and no parameter combination exists in which B increases its market share in all 500 repetitions. Similar results pertain if calling clubs are included in the model with active price setting

by networks. In 6,873 parameter combinations, A increases its market share in at least 250 repetitions, which represents a slight increase compared to the model without active price setting. The number of combinations in which A increases its market share in all 500 repetitions decreases to 4,380. Moreover, the parameter space in which B can increase its initial market share drastically shrinks: Only 44 combinations exist in which B increases its market share in at least 250 combinations, while there is no case in which B always increases its market share.

Table 17 shows that the number of parameter combinations in which network A corners the market at least 250 (500) times increases (decreases) to 1,078 (366) compared to the baseline model. In contrast, network B is less likely to corner the market in either 250 or 500 repetitions if networks adjust their tariffs to changes in market shares. Again, the same applies if calling clubs are included in the model. More parameter combinations exist in which network A corners the market at least 250 times (6,873 combinations), but less combinations exist in which this happens in all 500 repetitions (4,380). Network B is less likely to corner the market at least 250 times (44 combinations) and never corners the market in all 500 repetitions.

Table 6-17: Frequency of monopolization for model with active price setting by networks

		Number of parameter combinations in which…			
		...network A corners the market in at least…		...network B corners the market in at least…	
		no calling clubs	calling clubs	no calling clubs	calling clubs
250	repetitions	1078	6873	27	44
300		1066	6590	13	0
350		1059	6422	8	0
400		1032	6244	6	0
450		926	5827	2	0
500		366	4380	0	0

Also in the model with active price setting by networks, market share growth typically leads to a corner equilibrium as a comparison of Tables 16 and 17 reveals. In fact, if calling clubs are included in the model with active price setting behavior, market share growth by either network always leads to a corner equilibrium.

The graphical results of the model with active price setting behavior by networks are shown by Figures 16 to 21 in Appendix D. If no calling clubs exist in the model, the general results are qualitatively similar to the results from the baseline model, albeit in general the results are more favorable to network A (see Figure 16). Network A always realizes its full growth potential if the fraction of FICs is at least 40% or if network A's initial market share exceeds a certain threshold, which varies between 65% and 75%. Furthermore, the fraction of network A's realized market share growth decreases with an increasing

fraction of PICs or LICs and increases if either A's initial market share, the number of clusters, or PICs' sensing radius increases. Besides, similar to the baseline model, network B is much more likely to increase its market share if the fraction of FICs decreases from 20% to 0%.

Yet, a closer inspection of the graphical results reveals not only similarities with the baseline model but also some interesting differences. While in the baseline model mostly corner equilibria occurred if the fraction of FICs is 20%, network A's initial market share is 65%, and 1 cluster exists, this is no longer the case if networks adjust their prices. In these parameter combinations, the average monopolization ratios range between 437 : 62 (PIC = 20%), 429 : 71 (PIC = 40%), 405 : 95 (PIC = 60%), and 376 : 123 (PIC = 80%).

If the fraction of FICs decreases to 0%, networks A and B take turns in cornering the market as long as network A's initial market share is 65%, with network A being more likely to corner the market the lower the fraction of PICs is. For instance, the average monopolization ratio across the six parameter combinations in which the fraction of PICs is 20%, A's initial market share is 65%, and 1 cluster exists, is 170 : 155, while it is 90 : 330 if, ceteris paribus, the fraction of PICs is 100%. On the other hand, with an increasing number of clusters network A is more likely to corner the market. This is illustrated, for example, by the monopolization ratios for the case in which the fraction of PICs is 60% and network A's initial market share is 65%. If the number of clusters increases from 1 to 10, the average monopolization ratio changes from 108 : 283 to 280 : 160. Moreover, Figure 16 reveals that even if no consumer is fully informed, network B is substantially less likely to increase its market share or to corner the market if A's initial market share exceeds 65%.

If calling clubs are included in the model with active price setting behavior by networks, network A still always corners the market if its initial market share exceeds 65%, irrespective of the number of friends and the probability of calling a friend. Therefore, the following analysis only considers the parameter combinations in which A's initial market share is 65%.

For the case in which consumers have at least five friends which are called with a probability of 50%, network B generally has a higher probability of cornering the market as compared to the model with fixed prices. Network B already has a non-negligible probability of cornering the market if the fraction of FICs is 40% with monopolization ratios ranging between 488 : 12 and 433 : 67. If the fraction of FICs decreases to 20%, the average monopolization ratios are slightly less favorable for network B if the number of clusters is 1 and slightly more favorable if the number of clusters is 5 or 10.

Increasing the probability of calling a friend to 75% leads to qualitatively similar results as the model with fixed tariffs, albeit with slightly more (less) favorable monopolization ratios for network B if the fraction of FICs is 40% or higher (20% or lower). Still, the probability that network A corners the market decreases if the fraction of LICs or the fraction of PICs increases at the expense of the fraction of FICs and increases if the fraction of PICs increases at the expense of the fraction of LICs, if the number of clusters increases, or if PICs' sensing radius increases. However, contrary to the model with fixed tariffs,

no parameter combination exists in which network B has a higher probability of cornering the market than network A.

Further increasing the probability of calling a friend to 95% again largely confirms the results from the model with fixed tariffs. For values of the fraction of FICs below 80%, the average monopolization ratios are generally less favorable for network B while the opposite is true for values of 80% and above. An increase in the fraction of PICs or LICs at the expense of the fraction of FICs still decreases network A's probability of cornering the market, while an increase in the number of clusters or in PICs' sensing radius in most cases increases it. Contrary to the model with fixed tariffs, the effect of increasing the fraction of PICs at the expense of the fraction of LICs is inconclusive since some parameter combinations result in an increase of network A's probability to corner the market, while others result in a decrease.

In all parameter combinations in which the minimum number of friends is 10, network A always corners the market if its initial market share is higher than 65%, which confirms the findings from the model with fixed prices. However, if A's initial market share is 65%, different results for the model with active price setting by networks emerge. Network B has a higher probability of cornering the market as indicated by an increase in the average monopolization ratio to 467 : 33 if the probability of calling a friend is 75% and to 432 : 68 if the respective probability is 95%. If, on the other hand, consumers call friends and strangers with equal probability, the monopolization ratios of the model with active price setting correspond to the ones of the model with fixed prices if the fraction of FICs is 40% or higher. Setting the fraction of FICs to 20% or 0% changes the monopolization ratios in favor of network B, albeit with one exception: While in the model with fixed prices B has a substantial probability of cornering the market if the fraction of FICs is 0, the fraction of PICs is 80% or 100%, and the number of clusters is 1, this probability is significantly reduced in the model with active price setting.

The regression results for the model with active prices setting by networks are shown in Table 18 for the case without calling clubs and in Table 20 for the case with calling clubs while Tables 19 and 21 show the estimated average marginal effects of the respective regression models.

Table 6-18: Regression results of the model with active price setting by networks and without calling clubs

	(I)		(II)		(III)		(IV)	
PIC	-0.83		-0.83	***	0.06		0.06	*
LIC	-1.76	***	-1.76	***	-1.55	***	-1.55	***
Radius	-0.01	*	-0.01	***	-0.01	***	-0.01	***
Initial MS	3.52	***	3.52	***	4.29	***	4.29	***
Clusters	0.02	***	0.02	***	0.01	***	0.01	***
PIC^2	-2.95	***	-2.94	***	-2.22	***	-2.22	***
LIC^2	-1.57	***	-1.57	***	0.03		0.03	
$Radius^2$	0.00		0.00	***	0.00	**	0.00	***
$(Initial\ MS)^2$	-3.012	***	-3.02	***	-3.07	***	-3.07	***
$Clusters^2$	0.00	***	0.00	***	0.00	***	0.00	***
PIC x LIC	1.20	*	1.20	***	0.40		0.40	***
PIC x Radius	0.02		0.02	***	0.01		0.01	***
PIC x (Initial MS)	1.77	***	1.77	***	0.38		0.38	***
PIC x Clusters	0.00		0.00	***	0.00		0.00	
LIC x (Initial MS)	2.77	***	2.77	***	2.09	***	2.09	***
PIC^2 x LIC	-2.96	***	-2.96	***	-1.18	***	-1.18	***
PIC^2 x Radius	0.00		0.00		0.00		0.00	***
PIC^2 x Clusters	0.02		0.02	***	0.02		0.02	***
PIC^2 x (Initial MS)	2.27	***	2.27	***	1.99	***	1.99	***
LIC^2 x PIC	-2.97	***	-2.97	***	-0.99	***	-0.99	***
LIC^2 x (Initial MS)	1.27	**	1.27	***	-0.34		-0.34	***
Constant	0.02		0.02		-0.48	***	-0.48	***
N	1152		576000		1152		576000	
R-sq	0.66		0.59		0.70		0.25	
adj. R-sq	0.65		0.59		0.70		0.25	

* p<0.1, ** p<0.05, *** p<0.01

To facilitate an easier comparison with the regression results of the baseline model, Table 18 states the regression results of models IV and V from Table 7 in columns I and II, while columns III and IV show the results of the regressions for the extended model without calling clubs using the averaged data set and the full data set, respectively. Compared to model I, model III shows a slightly better fit with an R^2 of 0.70. As before, several coefficients in model III are insignificant, possibly due to the high multicollinearity induced by the regression specification. Therefore, model IV uses the full data set containing 500 repetitions per parameter combination. While this does not change the estimated coefficients due to the strict independence of all variables, all but two coefficients in model IV are significant at least at the 10% level. On the other hand, model IV can only explain 25% of the variance of network A's final market share, which is less than half the value achieved by model II. This worse model fit might be caused by additional random elements injected into the model by the active price

setting behavior of networks. A comparison of the estimated coefficients of models I and III shows that most of the findings from the model with fixed tariffs extend to the model with active price setting by networks since almost all coefficients have the same sign and are of comparable magnitude. Three exceptions are worth mentioning. First, the coefficient for the fraction of PICs is slightly positive and only significant at the 10% level. Second, LIC^2 is insignificant and, third, the interaction between LIC^2 and Initial MS is negative in model III. However, this does not lead to a qualitative change in the results for two reasons. First, the increase of the coefficient for PIC is at least somewhat compensated by the decrease of the coefficient of the interaction between PIC and LIC. Second, the substantial increase of the coefficient of LIC^2 is neutralized by a substantial decrease of the coefficient for the interaction between LIC^2 and Initial MS and, therefore, the fraction of LICs continues to exert an inverted U-shaped effect on network A's market share (see also Table 19).

The fact that the results of the model with active price setting by networks largely confirm the findings from the model with fixed tariffs can also be inferred from Table 19, which shows the estimated average marginal effects of both models. All coefficients have the same sign and are of comparable magnitude. All variables continue to be highly significant except for PIC's sensing radius which is insignificant due to the very high multicollinearity present in model III, but would be significant at the 1% level if the average marginal effects were calculated based on model IV.

Table 6-19: Average marginal effects of the model with active price setting by networks and without calling clubs

	(I)		(II)	
PIC	-0.67	***	-0.29	***
LIC	-0.63	***	-0.33	***
Radius	0.01	***	0.00	
Initial MS	1.02	***	0.61	***
Clusters	0.01	***	0.01	***

* p<0.1, ** p<0.05, *** p<0.01

The regression results of the model incorporating both active price setting by networks as well as calling clubs are displayed in Table 20, whereby the results of model V from Table 14 are again included in column I to facilitate an easier comparison of both models. With an R^2 of 92%, model II explains the data of the simulation model significantly better than model I. Furthermore, except for the coefficient of the interaction between the number of clusters and the dummy variable indicating whether network A's initial market share is above 65%, all coefficients have the same sign, are of the same magnitude, and are significant at the 1% level. In model II, additionally the coefficients of the interactions between radius and weight and between clusters and weight are significant at the 1% level, albeit the magnitude of their effect can be considered economically insignificant.

Likewise, the estimated average marginal effects of both models demonstrate that the findings from the model with calling clubs but fixed tariffs continue to hold if networks are allowed to adjust their prices (see Table 21). In fact, the estimated marginal effects are even almost numerically identical which, further corroborates the robustness of the results.

Table 6-20: Regression results of the model with active price setting by networks and with calling clubs

	(I)		(II)	
PIC	-0.26	***	-0.20	***
LIC	-0.31	***	-0.26	***
Radius	0.00	***	0.00	***
Initial MS > 65%	-0.11	***	-0.06	***
Clusters	0.01	***	0.01	***
Friends = 10	0.11	***	0.12	***
Weight of friends	-0.66	***	-0.54	***
PIC x (Initial MS > 65%)	0.18	***	0.12	***
LIC x (Initial MS > 65%)	0.23	***	0.16	***
Radius x (Initial MS > 65%)	0.00	***	0.00	***
Clusters x (Initial MS > 65%)	-0.01	***	0.00	***
(Friends = 10) x (Initial MS > 65%)	-0.33	***	-0.22	***
Weight of friends x (Initial MS > 65%)	0.52	***	0.44	***
PIC x (Friends = 10)	0.06	***	0.02	***
LIC x (Friends = 10)	0.10	***	0.04	***
Radius x (Friends = 10)	0.00	***	0.00	***
Clusters x (Friends = 10)	0.00	***	0.00	***
Weight of friends x (Friends = 10)	0.25	***	0.13	***
PIC x Weight of friends	0.06	**	0.10	***
LIC x Weight of friends	0.03	*	0.11	***
Radius x Weight of friends	0.00		0.00	***
Clusters x Weight of friends	0.00	***	0.00	***
Constant	1.22	***	1.14	***
N	6912		6912	
R^2	0.81		0.92	
adjusted R^2	0.81		0.92	

* p<0.1, ** p<0.05, *** p<0.01

Table 6-21: Average marginal effects of the model with active price setting by networks and with calling clubs

	(I)		(II)	
PIC	-0.05	***	-0.03	***
LIC	-0.06	***	-0.04	***
Radius	0.00	***	0.00	***
Initial MS > 65%	0.18	***	0.20	***
Clusters	0.00	***	0.00	***
Friends = 10	0.08	***	0.06	***
Weight of friends	-0.13	***	-0.11	***

* p<0.1, ** p<0.05, *** p<0.01

7. Discussion

The preceding analysis of the simulation results has unearthed five key insights into the effect of different model parameters on the distribution of market shares at the end of a simulation run. First, the findings show that network A's final market share decreases or, alternatively, that network A is less likely to corner the market if the fraction of PICs or the fraction of LICs increases at the expense of the fraction of FICs. Second, in the majority of parameter combinations, increasing the fraction of PICs (LICs) while decreasing the fraction of LICs (PICs) has a positive (negative) effect on network A's final market share and on its probability of cornering the market. Third, introducing calling clubs into the model generally increases A's ability to either increase its market share or to even corner the market. Yet, if consumers have only a limited number of friends which are very important to them, i.e., consumers almost exclusively call their friends, the probability that network A will increase its market share or corner the market decreases. Fourth, increasing the number of clusters also has a positive effect on A's probability to increase its market share or to corner the market. Finally, as a fifth insight, these findings largely extend to the case in which both networks are allowed to adjust their prices to changes in their market shares.

A close inspection of the first three findings reveals that these effects pertain to the amount of information on which consumers base their decision to subscribe to a network. Increasing the fraction of PICs or LICs at the expense of the fraction of FICs generally decreases the total amount of information used in the market since PICs and LICs use less information to decide about their network membership than FICs. Furthermore, since LICs use even less information than PICs, increasing the fraction of PICs (LICs) at the expense of the fraction of LICs (PICs) increases (decreases) the total amount of information in the market. The introduction of calling clubs has two different effects. On the one hand, the existence of friends increases the amount of information available to PICs and LICs: When trying to infer the market shares among strangers, each consumer also relies on the information on the market shares of both networks obtained from her friends. On the other hand, the existence of friends mitigates the

problem of costly information acquisition since I assume that consumers always know the network subscription of their friends and call them with a certain probability. The more important friends are relative to strangers, i.e., the higher the probability of calling the friend, the larger the extent of mitigation. In the extreme case in which consumers call their friends with a 95% probability, the problem of costly information acquisition disappears almost completely.

Taken together, these observations indicate that the total amount of information used for consumers' subscription decision plays an important role for networks' final market shares, which leads to the following hypothesis: *The higher the amount of information used by consumers in their decision process the higher network A's final market share will be*.

To test this hypothesis, I created the variable INFORMATION_MASS which contains the total amount of information used by all 1,000 consumers in each parameter combination. Since in the model the amount of information available is represented by the number of other consumers observed by each consumer, the construction of this variable proceeds as follows. FICs always observe the true market share, i.e., each FIC observes 999 consumers. PICs, on the other hand, observe all other consumers within their circular sensing field with the size of the field depending on PICs' sensing radius. Each PIC observes 48, 100, 148, 248, 499, or 749 consumers, depending on whether her sensing radius is 4, 5.66, 7, 8.945, 13.893, or 19.647, respectively. Finally, each LIC observes eight consumers. As explained in section 6.1, in the models with calling clubs, each consumer weights the market share of each network among strangers and among friends with the probability of calling a friend or stranger, respectively. Therefore, in the models with calling clubs, the number of strangers and friends observed is weighted with the respective calling probabilities.[40] The resulting variable, INFORMATION_MASS, ranges from 999,000, if all consumers are fully informed and no calling clubs exist, to 8,000 if all consumers are locally informed and no calling clubs exist.

Regressing INFORMATION_MASS on network A's final market share leads to highly significant results (see Table 22). Models I, II, and III contain the regression results for the baseline model, the model with calling clubs, and the model with active price setting behavior, respectively, while model IV pools the data from all models. To facilitate an easier interpretation, Table 22 reports the standardized beta coefficients since the dimensionality of the four variables varies greatly.

The results show that in all four models the total amount of information used by consumers when deciding about their network subscription has a positive decreasing effect on network A's final market share. The explanation for this positive effect is as follows. If a consumer bases her subscription decision on a limited amount of information, i.e., infers networks' market shares from the observation of a small sample of consumers, there is a high probability that the market shares within the sample of observed consumers do not resemble the true market shares. For instance, it might be the case that a LIC happens

[40] In the calculation of the total amount of information available, I use the simplifying assumption that friends are not part of PICs' sensing radius and are not among LICs' eight neighbors.

to be surrounded by six subscribers to network B inducing her to subscribe to network B since it appears to be the dominant network operator with a market share of 75%, while, in fact, B's market share might be much smaller. Of course, the same applies if a PIC happens to observe a disproportionally large number of subscribers to network B within her sensing radius, for instance because she is located adjacent to a cluster of subscribers to network B.

Table 6-22: Results of regression with INFORMATION_MASS as explanatory variable

	(I)	(II)	(III)	(IV)
Information_Mass	1.36 ***	0.65 ***	0.45 ***	0.47 ***
Information_Mass^2	-0.97 ***	-0.46 ***	-0.29 ***	-0.32 ***
Initial MS > 65%	0.36 ***	0.54 ***	0.68 ***	0.55 ***
Clusters	0.13 ***	0.05 ***	0.05 ***	0.06 ***
N	1152	6912	8064	16128
R-sq	0.40	0.36	0.50	0.35
adj. R-sq	0.40	0.36	0.50	0.35

* p<0.1, ** p<0.05, *** p<0.01

Nevertheless, the results in Table 22 also clearly show that in addition to the amount of information used by consumers, network A's initial market share and the number of clusters have a significant positive effect on network A's final market share. The explanation for this positive effect closely relates to the "deceiving effect" just described. Both network A's initial market share as well as the number of clusters are decisive for the actual size of the clusters: The higher A's initial market share and, hence, the lower B's initial market share, the smaller the size of the clusters since a smaller number of subscribers to network B is allotted to the existing number of clusters. Similarly, an increasing number of clusters implies smaller clusters since the given number of subscribers to network B is allotted to more clusters. However, with a smaller cluster size it is more likely that PICs located adjacent to a cluster can observe other consumers beyond the cluster's boarder as illustrated by Figure 10.

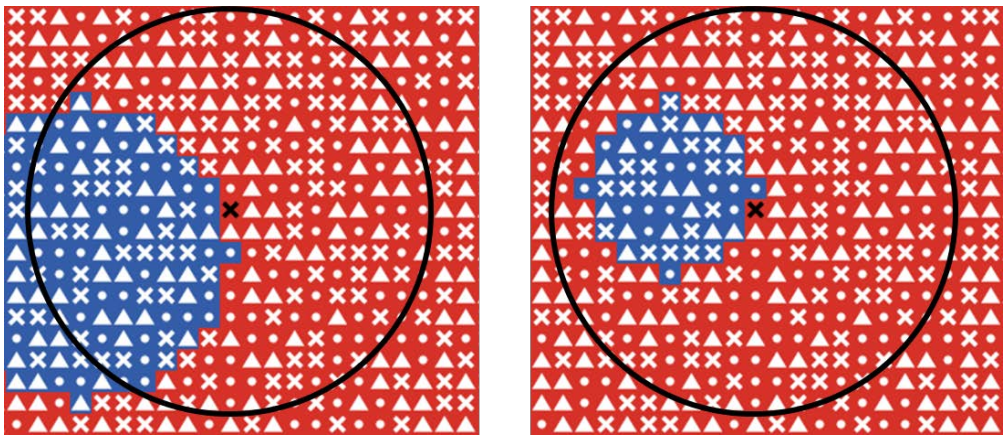


Figure 6-10: Effect of cluster size on PICs' sensing field

In the left panel of Figure 10, the size of the cluster is sufficiently large so that the sensing radius of the PIC marked in black does not protrude beyond the cluster. As a result, this consumer perceives network B to have a rather large market share which might be sufficiently high to make her subscribe to network B. In contrast to that, the right panel of Figure 10 shows a situation in which the cluster is substantially smaller so that the sensing radius of the consumer in question spans beyond the cluster. Accordingly, for this consumer network B appears to have a rather small market share and, hence, she most likely decides to remain subscribed to network A.

Therefore, the larger A's initial market share and/or the higher the number of clusters, the more likely it is that PICs located adjacent to a cluster of subscribers to network B observe consumers beyond the cluster's border making it less likely that these consumers perceive network B as having a higher market share than it actually has which, ultimately, negatively affects network B's odds of increasing its market share.

8. Summary and Conclusion

The extant literature argues that on-net/off-net differentiation is detrimental for small network operators due to tariff-mediated network effects which provides consumers with an incentive to subscribe to the largest network (Harbord and Pagnozzi 2010). While these studies assume that consumers have perfect information about all relevant market parameters (especially prices and market shares) at zero cost, the literature on search costs posits that consumers have to costly search to obtain such information. As a result, some consumers may choose to remain imperfectly informed or even uninformed due to prohibitively high search costs. This paper aims at combining these two previously separated streams of literature to investigate whether on-net/off-net differentiation is still detrimental for small networks if at least some consumers are incompletely informed about networks' true market shares.

To study this research question, I employ an agent-based simulation model in which the market for mobile telecommunications is represented by a rectangular grid of 1,000 cells each occupied by exactly one consumer. Consumers are subscribed to exactly one of two networks which have asymmetric market shares and offer differentiated linear tariffs for on-net and off-net calls. A priori, consumers lack information on the market shares of both networks. To obtain this information, consumers have to use a costly fixed sample size search strategy, i.e., they observe the market shares of both networks in a sample of other consumers and use them as an estimate for the true market shares. With respect to the extent of search costs, I distinguish between three types of consumers: First, fully informed consumers (FICs) have non-positive search costs and, accordingly, always observe the network membership of all other consumers, which makes them perfectly informed of networks' market shares; second, partially informed consumers (PICs) have moderate search costs and are assumed to observe other consumers within a circular sensing field; and, third, locally informed consumers (LICs) have high search costs and are assumed to only observe their immediate eight neighbors. Irrespective of their type, consumers maximize their expected utility by subscribing to the network offering the lowest expected cost for a

call to a random consumer. Furthermore, I assume that, initially, membership to the smaller network B is distributed clusterwise which is line with the empirical observations of Karacuka, Çatik, and Haucap (2013).

To analyze the simulation model, I systematically explore the parameter space spanned by the four key variables of the model. These include, first, the fraction of FICs, PICs, and LICs, second, the initial distribution of market shares, third, the number of clusters of subscribers to network B in t = 0, and, fourth, the radius of the circular sensing field of PICs. Using a full factorial design results in 1,152 different parameter combinations, each of which is simulated 500 times to mitigate the effects of random elements in the model.

Subsequently, I check for the robustness of the results by means of two extensions. First, I allow for the existence of calling clubs. More specifically, I assume that each consumer befriends a minimum number of random other consumers (friends) which are called with a probability q whereas the remaining consumers (strangers) are called with probability 1-q. In the second extension, I allow for active price setting by both networks. In each period, each network has an exogenous probability λ to be allowed to change its tariffs by choosing among five different pricing strategies. Both networks evaluate the effectiveness of each strategy by using a simple variant of a recursive algorithm and implement the strategy yielding the highest expected profit.

The results of the simulation offer two key insights. First of all, the initially larger network A has a lower final market share or becomes less likely to corner the market the higher the fraction of PICs or LICs, while A is more likely to do so if PICs' sensing radius increases. While these result are robust to the introduction of calling clubs and to active price setting by networks, the results from the models with calling clubs additionally indicate that A's final market share or its probability to corner the market increases if the minimum number of friends increases and decreases if friends become more important relative to strangers.

These findings highlight the crucial role of the amount of information available to consumers when deciding which network to subscribe to. Since PICs and LICs generally use less information than FICs, increasing their fraction in the population of consumers decreases the amount of information used, while a larger sensing radius implies that PICs possess more information when making their subscription decision. Furthermore, incorporating calling clubs generally increases the available information since, first, consumers always know which network their friends are subscribed to and, second, friends can be located anywhere in the market. Yet, the amount of information used by consumers in their subscription decision again decreases as friends become more important than strangers. Taken together this suggests that the amount of information available to consumers positively affects network A's final market share and its probability to corner the market.

Since consumers in the model obtain information about networks' market shares by observing the network membership of other consumers, the total amount of information can be measured as the total

number of other consumers observed by each of the 1,000 consumers. A regression of the total amount of information available on network A's final market share confirms its postulated positive effect. Intuitively, this effect can be explained by the fact that the less information a consumer possesses the more likely it becomes that the observed market shares significantly differ from the true ones. Such a misconception could occur, for instance, if a PIC only observes a very small number of other consumers (due to a small sensing radius) but happens to be located adjacent to a cluster of subscribers to network B (see Figure 10). Due to her proximity to the cluster, she will observe a disproportionally large fraction of subscribers to network B, which induces her to think that B has a large market share and might cause her to also subscribe to network B.

The second key insight from the model is that network A's final market share and its probability of cornering the market is positively affected by the initial number of clusters and A's initial market share. An increase in these two variables reduces the size of the clusters. Smaller clusters, in turn, make it more likely that the sensing field of PICs located adjacent to a cluster spans beyond the cluster hence leading to a smaller probability that the market shares observed by these PICs are biased as a result of their proximity to the cluster.

The contributions of this study are threefold. First of all, it contributes to the literature on tariff-mediated network effects by confirming and extending previous findings of the theoretical literature. In line with previous theoretical research in this area, the findings of the simulation model suggest that if consumers have perfect information or are, at least, sufficiently well informed, tariff-mediated network effects harm small networks and might even induce market exit. At the same time, this study extends previous findings by showing that tariff-mediated network effects can also work in favor of small networks if consumers possess only limited information about crucial market parameters, such as, for instance, the market shares of both networks. Hence, contrary to the extant theoretical literature, which unanimously stresses the detrimental effect of tariff-mediated network effects, this study demonstrates that both shared-market equilibria as well as corner equilibria in favor of the initially smaller network can exist under on-net/off-net differentiation.

Moreover, this study also contributes to the literature on costly consumer search. While the extant literature argues that costly information acquisition by consumers decreases total welfare by enabling firms to charge prices above marginal cost, the findings of this study suggest that under certain circumstances search costs can actually improve total welfare, at least in the long run. This is the case if, as a result of costly information acquisition, the existence of incompletely informed consumers decreases barriers to market entry created by tariff-mediated network effects, thereby allowing a new network operator to enter the market. This, in turn, might increase the competitiveness of the market, at least in the long run, thereby leading to lower prices and higher welfare. Of course, this is contingent on the entrant being sufficiently efficient so that prices decline as a result of the competition.

Finally, this study also contributes to an emerging literature which uses agent-based simulation models to study telecommunication markets (Twomey and Cadman 2002, Osnumakinde and Potgieter 2006, Kamiński and Łatek 2008, 2010, Schade, Frey, and Mahmoud 2009, DeMaagd and Bauer 2011, Grove and Baumann 2012, Diedrich and Beltrán 2012). By combining two previously separated research streams, this study demonstrates the ability of agent-based computational models to extend existing theoretical models by relaxing modeling assumptions which, in turn, makes these models analytically intractable. This is especially relevant for research on telecommunication networks which are characterized by interactions among consumers' behavior which lead to feedback loops in the behavior of the system as a whole. Agent-based computational models are exceptionally well suited to address models in which interactions and feedback loops play a prominent role. By providing an analytical framework, this study might serve as a starting point for future endeavors to study less restrictive theoretical models in order to further deepen our knowledge of the functioning of telecommunications markets.

From a practical point of view, the findings of this study imply that better informed consumers do not necessarily lead to improved market outcomes in terms of consumer surplus or total welfare. In fact, the results suggest that under certain conditions it might even be detrimental to foster market transparency, for instance, by means of a public information system as recently implemented in gasoline markets (Dewenter and Heimeshoff 2012). Instead, it might even be desirable to actively limit the amount of information possessed by consumers if this helps to decrease barriers to market entry and to promote long-term competition. Furthermore, this study suggests that entrant network operators should aim at establishing one or more local clusters upon market entry, for instance, by predominantly targeting single cities or regions, or by focusing on distinct social groups. The clusters could then serve as nuclei for further market share growth. A possible point in case might be the strategy of E-Plus, Germany's second smallest mobile network operator, who founded the mobile virtual network operator Ay Yildiz in 2006. The tariffs offered by Ay Yildiz are specifically targeted at the needs of Turkish mobile phone users in Germany, for instance, by offering flat rate tariffs for calls to Turkey (Ay Yildiz 2014).

The findings and implication of this study should be viewed in light of its limitations which could serve as starting points for future research. A first limitation of the study is that it simply assumes that ex-ante both networks price discriminate between on-net and off-net calls without investigating whether or not networks would have an incentive to do so in the first place. Hence, future studies could explore models in which, initially, both networks charge equal tariffs for on- and off-net calls and study whether or not on-net/off-net differentiation emerges endogenously from operators' efforts to maximize profits. Preliminary findings from this study suggest that on-net/off-net differentiation likely also emerged endogenously since in the extension with active price setting by networks both networks did not abandon termination-based price discrimination but continued to price discriminate between on- and off-net calls.

A second starting point for further research could be the assumption that consumers only lack information on the market shares of both networks but are perfectly informed about the tariffs charged

by them. Future studies could set out to test whether or not the findings of this study also hold if consumers alternatively or additionally are ex-ante uninformed or only incompletely informed about the tariffs charged by all network operators.

Thirdly, the present model is limited by the assumption that although both networks differ in size, they offer identical services, i.e., both networks offer the same network quality, coverage, and added services. While this allowed me to concentrate on the impact of costly information acquisition on the competitive effect of on-net/off-net differentiation, future studies may find it worthwhile to relax this assumption and allow for horizontal or vertical product differentiation to improve the internal and external validity of the model.

Fourthly, the network structure of the calling clubs appears as a fruitful area for additional studies. Presently, I assume that calling clubs are organized as a random network, i.e., the probability that two random consumers are friends is $\frac{1}{999} \approx 0.1\%$. It might be interesting to check whether more realistic network topologies such as, for instance, small-world networks, would lead to diverging results.

Finally, future research might extend the present model by using real-word data to calibrate the parameters of the variables used in the model, thereby greatly broadening its practical applicability. For instance, laboratory experiments could be designed such that it is possible to infer the amount of information used by consumers when making their decision to subscribe to a mobile network. This information could then be used to estimate the fraction of FICs, PICs, and LICs in the population as well as PICs' sensing radius. Furthermore, the size of calling clubs could be inferred either by conducting surveys among subscribers to mobile networks or by studying the communication behavior of consumers on social networks, such as Facebook. The number of friends with which members of a social network communicate frequently, e.g., at least once a week, could be used as a proxy for the size of a calling club. Information on the tariffs for on- and off-net calls could be inferred from publicly available databases, such as the one provided by the OECD. Finally, the decision on the number of network operators, the extent of market share asymmetry, and the initial number of clusters could be guided by the historic characteristics of the mobile telecommunications market under investigation.

Despite the widespread introduction of flat rate tariffs in recent years, the investigation of tariff-mediated network effects remains both a promising and a relevant research area since the competitive problems raised by on-net/off-net differentiation are not limited to markets in which several mobile network operators compete with each other. Rather, as demonstrated recently by Hoernig, Bourreau, and Cambini (2014), tariff-mediated network effects continue to play a role in markets where an integrated fixed/mobile network operator competes with several mobile operators and price discriminates between calls to the fixed-line network originating on his integrated mobile network and those originating on competitors' mobile networks. Hopefully, this study serves as a starting point for future endeavors to further explore the competitive effects of tariff-mediated network effects.

References

Armstron, M. (1998), Network Interconnection in Telecommunications. *The Economic Journal*, 108, 545-564.

Astorne-Figari, C., Yankelevich, A. (2014), Consumer Search with Asymmetric Price Sampling. *Economics Letters*, 122, 331-333.

Autorité de la Concurrence (2012), *Press Release from 13. December 2012*. Retrieved from: http://www.autoritedelaconcurrence.fr/user/standard.php?id_rub=418&id_article=2014.

Axelrod, R., Tesfatsion, L. (2006), A Guide for Newcomers to Agent-Based Modeling in the Social Sciences. In: Tesfatsion, L., Judd, K. L. (Eds.) *Handbook of Computational Economics*, Elsevier, Amsterdam, 2006: 1647-1659.

Ay Yildiz (2014), *Über Ay Yildiz*. Retrieved from http://www.ayyildiz.de/Ueber-Ay-Yildiz.

Baye, M. R., Morgan, J., Scholten, P. (2006), Information, Search, and Price Dispersion. In: Hendershoot, T. (ed.) *Handbook on Economics and Information Systems*. Emerald Group Publishing, Howard House, 2006: 323-376.

Berger, U. (2004), *Access Charges in the Presence of Call Externalities*. Mimeo.

Berger, U. (2005), Bill-and-Keep vs. Cost-Based Access Pricing Revisited. *Economics Letters*, 86, 107-112.

Blonski, M. (2002), Network Externalities and Two-Part Tariffs in Telecommunication Markets. *Information Economics and Policy*, 14, 95-109.

Birke, D., Swann, G. M. P. (2006), Network Effects and the Choice of Mobile Phone Operator. *Journal of Evolutionary Economics*, 16, 65-84.

Braverman, A. (1980), Consumer Search and Alternative Market Equilibria. *Review of Economic Studies*, 47, 487-502.

Burdett, K., Judd, K. (1983), Equilibrium Price Dispersion. *Econometrica*, 51, 955-970.

Cabral, L. (2011), Dynamic Price Competition with Network Effects. *Review of Economic Studies*, 78, 83-111.

Calvo, G. (1983), Staggered Contracts in a Utility-Maximizing Framework. *Journal of Monetary Economics*, 12, 383-398.

Calzada, J., Valletti, T. M. (2008), Network Competition and Entry Deterrence. *The Economic Journal*, 118, 1223-1244.

Cambini, C., Valletti, T. M. (2003), *Network Competition with Price Discrimination: 'Bill-and-Keep' is not so Bad After All*. Mimeo.

Carlton, D. W., Perloff, J. M. (2005), *Modern Industrial Organization*. 4th ed. 2005. Boston: Addison Wesley.

Chandra, A., Tappata, M. (2011), Consumer Search and Dynamic Price Dispersion: An Application to Gasoline Markets. *RAND Journal of Economics*, 42, 681-704.

Cricelli, L., Di Pillo, F., Levialdi, N., Gastaldi, M. (2004), Mobile Telephony Industry: Price Discrimination Strategies for Interconnected Networks. *Lecture Notes in Computer Science*, 3124: 192-198.

De Los Santos, B., Hortaçsu, A., Wildenbees, M. R. (2012), Testing Models of Consumer Search Using Data on Web Browsing and Purchasing Behavior. *American Economic Review*, 102, 2955-2980.

DeMaagd, K., Bauer, J. (2011), Modeling the Dynamic Interactions of Agents in the Provision of Network Infrastructure. *Information Systems Frontiers,* 13, 669-680.

Dewenter, R., Heimeshoff, U. (2012), *Less Pain at the Pump? The Effects of Regulatory Interventions in Retail Gasoline Markets*. DICE Discussion Paper No. 51.

Dietrich, S., Beltrán, F. (2012), Comparing Traffic Discrimination Policies in an Agent-Based Next-Generation Network Market. In: Teglio, A., Alfarano, S., Cuena, E. C. (Eds.) *Managing Market Complexity: The Approach of Artificial Economics*, Springer, Heidelberg: 3-14.

Elliot, D. (2004), *Two-Way Access Charges and On-Net/Off-Net Differentials*. Retrieved from http://www.frontier-economics.com/_library/publications/frontier%20paper%20-%20differentials%2015-10-04.pdf.

Fischer, C. S. (1992), *America Calling: A Social History of the Telephone to 1940*. University of California Press, Berkley.

Fletcher, A. (2013), Modelling Naïve Consumers. In: Mehta, J. (ed.) *Behavioural Economics in Competition and Consumer policy*. ESRC Centre for Competition Policy, University of East Anglia, 2013: 107-116.

Gabrielsen, T., Vagstad, S. (2008), Why is On-Net Traffic Cheaper than Off-Net Traffic? Access Markup as a Collusive Device? *European Economic Review*, 52, 99–115.

Gans, J. S., King, S. P. (2001), Using 'Bill-and-Keep' Interconnect Arrangements to Soften Network Competition. *Economics Letters*, 71, 413-420.

Geoffron, P., Wang, H. (2008), What is the Mobile Termination Regime for the Asymmetric Firms with a Calling Club Effect? *International Journal of Management and Network Economics*, 1, 58-78.

German Federal Cartel Office (2010), *Examination of Possible Abuse of a Dominant Position by T-Mobile and Vodafone by Charging Lower On-Net Tariffs for Mobile Voice Telephony Services*.

Retrieved from http://cms.bundeskartellamt.de/wEnglisch/download/pdf/Fallberichte/B07-170-07-engl.pdfS.

Grimm, V., Berger, U., Bastiansen, F., Eliassen, S., Ginot, V., Giske, J., Goss-Custard, J., Grand, T., Heinz, S. K., Huse, G., Huth, A., Jepsen, J. U., Jorgensen, C., Mooij, W. M., Müller, B., Pe'er, G., Piou, C., Railsback, S. F., Robbins, A. M., Robbins, M. M., Rossmanith, E., Rüger, N., Strnad, E., Souissi, S., Stillman, R. A., Vabo, R., Visser, U., DeAngelis, D. L. (2006), A Standard Protocol for Describing Individual-Based and Agent-Based Models. *Ecological Modelling,* 198, 115-126.

Grimm, V., Berger, U., DeAngelis, D. L., Polhill, J. G., Giske, J., Railsback, S. F. (2010), The ODD Protocol: A Review and First Update. *Ecological Modelling*, 221, 2760-2768.

Grove, N., Baumann, O. (2012), Complexity in the Telecommunications Industry: When integrating Infrastructure and Services Backfires. *Telecommunications Policy*, 36, 40-50.

Harbord, D., Pagnozzi, M. (2010), Network-Based Price Discrimination and ‚Bill-And-Keep' vs. 'Cost-Based' Regulation of Mobile Termination Rates. *Review of Network Economics*, 1, Article 1.

Haucap, J., Heimeshoff, U. (2011), Consumer Behavior Towards On-Net/Off-Net Price Differentiation. *Telecommunications Policy*, 35, 325-332.

Haucap, J., Heimeshoff, U., Stühmeier, T. (2011), Wettbewerb im deutschen Mobilfunkmarkt. *Zeitschrift für Wirtschaftspolitik,* 60, 240-267.

Hendricks, W. A., Robey, K. W. (1936), The Sampling Distribution of the Coefficient of Variation. *Annals of Mathematical Statistics*, 7, 129-132.

Hoernig, S. (2007), On-Net and Off-Net Pricing on Asymmetric Telecommunications Networks. *Information Economics and Policy*, 19, 171-188.

Hoernig, S. (2008), Tariff-Mediated Network Externalities: Is Regulatory Intervention any Good? *CEPR Discussion Paper* No. 6866.

Hoernig, S. (2009), *Competition Between Multiple Asymmetric Networks: A Toolkit and Applications*. Retrieved from http://fep.up.pt/conferencias/ict/Papers/Steffen_Hoernig.pdf.

Hoerning, S., Bourreau, M., Cambini, C. (2014), Fixed-Mobile Integration. *Journal of Regulatory Economics,* 45, 57-74.

Hoernig, S., Inderst, R., Valletti, T. M. (2014), Calling Circles: Network Competition with Nonuniform Calling Patterns. *RAND Journal of Economics*, 45, 155-175.

Janssen, M. C. W., Non, M. C. (2008), Advertising and Consumer Search in a Duopoly Model. *International Journal of Industral Organization*, 26, 354-371.

Janssen, M. C. W., Parakhonyak, A. (2013), Price Matching Guarantees and Consumer Search. *International Journal of Industrial Organization*, 31, 1-11.

Janssen, M. C. W., Parakhonyak, A. (2014), Consumer Search in Markets with Costly Revisits. *Economic Theory*, 55, 481-514.

Jeon, D.-S., Laffont, J.-J., Tirole, J. (2004), On the 'Receiver-Pays' Principle. *RAND Journal of Economics*, 35, 85-110.

Kamińsky, B., Łatek, M. (2008), *Computational Model of Strategy Selection Mechanisms on Telecommunication Markets*. Mimeo.

Kamińsky, B., Łatek, M. (2010), The Influence of Call Graph Topology on the Dynamics of Telecommunication Markets. *Agent and Multi-Agent Systems: Technologies and Applications. Lecture Notes in Computer Science*, 6070, 263-272.

Karacuka, M., Çatik, A. N., Haucap, J. (2013), Consumer Choice and Local Network Effects in Mobile Telecommunications in Turkey. *Telecommunications Policy*, 37, 334-344.

KPN (2007), *Complaint by Royal KPN N.V. Against T-Mobile Deutschland GmbH and Vodafone D2 GmbH to the European Commission Pursuant to Council Regulation EC No. 1/2003*, 16 July 2007.

Laffont, J.-J., Rey, P., Tirole, J. (1998a), Network Competition: I. Overview and Nondiscriminatory Pricing. *RAND Journal of Economics,* 29, 1-37.

Laffont, J.-J., Rey, P., Tirole, J. (1998b), Network Competition: II. Price Discrimination. *RAND Journal of Economics*, 29, 38-56.

Łattek, M., Axtell, R., Kamińsky, B. (2009), Bounded Rationality via Recursion. P*roceedings of the Eigth International Conference on Autonomous Agents and Multiagent Systems,* 1, 457-464.

Lorscheid, I., Heine, B-.O., Meyer, M. (2012), Opening the ‚Black Box' of Simulations: Increased Transparency and Effective Communication through the Systematic Design of Experiments. *Computation and Mathematical Organization Theory*, 18, 22-62.

López, A-L., Rey, P. (2012), *Foreclosing Competition Through Access Charges and Price Discrimination*. Retrieved from http://www.idei.fr/doc/wp/2012/wp_idei_570_revised_feb_2012.pdf.

Mazza, R. (2009), *Introduction to Information Visualization*. London, Springer.

Michihiro, K. (1997), Evolutionary Game Theory in Economics. In: Kreps, D. M., Wallis, K. F. (Eds.) *Advances in Economics and Econometrics: Theory and Applications*, Cambridge University Press, Cambridge: 244-279.

Möbius, M. (2011), *Death Through Success: The Rise and Fall of Local Service Competition at the Turn of the Century*. Mimeo.

Osunmakinde, I. O., Potgieter, A. (2006), Agent-Based Behavioural Modelling for Anomaly Detection in Call Data from Telecommunication Networks. In *Proceedings of Southern African Telecommunications Networks and Applications Conference,* 8-13.

Peitz, M. (2003), On Access Pricing in Telecoms: Theory and European Practice. *Telecommunications Policy*, 27, 729-740.

Perloff, J. M., Salop, S. C. (1986), Firm-Specific Information, Product Differentiation, and Industry Equilibrium. *Oxford Economic Papers*, 38, 184-202.

Plackett, R. L., Burman, J. P. (1946), The Design of Optimum Multifactorial Experiments. *Biometrika*, 33, 305-325.

pressetext.com (1999), "max.plus" mit Ein-Schilling-Tarif für ganz ÖSterreich. Retrieved from http://www.pressetext.com/print/19990622020.

Railsback, S. F., Grimm, V. (2012), *Agent-Based and Individual-Based Modeling*. Princeton, Princeton University Press.

Rob, R. (1985), Equilibrium Price Distributions. *Review of Economic Studies*, 52, 487-504.

Schade, S., Frey, T., Mahmoud, N. (2009), Simulating Discount-Pricing Strategies for the GSM-Mobile Market. *Business & Information Systems Engineering*, 4, 335-345.

Siebertz, K., van Bebber, D., Holzkirchen, T. (2010), *Statistische Versuchsplanung – Design of Experiments*. Berlin, Springer.

SINUS Markt- und Sozialforschung GmbH (2011), *Informationen zu den Sinus-Millieus*.

Stahl, T. (1989), Oligopolistic Pricing with Sequential Consumer Search. *American Economic Review*, 79, 700-712.

Stahl, T. (1996), Oligopolistic Pricing with Heterogeneous Consumer Search. *International Journal of Industrial Organization,* 14, 243-268.

Stennek, J., Tangerås, T. P. (2008), Intense Network Competition. *NET Institute Working Paper* No. 08-36.

Stigler, G. T. (1961), The Economics of Information. *Journal of Political Economy*, 69, 213-225.

Stiglitz, J., (1987), Competition and the Number of Firms in a Market: Are Duopolies More Competitive than Atomistic Markets? *Journal of Political Economy*, 95, 1041-1061.

Twomey, P., Cadman, R. (2002), Agent-Based Modelling of Customer Behaviour in the Telecoms and Media Markets. *info*, 4, 56-63.

Wirtschaftsblatt.at (2012), *Österreichts Mobilfunkbetreiber im Kurzportrait*. Retrieved from http://www.wirtschaftsblatt.at/home/dossiers/mobilfunk/1223590/index.

Wollinsky, A. (1986), True Monopolistic Competition as a Result of Imperfect Information. *Quarterly Journal of Economics*, 101, 493-511.

Appendix A: Description of the Model According to the ODD Protocol

The following section describes the agent based model employed according to the ODD protocol (Grimm et al. 2006, Grim et al. 2010).

Purpose. The objective of the model is to study the impact of costly information acquisition on the competitive effect of tariff-mediated network effects.

Entities, state variables, and scales. The model consists of two mobile network operators offering linear tariffs with on-net/off-net differentiation as well as 1,000 consumers who maximize their expected utility by subscribing to the network which offers the lowest expected cost for a call to a random other consumer. A priori, consumers lack information on the market shares of both networks. To obtain this information, consumers use a costly fixed sample size search strategy, i.e., they observe the network membership of other consumers and use that information to infer the market shares of both networks. With respect to the extent of the search costs, I distinguish between three types of consumers. Fully informed consumers (FICs) have non-positive search costs and, therefore, always observe the network membership of all other consumers. Partially informed consumers (PICs) have moderate search costs and, therefore, are assumed to observe the network membership of all consumers within a circular sensing field whose radius is exogenously set by the variable "sensing-radius." Finally, locally informed consumers (LICs) face high search costs and, consequently, are assumed to be able to observe only the network membership of their immediate eight neighbors. Key characteristics of all consumers include their position on a two-dimensional grid, a dummy variable "network-a" which takes on the value one if the consumer is currently subscribed to network A and zero if she is subscribed to network B[41], and a variable "search-costs" indicating the consumer type (FIC, PIC, or LIC). The market for mobile telecommunications is represented by a rectangle of 50 x 20 cells and each cell is occupied by exactly one consumer located at the center of the cell. The grid is toroidal, i.e., the world wraps both horizontally and vertically so that all consumers have exactly eight neighbors. The length of one time step is not explicitly defined. However, it is shorter than the average duration of a mobile contract because in each time period only a fraction of consumers, specified by the variable "prob-of-switch", is allowed to decide whether to stay with the current network or switch to the competitor. The model automatically stops after 999 time periods.

Process overview and scheduling. In each period, five actions are executed successively. First, the computer draws a random sample of consumers who are allowed to decide on their network membership. The sample size is determined by the variable "prob-of-switch" which is determined exogenously. Second, all consumers of this sample execute the process "calculate-current-share-a" to calculate the current market share of network A as perceived by each consumer. Since FICs observe the network

[41] I assume full market participation, i.e., all consumers are always subscribed to one of the two networks.

membership of all other consumers they observe the true market shares. PICs calculate the market share of network A as the fraction of consumers within their sensing field who are subscribed to network A. LICs calculate network A's market share as the fraction of subscribers to network A among their eight neighbors. Third, all selected consumers execute the process "calculate-utility" to calculate the expected utility from both networks. Fourth, each consumer of the sample executes the process "decide-switching" which induces the consumer to either stay with her current provider if the expected utility from the current network is larger or equal to the expected utility of the competing network or to switch to the competing network otherwise. Therefore, switching takes place simultaneously, and switching costs are assumed to be zero. Fifth, the process "do-plotting" is used to update the plot of market shares of both networks.

Design concepts. The focus of the model is on the sizes of networks A and B, which *emerge* endogenously from the interaction of the three different consumer types. The decision of each consumer to join a network depends on the market share of each network, which, in turn, depends on the decisions of all other consumers in previous periods. Due to this feedback loop, network sizes emerge in complex ways and cannot be inferred by simply considering initial market shares and consumers' search costs. Consumers *adapt* to their environment by either staying with their current network operator or by switching to the competing network. In doing so, consumers pursue the *objective* of being subscribed to the network which offers them the highest expected utility. When calculating the expected utility derived from each network, consumers do not make any *predictions* about the future or about other consumers' behavior. All consumers *sense* the tariffs for on-net and off-net calls of both networks. Moreover, FICs sense the network membership of all other consumers, whereas PICs sense the network membership of consumers within a circular sensing field and LICs only sense the network membership of their eight neighbors. *Interaction* takes place only indirectly through network externalities that arise from the decision of each consumer to join a specific network. The sole s*tochastic* element of the model is the recurrent sampling of consumers which are allowed to decide on their network membership. The main *observations* of the model are the market share of networks A and B.

Initialization. The initialization of the model proceeds in four steps. First, 1,000 consumers are created and distributed across the rectangular grid so that each cell is occupied by exactly one consumer.

Second, each consumer is assigned to exactly one of the two networks so that the actual fraction of subscribers to network A matches the market share of network A as specified exogenously in the variable "initial-share-a." To this end, the process "distribute-shares-in-clusters" is executed which distributes network membership such that clusters of subscribers to network B occur.

In the third step of the initialization, consumers' search costs are assigned randomly by setting the variable "search-costs" to one for FICs, to two for PICs, and to three for LICs. The distribution is such that the fraction of FICs and PICs corresponds to the value of the variables "share-fic" and "share-pic," respectively. The remaining consumers are assigned to be LICs.

Fourth, the values for the variables "prob-of-switch," "tariff-a-onnet," "tariff-a-offnet," "tariff-b-onnet," and "tariff-b-offnet" are initialized.

Input Data. The model does not use input data from external sources.

Submodels. In executing the process "calculate-utility", consumers who have been selected to decide on their network membership calculate the expected utility from both networks according to (2).

The process "distribute-shares-in-clusters" assigns membership to network B in clusters across the rectangular grid and proceeds in six steps. First, the variable "network-a" is set to one for all consumers. Second, the process calculates how many subscribers to network B are needed to mirror the market share of network B as implicitly defined by the variable "initial-share-a." This number is divided by the number of clusters specified by the variable "number-of-clusters" and subsequently rounded down to approximate the average number of consumers per cluster subscribed to network B. Third, the necessary radius of each cluster is approximated by

(11) $radius = \sqrt{average\ cluster\ population}/2,$

i.e., a cluster is viewed as a square and the cluster radius is approximated by the half of the square's edge length. Fourth, a number of consumers equal to the number of clusters is randomly chosen as the center of a cluster and all consumers within the calculated radius are assigned to network B (including the consumer located at the center of the cluster). Fifth, the number of consumers actually subscribed to network B is compared to the required number of consumers calculated in step two. If the actual number of subscribers to network B is too small (large) then the computer randomly picks the necessary number of consumers from network A (B) and assigns them to network B (A). In the sixth step, the colors of the cells are updated to correctly display the network membership of the consumer inhabiting the cell.

Appendix B: Substitutability of On-net and Off-net Tariff Changes

If a network increases its on-net tariff by x-%, the resulting profits are given by

(12) $1000[MS * p^{on}(1 + x) + (1 - MS) * p^{off})]$

Likewise, the expected profit for a y-% increase in the off-net tariff is given by:

(13) $1000[MS * p^{on} + (1 - MS) * p^{off}(1 + y)]$

Equating (12) and (13) and solving for x yields:

(14) $x = \frac{1-MS}{MS} * \frac{p^{off}}{p^{on}} * y$

That is, every y-% increase in the off-net tariff can profit-neutrally be substituted by an appropriate increase in the on-net tariff and vice-versa. The magnitude of the necessary increase in the on-net tariff depends on the relative market shares of both networks and the ratio of tariffs for off- and on-net calls, respectively.

Appendix C: Graphical Visualization of the Simulation Results of the Model with Calling clubs

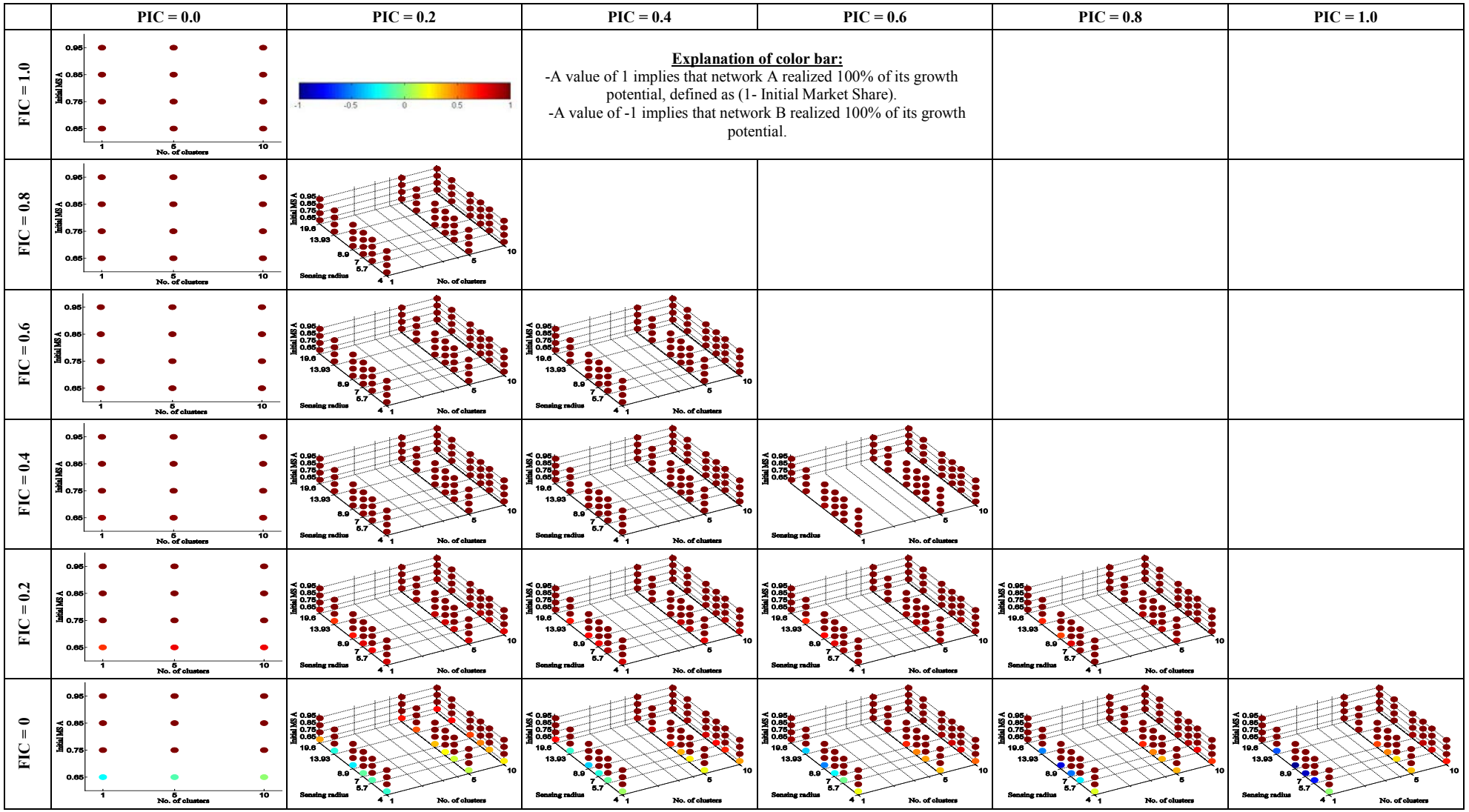


Figure 6-11: Graphical visualization of simulation results of model with calling clubs (friends = 5, weight = 50%)

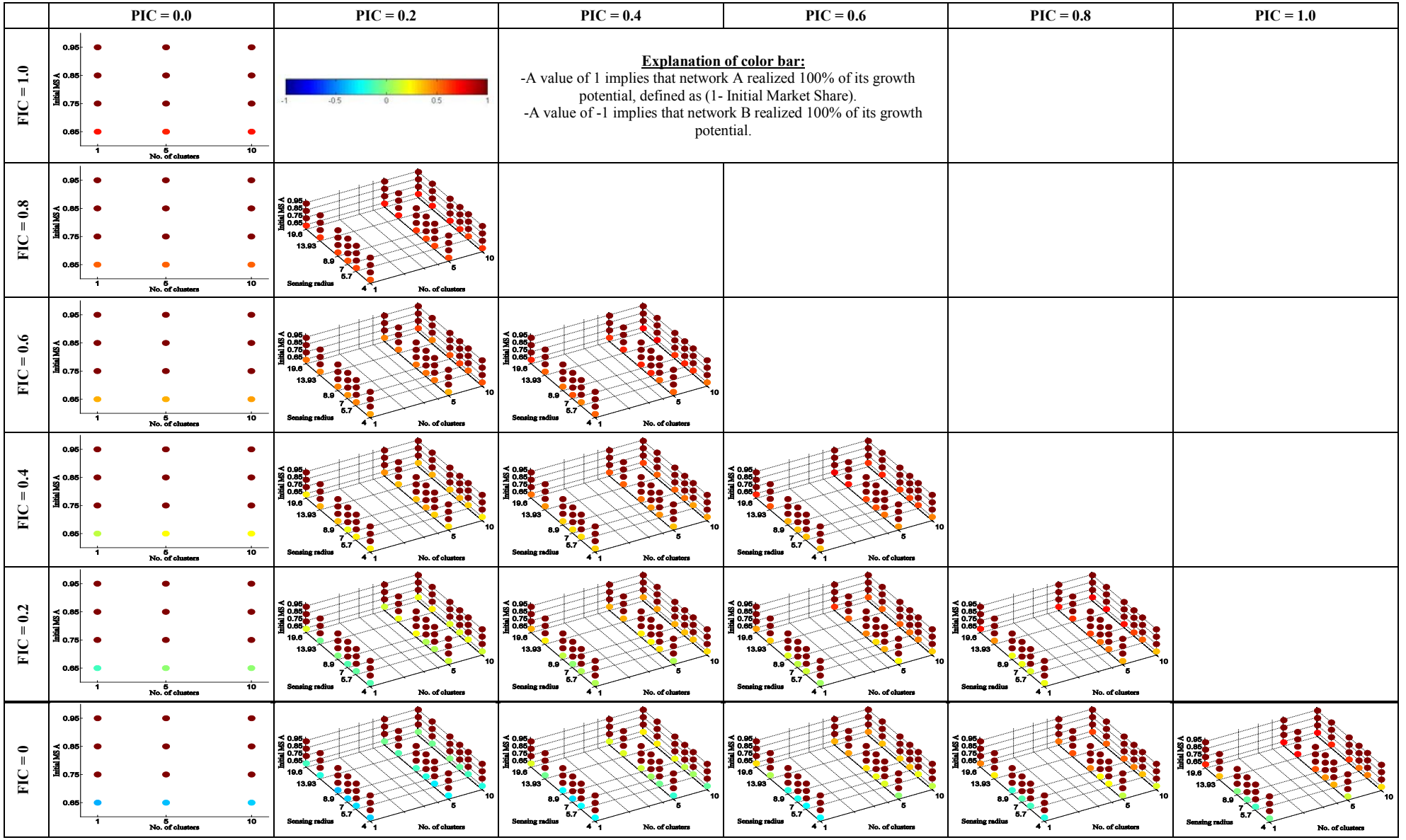


Figure 6-12: Graphical visualization of simulation results of model with calling clubs (friends = 5, weight = 75%)

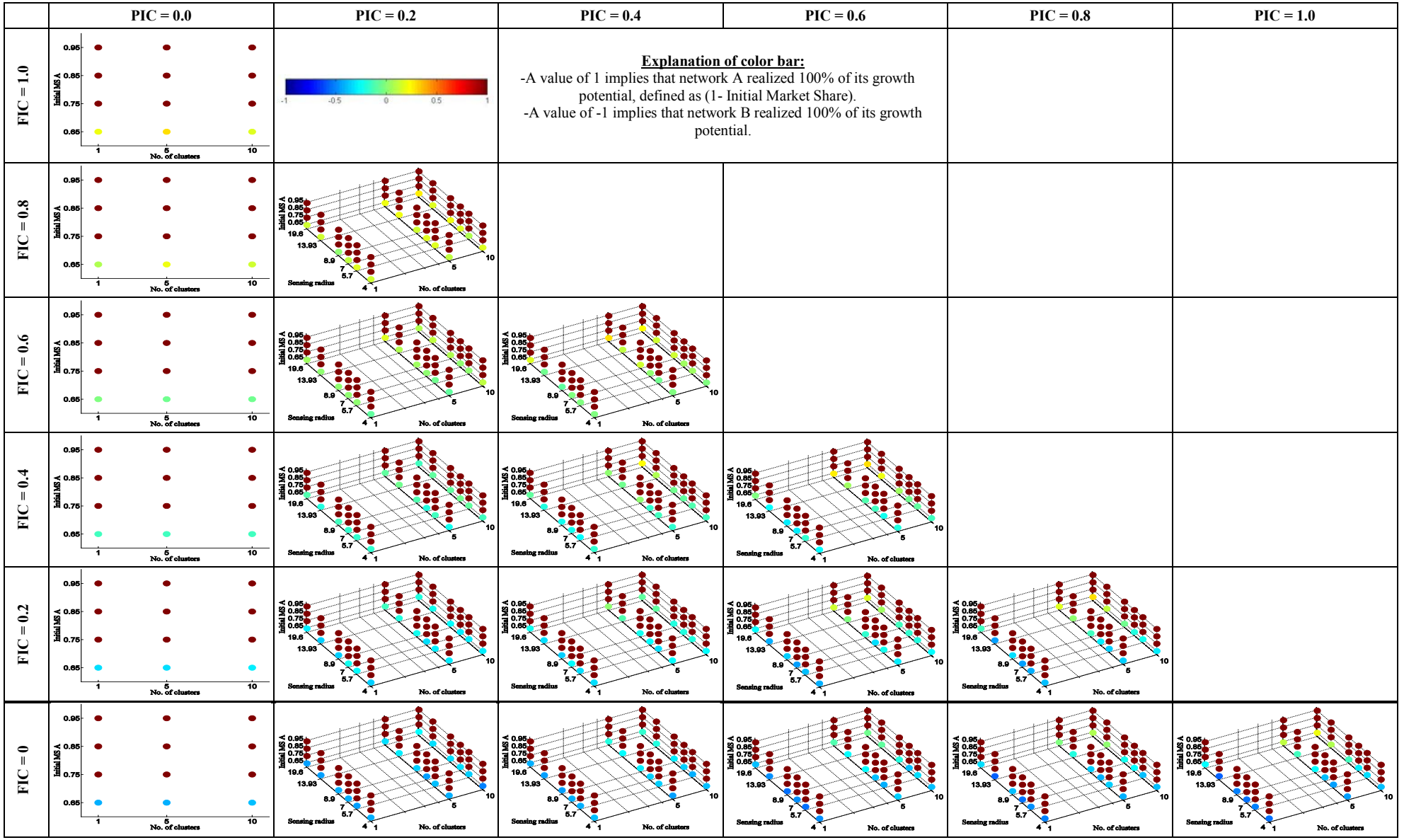


Figure 6-13: Graphical visualization of simulation results of model with calling clubs (friends = 5, weight = 95%)

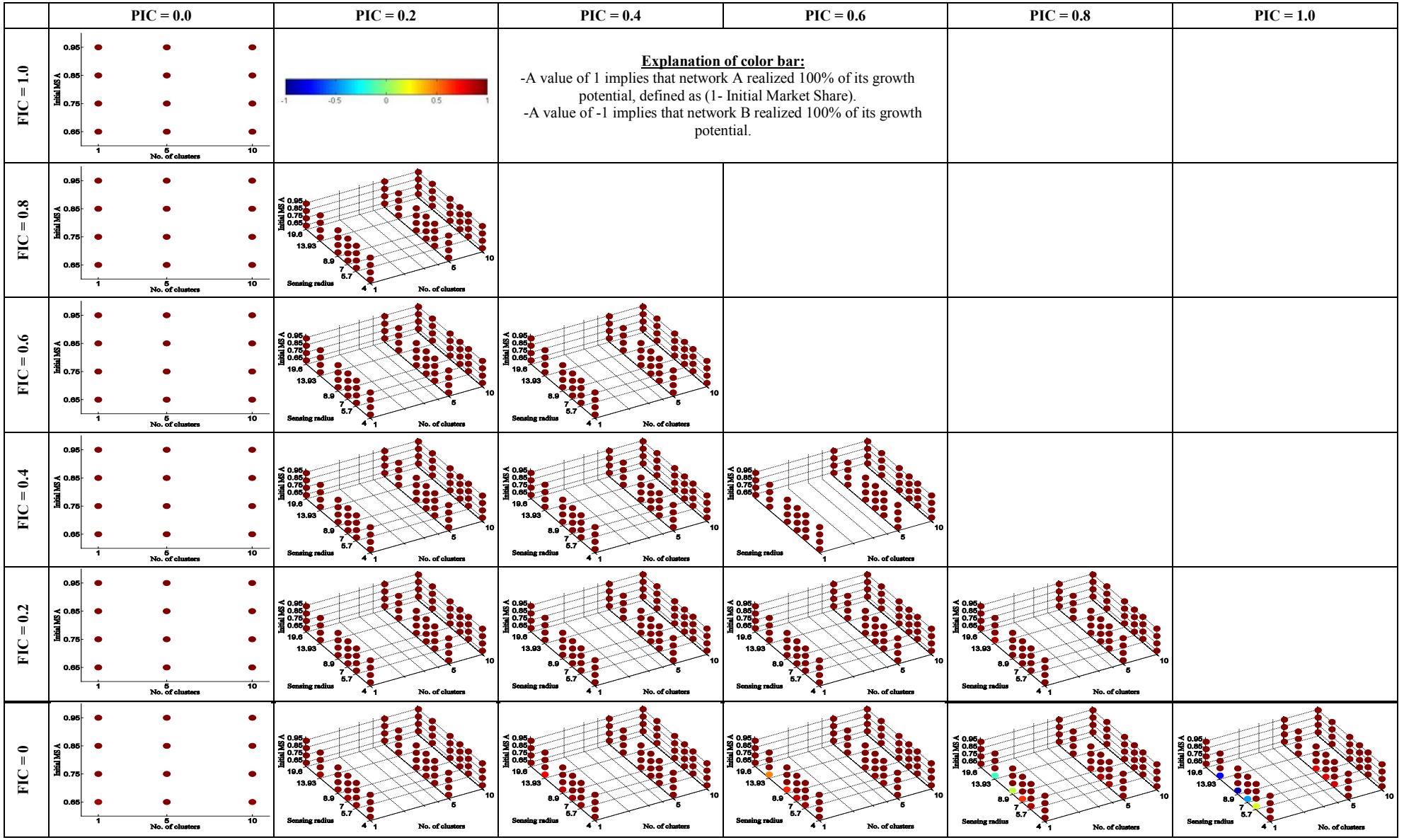


Figure 6-14: Graphical visualization of simulation results of model with calling clubs (friends = 10, weight = 50%)

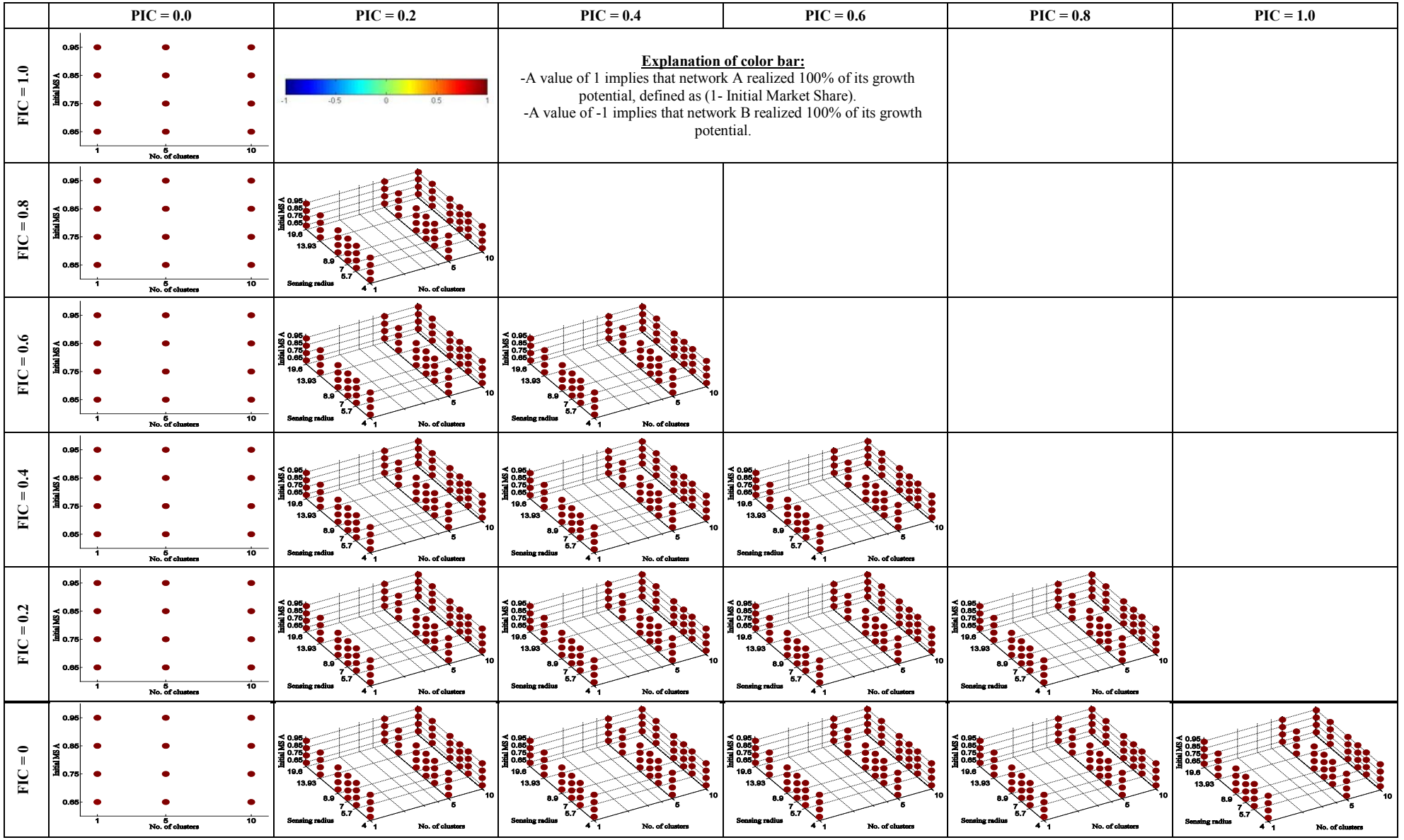


Figure 6-15: Graphical visualization of simulation results of model with calling clubs (friends = 10, weight = 75%)

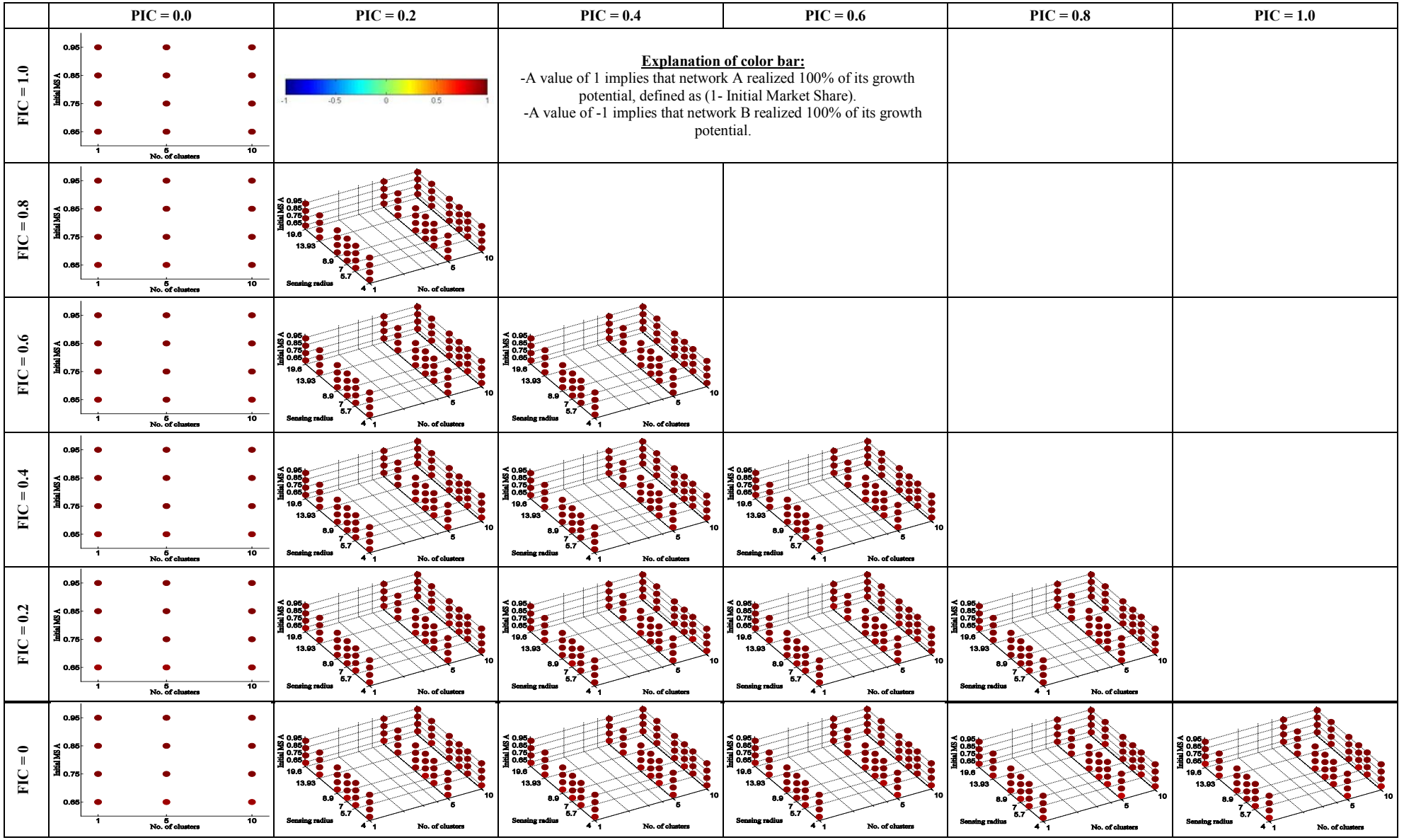


Figure 6-16: Graphical visualization of simulation results of model with calling clubs (friends = 10, weight = 95%)

Appendix D: Graphical Visualization of the Simulation Results of the Model with Active Price Setting

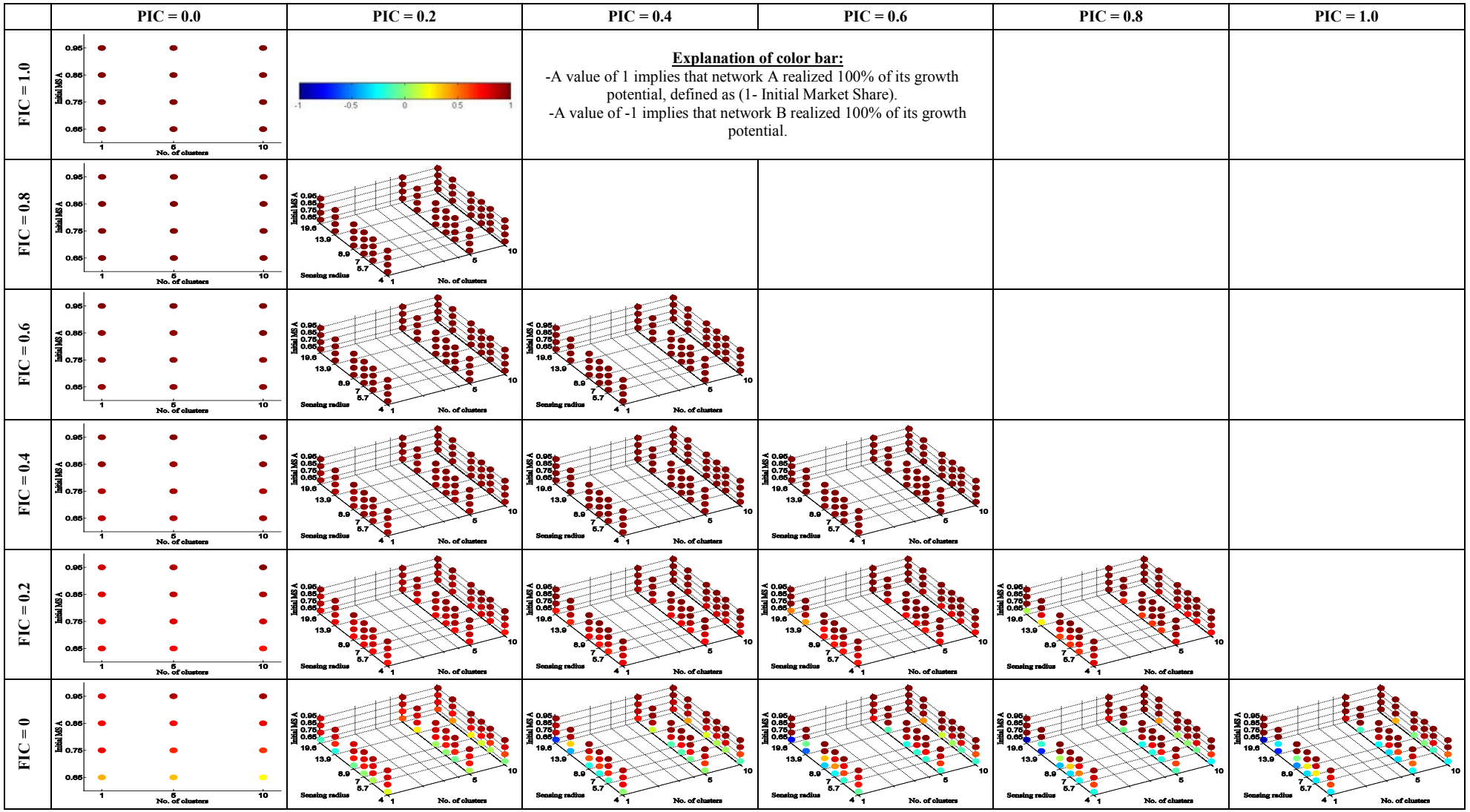


Figure 6-17: Graphical visualization of simulation results of model with active price setting by networks (friends = 0)

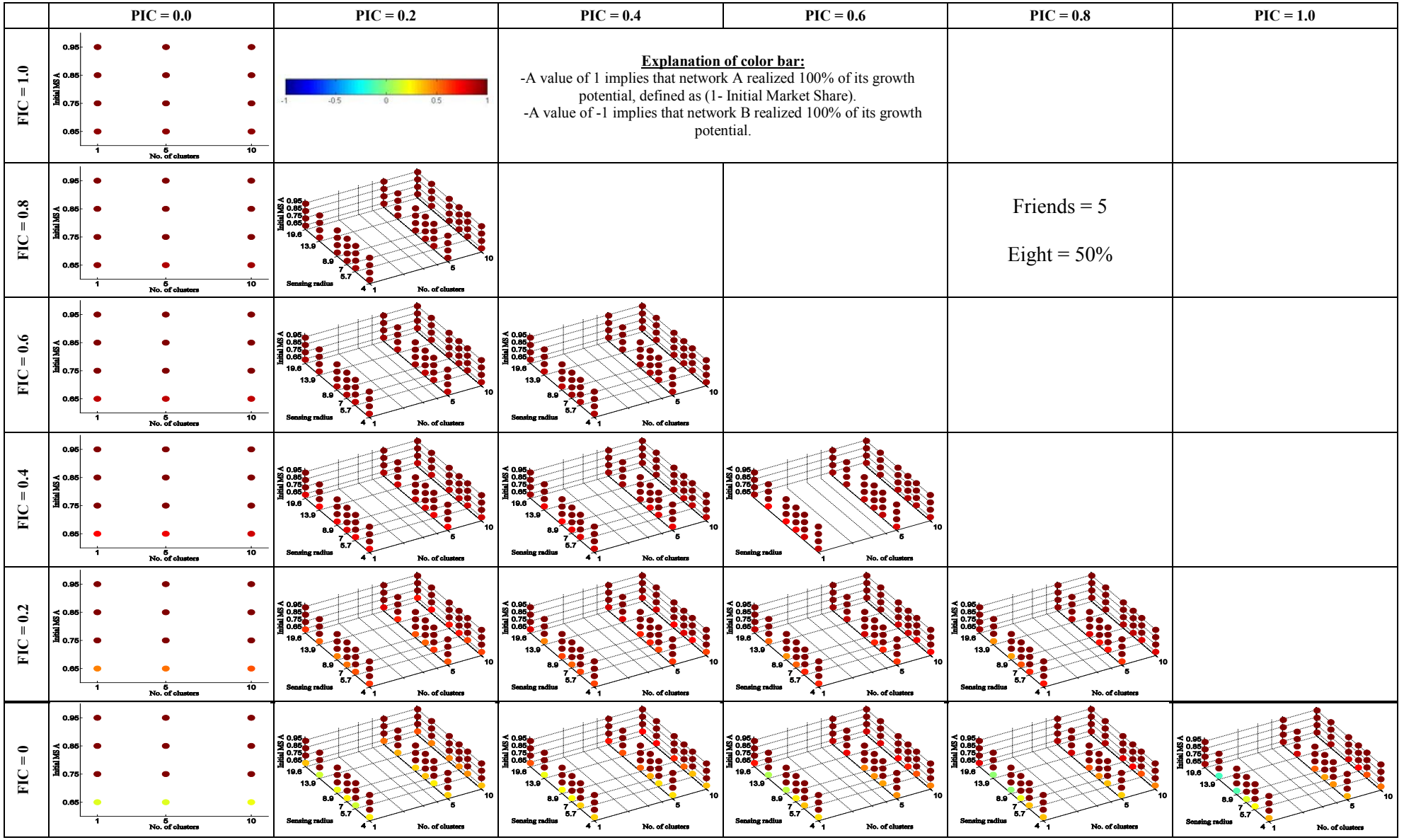


Figure 6-18: Graphical visualization of simulation results of model with active price setting by networks (friends = 5, weight = 50%)

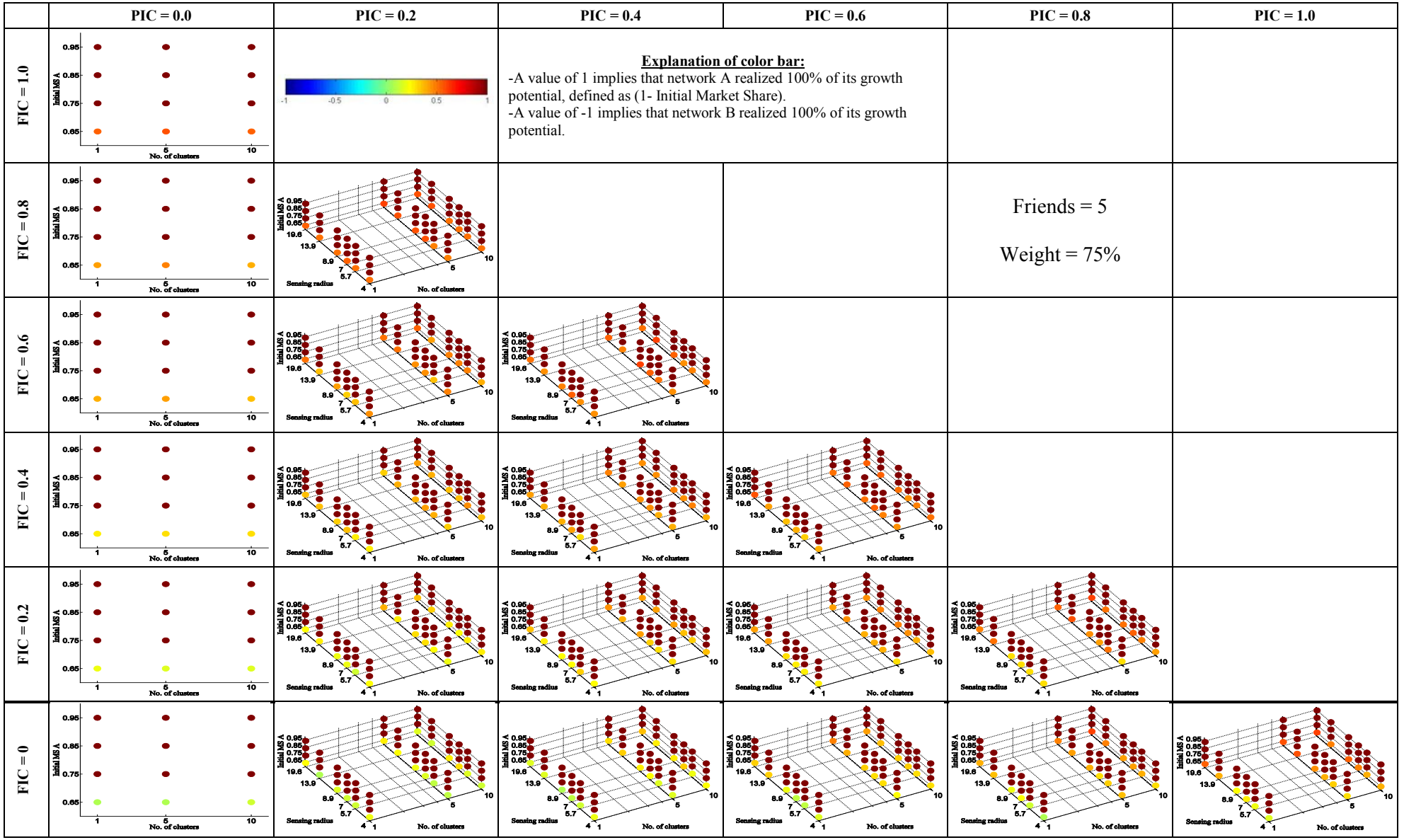


Figure 6-19: Graphical visualization of simulation results of model with active price setting by networks (friends = 5, weight = 75%)

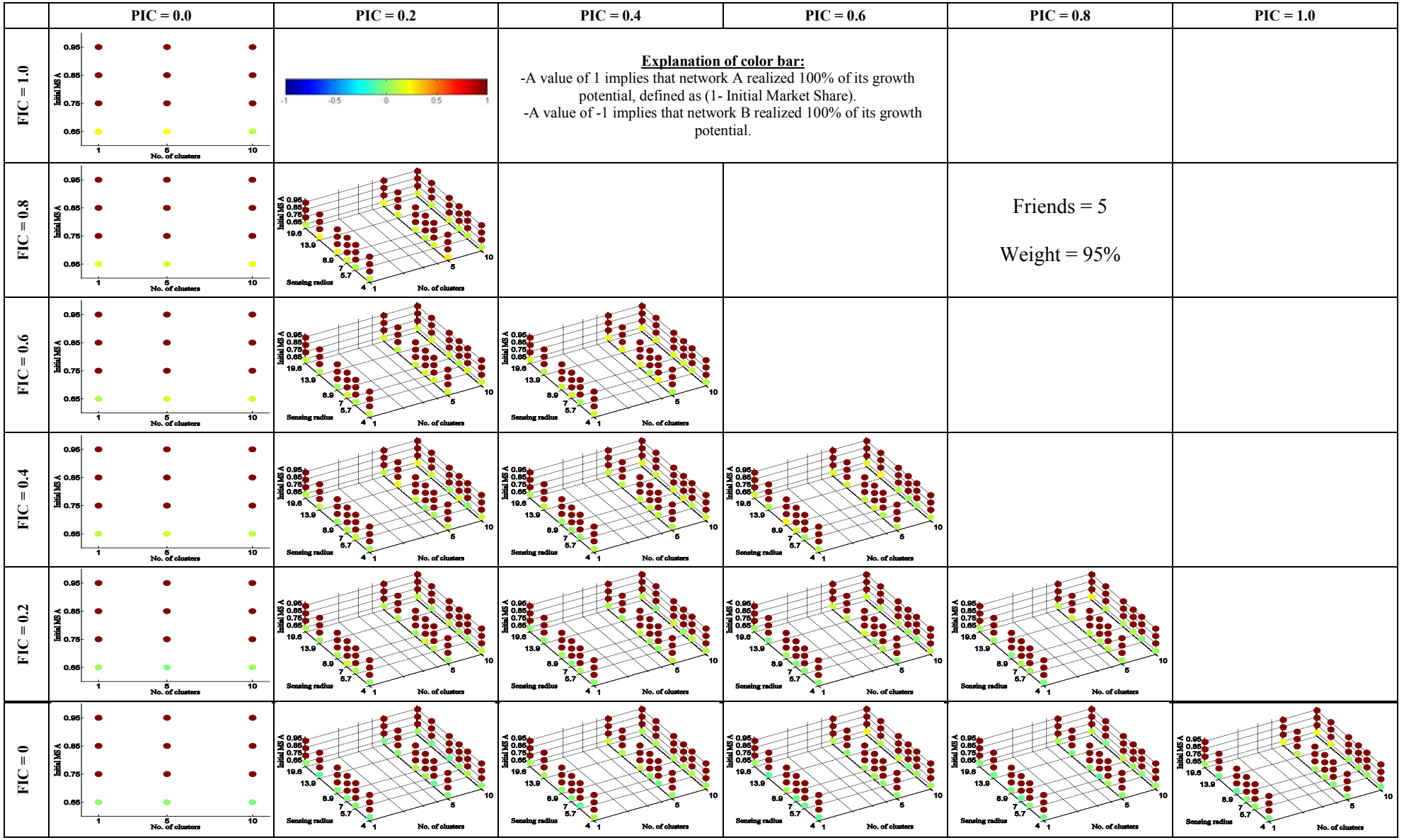


Figure 6-20: Graphical visualization of simulation results of model with active price setting by networks (friends = 5, weight = 95%)

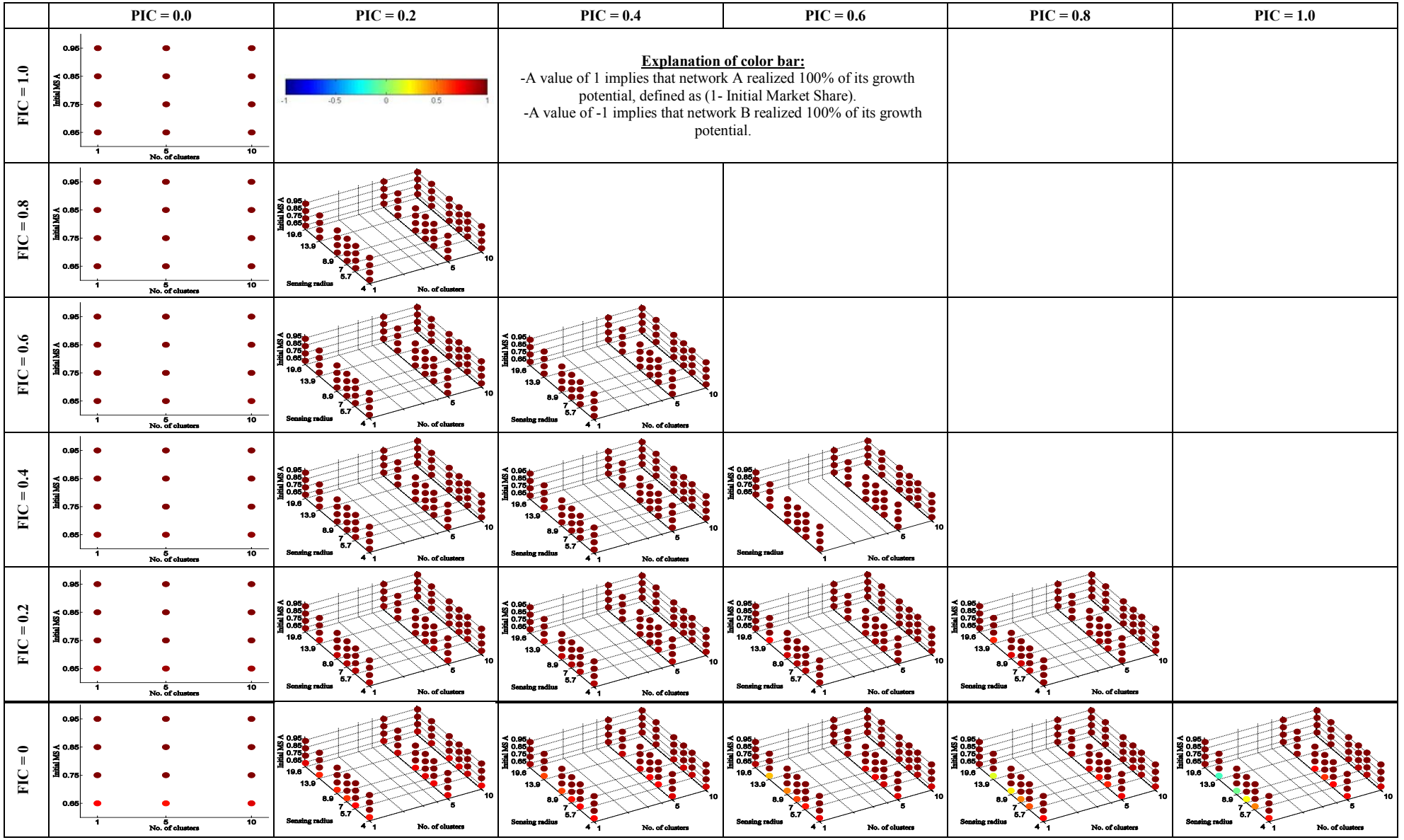


Figure 6-21: Graphical visualization of simulation results of model with active price setting by networks (friends = 10. Weight = 50%)

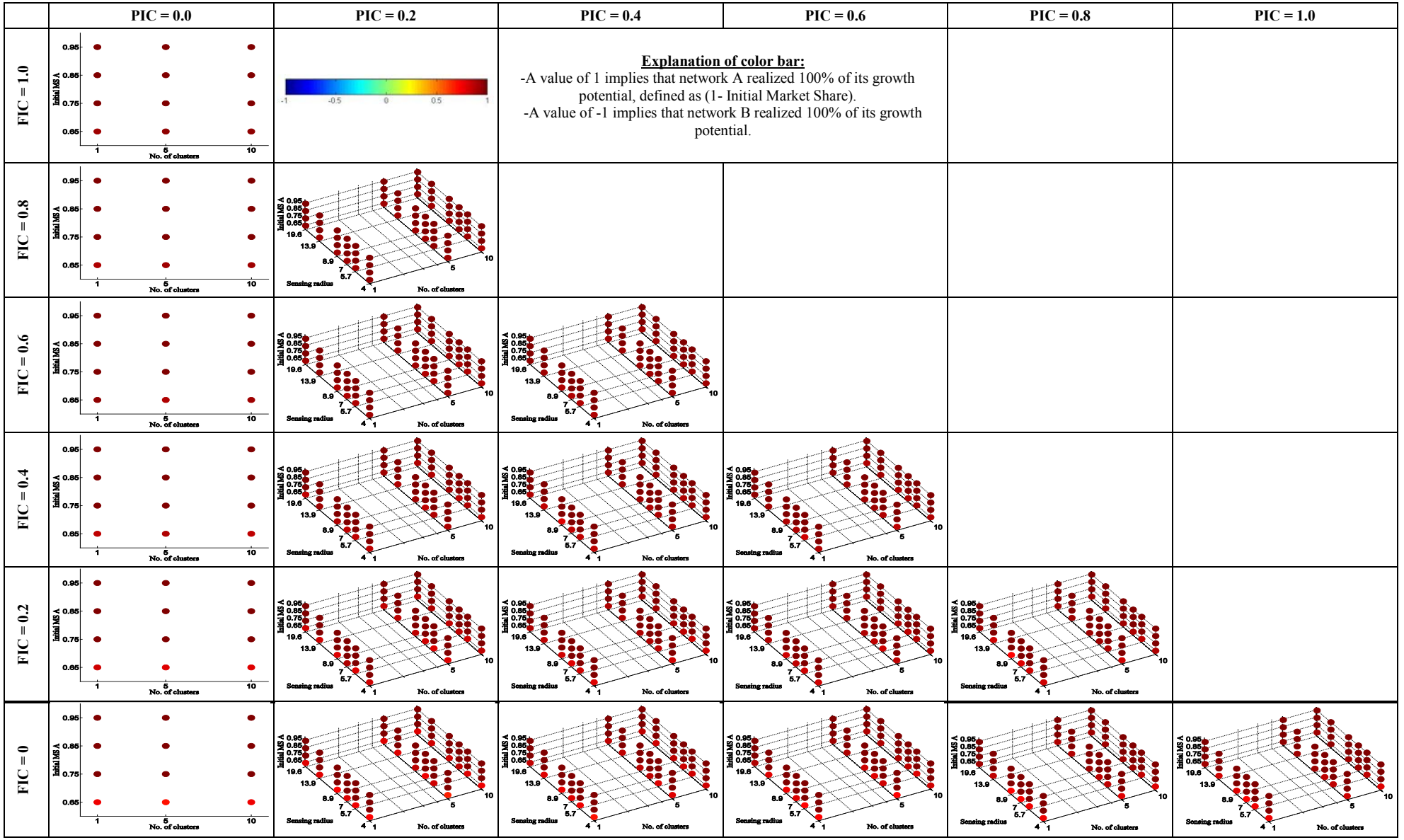


Figure 6-22: Graphical visualization of simulation results of model with active price setting by networks (friends = 10, weight = 75%)

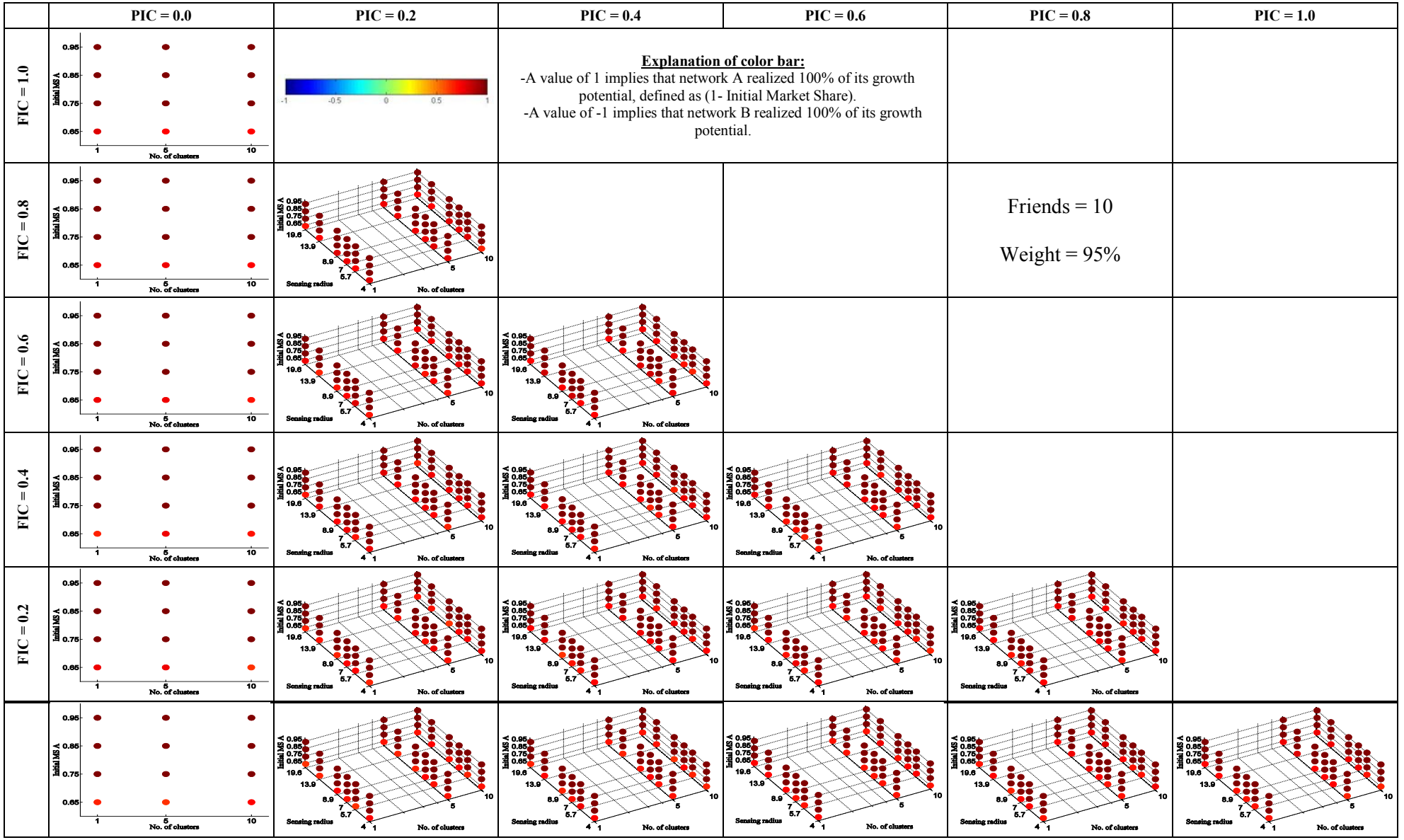


Figure 6-23: Graphical visualization of simulation results of model with active price setting by networks (friends = 10, weight = 95%)

Declaration of Contribution

Hereby I, Johannes Muck, declare that I am the single author of the chapter „Tariff-mediated network effects with incompletely informed consumers.“ All contributions are my own.

Eidesstattliche Erklärung

Ich versichere an Eides statt, dass die vorliegende Dissertation von mir selbstständig und ohne unzulässige fremde Hilfe unter Beachtung der *Grundsätze zur Sicherung guter wissenschaftlicher Praxis an der Heinreich-Heine-Universität Düsseldorf* erstellt worden ist.

Diese Dissertation hat in gleicher oder ähnlicher Form noch keiner anderen Fakultät oder Prüfungsbehörde vorgelegen.

Düsseldorf, 7. Dezember 2015

_____

Johannes Muck