Exit Versus Voice: Competition and Dissatisfied Patients' Responses to General Practitioners

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Master Thesis as part of the Master of Philosophy Degree in Health Economics
University of Oslo
The Faculty of Medicine, Department of Health Management and Health Economics
November 30, 2016

2016

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Trykk: Reprosentralen, Universitetet i Oslo

Abstract

Background: Hirschman's (1970; 1980) analytical conceptualization of the influence of competition on exit vs. voicing, the point of departure for this study, suggests that the presence of competitive providers' fosters patients' decisions to switch GPs (exit). In Norway, the list patient system introduced in 2001 gives patients the option of changing GPs up to twice within a year. Although patient exiting can signal dissatisfaction with a particular GP, this signal is less informative about which aspect of the service is the issue. A private web-based rating site, Legelisten, was launched in Norway in May of 2012 to give patients a platform for voicing their opinions about the health care they receive, thereby also providing feedback that doctors can use to improve their services. Higher exit opportunities in a competitive market can reduce a patient's motivation to voice about his or her provider; however, online voicing creates available knowledge about GPs and becomes a public good of high interest, especially in large-market settings, leading to higher participation in voicing in these markets than in smaller ones.

Objective: The study aims to test the influence of GP market competition on dissatisfied patients' choice to exit (switch physician) or to voice (participate in online rating).

Method: A panel data set covering the entire population of Norwegian GPs was utilized for every half year from January 2010 to January 2015 for patient exiting and from January 2012 to January 2015 for patient voicing. The analysis was primarily quantitative, involving descriptive statistics and appropriate panel regression methods for both GP and market-level analyses (multilevel mixed-effect linear regression for the GP-level exit, multilevel mixed-effects logistic regression for the GP-level voice, linear regression for the market-level exit, and the Tobit regression for market-level voice).

Findings: Higher GP market competition both with and without adjusting for municipality size increased the proportion of patients switching (exit). However, for voice, higher GP market competition not adjusted for municipality size led to more participation for both dissatisfied and overall voice, while adjusted for municipality size led to less participation. This opposite effect, reflects the municipality size effect and the associated difference in the public good motive for contributing to the online voice. This result is consistent in both the GP-level and market-level analyses, strongly supporting the hypothesis adopted by this study.

Acknowledgment

First and foremost, I would like to thank the Almighty God for always being with me and enabling me to achieve this.

Then, I would like to express my sincere gratitude to my supervisor Associate Professor Geri Godager for his constructive guidance and for always being available to discuss ideas and answer my questions.

My sincere thanks also go to my immediate family, particularly to my mother Abebech Tiramo, all of whom have been supported me during the years of my studies.

I would also like to thank the Department of Health Management and Health Economics/University of Oslo, for offering me the opportunity to pursue the Master's program.

Last but not least, I am indebted to scholars whose works were cited in my document. The thesis has benefited greatly from the works of these thoughtful researchers.

Tigist Woldetsadik Sommeno

Oslo, November 30

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Abbreviations

GPs	General Practitioners
AMA	American Medical Association
US	United States
MCOs	Managed care organizations
HHI	Herfindahl-Hirschman Index
SSB	Statistisk sentralbyrå (Statistics Norway)
VIF	Variance Inflation Factor
CI	Confidence Intervals
SE	Standard Error
OV	Omitted variable
HAC	Heteroscedasticity and autocorrelation consistent
MLE	Maximum Likelihood Estimation
OLS	Ordinary Least Square
NOK	Norwegian Kroner
NAV	Norwegian Labor and Welfare Administration
SSB	Statistics Norway
NSD	Norwegian Social Science Data Service
NO	Number Of

1 Introduction

The Norwegian Regular General Practitioner scheme, introduced in 2001, gives the country's residents the right to be listed with a general practitioner (GP), as well as the option of switching GPs up to twice within a year. The Norwegian Labor and Welfare Administration, after receiving both the patients' choice of preferred physician and the physicians' preferences for maximum number of patients, undertakes to allocate GPs to patients (Sivertsen, 2014).

In May 2012, Legelisten.no was launched to help people identify physicians suiting their needs and expectation. In addition, the first initiative of its kind in Norway, it provided a space for the public to express their views about the healthcare service they received. Even though web-based physician ratings are practiced in America and Britain, online physician ratings are still considered controversial, with the American Medical Association (AMA) opposing such websites and arguing that the feedback on them are anonymous and most reviews are negative (Lagu et al., 2010). On the other hand, the proponents of these sites believe that they provide essential feedback for doctors, comments that can improve the standard of care, especially for those doctors prepared to transform their delivery of care based on the experiences of the patients they serve. As doctors are known to be poor judges of their patients' satisfaction and experience, web-based ratings provide a platform for patients to voice their opinions, one that offers the advantages of immediacy and interactivity (Bacon, 2009).

In addition to voicing their dissatisfaction through an online rating system, patients can also respond to unsatisfactory treatment by switching to another general practitioner. However, this exit option is not as informative in that it does not provide any reasons for the dissatisfaction (Hirschman, 1970). According to Hirschman (1970), exit is a viable solution for dissatisfied customers when there are a number of other choices available. Thus, in a competitive market system with multiple alternatives, customers exit proactively, creating a viable alternative for themselves (Ippolito et al., 2013). While Hirschman (1970) sees exit as a clear-cut, either-or decision that depends on alternative providers, he believes that voicing opinions is an art that evolves as the methods for doing so become less costly and more effective.

For Hirschman (1970) voice is an attempt to affect change from within through collective or individual petitions to a provider who is in control of the problem. As the availability of competitive provider's increases, the need for using one's own voice to influence a provider is reduced. However, Hirschman (1970) added that the creation of new channels for communicating customers' dissatisfaction cheaply and effectively increases the propensity for customers using their voice, balancing this option with the choice to exit. In his later research (1980), he reflected that voice, once well established in connection with public-interest issues, will become widely used by individuals even in places where there are opportunities to exit.

In the 70's, when Hirschman developed this concept, there was no internet and the online consumer voicing system was not common. The advent of web-based communication of disappointment supported the belief in the creation of knowledge as a public good freely available to everyone (Garnefeld, Iseke and Krebs, 2012). Online rating has the characteristics of a public good, since it is characterized by non-rivalry and non-excludability. This creates a new dynamic in the market. A person posting an opinion online, communicate to the provider and to the community at the same time. In larger municipalities, with both more GPs and population, this online information is important for the community, particularly because of the high search costs associated with finding a physician. Because of the high community interest in accessing the online voice, the community contributes to it, maintaining it through mutual support and generalized future reciprocity (Wasco & Faraj, 2000). The online voice channel also increases the collective influence of the patients by improving the availability of information about GPs which otherwise was difficult to obtain because of the large number of providers in the large market. Therefore, the frequency of voice is increased because according to Hirschman, (1970), people will use it more if they are sufficiently convinced that it will be effective. Moreover, voicing to and about providers will also generate public interest beyond individual concern because it involves a large number of community members who will benefit from it.

In small municipalities with fewer providers, voicing can be seen as an option available to the patients who are discontented with their provider. However, apart from individual interest, the voice does not involve much public interest because relatively small number of community members will share any improvement that results. The motive for informing other patients will also be relatively lower because they already have relatively more information about the available providers than those in a large municipality.

To examine this area further, this study aims to test the hypothesis that market conditions influence patients' use of exit and voice. This thesis is divided into six parts, with the first section, the introduction, providing the background for and the goals of the study, the research questions, the analytical concept, the hypotheses and the study setting. The second section reviews literatures as a background for the study, while the third section presents the data and methods. The fourth section reports the descriptive statistics and regression results, followed by the discussion of the findings, the study's limitations, and the future researched needed in the fifth. The sixth section includes the conclusions and recommendation /policy implications/ resulting from this study.

1.1 Background

There is no general consensus on the importance of competition in the health care providers market. Porter and Teisberg (2006) noted that provider competition leads to innovation, improved quality and efficiency whereas opponents argue that it results in supplier-induced demand and health inequality.

The appropriateness of competition in healthcare markets is frequently debated and is often questioned, thus requiring empirical studies to thoroughly understand its implication (Brown, 2016). In one such study, Iversen, & Ma (2009) examined how radiology referrals of GPs responded to market competition using a cross-sectional survey of Norwegian citizens merged with the data at the municipality and specialist level. Their model was in the context of the Norwegian health care system, where GPs receive payment through the capitation system of patient lists as well as fees for service reimbursements. Their empirical result demonstrated that GP's operating in a more competitive market has a higher referral rate.

The influence of GP market competition on the proportion of patients switching physician (exit) and expression of their discontent (voice) has seen limited research. Changing doctors involves costs to the patient including reduced continuity of care, the transaction costs of finding information about the new GP, uncertainty about the characteristics of the new GP and the cost of properly transferring their medical history (Iversen & Lurås 2011). Patient switching does not offer as much information as voice in terms of enabling a GP to improve his practice because according to Hirschman (1970) the true voices of patients, which are not

based on self-interested behavior, can be helpful in addressing the deficiency of the service. Patients switching can signal dissatisfaction, but this signal is less informative concerning which aspect of the service is causing the issue. Since GP competition offers patients more alternatives, dissatisfied patients are more likely to switch in a competitive market. On the other hand, although a high number of alternatives can weaken voice, online voicing creates a new dynamic particularly in a large market. The voice through online rating is communicated in a non-excludable and non-rival way to both the provider and the community in general. Larger municipalities have more competitive GP market with both more patients and more GPs. Smaller municipalities on the other hand, contain fewer residents and usually have very few GPs or a monopoly, who are already known by the residents. Therefore, in a large market with many providers, there are a large number of community members who are interested in the online voice, for retrieving better information about GPs from it. Voice can also increase community influence in such a market, by improving accessibility of information. Moreover, as in Hirschman (1980), view of the cost of voice turns to benefit, when voice is linked to larger public interest, voice get an occasional edge over exit. In line with this, voice and any improved practice as a result of voice, will also see high community interest in a health sector and even more in a larger market because it is linked to large number of community members' concern. With this we propose that the concepts introduced by Hirschman (1970; 1980) is a useful point of departure for analyzing resident participation in Online GP rating and GP switching.

Ippolito et al (2013) adopted the methodological scheme developed by Hirschman, using exit, voice and loyalty; to evaluate the effects of possible dissatisfaction of Italian public health service customers on public health organizations. Schlesinger, Mitchell & Elbel (2002) conducted a comprehensive assessment to better understand the factors that discourage consumers from voicing to problems with the health plans. They used a national representative survey of U.S working-age consumers, conducted at the end of 1999. Among other factors they listed the possibility of exit, as one of the settings that might alter the propensity of voice. They connoted that the opportunity of exit may restrain voice, as in Hirschman's (1970) initial conception, or the possibility of alternative options may actually increase the willingness to give voice similar to Hirschman's (1980) approach in which he acknowledged that there could be more dynamic and complex relationship between voice and exit opportunities.

Iversen & Lurås (2011), found that patient switching could be explained by patient shortage in a GP list. They used a panel data set that covered the entire population of Norwegian general practitioners (GPs) and studied whether the occurrence of patient shortages in the GP list increased patient switching. They derived a theoretical model in which inferior physician quality as perceived by patients implied patient shortage for the physician and more patients switching physician. Their empirical result supported their theoretical model that GPs with patient shortage experienced more patients switching than GPs with full list.

This paper follows, for assessing to what extent competition influences dissatisfied patients in expressing their discontent with exit or voice channel. Its analysis will apply the Hirschman (1970;1980) approach in the context of the Norwegian GP market.

1.2 Analytical approach

The study will utilize Hirschman's (1970) analytical approach. His concept of exit versus voice can easily be understood by looking at one of the primary examples from his book that focused on a firm that produces a particular product.[1]

The example from Hirschman (1970) summarized as below:

When the quality of the firm product deteriorates the consumer either: exit (quit purchasing the firm's product and be a customer of another competing firm) or voice (make an effort to see improvement in the firms' product by complaining directly to the responsible management). The presence of available alternative in the market that is the extent of market competition influences, the decision of the customer in choosing between the two options. In a competitive market, the availability of large number of alternative firms makes the option of switching to competing firms practicable by the customer. On the other hand, in a less competitive market, attempting the firm correct, the quality deterioration seems the most permissible alternative and hence the customer more likely chooses voice.

Depending on market competition, the exit or voice channel, therefore, enables customers to express their dissatisfaction. However, in subsequent research Hirschman (1980) expanded his concept to include the idea that a consumer's use of voice not only serves his private

[1] Here our focus is his explanation on the influence of market completion on exit vs voice. So in our illustration here and in all the other parts of the thesis, we focused on the two options and do not taken into account the loyalty option.

interest but also that of the general public interest as well. Thus, voice can become a decisive factor in relation to those goods, and services having a significant impact on public welfare.

> According to his view in Hirschman (1980):
>
> The deterioration quality of the firm's product in the above example will give rise to exit particularly in competitive market settings, however, the presence health hazard in case of food product, and safety concern in case of automobiles products lead to voice.

Voice is also presented as an art that depends on the influence one can have on the firm responsible for the product. With the opportunity to create a collective action through the voice of a buyer, or with a buyer wielding more power and a great deal of influence, the customers' voices have a greater impact on the firm than exit in this case (Hirschman, 1970).

Technological advancements have introduced online rating as a new channel through which customers may voice their opinions. In the 1970s there was no internet, and Hirschman did not incorporate the dynamic that this new opportunity introduces, thereby concluding that voice was only occasionally more effective than exit. Through online voicing, customers transmit information about the product not only to the provider but also to the community as a public good, thus creating knowledge as a public good that is shared and spread freely throughout the community without losing its value or being consumed (used up) in the process of its transfer (Wasco & Faraj, 2000). This, in turn, enables customers to exercise greater collective power, exerting more influence on the provider because of the ease of information transfer this channel affords (Baker & Green, 2005).

Hence, the influence of market on voicing can be twofold. Although exit opportunities weaken voicing to the provider in a large market setting, online voicing creates knowledge of high interest to the public even in a large market, in part because a market with many firms, the consumer search cost is high. As Janssen & Luis (2004) found, when the consumer search is intense, a larger number of firms in the market result in more search by consumers. This is similarly true in the GP market. When the number of GP increases, consumers begin with less information and their search is less efficient as they have to spend more time and energy obtaining information about these health care providers in their area (Pauly & Satterthwaite, 1981). In addition, in a large market, the online voice has a large audience who seeks information about the providers. When there is high community interest in the voice, it, as a

public good, supersedes any one individual as it is maintained and exchanged within the community through mutual support behavior and generalized reciprocity (Wasco & Faraj, 2000). Generated reciprocity means that the person who provides the voice does not expect to have the same help in the future from the same individual who has read and benefited from his online voice but from someone else in the community. Therefore, as a result of community interest in the online voice, members of the community access the knowledge provided and collectively contribute to its provision as a moral duty in a desire to contribute to the public good (Wasco & Faraj, 2000). The benefits of voicing are also shared with a large number of community members in a big market, meaning the voice contributes more to the public interest or happiness than in a smaller market. According to Hirschman (1980), when there is high public interest associated with voicing, the voice become a desired end in and of itself.

On the other hand, in small municipalities with fewer GP options, online voicing can be seen as a means of informing the provider about his limitations particularly when the available GP options are very limited. However, in a small community with a smaller number of physicians, the detailed reputation of a physician is well-known (Pauly & Satterthwaite, 1981). Hence, online ratings are relatively less important in small communities for informing the community about the provider. Therefore, in such circumstances, society will be less motivated by the mutual obligation for maintaining and contributing to the community voice, resulting in lower propensity to use voicing.

1.3 Research Objective

The main objective of the study is to investigate the influence of GP market competition on dissatisfied patient choice of exit (switching physician) vs. voice (participating in online rating)

1.3.1 Research question

The following research questions are to be answered:

- Does competition influence the number of patients who decide to change physicians? In which direction?
- Does competition influence the number of people deciding to participate in online rating? In which direction?

1.3.2 Hypothesis

Based on the conceptual frame work presented earlier, we test the following hypothesis:

According to Hirschman (1970), exit is a clear-cut, either-or decision that depends on the number of alternatives present.

Hypothesis 1: - When the GP market is competitive, a larger proportion of patients switch from a given GP list and/or change GPs in a market. ("exit").

The high outside opportunity in the competitive market weakens voice. However, according to Hirschman (1970) voice is an art that depends on its cost-effectiveness, not only the exit opportunities. Unlike in the 1970's, today's online system enables voice to be transmitted both to the provider and to the community. Hence, voice is more cost-effective in a large market than a small one because it informs a larger number of community members, who face a higher information asymmetry because of the larger number of providers. It also increases the collective influence of the larger number of community members by making them better informed about the providers than they would otherwise be. Hirschman's (1980) analysis suggests that when there is high public interest and public happiness associated with voicing, voice becomes a highly desired end in itself. The benefit of voicing will be experienced by a larger number of community members in bigger municipalities than in small ones with fewer people, thereby increasing the resort of voice. Hence, we have two kinds of prediction for voice: -

Hypothesis 2a): In large municipalities, where the GP market is more competitive, it is highly likely that patients rate their GP and/or large proportion of patients rates their GPs in the market. ("Voice").

Hypothesis 2.b): - After adjusting for the municipality size, when the GP market is competitive, it is less likely that patients rate their GP and / or smaller proportion of patients rate their GPs in the market ("Voice").

1.4 Study setting

This study took place in Norway, which has a three-level governmental structure, consisting of the state at the top level, the 18 counties at the next level and the 430 municipalities at the bottom level. Similarly, the National Health Service system is decentralized at the national, regional and local levels, providing health care to the population financed by general taxation. The regular general practitioner scheme, which is part of the National Health Service, falls

under the responsibility of the municipalities. This scheme was introduced in 2001, with the aim of improving the quality of health service by making it accessible to everyone who wanted a GP. Under this scheme, a GP decides the maximum size of his patient list, while the citizens can choose a maximum of three preferred GPs. Subsequently, the National Health Insurance assigns inhabitants to their choices, if the GPs have an available spot. A GP can also have an open list when he has fewer patients than his maximum.

The regular GP scheme is voluntary. If a citizen does not wish to join, he can find a GP by himself; however, he will usually be charged a higher fee. For this reason, there is close to 100% participation in the scheme, among both GPs and patients (Iversen & Lurås2011). Of the GPs, 90% are private practitioners contracted with municipalities, while the remaining are directly employed by municipalities at a fixed salary (Iversen & Ma, 2011). Contracted GPs can practise as members of a group practice or on their own. They have three sources of income; capitation payment by municipality for each patient listed to him without risk adjustment; fee-for-service payment from the National Health Insurance; and patient co-payments. Each of the three sources comprises of one third of the GPs' income (Iversen & Ma, 2011). For each visit to a GP, the patient co-payment is approximately 5.5 Norwegian Kroner or US $1.00. If within a year, a patient's total co-payment for health care exceeds US $340, the National Health Insurance pays the excess (Iversen & Ma, 2011) A GP can have a specialization, the most ones being general medicine and community medicine. His practice characteristics also vary, with some having a handicap accessible practice and some not.

In 2012, Legelisten.no, a private web-based rating site, was launched to provide patients with a platform for giving their opinion on their health care treatment and at the same time enabling them to identify physicians who suit their needs. This web-based site includes general practitioners, dentists, specialists and chiropractors rating, allowing citizens to rate them using a numerical scale from 1 to 5 stars and by providing additional narrative description. Users rate their GPs anonymously and voluntarily without any explicit incentive from the administrator or some other external body to motivate their participation. On this system, reviewers can numerically rate their GPs on one mandatory overall satisfaction score as well as on such optional dimensions as availability, waiting time, consultation, listening skills, among others. The goal of this site is to help patients increasingly voice their opinions of their treatment.

2 – Literature review

2.1 GP market and competition

General practitioners provide health services which, according to Pauly and Satterthwaite (1981), are reputation-based goods or services. As they define them, these are products or services for which the sellers are differentiated, with consumers searching and subsequently choosing one based primarily on recommendations from relatives, friends, and associates (Pauly & Satterthwaite, 1981). The services provided by general practitioners are differentiated by place, style and technical competence (Pauly & Satterthwaite, 1981) and those searching for a physician do so directly by asking for recommendations through their social network (Booth and Babchuk , 1972).

The structure of the GP market can vary depending on the number of competitors (Brown 2016), with some operating as a monopoly with only one provider or as an oligopoly with only a few providers, meaning there is much less competition. On the other hand, other markets have monopolistic competition with many inhabitants and providers, meaning there is much more competition. When there are many physicians and inhabitants, the GP market more closely resembles a monopolistic competition than a perfect one because there is heterogeneity among GPs and the patients have information asymmetry about the providers (Sloan & Hsieh, 2012).

The geographic location of physicians in most countries indicates that often many physicians decide to locate in large cities and only a few in rural areas (Sloan & Hsieh, 2012). This distribution and the long-standing shortage of doctors in rural areas is supported by studies conducted in several developed countries (Scott et al., 2013; Li et al., 2014; Mcisaac, Scott & Kalb, 2015), with Shannon and Cutchin (1994) finding that this geographic distribution is universal and intransigent. The Norwegian general practitioner's data set for this study shows a similar trend: a large number of GPs serving in larger municipalities, creating more competition and a small number in small municipalities, including situations with only one GP monopolizing the market on some of the remote islands.

In small communities with few GPs, their reputations can easily be known in detail and remembered throughout the community (Pauly & Satterthwaite, 1981), making the residents'

search cost low whereas in a large community with several GPs, it is not easy to find a source who knows about a given physician. Moreover, individuals cannot easily associate and remember what information about a reputation matches whom (Pauly & Satterthwaite, 1981). Sloan and Hsieh (2012) use this higher search cost as one of the justifications for higher physician fees in a market with a larger number of physicians.

In most countries, including in the regular general practitioner scheme of Norway, market forces do not set GP fees; rather GPs contract with administrative bodies to receive payment from insurance companies. The most common GPs reimbursement mechanisms include fee for service (payment based for every item of service or unit of care that they provide), capitation (ex ante fixed payment based on the number of patients on the GP's list) and salary (ex ante fixed lump sum payment for fixed set number of working hours per week) (Gosden et al, 2000). As explained previously, in Norway most GPs contract with municipalities to receive payment from the national insurance scheme based a mixture of fee for service, capitation and a small patient co-payment with an upper ceiling. Besides, still some GPs choose to be employed by municipalities on the basis of salary payments. Patients pay the same, regardless of the provider they use for their healthcare. Hence, the economic model of competition as explained in Gaynor (2006) resembles the GP market, with physicians competing by selecting the number of patients and the types of services provided per person or per total.

The degree of competition among GPs commonly measured in the literatures based on the number of GPs within a particular geographic area, the number of GPs per population and the Herfindahl–Hirschman index (HHI). Baker (2001) represents an example. However, these measures do not take into account the fact that in the Norwegian regular GP scheme, patients can change GPs only if they find one with an open list (Godager, Iversen & Ma, 2015). Hence, in this study we follow Iversen and Lurås (2011), Iversen and Ma (2011), and Godager, Iversen and Ma (2015) by using the number of open practices in a municipality both with and without a population adjustment (#Open and #Open/Capita) as well as the Herfindahl Hirschman index(HHI). Municipality is used as a market and as a boundary for the competition measures since most inhabitants in Norway are listed with GPs within their home municipalities. Since both #Open and #Open/Capita measures indicate the choices available for the patients who consider changing physicians (Godager et al., 2015), higher #Open and #Open/Capita mean more competition. According to Iversen and Lurås (2011), other things

being equal, larger municipalities are likely to have larger values of #Open. Therefore, #Open/Capita can also adjust for the effect of municipality size. The HHI is a standard competition measure of market concentration. Other factors being equal the concentration of providers in the market is an important element of its structure in determining competition (Rhoades, 1993). For a given market, it is expressed as the sum of the squared market shares of individual GPs. For each GP, the output is the number of patient in his list (Chen and Godager, 2011). Markets served by a larger number of GP practices, each with a small market share, will have a low HHI, indicating more competition. On the other hand, when a market is served by a few providers or when the market share of one GP practice increases relative to the others, then the HHI increases, indicating less competition.

2.2 Patient exit and voice choice

For Hirschman (1970), the availability of competitive providers promotes the decision of a customer to exit a firm responsible for a defective product. He analyzed this situation based on deterioration in quality with the prices of the products and the costs of the firms being similar and constant. We can expect the same situation in the general practitioners' market: since the prices of the GPs are fixed and similar, product deterioration can lead to a patient changing physicians when he has more outside options. As Hirschman (1970) explained, the quality elasticity of demand can be higher in a market with more providers.[2] Hence, a small amount of discontentment in GP service can lead to more exits of customers from a given provider. This is similar to the phenomena in product market illustrated in Hirschman (1970, p.27) "… the presence of a number of competing firms fosters in this case the perpetual illusion that "the grass is always greener on the other side of the fence," that is, that an escape from defectiveness is possible through purchase of the competitor's product." This reaction by customers, however, does little to inform the provider about the problematic issue, making a possible recuperation difficult particularly when exiting occurs quickly and is the response of many; in contrast, the voice mechanism offers a feedback mechanism (Hirschman, 1970). Although Hirschman (1970) frequently associates exit with a lower cost and voice with a higher one, changing GPs (exit) has a cost associated with it. Thus, being discontented with a physician's service may not always lead to a patient exiting. Klemperer (1995) explains that consumers with many options experience a cost when changing to a competitive provider

[2] Please refer to appendix 2, figure 2.2.1 concerning the demand curve as a function quality and competition and elasticity of demand.

even if the two products or services are identical. As put, in section 1.1, Iversen and Lurås (2011), discussed these exit costs in the context of the GP market.

Hirschman (1970) explains that the voice option is enacted either through individual complaints or through collective petitions. In accordance with his view, voicing increases when the opportunity for exit reduces: up to the point where the outside option is not available, the choice of voice will be a dominant means of expressing discontentment to the provider (in this case to the GP). A reduction in the number of providers gives patients "no real choice" and, thus, voice is the dominant strategy (Hirschman, 1970). However, if a patient is sufficiently convinced that a GP has taken corrective actions based on his voice, he may prioritize voice even in situations where exit is a possibility (Hirschman, 1970). Thus, voice becomes a substitute and complement for exit (Hirschman, 1970). Even with the availability of a substitute, a customer may resort to voice if he sees the potential for improvement and the possibility of exerting influence on the provider (Hirschman, 1970). Hirschman (1970) sometimes saw exit as a last resort for voice in that once it is used, the consumer has lost the ability to complain. However, in an online voicing system, patients can rate both their current and previous GPs, making both phenomena complementary in such occasions and hence exit not necessarily last resort for voice.

Voicing, in general, is a more direct and informative way of alerting the provider about the possible discontentment than exiting (Hirschman, 1986). However, it is seen as costly by Hirschman (1970), particularly if there is a possibility of retaliation. The anonymity of online voicing eliminates this fear, encouraging those who otherwise may be reluctant to voice. Online voicing is also less costly than other traditional means of complaining that are used, for example protesting or directly telling the provider about the issues (Hirschman, 1970). Since some managers may not like to be told their shortcomings directly, direct voice may expose the customer to possible reprisals (Hirschman,1986). In addition, an online voice creates voice as a public good as it is freely available in a non-excludable and non-rival way not only to the provider but also to the community in general. This creates a new dynamic in the market that will be discussed in detail in the section later.

The analytical concepts of exit and voice have been widely applied in various disciplines even though there is relatively limited research in the economic domain. In political science, Hirschman (1993) applied them to his investigation of the decision of citizens to leave a state or to complain. In marketing, Fornell and Bookstein (1982) used structural equation models to

test individual reactions to discrepancies in product quality either by changing brands or making a verbal protest, hypothesizing that exit should dominate in highly competitive markets whereas monopolistic markets should foster voice. Based on survey evidence, they found a positive relationship between competition and exit but a weak relationship between competition and voice, concluding that a multitude of factors contribute to consumer complaint behavior (voice). The potential for exit, in contrast, is reduced when the opportunities for changing brands and products are restricted. Rodwin (1999) explored the relationship between exit and voice in American healthcare and its prospect for the future, finding that after the 1960s, the new opportunities for voicing such as in women's health and the disability rights movements brought increased use of voice by patients. In addition, managed care organizations (MCOs) were operating in a way that did not allow patients to have a meaningful exit option. As a result, he was expecting to see the voice of patients influencing these MCOs; however, his findings did not support that expectation. His analysis showed how the channel of voicing and the responsiveness of the managements/providers to the consumer voice also influence whether consumers resort to voice. Rodwin (1999) concluded that the MCOs where not responsive to the consumer voice and the satisfaction survey that was used as a channel for voicing was not developed in a way that led to consumer participation.

2.3 General practitioners' reviews as a public good

According to Hirschman (1970), in a competitive market when a consumer expects that he cannot exert enough influence on the provider, he exits to an available alternative. However, today unlike in the 70s, the advancement of technology allowing for patient online voicing creates a new dynamic in the market. This channel is inexpensive and has a broad scope coupled with increased anonymity (Hennig-Thurau et al., 2004). It also increases the participation of individuals who otherwise are unlikely to voice their thoughts as well as strengthening the patient's power by enabling information and advice to be communicated easily to the community in general (Baker & Green, 2005). Using the online voice channel, patients not only voice to their doctor but also to the community in general because this channel creates knowledge as a public good that is freely shared and spread throughout the community without losing its value (Wasco and Faraj, 2000). The knowledge created is non-

excludable (freely available to any reader) and non-rival (the use of the information by one individual cannot reduce the amount and quality of information available to others). When knowledge is managed as a public good, people desire to share it more from a sense of moral obligation than the desire to maximize self-interest or reciprocity (Wasco and Faraj, 2000). This situation is completely different from one in which knowledge is shared as a private good. In accordance with Wasco and Faraj (2000) distinction , when knowledge is a private good, it is shared based on self-interest, personal gain, and returns such as direct reciprocity[3]; however when knowledge is a pubic good, as in the case of online voice, the motive for contributing goes beyond the maximization of self-interest and personal gain. This explains why people contribute to electronic information as a public good even if they have a personal interest to free ride (Wasco & Faraj, 2000). Particularly, when online knowledge is a public good, it is collectively owned and exchanged by a community through pro-social concern rather than the desire to maximize self-interest (Wasco & Faraj, 2000).

According to Hirschman in Hirschman (1980), voice can be seen as a contribution to public happiness because the corrective measures enacted by the provider as a result of it can be enjoyed by everyone. Hence, voice can be considered as public interest, not only private interest. However, advocating for change through voice involves a cost of someone's time and energy for the public good that is shared to the community in general, a concept that in accordance with public good theorists, leads to free-riding (a thought that someone can voice on someone else's behalf) (Hirschman, 1980). According to Hirschman (1980), this phenomenon, however, has another side opposite of the usual public good theoreticians' concept of the free-riding problem. Hirschman (1980, p. 433) stated, "it is in the nature of *the* "public good" … that striving for it cannot be neatly separated from possessing it". Meaning that in accordance with his view, voicing to bring change for the good linked to the "public happiness", does not have a sense of cost in the sight of the person that is voicing, rather it is counted as the best alternative that is available for the change that is sought. Overall whenever the desire to achieve public interest is involved, voice will not be seen as a cost, but as a decisive contribution to the public good, and, thus, voice will then attract higher interest of participation (Hirschman, 1980).

[3] Direct reciprocity is different from generalized reciprocity as it is an expectation to receive future help from the same individual who has benefited from one voice.

Dowding et al. (2000) distinguish between individual and collective voicing, saying the former brings about the desired effect solely through that action while the latter contributes to the desired effect through that action. According to them, this classification of voicing mirrors the distinction between private and public good. Collective voice depends on the desire to contribute to the collective welfare, and, hence, it has characteristics of public good (Dowding et al., 2000). As online consumer reviews are collectively owned and exchanged by the community through pro-social concern for it (Wasco & Faraj, 2000), voicing online shares some characteristics of the collective voice as defined by Dowding et al. (2000). Patients actively voicing online contribute to the desired effect. Moreover, the anonymity of online voicing and the limited time and energy that it requires mean the cost for individual participation is minimal. Hence, participation in voicing is encouraged particularly in large municipalities where a large number of people will benefit from any improvement as a result of the voice action.

As far as online voicing is concerned, the members of the community only benefit if some improvement results because of the voice action. This unique feature of online voicing that suggests a motive for voicing to the community (horizontal voice) was not discussed by Hirschman (1970) in detail. The voice that Hirschman primarily discusses is the vertical voice used either collectively or individually in order to bring change. However, when patients use online ratings to complain about a service, it also provides information about the provider to the community in general. Voicing to the community is more important in a large municipality with a larger population and number of GPs. Because the cost associated with finding a physician is higher in these large markets, where there are many physicians to choose from. A given individual has to ask many people before finding someone who knows a specific doctor, leading to higher search costs in a large market (Sloan & Hsieh, 2012). Therefore, in a large market people have a high interest in the knowledge created through online voicing and, thus, people contribute beyond the maximization of self-interest foregoing free-riding as they are motivated by mutual obligation and generalized reciprocity (Wasco & Faraj, 2000). On the other hand, in a small market with few physicians, patient have relatively more information about the physicians in their community and, hence, their interest in the online voice is relatively low. The motivation for contributing to this voice will then also be relatively lower.

3 Data and Methodology

This chapter discusses the data, including their sources, quality, and limitations. In addition, it provides an explanation of the statistical methods and empirical models, along with their main assumptions, used to test the hypothesis.

3.1 Data and source

This study uses a comprehensive data set that contained the entire population of Norwegian general practitioners (GPs). Since there is almost 100% participation in the regular general practitioner scheme both by GPs and patients, it was not necessary to be concerned about possible self-selection in the system. We used the longitudinal data on General practitioners (GPs), for the rating of GPs from legelisten and registered profile data of the general practitioner from the general practitioners' scheme. We also combined additional data from statistics Norway (SSB) on municipality population. Legelisten was initiated in July2011, with the first half year rating report being released in January 2012. This study used its rating data for every half year from January 2012 until January 2015 and the data from the general practitioner's scheme for every half-year from January 2010 until January 2015.

3.1.1 Study design

This study will be a quantitative panel data analysis of GPs over a period of 10 half years for exit and 6 half years for voice. The market competition is measured at the municipality level, therefore crosschecking of the hypothesis with the municipality level analysis will also be done by aggregating the data for every half year and each municipality.

Most of the variables were taken directly from the data set with some adjustments to fit them to the regression model. The analysis primarily focused on the influence of GP market competition on patient switching and rating, taking into account the covariates.

3.1.2 Ensuring data quality

Since the data used, included the entire the Norwegian general practitioners, this study did not involve any sampling However, we checked for errors and logical inconsistency in the data

such as duplicates, which were subsequently removed. This process did not introduce any biases as only the number of errors decreased, not the general sample.

To ensure the quality of the data, we checked for reliability and validity, specifically of the data measuring the main dependent and independent variables and the covariant. Kirk and Miller (1986), define reliability of measurement as the degree to which it gives similar result either with a given period of repeated measurement and/or over different period of measurement. Validity is seen in terms of both internal and external. Internal validity deals with whether the variables retrieved from the dataset measure what they are intended to measure i.e., which pieces of data and, how they are used (Wainer and Braun, 1998) and according to Joppe (as cited in Golafshani, 2003) how truthfully the results address the research objective. External validity as defined in Campbell and Stanley (1963) addresses the generalizability of the results to other populations, settings and times.

For this study, the primary variables, exit and voice, were measured by the proportion of patients changing and rating their GPs, respectively. This agrees with Hirschman's two ways of responding to disappointment, exit as voting by feet/leaving and voice as complaining (Hirschman, 1970).

The general practitioners' dataset specifies the reason for the change, this classification helping to identify the approximate number of patient exiting due to discontentment. The main reasons are; switching initiated by physician because he has reduced or ended his practice and patient switching initiated by the patient because he has moved from the municipality, undergone an ordinary switch, or for other reasons. Following Iversen and Lurås (2011), this study defined the sum of patient switching due to an ordinary and some other reason as the number of patients changing due to dissatisfaction. Although the reliability and validity of this measure would have improved if the general practitioners' database had incorporated an explicit option of switching due to dissatisfaction, the approximate measure used here is in line with previous research, and, thus, we can support its validity and reliability

Legelisten made it possible to obtain the voices of patient because it enables them to rate a physician using a scale from 1 to 5. This study considered a score of 3 and below indicated discontentment with a physician. The total number of assessments for a GP can be measured by the total number of patients rating him, and the total number of dissatisfied assessments

can be measured by the total number of patients rating a GP from 1 to 3. This procedure provided a valid measure of voice for this study.

Measuring competition by the number of GPs who accept new patients, number of GPs who accept new patient per 1000 inhabitants and the Herfindahl index is consistent with Godager, Iversen and Ma (2015), Iversen and Lurås (2011) and Iversen and Ma (2011). The number of open practices with and without population adjustment indicates the choice options for patients considering changing GPs (Godager, Iversen and Ma, 2015), supporting its validity as a measure of GP market competition. The Herfindahl index is also a standard competition measure that takes into account the relative size and the number of providers in the market. For this study, these measures were aggregated over GPs in a municipality, meaning they are exogenous as the decision of one patient to exit or rate a GP does not affect the measures.

The internal validity of the findings is evaluated based on the level of confidence in inferring the causal relationship suggested by the prediction after accounting for the effects from other possible explanations and/or confounding (Cook, Campbell and Day, 1979). Appropriate covariates consistent with previous research were also taken into account in order to address the confounding effect (e.g., Iversen and Lurås, 2011; Lurås, 2003). Furthermore, this study did not need to be concerned about reverse causality in the inference regarding the effect of competition since its measures are exogenous, thus strengthening the internal validity of the results.

However, caution should still be used when generalizing these findings to physicians other than GPs and to other countries because of potential differences in the relevant characteristics and market system of other types of physicians and other areas. In addition, generalization to possible future periods also requires caution because of potential changes in the GP market conditions and the online rating system.

3.1.3 Data Limitation

One important limitation is the few people who participate in physician rating services. One reason for this low response could be because it is a new practice in Norway. However, it also sees a limited usage rate internationally, with only 1 of 6 physicians receiving a rating (Emmert, Sander and Pisch, 2013). If this low rate is because patients are not familiar with the site as a means of voicing their opinions, then the voice indicator for this study may be biased.

On the other hand, since the rating is anonymous, it is not easy to confirm whether it was expressed by a valid patient, meaning it could have come from people with the intent of raising or lowering a specific physician's rating (Ellimoottil et al., 2013). With improvement by legelisten in verifying the authenticity of the reviews, the validity of using its data increases.

The nature of registered data calls for caution concerning their reliability as their management is shared by a number of people and because of the possibility of selection biases and confounding factors.[4] Once cannot fully control for all cofounding factors unless to control for available covariates and thereby decrease omitted variable problem. Hence, based on previous researches we have taken into account appropriate variables for controlling for their potential effect. Hence, based on previous research, this study has taken into account the appropriate variables for controlling for their potential effect. However, during the study period, we could not acquire the patient-level information, but using both a GP-level and a market-level analysis can cross validate the results, providing a partial solution for this issue, particularly because the patient characteristics across the market are similar so that there we do not need to be concerned about the omitted variable biases to be resulted due to lack of patient level data at market level. Since this study includes both a GP- and market-level analysis, it will provide robust findings.

3.2 Methodology

The analysis is mainly quantitative with descriptive statistics to have a detail look about the variables followed by a panel regression analysis.

3.2.1 Descriptive statistics

To describe the basic feature of the data and form a base for the analysis; quantitative description and variable definitions are given. The quantitative description is mainly done using summary statistics, graphic analysis, nonparametric Mann Whitney test. The summary

[4] Selection biases or confounding factors here come from the perspective of the decision of patients to exit or voice. Patients could also be affected by factors other than our variable of interest. Controlling for appropriate covariates increases the reliability of our estimate. On the other hand, as mentioned, in our data we do not need to be concerned for possible selection problem associated with participation in the regular GP scheme. Our data consist of the entire population about general practitioners, and there is close to 100% participation in the system, meaning this study does not involve a selection problem from perspective of the GP scheme or sample.

statistics provide a picture of the panel variables in terms of their mean, standard deviation (both within and between standard deviations) and number of observation.

Mann Whitney test is used for all pairwise comparison two independent groups of each dummy variables. The test is to check if the dependent variables and the competition measures are difference among the groups of each dummy variables. Mann Whitney is a non-parametric alternative for the two sample t-test which compares equality of the central tendency using median than mean. Mann Whitney test provide robust p-value when we do no relay on normal distribution of the data. We have checked the normality of the variables with histogram and hence selected the non-parametric tests.

To graphically describe the variables boxplots and bar graphs are also used. The boxplots help to depict the quartiles of the dependent variables over each period. Besides, it is a suitable non-parametric representation, when we cannot assume normal distribution of the data.

3.2.2 Empirical model

The effect of competition and covariates on voice and exit are investigated using panel regression analysis. Panel data regression has a unique advantage to control for omitted variables that differ across entities but are constant over time without actually seeing them (Stock, J, & Watson, M, 2012). Separate panel regressions will be used for exit and voice. The analysis will also be done at both GP and municipality level separately for the reason we will explain in the result section.

The hierarchal structure of GP level data, let us use multilevel analysis. GPs are clustered in municipalities and GPs in the same municipality share similar practices and culture. Hence, ignoring the group structure of the data, risks overlooking the importance of group effects, and may also render invalid (Goldstein, 2011). The multilevel analysis therefore, helps us to take into account the structure of the data and non-independency of the observations and distinguish the variability at both GP and municipality level.

For GP level analysis: -

Since the dependent variable for exit regression is positively skewed, it is transformed to logarithmic scale. On the other hand, the dependent variables of the voice model contain lots of doctors who do not get rating, therefore classifying the dependent variable into binary form

is more appropriate. We will then use multilevel mixed effect logistic regression for GP level voice and multilevel mixed effect linear regression for GP level exit. Accordingly, the general forms of the models are below:

For GP level exit and voice[5]: -

$Y_{ijt}^{E} = \beta X_{ijt} + \gamma Z_i + v_{ij}^{E} + u_j^{E} + \varepsilon_{ijt}^{E}$ ---- (GP level exit) ------eq (1)

Logit($Y_{ijt}^{V} = 1 | X_{ijt}, Z_i, v_{ij}^{v}, u_j^{V}, \varepsilon_{ijt}^{V}$) $= \beta X_{ijt} + \gamma Z_i + v_{ij}^{V} + u_j^{V} + \varepsilon_{ijt}^{V}$ GPleveVoice)--eq(2)

The superscripts "E" and "V" on the top of the random intercepts(v_{ij}, u_j) and error term (ε_{ijt}) are made to distinctly indicate the terms in exit and voice regressions respectively. In either of the regression equations, the random intercepts and the error terms have the following assumptions:

$v_{ij} \sim N(0, \sigma_V^2)$, $u_j \sim N(0, \sigma_u^2)$, (the random intercepts are assumed to have zero expectation and constant variance) & ε_{ijt} is iid type 1 extreme value distributed cov(u_j, ε_{ijt}) = 0, cov(v_{ij}, ε_{ijt}) = 0, (the random intercepts and the residual errors are assumed to be mutually independent) , cov($\varepsilon_{ijt}, \varepsilon_{ijs}$)=0 where, t≠ s (no autocorrelation)

where $i = 1, \ldots$ 4,896 GPs , $j = 1, \ldots$ 419 municipalities and t=1…,11 half-year periods.

Y_{ijt}^{E} :-the dependent variable in GP level-exit regression, and it is a continuous variable that represents the number of patient switching from GP per 1,000 listed. (in log scale)

Y_{ijt}^{V} the dependent variable in GP level-voice regression, and it is binary latent variable that represent assessment/dissatisfied assessment. In the assessment regression Y_{ijt}^{v} equal to 1 if a GP received a rating and zero if he doesn't . Similarly, in the dissatisfied assessment regression, Y_{ijt}^{V} is 1 if a GP received dissatisfied assessment and 0 otherwise.

The right hand side (RHS) variables in both regressions represents: -

X_{ijt} a vector of time varying independent variables, Z_i is a vector of time invariant variables constant across all GPs, β & γ are vectors of coefficients to be estimated, v_{ij} & u_j doctor and municipality level random intercepts to allow for unobserved heterogeneities at both levels respectively and ε_{ijt} is the error term.

For Municipality level analysis: -

The municipality level data is not hierarchical. Hence, we used linear panel regression for exit and as a result of positively skewed dependent variable we transformed the dependent

[5] See, for e.g., Rabe-Hsketh, Skrondal & Pickles (2005, p.307)

variable to ln scale. Whereas for municipality level voice regression, we have come across, a number of municipalities with 0 assessment and dissatisfied assessment of their GPs. This create censored or truncated dependent variable. Meaning that we do not observe the dependent variable for values above a certain magnitude. Linear regression which is based on OLS will give biased and inconsistent estimate as we are observing the true values of the dependent variable only for restricted values of x (Amemiya, 1984). Tobit model, will be an appropriate empirical model and take into account the phenomena of censored dependent variable. It will be estimated based on maximum likelihood estimation with the general form as in equation 4 below[6].

Municipality level exit and voice: -

$$Y_{it}^{E} = \beta_1 \boldsymbol{X}_{it} + \alpha_i^{E} + \varepsilon_{it}^{E} \text{ ----------(Market level EXIT) ---------eq (3)}$$

$$\left.\begin{aligned} Y_{it}^{V} &= \beta_1 \boldsymbol{X}_{it} + \alpha_i^{V} + \varepsilon_{it}^{V} \text{ if } \quad RHS > 0 \\ &= 0 \quad \text{otherwise} \end{aligned}\right\} \text{----------(Market level VOICE) --------eq(4)}$$

$i = 1, \ldots$ 419 municipalities, or t=1,11 half-year periods.

Y_{it}^{E} : - is a continuous variable represents: the proportion of patients switching in a municipality per 1,000 listed. (in ln scale)

Y_{it}^{V} in the voice regression is latent binary variable for assessment/dissatisfied assessment. In the assessment regression it equals to 1 if GPs in a municipality receive assessment and 0 otherwise. Similarly, for dissatisfied assessment regression, it equals 1 if GPs in the municipality receive dissatisfied assessment and zero otherwise.

Again, the superscripts "E" and "V" are used to distinctly indicate, the dependent variables, the random intercepts and the error terms for Exit and Voice regressions respectively.

$\boldsymbol{X}_{it}$ a vector of time varying independent variables, β a vector of coefficients to be estimated, and α_i is municipality specific random variables that capture municipality level unobserved heterogeneity that differs among municipalities, but not for a particular municipality over time & ε_{ijt} the error term. With assumptions:

$E(\varepsilon_{it} | X_{it}, \alpha_i) = 0$: Strict exogeneity, var (ε_{it}) = σ_ε^2 (No heteroscedasticity) cov($\varepsilon_{it}, \varepsilon_{is}$)=0 (no autocorrelation) , $\alpha_i \sim N(0, \sigma^2)$, (the municipality specific heterogeneity assumed to have zero expectation and constant variance), cov($\alpha_i, \varepsilon_{it}$) = 0, (the municipality specific heterogeneity and the residual errors are assumed to be mutually independent) . In addition to

[6] See, for instance, Cameron and Trivedi (2005, p.701) for (eq3); and Amemiya (1973, p.997) for (eq4)

that when the random effect models are valid after hausman test check: restriction cov(α_i, x_{it}) = cov(α_i, x_{it}) =0 also hold.[7]

3.2.3 Assumptions

When the data structure is hierarchal, the multilevel analysis considers the non-independency of observation. Ignoring the multilevel structure of the data, however leads to the violation of independent identically distributed (i.i.d.) observations assumption. It also leads to underestimated errors and thus, a spuriously significant effect (Hox, Stoel and Wittenboer, 2003).

Hence, in both the multilevel mixed effect logit and multilevel mixed effect linear model, the unobserved heterogeneity is modelled at both the GP and municipality level. The multilevel mixed effect linear and logistic regression share the linear and logistic panel regression assumption respectively, with an additional assumption for the random intercept terms. That is: the random intercepts at municipality level (u_j) and GP level (v_{ij}) are assumed to have 0 expectation and constant variance. In addition, the random intercepts and the residual errors are assumed to be mutually independent.[8] The remaining assumptions are similar to the typical linear panel and logistic panel regression assumptions for each of regressions respectively. Hence, we hereafter discuss the linear panel regression assumption followed by the logistic regression assumption

First we have checked the normality of the exit regression dependent variables using histogram. Since we have found the that the variables are positively skewed, we transformed the exit regression dependent variables to logarithmic scale; and then histograms look more normal. After the regressions, we have also predicted the residual and done Q-Q plot and Shapiro–Wilk test to check the normality of the residual. Note that when the sample size is large the Shapiro-Wilk test is biased by sample size and the test may be statistically significant from the normal distribution in any large sample. The Q-Q plot is usually required for verification and visualization of the residual is therefore more important. The Q-Q plot of both GP and municipality level regression residual presented in the appendix verifying normality.

[7] For tobit regression the restriction is always assumed as it is only the random effect model that is computed for the reason explained in the assumption section 3.2.3 above.
[8] Hausman test for multilevel analysis is nontrivial.

No heteroscedasticity and autocorrelations, are also another important assumption for the linear regression. Heteroscedasticity is said to occur when the variance of the residual term conditional on independent variables are not constant.[9] Existence of heteroscedasticity lead us to loose efficiency (that is higher variance) but the estimate will still be unbiased. To avoid problems related to that, we used clustered standard errors, that are heteroscedasticity and autocorrelation consistent (HAC) standard errors. HAC standard errors are valid during such potential problems and consistent with the assumptions of the regression. (Stock & Watson, 2012)

The assumption of no perfect multicollinearity is also fulfilled. In the existence of such a problem, it is impossible for the software to compute the estimate of all collinear variables; because it is illogical question of trying to find the partial effect of one of variable holding all other constant (Stock & Watson, 2012). However, if there exist imperfect multicollinearity, the estimate of the variables can be done but it will be with a lot of imprecision and inflated variance. Hence, we have checked if two or more of our repressors' are highly correlated using variance inflation factor(VIF) and Pearson correlation. VIF measures how much variance of an estimated regression coefficient is increased because of collinearity; and recommended that it is not exceed 10. The mean VIF is 4.19 and few VIF values exceed 10. One solution is to drop the variables. However, in regression with dummy variables, like in this study, if reference category has smaller proportion of the cases than the other categories, the correlation will inherently be higher but not change the outcome of the regression. On the other hand, the test result Pearson correlation has given very low value of linear correlation between the variables. Therefore, multicollinearity will not be a major problem. in using linear regression, we should also assume that the dependent variable is linearly related to the independent variables and no omitted variable (OV) biases. We have discussed the issue with OV above and in the later in this section.

For the logistic regression of our "voice" model, we do not need to make the key assumptions of generalized linear models such us, linearity, normality, no homogeneity of variance. Although we do not require the independent variables to be related linear, we still require that

[9] That is if the variance of the error term varies with the independent variables or dependent variable, then the model is heteroscedastic

the independent variable to be linearly related to the log odds. Otherwise, there will be high chance of making type error II[10].

We also assume that the dependent variable needed to be binary with the event occurring represented by pr(y=1). In addition, Aldrich &Nelson, (1984) stated that the two event of the dependent variable are assumed to be independent of one another and consist of a random sample of units (as cited in Sivertsen 2014). For a correlation that emanates from similar practices and culture between GPs in the same municipality, we have undertaken multilevel analysis that take into account such potential correlations.

Moreover, it is also important to assume that the model is correctly specified: no important variables are omitted, no extraneous variables are included and the variables are measured correctly. Hence, we have used supporting literatures as an approach for covariates inclusion. GP level attributes are crucial and can affect patient preference or perceived quality about physician and thereby their decision to switch and voice. Lurås (2003) and Iversen & Lurås (2011) can be a base for this. We will exhibit how the GP level characteristic correlate with patient decision of exit and voice and our competition measures in the descriptive section using statistical tests and bar graphs. In doing it provide support, that including these variables in the regressions, is reinforced by the motive for getting more precise estimate of market competition measures via decreasing omitted variable biases. Omitted variable bias is a bias that occur when any omitted factors are correlated with both our competition measure and dependent variable, leading to overestimated or underestimated estimate of the effect that we are interested to know (Stock & Watson, 2007).

The panel Tobit regression also has normality of residual and no heteroscedasticities assumption that are explained above. When the number of observation is large enough, as in our data set, the distribution will be normal, the estimate can represent our population estimate, based on law of large numbers and central limit theorem (Newbold, Carlson, and Thorne 2010, 274-275). The issue of normality can then be taken into account, as we have large enough number of observiations.

For the Tobit, we fit only random effect panel Tobit model, as there is no sufficient statistics to allow the fixed effect conditioned out of the likelihood, for the panel fixed effect command

[10] Incorrectly retaining a false null hypothesis.

to work. However, for the market level linear regression, we run Hausman test for selecting between fixed and random estimate model. The random effect model has an additional assumption that the municipality level unobserved heterogeneity α_i in (eq3) above, should be uncorrelated with independent variables (i.e. cov(α_i, x_{it}) =0). We tested this restriction by means of Hausman test. Hausman test has the null hypothesis that the random and fixed effect estimates coefficient are the same and the alternative that the estimates are different. Under the null hypothesis the random effect estimate is preferred as they give higher efficiency while under the alternative hypothesis the fixed effect estimate is preferred because they are at least consistent estimate.

4 Results

This section presents the descriptive statistics of the panel variables; the measures and distribution of exit, voice and competition; the panel regressions estimation results

Observing the descriptive statistics of the variables, the dependent variables distributions, the general relationship between competition and exit /voice helps to understand the panel variables, the naive association between the dependent and independent variables, and the necessity of controlling the panel regression variables for obtaining precise estimates. For this reason, the descriptive presentations of the panel variables along with the measures of competition and dependent variables are put proceeding to the panel regression result.

4.1 Descriptive presentation

The descriptive presentation includes all variables that are in the GP-level and market-level panel regression. In addition to showing the descriptive statistics, we tested the similarity of all dependent variables and competition measures across different categories of each GP attributes. The test helps to see whether there is systemic difference in GP specific factors that are potentially presumed as a control variable. Since the dependent variables and the competition measures are not normally distributed, in the investigation, we focus on the median values comparison using the non-parametric test. Similarly, as a result of positively skewed dependent variables, we also emphasize on median evaluation, for examining the trends of exit and voice variables overtime in Section 4.2 using box plots.

Table 4,1.1 and Table 4.1.2 below display the definition and descriptive statistics of the GP-level and market-level panel regression variables, respectively[11]. The mean values of the variables in the table are over all observations [12].

[11] Variables not directly in the panel such as" POP" are included in both tables to give a thorough presentation of the variable formation. Age_doc is also categorized into dummy variables: young age group (reference group) for below 35; medium age from 35 to 50, old age group for 50 and above.

[12] Since the data are longitudinal, the interpretation of the mean values from the table are over all GPs & half years. For the total of 39, 850 observations except age for total of 39,831. This is because for 19 observations age is missing. Moreover, the maximum age, 86 was not in accordance with the regulation, particularly article 56 of the doctors' regulation that do not allow to practice after the age of 80. But we have checked in the data and found that it is because of 1 GP that was born in 1926 and 86 years old as of 2012; and have been available from period 1 to 6 in our data. Besides, we understood from the date that: -1 person & 2 persons as of January and as of July 2012 respectively assessed him; 1 person as of January 2012 gave him dissatisfied assessment: and 71 as of January 2012 & 65 as of July 2012 switched from his list. He had 1131 & 1045 patients in his list as of January and July 2012 respectively.

Table 4.1.1 Descriptive of the GP level panel.

VARIABLES	Definition	N	mean	sd	SD betwean	SD within	min	max
prswitch	Semiannual no. of switching per 1000 patients listed in the beginning of the period	39,850	23.60	22.90	27.4	14.5	0	1
prassessed	Semiannual no. of patients that rate their GP per 1000 patients listed with the GP in the beginning of the period (a Continuous variable categorized into dummy variables equal to 1 if a GP received a rating and zero if he does not)	39,850	0.98	6.54	6.77	5.28	0	1
prdisatisfied	Semiannual no. of dissatisfied patients that rated their GP per 1000 patients listed with the GP in the beginning of the period. (a Continuous variable categorized into dummy variables equal to 1 if a GP received dissatisfied assessment a rating (1,2,3) and zero if he does not)	39,850	0.31	1.64	1.21	1.40	0	200
L_Actual list	The size of the GP list in terms of 1000 patients listed at the end of each periods.	39,850	1.18	0.39	0.40	0.09	0.001	2.53
#Open	Semi-annual no. of GPs in a municipality who accept new patients	39,850	36.23	66.93	64.82	8.76	0	242
#Open/capita	Semi-annual no. of GPs in a municipality who accept new patients per 1000 residents	39,850	0.37	0.33	0.31	0.14	0	5.40
herfindahl	A measure of market concentration in a municipality. Calculated as a Sum of squares of market share ranges between 0 and 1 where 1= Monopoly.	39,850	0.11	0.16	0.16	0.04	0.002	1
Male	A dummy variable equal to one if a GP is male	39,850	0.63	0.48	0.49	0.00	0	1
Age_doc	The GP's age in years	39,831	51.38	10.63	11.23	1.41	25	86
With speciality	A dummy variable equal to one if the GP has at least one specialty	39,850	0.69	0.46	0.49	0.00	0	1
Handicap accessible	A dummy variable equal to one if the GP's practice is handicap accessible	39,850	0.89	0.31	0.34	0.00	0	1
Group	A dummy variable equal to one if the GP's practice is group	39,850	0.83	0.37	0.39	0.00	0	1
Salary	A dummy variable equal to one if the GP has a fixed salary	39,850	0.05	0.22	0.21	0.03	0	1
Gray	Dummy variable equal to one for GPs with 0≤(preferred—actual list) < 100	39,850	0.70	0.46	0.36	0.31	0	1
Short	Dummy variable equal to one for GPs with (preferred—actual list) ≥100	39,850	0.15	0.36	0.34	0.19	0	1

Note :- because our panel is unbalanced, the within and between standard deviations do not sum to the overall standard deviation.

The mean GP list size per 1000 patents listed is 1.18. The mean value of the dependent variables: proportion of switching, proportion of assessments and proportion of dissatisfied assessments per thousands are 23.6, 0.98 and 0.31 respectively. The mean value of proportion of switching is higher than both proportion of assessments and proportion of dissatisfied assessments, indicating that exit (switching a GP) is more common than voice (rating) a GP.

The variable of interest, competition can be manifested through the variable #Open, #Open/capita and Herfindahl. From table 4.1.1, on average, 36 GPs accept new patients in the municipalities; and on average 0.37 GPs per 1000 inhabitants accept new patients in the municipalities. The variable Herfindahl has a mean of 0.11.

GP level attributes and practice profiles are associated with patients' preference of GPs and can affect patients 'decision to switch or assess their GPs. Lurås (2003), studied individual preference for GPs and found that the probability of choosing a GP increases, if the GP is old age, specialist in general medicine, and the GP and the individual are same gender. Therefore, GP specific factors are added in both regressions to control for these variables.

The average age of GP's in the data is 51 ranging from 25 to 86. From the total of 4,896 doctors, 2,994 are males and 1,902 are females: the male doctors account for 63% of our observations. Variables short and gray indicates whether or not a particular GP is experiencing patent storage (refer the definitions in the table). Iversen and Lurås 2011, had found that GPs patient shortage determine patient switching. In our data set, on average 0.15 GPs, have short list; and on average 0.70 GP's, have gray list.

An individual doctor appears to have a minimum of zero and maximum of up to three types of specialty. The most common types of specialties are: specialty in general medicine, and community medicine. The percentage of GP's with only one, two, three and no specialty are, 52%, 6.5%, 0.8% and 40% respectively[13]. The variable "with specialty" is recorded as a binary variable, which equals to 1 if a GP has at least one type of specialty and 0 otherwise. On average 69% of the observations is "with specialty". Since "with specialty" variable is time independent its within standard deviation is equal to zero.

Other GP features are also presented as a dummy variable. Since these GP attributes are time independent, the within standard deviation of these variables are also zero. GPs with fixed salary comes out with some within standard deviation due to 15 GPs who stop having fixed salary and 8 GPs who started having fixed salary during the data period.

GP level characteristics such as: gender, handicap accessibility of practice, group practice, doctors with fixed salary, are recorded as a dummy variables having two categories. The age of the doctor is also converted to dummy variables as we do not expect a linear relationship between age and the dependent variables. Accordingly, Young-age (reference group) equals 1 if Age < 35 and 0 otherwise; Medium-age equals 1 if 35 ≤Age < 50 and 0 otherwise; Old-age equals 1 if Age ≥ 50 and 0 otherwise.

[13] This detail information on % of GPs with different number of specialty is not presented in the table. This is because specialty variable in the panel regression is recorded as a binary variable which equals to 1 for GPs with at least one specialty and 0 otherwise. Hence, we depicted in the table information on the mean GP's with specialty.

Hence, using Mann-Whitney two tailed test, we tested if there is no statistically significant difference in all dependent variables and competition measures, across different categories of each GP level characteristics The Mann-Whitney test has the null hypothesis that the medians are equal and the alternative hypothesis that the medians are not equal. This test is done in order to investigate whether there are any biases from the covariates that could influence our dependent variables.

We also presented a bar graph in Appendix 4 (Figure 4.1.1) to show how these differences in the dependent variables between categories of each GP level characteristics look like. From the bar graph we see that: proportion of switching is higher for female than male GPs, for younger than older GPs, GPs with no specialty than with specialty, GPs with no handicap accessible practices than handicap accessible practices, and GPs with patient shortage than full. On the other hand, we observe that higher both assessment and dissatisfied assessment for; female GPs than male, GPs with short list than full. We also see from the bar graph that GP attributes that have higher assessment not necessarily have higher dissatisfied assessment. This is the case for; GPs with specialty, handicap accessible practices, group practice and GPs with no salary, which happen to have higher assessment. However, simultaneously there are, lower dissatisfied assessment for these GPs. That is lower dissatisfied assessment for GPs with: specialty than no specialty, handicap accessible practices than without, group practices than with no group practice, other payment system than salaried GP. As we referred the work of Lurås (2003) above, this over all difference in both patient exit and voice, over GP level attributes, can emanate from different patient preference for GP level characteristics.

The Mann-Whitney test results are also indicating that at 5% significance level, all the three dependent variables are significantly different among each group of every variable; except no significant difference in switching between young and middle age doctors, and between doctors with- fixed salary & others; no significant difference in assessment between men and female doctors; and no significant difference in dissatisfied assessment between doctors with specialty and no specialty.

Likewise, the categories of each GP attributes are significantly different from each other at 1% significance level on the competition measures, except no significance difference in median #open & #open/capita between male and female doctors; no significance difference in median of #open, between doctors with handicap accessible practice and no handicap accessible practice; no significance difference in median of #open/capita, between middle and

old age GPs.; no significance difference in median of Herfindahl between doctors with gray and full list.

These results indicate that most of the dependent variables and the competition measures are significantly different for each group of most of the categorical variables except for a few. This, supports the necessity for including these variables in the regression, to controlling for their potential effects.

The table below, presents descriptive information for the market level panel variables.

Table 4.1.2 Descriptive of the market level panel.

VARIABLES	Definition	N	mean	sd	SD betwean	SD within	min	max
prswitch_M	semiannual no. switching in the municipality per 1000 patients listed in the begining of the period	4,115	19.07	10.37	6.36	8.29	0	297.60
prassessed_M	Semiannual no. of assessments in the municipality that rated their GP per 1000 patients listed in the begining of the period	4,115	0.56	1.28	0.43	1.21	0	24.19
prdisatisfied_M	Semiannual no. of dissatisfied assessments in the municipality per 1000 patients listed in the beginign of the period	4,115	0.18	0.50	0.19	0.47	0	9.22
L_Actual_list _M	Total no. of GPs list sizes in the munciplaity at the end of each period.	4,115	11.400	36.820	36.51	1.89	0.15	661.80
# Open	Semi-annual no. of GPs in a municipality who accept new patients	4,115	4.16	11.80	11.55	1.93	0	242.00
#Open/capita	Semi-annual no. of GPs in a municipality who accept new patients per 1000 residents	4,115	0.61	0.54	0.49	0.23	0	5.40
herfindahl	A measure of market concentration in a municipality. Calculated as a Sum of squares of market share ranges between 0 and 1 where 1= Monopoly.	4,115	0.34	0.29	0.28	0.10	0.002	1
prmale_M	semiannual no. of male GPs in the municipality, per 1000 residents	4,115	0.61	0.42	0.40	0.13	0	5.40
prMedium_age_M	semiannual no. of GPs in the municipality with age 35 -50 , per 1000 residents	4,115	0.43	0.35	0.31	0.16	0	2.91
prOld_age_M	semiannual no. of GPs in the municipality with age 50 and , per 1000 residents	4,115	0.49	0.44	0.42	0.13	0	5.40
prwith_speciality_M	semiannual no. of GPs in the municipality with at least one type of specialty, per1000 residents	4,115	0.57	0.40	0.39	0.10	0	3.60
prhandi_accessible_M	semiannual no. of GPs in the municipality with handicap accessible practice, per 1000 residents	4,115	0.87	0.39	0.35	0.18	0	3.86
prgroupp_M	semiannual no. of GPs in the municipality with group practice, per 1000 residents	4,115	0.72	0.41	0.38	0.16	0	2.45
prsalary_M	semiannual no. of GPs in the municipality with fixed salary , per 1000 residents	4,115	0.16	0.36	0.35	0.07	0	2.91
prshort_M	semiannual no. of GPs in the municipality with (preferred—actual list) ≥100, per 1000 residents	4,115	0.30	0.44	0.40	0.19	0	4.01
prgray_M	semiannual no. of GPs in the municipality with 0≤(preferred—actual list) < 100, per 1000 residents	4,115	0.59	0.44	0.40	0.19	0	5.40
pop	No.of inhabitants of the municipality in 1000	4,115	12.110	36.420	36.15	1.02	0.34	647.70

Note:-Because our panel is unbalanced, the within and between standard deviations do not sum to the overall standard deviation

The market level variables are aggregated at municipality level for each half year. The mean value of the three dependent variables, prswitch_M, prdisatisfied_M and prassessed_M are 19.07,0.56 & 0.18 (per 1000) respectively. To take into account the GP list size difference, the three dependent variables are adjusted by the number of inhabitants in GPs lists. [14] The average list size in a municipality are 11.4 (in thousands).

Since competition is already measured at market level, the variables #Open, #Open/capita, and Herfindahl are the same as in table 4.1.1. However, since the average of #Open, #Open/capita and Herfindahl over all municipality and period are different from the average calculated over all GPs and period, the mean value of #Open, #Open/capita and Herfindahl in table 4.1.2, are 4.16, 0.61 and 0.34 respectively.

The rest of the control variables are also summarized at municipality level and adjusted for the municipality population size. The mean number of municipality inhabitants are 12.11 (in 1000).

4.2 Measures of exit, voice and competition

Dependent variables (Exit & Voice)

We propose that, exit and voice decisions by patients in GP market are manifested by the number of patients switching and rating their physician. These variables are adjusted for the total number of patients' differences among GPs. Switching, assessments and dissatisfied assessment are flows that happen during certain time period whereas the counts of total patients for each GPs, are stocks that can be observed at a particular point in time. Accordingly, the dependent variables are calculated by dividing the number of patients who switched and assessed a physician by list size.[15]. Likewise, at the market level, the number of assessments and switching received by GPs, are aggregated at the municipality level for each period and normalized by the GPs list size in a municipality[16]. Henceforth, the dependent variables are expressed in terms of proportion and, therefore, their values are between 0 &1.

[14] That is all dependent variables are adjusted by the sum of patients in GPs lists of the Municipality at the beginning of each period. The beginning of the period is because, the number of patients that are switching or assessing during a particular period is out of the patients listed in the beginning of the period.
[15] The denominator is the total number of patients on the physician list at the end of the previous period. Value at the end of period (t-1) = value at the beginning of period t (that is end of the previous period is equivalent to beginning of the current period)
[16] That is :- by total number of previous period inhabitants on the GPs list in the municipality.

Following Iversen & Lurås, (2011) approach, we measure patients switching a physician resulted from dissatisfaction, as the sum of patients switching due to ordinary and other reasons. Besides in our data, patients switching due to other reason and ordinary reason are distinguished from the patients switching that occur, when a patients or a physician change municipality, and a physician reduced/ended practice. Hence, with the former two types of switching, we aim to measure, patient switching due to dissatisfaction.

Voice is observed in two ways. General assessment that is a count of either dissatisfied or satisfied patients who rated their GPs during a particular period in time; and dissatisfied assessments which include only the number of patients who gave an overall assessment of 1,2 &3. Accordingly, proportion of dissatisfied assessments is expected to represent dissatisfied patients' voices. Having both proportion of assessment & dissatisfied assessment enables detailed comparisons. GPs that received no assessment are not included in the analysis of proportion of dissatisfied assessment. One of the main reason for this is, GP assessment potentially be correlated with patient satisfaction either positively or negatively. Most ratings, in online physician ratings sites are favorable (Kadry et al. 2011, & Emmert et al. 2013). If this is because patient satisfaction is leading to more rating, then restricting our analysis for dissatisfied assessment on only those GPs who are assessed, will decrease any biases on our estimates from the effect of satisfaction. That is, GPs potentially receive no rating at all, because of low patient satisfaction in general or GP market condition. Hence, we analysis dissatisfied assessment , conditional that GPs are assessed.[17]

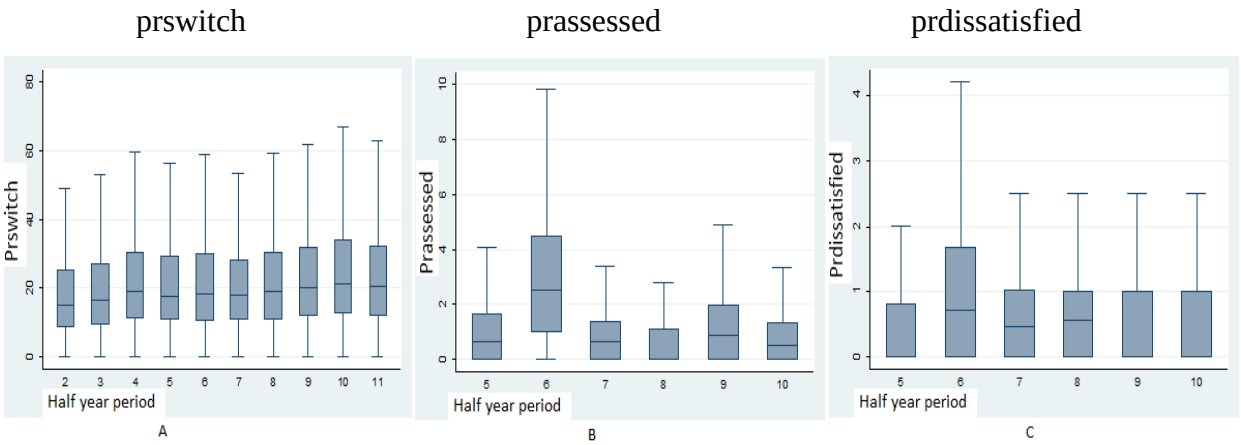
Therefore, the analysis of dissatisfied assessments at GP level, focuses on the 14,367 observations of GPs in 6 half-year periods that are rated. Correspondingly, the analysis of dissatisfied assessment at market level, focuses on the total of 1,776 observations of municipalities in 6 half-year periods with GPs who are assessed.

For overall picture of the values of the dependent variables, the distribution of these variables over time is illustrated in a box plot. In order to assist the reader, we have also incorporated a table in appendix that shows the values of the quartiles for each of the dependent variables over the period. [18]

[17] Similarly, other than satisfaction, other factors that is not explained or observed could create the truncation of positive assessment and zero assessment. For our market level analysis, the use of Tobit, will take into account the truncation, enabling to see the effects conditional on dissatisfied assessment greater than zero.

[18] We portray the box plot by truncating the outside value. Since our main interest is to illustrate and show the trend of the values of dependent variables over time with the quartiles, the outside values are not of interest only for this graphical representation. It should also be noted that we have not removed any outside values in our

Figure 4.2.1 GP-level box plot for patient switching, assessment, and dissatisfied assessment per 1000 listed patients over each half year. [19]



A B C

The horizontal lines inside the boxes or the 50th percentile of prswitch in table 4.2.1 in appendix, indicate the median proportion of switches in each half year. The median proportion of switches before the introduction of legelisten, from the beginning of 2010 until the first half of 2011, for three half years, showed an increasing trend. After the commencement of legelisten, it decreased in 2011 second half and showed a fluctuating trend over the subsequent half-years. Nevertheless, the sign test comparison of proportion of switching, between half year just before and after the start of legelisten in 2011, is not significant (at 5%) (with the P-value 0.0766).

Whereas at market level, the median proportion of patients switching in a market(prswitch_M), shows small increment over time as shown by the horizontal line inside the boxes in figure 4.2.2 A below and table 4.2.3 in appendix 4. Here again, the median proportion of switches decreased from period 4 to 5. However, the decrease is not statistically significant (at 5%). (with sign test p-value 0.06)

Both the market level and the GP level, decrease in the proportion of switching from period 4 to 5, are not significant and do not continue to the subsequent period. This is analogous with the Hirschman concept (Hirschman, 1970). If the GP market is monopolized, patient have

analysis. Doing that will create a biases, the whole observations are part of the regression without the truncation of outside values.

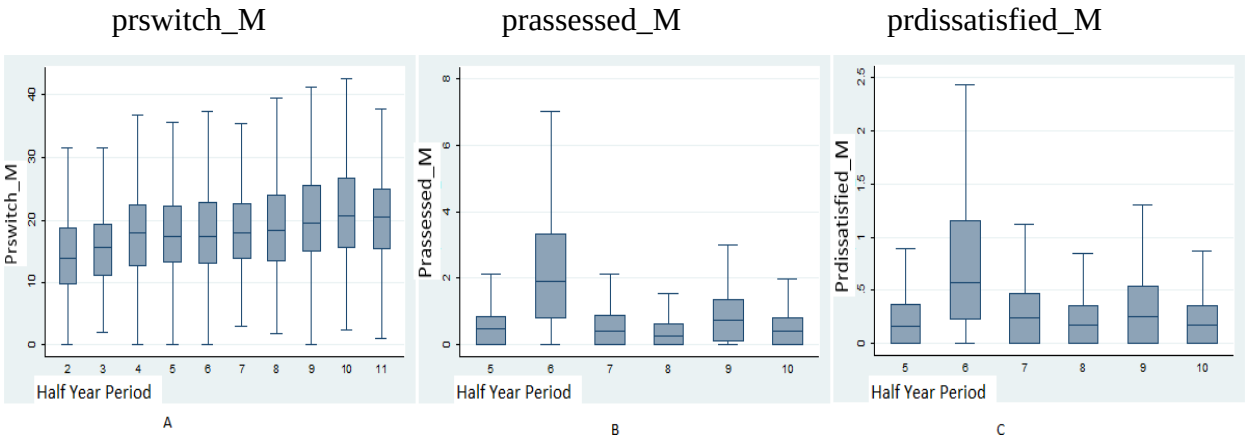
[19] For all the box plots and the two tables (table 4.1.1 &table 4.1.2 in appendix) that depict the quartiles, the data is from July 2010 until January 2015 for switching; and from January 2012 to July 2014 for rating.

limited options to exit. As a result, we expect that the proportion of switching to hardly be affected by the new opportunity of voicing in monopolized market. In the case of competitive market, patients still have more available options for exiting, and hence, patient do so even after the opportunity of voicing. Besides, exit is not a last resort for the online voice, because the online rating channel allows patients to rate their GPs even if the patients exit. This lets the choice of exit and voice to occur simultaneously. Thus, we found above that, switching trend before and after legelisten is not significantly different.

However, we expect that the online voicing created new opportunity of expressing discontent. Thus, this study hypothesized that in large municipalities with a higher GP market competition, patient will frequently use this opportunity. Whereas, after we adjust for the municipality size, in a competitive GP market, the new voicing channel is predicated to be used less frequently.

The box plot B & C in Figure 4.2.1 above & 4.2.2 below represents the GP and market level distribution of proportion of assessment and dissatisfied assessment respectively.

Figure 4.2.2: Municipality-level box plot at for proportion of patient switching, assessment and dissatisfied assessment over each half year.



The proportion of assessment appears stable over the half-years, except some differences in period 6 and 8. The median for the half-years are very similar, 0.48 in the end 2011 and 0.41 in the first half of 2014. The proportion of dissatisfied assessment is measured only for 14,367 observations that have already received an assessment. Not all assessments are dissatisfied assessment. Among GPs who have received rating in the 6 time periods, 50% have received dissatisfied assessments. Since dissatisfied assessment contains the count of patients that give overall assessment 1, 2 and 3, the proportion of dissatisfied assessment received by each GP

is at most as high as the proportion of assessment received. Therefore, the values are very small and figure 4.2.1 C and (table 4.2.1 in appendix) shows that median proportions of dissatisfied assessment received by GPs are zero for some of the periods.

Hence, we compare the proportion of dissatisfied assessment using the mean. The mean trend is almost stable: 0.31 in the end of 2011 and 0.36 in the first half of 2014. The mean is yet biased, as each periods proportion of dissatisfied assessment in the box plots shows some outliers. Higher mean proportion of assessment and dissatisfied assessment has occurred, during the first half of 2012; with mean prassessed and mean prdissatisfied amount 3.56 and 1.11 respectively. This is also true, for the percentiles of prassessed & prdissatisfied as depicted in the GP level Table 4.2.1 and as shown by the higher 1st, 2nd and 3rd quartiles in 2012 in Figure 4.2.1 B and C.

From the municipalities in the 6 time periods where their GPs have received rating, 70% of them have GPs that received dissatisfied assessment. In contrast to the GP level, the market level median prdissatisfied_M and median prassessed_M fluctuates over time in Figure 4.2.2-B and C. However, as in GP level representation, during first half of 2012, higher market level median proportion of assessment and dissatisfied assessment was encountered.

Competition

In Norway, patients can switch to other GP only if the GP has open practices. Therefore, as explained in section 2.1 & 4.1, we measure competition by the number of GPs with open practices in a municipality with and without number of population size adjustment. Both measures indicate patient potential options for GP service.[20] The distribution of patient across different GPs also measures competition (Godager, Iversen & Ma, 2015). Hence, we also use Herfindahl index as our third competition measure. Primary care is the responsibility of municipalities and all residents are listed in their home municipality therefore we used municipality to define the market border. This is similar to other studies in Norway (e.g. Iversen and Ma 2011).

Since the data is longitudinal data, the numbers of GPs with open practices are counted for each half-years and municipalities. When many GPs accept new patients, there are more GP options for patients and therefore indicate a more competitive market. But merely #Open does

[20] Markets with higher GP market competition, offer more options for patients and the demand curve for GP service is flatter. On the other hand, with lower GP market competition, fewer options are available for patients and the demand curve is more inelastic.

not take into account the difference among municipalities in the number of inhabitants. The largest 75% of #Open is experienced by Oslo municipality. Next to Oslo, Bergen, and Trondheim have highest GP market competition when measured by # Open.

Godager, Iversen & Ma, (2015) explained that patients in municipalities with the same geographic size and #open but different population size, will have different chances of getting suitable GPs. Therefore, #Open/capita enable us to take into account the population size difference among municipalities[21]. In our data set, Leka, Værøy and Modalen have shown highest competition as measured by #Open/capita.

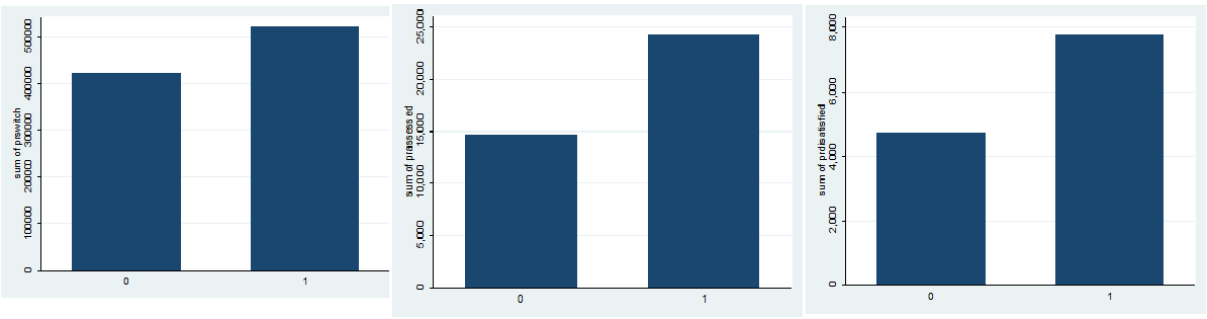
Iversen & Lurås, (2011) stated that other things equal, larger municipalities are likely to have larger value of #Open. However, the mere #open measure, overestimate the extent of competition as it does not capture the longer travel distance between patients and GPs in larger municipalities. #Open/capita can adjust for municipality size effect. Therefore, competition measured by #Open/capita can take into account the municipality size effect.

Below bar graph is used to show the naïve relation between our dependent variables and the two competition proxies (#open and #open/capita). For the purpose of comparison both competition measures are converted to categorical variables using their median value. #Open equal to 1 when #Open is above median and 0 otherwise; and #Open/capita is equal to 1 when #Open/capita above median and 0 otherwise.

Gp Level comparison

Figure 4.2.3 Total proportion of GP level switches, assessments and dissatisfied assessments per 1,000 listed patients over #Open and #Open/capital above and below the median.

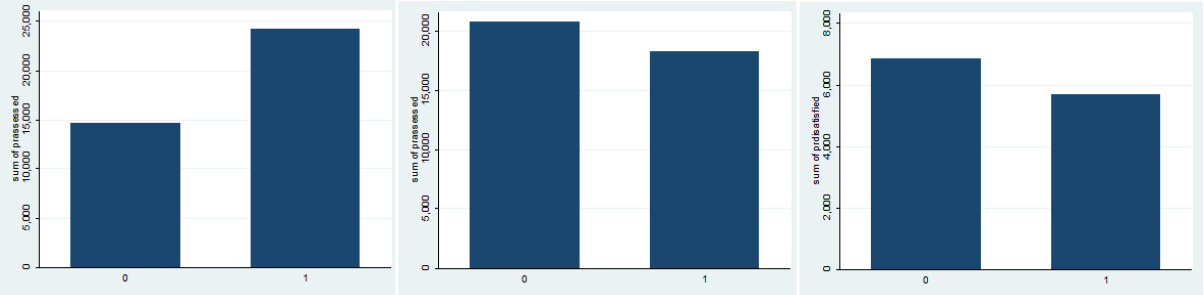
I. For #Open above and below median



A) Total prswitch B) Total prassessed C) Total prdissatisfied

[21] For municipalities with the same Geographic size, we can also say that #Open/capita, can also adjust for the population density difference among the municipalities.

II. #Open/capita above and below median



A) Total prswitch B) Total prassessed C) Total prdissatisfied

We see that, when competition is measured by #open; total proportion of switching total proportion of assessment, total proportion of dissatisfied assessment is higher in municipalities with #open above the median. This is similar to what we predicted. As explained above higher value of #open is likely in a big municipality. Hence, in a large municipality, the higher GP options give patients to undertake GP switching. On the other hand, the public good nature of voicing, voicing to the community gives voicing higher importance in a large municipality, and therefore we also see higher assessment and dissatisfied assessment in a big municipality.

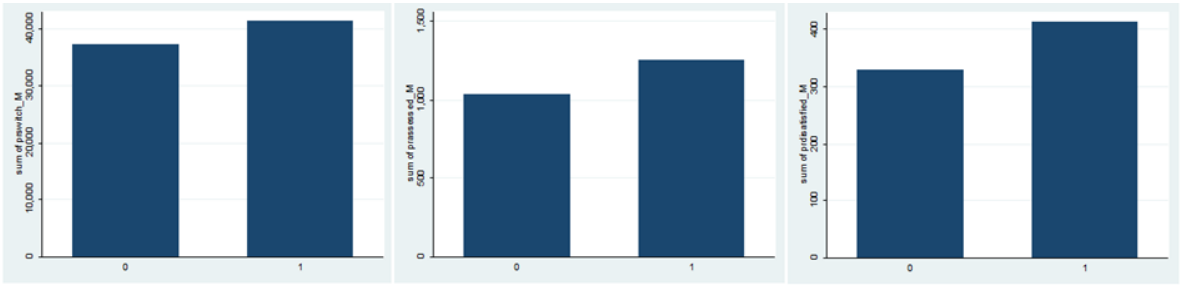
When the same comparison is done with #Open/capita, still GP level total proportion of switching, is higher in municipalities above median. However, both measure of voices in Figure II-B, & II-C, shows lower total prassessed and total prdissatisfied in municipalities with #open/capita above median. This is because #open/capita adjusts for the municipality size effect. As put above, those municipalities with higher #Open/capital are small municipalities in terms of both population and geographic size. In small municipalities, the public good motive of contributing for the online voicing could be small. Therefore, this support our prediction that competition measure that takes into account the size effect of the municipality, show lower voicing in municipality with higher GP market competition than with lower GP market competition.

Similar comparison at municipality level below has also been done.

Municipality Level comparison

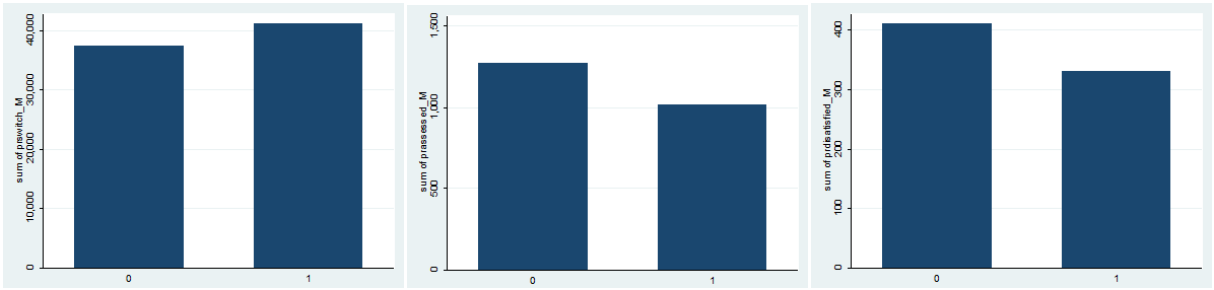
Figure 4.2.4 Total proportion of municipality level switches, assessments and dissatisfied assessments per 1,000 listed patients over #Open and #Open/capita below and above median.

I. #Open above and below median



A) Total prswitch_M B) Total prassessed _M C) Total prdissatisfied_M

II. #Open/capita above and below median



C) Total prswitch _M D) Total prassessed _M C) Total prdissatisfied_M

As in GP level result above, the municipality level result in Figure 4.2.4, shows similar relation. The total municipality level proportion of switching is higher in both competition proxies, for municipalities above the median #Open (I-A) & #Open/capita in figure (II-A). For voice, the opposite relation is still realized when competition is measured by #Open and #Open/capita. Higher municipality level prassessed_M, and prdissatisfied_M, are shown in municipalities above the median #open (figure 4.2.4 (I-B & I-C)). Whereas for comparison using #open/capita, higher prassessed_M and prdissatisfied_M is shown in municipalities below the median #Open/capita (figure 4.2.4 (II-B & II-C)).

To investigate whether this difference in the dependent variables across the two categories of our competition proxies is significant, we used non- parametric Wilcoxon rank sum test (Mann Whitney). We used the non-parametric alternative, as our dependent variables in each group are not normally distributed. The Mann Whitney test compares central tendencies of each dependent variables, using the median across the two categories of the competition

proxies (that is, between #open below and above the median: and between #open/capital below and above the median). For each of the dependent variables, the test result rejected the null hypothesis that there is no difference in medians among the two categories of each competition proxies (at 1%). The test result thus supports the graphical comparison above. [22]

Other things equal, the concentration of providers in the market is also an important element of market structure and determine competition (Rhoades, 1993). In economic theory the presence of many "small" providers are associated with more competition. "small" in a sense that the market power is not concentrated in few firms (baker, 2001). Hence, Hirschman Herfindahl index is also used to measure market competition. The index measures market concertation by taking into account the relative size of each provider in the market that a simple counts of providers do not capture (baker, 2001). For a given market, the index is calculated as the sum of squared market share of each GP. As explained in Chen and Godager (2011), for an individual GP his output is the number of patients listed with him. As presented in Chen and Godager (2011, p.4)

HHI = $\sum_{i=1}^{K_j}\left(\frac{n_{ij}}{N_j}\right)^2$, where "i" represent a GP in a "jth" market that consists of "K" number of GPs. And the market share for a given GP is represented by $\left(\frac{n_{ij}}{N_j}\right)$, where "n" is actual list size of GP "i" in market "j" and "N" is the total patients in GPs list in market "j".

Thus , the index is between 0 and 1.[23] For a market with only one GP, the HHI is 1, showing only one provider is monopolizing the market. Whereas for a market with a large number of GPs each having relatively smaller market share, HHI will be close to zero. [24] Therefore, other things equal, when the number of firms decrease or when the market share of any given provider in the market increase, the market will be more concentrated becoming less competitive; with the converse phenomena leading to less market concertation and more competition. Hence, HHI takes into account both the number of providers and market concertation (Rhoades, 1993). However, the index cannot enable us to consider the fact that in the list patient system in Norway, patient only switch to the other GP, only if the other GP has

[22] For the graph we used the (sum) of each dependent variables in each category rather than the (median). This is because, the median for dissatisfied assessment for some cases are 0. Nevertheless, the median graphical illustration also shows the same result. To be consistent, we used the (sum) of the dependent variable in each category in all our graphical illustration.

[23] In some literatures they multiply the index by 10,000. In that case it ranges between 0 and 10,000

[24] If a market consists of K number of GPs each having equal share of the total patient N then HHI= K*$(\frac{\frac{N}{K}}{N})^2$ = $\frac{1}{K}$

an open practice. Therefore, we hope that combining it with our two measures, #Open and #open /capita, will enable us to conduct robust analysis.

In our data set, Oslo, Bergen, and Trondheim have shown higher competition as measured by Herfindahl index. As with our measure #Open, higher competition as measured by Herfindahl is observed in the large municipalities. This is because, normally there are large number of GPs with smaller market share located in a big municipality than small. Indicating less market concentration and more competition. In contrast, in small municipalities usually the number of GPs are small, and in some cases one or very few GPs serve the municipality. This then portray, higher market concertation in small municipality implying less competition.

Table 4.3.2 in appendix also used to show, how the dependent variables vary in areas with GP market competition measured below and above the median of Herfindahl and the former two competition measures (#open & #open/capita). The table supports that each of the three dependent variables (Prswitch, prassessed and prdissatisfied), are positively correlated with competition as measured by #Open and HHI. This also holds at market level. Higher Herfindahl means lower competition. Hence, each of the dependent variables decreased as Herfindahl increase from below median to above the median level. This can easily be observed by the sign of the percentage change in the last column of the table. Whereas both prassessed, prdissatisfied shows opposite correlation, when competition is measured by #Open/capital. This holds at both GP and municipality level as shown in the table. This result is similar to the graphical result that we have found previously. The two competition proxies #Open and Herfindahl is higher in a big municipalities and hence voice in the big municipalities have bigger importance showing positive correlation as our prediction. Whereas #Open /capita adjusts for municipality size effect, hence we see that after taking into account the municipality size effect higher competition implies lower voice as our second prediction for voice.

4.3 Estimation results

The influence of GP market competition on dissatisfied patients' choice of switching (exit) and assessment (voice) is investigated using GP- and market-level panel regressions. This is similar to the form in descriptive parts above. Besides, sign and significance the variables of

regression results match with the descriptive comparison presented in section 4.1 & 4.2 above.

The municipality level data is summarized over each municipalities and period. As aforementioned, we used municipality as a market border for measuring competition Thus, the municipality level information facilitates the analysis of the exit and voice results over different markets and periods. The GP-level analysis, on the other hand, examines exit and voice encountered at each provider level. Hence, both levels are crucial for micro- and macro-level analysis investigating the effect of competition on exit and voice. This section presents first the GP-level estimation results followed by the municipality-level estimation results.

4.3.1 GP level estimation result

The GP level results that are presented in table 4.3.1, are based on the regression models that are presented, in chapter3, section 3.2.2. Accordingly, GP level Exit regression was represented by the multilevel mixed effect linear regression, general form as in eq(1), and GP level Voice regression was represented by the multilevel mixed effect logit regression as in eq(2) in the chapter3, section3.2.2.

In the GP level result table below the exit regression result is presented in the first three columns and the voice regression result is presented in the consecutive 6 columns. The three sets of regression results (Model I, Model II & Model III) in table 4.3.1, correspond to the three competition measures; #open; #open/capita and Herfindahl. The other covariates are common in all the regression. Voice regression, in addition, have L_actual list variable, to capture the effect of GP's list size. Since the dependent variable of exit regression is expressed as a proportion of patient switching per 1,000 listed, the effect of list size is already taken into account.

Table 4.3.1 GP- level Multilevel mixed-effects- linear and logit regressions for the effect of market conditions & covariates on patient exit and voice respectively.[25]

	GP Level Exit			GP Level Voice					
VARIABLES	**Ln Prswitch Estimation (SE)**			**Assessment Odds ratio(SE)**			**Dissatisfied Assessment Odds ratio(SE)**		
	Model - I	**Model -II**	**Model -III**	**Model -I**	**Model -II**	**Model -III**	**Model -I**	**Model -II**	**Model -III**
#Open	0.00509***			1.008***			1.002		
	(0.00166)			(0.00209)			(0.00153)		
#Open/capita		0.367***			0.621***			0.677***	
		(0.0333)			(0.0513)			(0.0819)	
herfindahl			-0.415***			0.0957***			0.356***
			(0.0695)			(0.0190)			(0.101)
Male	0.00263	0.00260	0.00114	1.047	1.048	1.041	0.817***	0.820***	0.819***
	(0.0192)	(0.0194)	(0.0193)	(0.0413)	(0.0412)	(0.0408)	(0.0492)	(0.0493)	(0.0492)
Mid_age_doc	0.0803***	0.0857***	0.0804***	1.058	1.057	1.081	1.160	1.164	1.161
	(0.0288)	(0.0289)	(0.0286)	(0.0979)	(0.0976)	(0.0991)	(0.170)	(0.170)	(0.169)
Old_age_doc	0.0144	0.0183	0.0153	0.831*	0.838*	0.856	1.363**	1.377**	1.368**
	(0.0301)	(0.0304)	(0.0300)	(0.0805)	(0.0809)	(0.0821)	(0.208)	(0.210)	(0.208)
With_specialty	-0.212***	-0.213***	-0.213***	1.011	1.009	1.000	0.923	0.916	0.915
	(0.0212)	(0.0216)	(0.0210)	(0.0450)	(0.0447)	(0.0441)	(0.0617)	(0.0611)	(0.0611)
Handicap accessible	-0.104***	-0.114***	-0.0897**	1.410***	1.421***	1.511***	0.991	0.998	1.019
	(0.0368)	(0.0393)	(0.0362)	(0.114)	(0.114)	(0.121)	(0.120)	(0.120)	(0.123)
Group	-0.141***	-0.129***	-0.160***	1.043	1.029	0.957	0.934	0.921	0.898
	(0.0377)	(0.0413)	(0.0370)	(0.0728)	(0.0715)	(0.0663)	(0.0956)	(0.0942)	(0.0923)
Salary	0.167**	0.142	0.196***	0.883	0.924	1.009	1.663***	1.757***	1.822***
	(0.0773)	(0.0876)	(0.0760)	(0.0846)	(0.0886)	(0.0955)	(0.252)	(0.268)	(0.279)
short	0.325***	0.291***	0.341***	1.492***	1.582***	1.606***	3.207***	3.387***	3.321***
	(0.0218)	(0.0214)	(0.0232)	(0.105)	(0.111)	(0.112)	(0.323)	(0.344)	(0.334)
gray	0.117***	0.106***	0.121***	1.254***	1.275***	1.269***	1.833***	1.864***	1.850***
	(0.0116)	(0.0116)	(0.0118)		(0.0606)		(0.125)		(0.126)
L_Actual list				1.001***	1.001***	1.001***	1.001***	1.001***	1.001***
				(6.08e-05)	(6.05e-05)	(5.99e-05)	(8.46e-05)	(8.49e-05)	(8.47e-05)
Constant	2.697***	2.509***	2.805***	0.101***	0.140***	0.191***	0.0572***	0.0699***	0.0711***
	(0.0441)	(0.0449)	(0.0474)	(0.0137)	(0.0200)	(0.0267)	(0.0117)	(0.0147)	(0.0149)
Dummies for times	YES	YES	YES	YES	YES	YES	YES	YES	YES
Random intercepts for GPs and municipalities	YES	YES	YES	YES	YES	YES	YES	YES	YES
log likelihood	-31748.435	-31748.435	-31748.435	-13876.812	-13836.314	-13819.654	-9100.6636	-9096.4428	-9095.0739
Observations	39,654	39,654	39,654	24,511	24,511	24,511	14,367	14,367	14,367
No. GPs	5081	5081	5081	4817	4817	4817	4308	4308	4308
No. of municipalities	418	418	418	419	419	419	394	394	394
No. observations per GP	Min: 1 Avg:7.8 Max: 10	Min: 1 Avg:7.8 Max: 10	Min: 1Avg:7.8 Max: 10	Min: 1 Avg: 5.1 Max: 6	Min: 1 Avg:5.1 Max: 6	Min: 1 Avg: 5.1 Max: 6	Min: 1 Avg: 3.3 Max: 6	Min: 1 Avg: 3.3 Max: 6	Min: 1 Avg: 3.3 Max: 6
Random effects parameters	**Standard deviation Estimate(SE)**								
Municipality	0.197	0.294	0.185	0.728***	0.697***	0.575***	0.381***	0.374***	0.351***
	(0.015)	(0.028)	(0.014)	(0.0424)	(0.041)	(0.0377)	(0.0528)	(0.0517)	(0.0531)
Doctor	0.516	0.521	0.513	0.608***	0.602***	0.603***	1.174***	1.170***	1.171***
	(0.008)	(0.008)	(0.008)	(0.0303)	(0.0303)	(0.0303)	(0.0399)	(0.0398)	(0.0398)

Robust standard errors in parentheses;
*** p<0.01, ** p<0.05, * p<0.1, indicating that the parameters are significant at the 1%, 5% &10% significance level for two tailed test

[25] Random intercept at both GP and municipality level. Data from July 2010-January 2015 for 10 half year periods for exit; and January 2012 to July 2014 for 6 half year periods voice. Time dummies in the table representing every half year.

GP Level Exit Result

The exit regression result in the first three columns, indicate that higher competition leads to more exit (at1%). #open and # open/capita have positive and statistically significant effect on the number of patient switching per 1,000 listed patients (at 1%). Ceteris Paribus, a unit increase in # open /capita increase proportion of patient switching (prswitch) from GP list, by 44%; and a unit increase in # open increases proportion of patient switching (prswitch) from GP list, by 0.51%[26] respectively. The magnitude means that, holding all other things fixed, if we increase #open (the number of GPs with open lists) by 10 units from its mean (36.23), the number of switches (prswitch) is predicted to increase by 5.1%, (that is by approximately 5 persons) per half year per list. A higher value of Herfindahl means more concentrated, hence less competitive, market. Accordingly, the measure Herfindahl also provides similar evidence. A unit increase in Herfindahl lead to a decrease in number of patient switching per 1000 listed by 34%. Based on all the three competition measures, competitive GP market, leads to higher patient switching (at1%). The positive effect of competition on patient switching is similar to the finding by Iversen & Lurås (2011).

All other factors constant, in all models I, II & III, some of GP attributes have negative and statistically significant effect on patient switching. GPs with specialty have lower effect with patient switching as compared to GPs with no specialty (at1%). GPs with handicap accessible practice have lower effect on patient switching as compared to GPs with no handicap accessible practice. GPs group practice have also lower effect on patient switching as compared to GPs with no group practice. (at1%).

On the other hand, all other covariates fixed, Mid age GPs faces 8% to 9% higher patient switching than young age GPs. There is also a positive and statistically significant contribution on patient switching from being GP with fixed salary than otherwise, holding all other things constant. The GP's patient shortage has also positive and significant effect on patient switching as reflected by the coefficient for short and gray (at 1%). Holding all other covariates fixed: GP with short list experience 1.3 to 1.4 times higher proportion of patients switching's(prswitch) per 1000 listed than GP's with full list.[27] Similarly, GP's with gray list

[26] (1-(e^b)) *100% which is in this case (1-(e^(0.00509)*100%=(1 - 1.00510) *100% = 0.51% similar formula is used for interpreting the logarithmic scale coefficients in a standard scale.
[27] The occurrence of GPs short list increases, proportion of switches(prswitch) from a GP's list by 34%-40%

will experience 1.1 times higher proportion of patients switching's(prswitch) per 1000 listed than GPs with full list.[28]

Moreover, in the random part of the model, the GP, and municipality standard deviation are estimated. These deviations are from the GP mean, and municipality mean respectively. Accordingly, the estimated standard deviation between GPs is 0.5 and the estimated standard deviation between municipalities is 0.2-0.3.

GP Level Voice Result

The GP level voice result is presented by the effect on the odd of assessment from column 6-9 and on the odd of dissatisfied assessment from column 10-12.

Market competition measured by #open in Model–I and #open/capita in Model–II, have opposite effect on both dependent variables for voice. #open has positive effect while #open adjusted for municipality population has negative effect on both assessments and dissatisfied assessments received. The estimated effects are also statistically significant at 1%, except the effect of #open on dissatisfied assessment. All other variables constant, the estimated effect of a unit increase in #open is, 0.8% higher odds of assessment. On the other hand, for a unit increase in #open/capita, we expect to see about 38% & 32% lower odds of getting assessment & dissatisfied assessment respectively. Similar to the effect of #Open, using the measure Herfindahl, competitive GP market leads to significantly higher odds of assessment and dissatisfied assessment respectively. Higher Herfindahl means less competition, hence a unit increase in Herfindahl has 90% & 64% decrease in the odds of assessment and dissatisfied assessment respectively.

When we see the effect of covariates, each at a time holding others constant, variables such as: handicap accessible, L_actual list, short and gray, has statistically significant effect on the odds of assessment (at 1%). The odds of getting assessment is 41-51% higher for GPs with handicap accessible practice than GPs without handicap accessible practice. If the GP actual list increased by one person, the odd of assessment in the next period increase by 0.1%. The odds of getting assessment is 49% -61% higher for GP with short list than GP with full list. Similarly, the Odds of getting assessment is 25%-28% higher for GP with gray list than GP with full list. On the other hand, holding all other factors constant, among the covariates only

[28] The occurrence of GP's gray list increases proportion of switch's(prswitch) from the GP's list by 11%-12%

old_age_doc has negative and statistically significant effect on general assessment in both model I & II. The odds of getting assessment is 14%-17% lower for old age GP than young age GPs[29].

Moreover, the effect of the covariates on dissatisfied assessment can also be observed in the table from column 7-9. Like in the general assessment regression, variables: L_actual list, short, and gray still have positive and statistically significant coefficients on dissatisfied assessment regressions (at1%). Moreover, the coefficient of variable Old_age_doc, is also positive and significant on dissatisfied assessment regression (at5%). These covariates are significant in all the three models for the dissatisfied assessment, with the meaning for the effect of a unit change in each covariate, holding the other constant as follows. Given that a GP received assessment, the odds of getting dissatisfied assessment is higher; for GPs with short list than full list, and for GP with gray list than full list. Given that a GP received assessment, an increase in GP actual list by 1 person have 0.1% higher odds on dissatisfied assessment received by a GP. Conditional that a GP received assessment, the odds of getting dissatisfied assessment is 66-82% higher for GP with fixed salary than GP without fixed salary (at1%). Although, we have seen previously that, old age GPs get lower odds of general assessment than young age GPs, conditional on receiving assessment, old age GPs get 36%-38% higher odds of dissatisfied assessment as compared to young age GPs (at5%). Among the covariates, holding all other factors constant, only male has negative and statistically significant effect on dissatisfied assessment received. GP male has 18% lower odds of receiving dissatisfied assessment than GP female, given that a GP received assessment(at1%).

Overall the GP level result in table 4.3.1 confirms that the sign and significance of our competition measures supports our hypothesis for exit and voice presented in chapter1. Moreover, variables such as: GP with; salary, short list, gray list have positive effect on both patient switching and dissatisfied assessment. Besides, handicap accessibility of GP practice has negative effect on patient switching, positive effect on general assessment and no effect on dissatisfied assessment.

[29] Young age GPs are the reference category.

4.3.2 Municipality level estimation result

Henceforth, the municipality level exit and voice regression result will be presented. This will enable us, to look for commensurate evidence at market level. Since municipalities are used as a market boarder, the municipality level analysis will provide finding over different market and period.

Based on the reasons, for model selection that we put in section3.2.2, we used linear regression and Tobit regression for municipality level exit and voice respectively.

The general forms of the models are also presented in chapter 3 section 3.2.2; eq(3) for market level exit and eq(4) for market level voice respectively.

In table 4.3.2 market level result below, the municipality level exit results are presented from column (1-3). Besides, the municipality level voice is illustrated by: the result on assessment from column (4-6) and on dissatisfied assessment from column (7-9). The three sets of regression result (Model I, Model II; & Model III), correspond our three GP market competition measures; #open, #open/capita and herfindahl, respectively. All the remaining explanatory variables are similar in all the regressions. We describe the municipality level exit result followed by municipality level voice.

Table 4.3.2 Municipality-level- linear and Tobit panel regressions for the effect of market conditions & covariates on patient exit and voice respectively.[30]

	Municipality Level Exit			**Municipality Level Voice**					
VARIABLES	**Ln prswitch_M Fixed/Random effect estimation (SE)**			**prassessed_M Marginal effect (SE)ª**			**prdisatisfied_M Marginal effect (SE) ª**		
	Model - I	**Model - II**	**Model - III**	**Model - I**	**Model - II**	**Model - III**	**Model - I**	**Model - II**	**Model - III**
#Open	0.00372**			0.00339***			0.00136***		
	(0.00154)			(9.15e-05)			(4.00e-05)		
#Open/capita		0.334***			-0.287***			-0.141***	
		(0.0391)			(0.0341)			(0.0145)	
herfindahl			-0.365***			-2.115***			-0.771***
			(0.0561)			(0.0485)			(0.0262)
prmale_M	-0.192**	-0.186***	-0.179***	-0.00412	-0.329***	-0.303***	-0.137***	-0.282***	-0.275***
	(0.0915)	(0.0692)	(0.0590)	(0.0450)	(0.0476)	(0.0431)	(0.0216)	(0.0225)	(0.0218)
Prmid_age_doc_M	0.201***	0.0673	0.0442	-0.353***	-0.607***	-0.576***	-0.0909***	-0.188***	-0.206***
	(0.0685)	(0.0659)	(0.0655)	(0.0567)	(0.0588)	(0.0557)	(0.0259)	(0.0267)	(0.0264)
prold_age_doc_M	0.105	-0.0772	-0.0743	-0.318***	-0.293***	-0.466***	0.0105	0.0348	-0.0538*
	(0.0924)	(0.0812)	(0.0749)	(0.0620)	(0.0655)	(0.0610)	(0.0285)	(0.0299)	(0.0294)
prwith_specialty_M	0.00957	0.0944	0.0503	0.302***	0.429***	0.135***	0.0531***	0.0972***	0.0128
	(0.107)	(0.0600)	(0.0548)	(0.0411)	(0.0446)	(0.0404)	(0.0191)	(0.0205)	(0.0199)
Prhandicap_accessible_M	-0.0412	-0.186**	-0.140*	-0.0584	-0.255***	0.00524	-0.0140	-0.0867***	0.0190
	(0.121)	(0.0803)	(0.0727)	(0.0549)	(0.0587)	(0.0541)	(0.0262)	(0.0278)	(0.0272)
prgroup_M	0.237*	0.204***	0.0921*	0.0659	0.163***	-0.148***	-0.0754***	-0.0399*	-0.126***
	(0.125)	(0.0593)	(0.0540)	(0.0418)	(0.0457)	(0.0410)	(0.0204)	(0.0219)	(0.0213)
prsalary_M	-0.116	-0.248***	-0.109*	-0.317***	-0.373***	0.155***	-0.0418*	-0.0591**	0.116***
	(0.147)	(0.0612)	(0.0604)	(0.0480)	(0.0525)	(0.0478)	(0.0235)	(0.0253)	(0.0249)
prshort_M	0.622***	0.0300	0.348***	-0.301***	0.403***	0.547***	-0.0197	0.297***	0.298***
	(0.0823)	(0.0889)	(0.0901)	(0.0497)	(0.0647)	(0.0491)	(0.0224)	(0.0291)	(0.0233)
prgray_M	0.294***	-0.0253	0.188***	0.0687	0.498***	0.492***	0.0473**	0.225***	0.209***
	(0.0609)	(0.0716)	(0.0710)	(0.0445)	(0.0496)	(0.0437)	(0.0194)	(0.0212)	(0.0197)
Constant	2.377***	2.508***	2.673***						
	(0.0865)	(0.0523)	(0.0497)						
Dummies for times	YES	YES	YES	YES	YES	YES	YES	YES	YES
Adjusted R-squared	0.240								
Log likelihood[b]				-44118.4	-44688.6	-43846.6	-16211.3	-16292.6	-16292.6
Observations	4,106	4,106	4,106	2,483	2,483	2,483	1,776	1,776	1,776
Number of municipalities	418	418	418	419	419	419	395	395	395
Obs. Per municipality	Min: 3 Avg: 9.8 Max: 10	Min: 3 Avg: 9.8 Max: 10	Min: 3 Avg: 9.8 Max: 10	Min: 1 Avg: 5.9 Max: 6	Min: 1 Avg: 5.9 Max: 6	Min: 1 Avg: 5.9 Max: 6	Min: 1 Avg: 4.5 Max: 6	Min: 1 Avg: 4.5 Max: 6	Min: 1 Avg: 4.5 Max: 6
Hausman test	p-Value 0.0000	chi2(19= -1718.73	p-Value 0.9640						

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1 indicating that the parameters are significant at the 1%, 5% &10% significance level for two tailed test. Data from July 2010-January 2015 for 10 half year periods for exit; and January 2012 to July 2014 for 6 half year period for voice. Censoring summary; in assessment regression 707 left-censored observations and 1,776 uncensored observations. In the dissatisfied assessment regression 522 left-censored observations and 1,254 uncensored observations.

ª $\frac{dE(y\ |y>0)}{dx}$. [b] All the regression have p-Value 0.000

[30] Time dummies in the table representing every half-year.

Municipality Level Exit Result

Since the exit regression is linear panel regression, we estimated for it both random and fixed effect models. For the random effect model to be valid, the municipality specific unobserved heterogeneity should be uncorrelated with the independent variables. We tested these restrictions by means of hausman test. The restriction is rejected in Model-I, but not rejected in Model II & III. Hence, the fixed effect estimate is selected for Model-I, as they are consistent estimates. We presented the random effect estimates for Model II & III, and they are more efficient than fixed effect estimators.

Accordingly, the result from table 4.3.2, indicated that, *ceteris paribus*, GP market competition lead to patient switching in all the three models. Holding all other factors constant; unit increase in #open, increases the proportion of switching in a market (prswitch_M)[31], by 0.37%; and a unit increase in #open/capita, increases the proportion of switching in a market (prswitch_M) , by 40%. The magnitude of the effect means that if we increase #open (the number of open practices) by 10 units from its mean (4.16), the number of switches in a market (prswitch_M) is predicted to increase by 3.7% (that is by approximately 3 to 4 persons) per half-year per market. The third competition intensity measure, Herfindahl, has a negative and significant effect on proportion of patient switching (at1%). Since higher Herfindahl means lower GP market competition: this implies that as market becomes more competitive, we see more patient switching. The coefficient shows that a unit decrease in Herfindahl is expected to increase the magnitude of proportion of switching in a market, (prswitch_M) by 30%[32].

Among the covariates, similar to the GP level regression, higher proportion of GPs with patient shortage is associated with higher patients switching in a municipality as indicated by the positive and significant coefficients of prshort_M and prgray_M. A unit increase in proportion of GPs with short list, increases proportion of patient switching in a market (prswitch_M), by 42%(as in Model III) & 86% (as in Model I); and a unit increase in proportion of GPs with gray list, increases proportion of patient switching in a market (pswitch_M), by 21% (as in Model III) & 34%(as in Model I). Moreover, in all the three models the coefficients of proportion of GPs with group practices in a market (prgroup_M)

[31] As aforementioned, Prswitch_M is per 1000 listed patients in the municipality in the beginning of each period.
[32] (1-(e^b))*100% which is in this case (1-(e^(-0.365)*100%=(1- 0.69420)*100% =30%

are positive and significant (at10%). The magnitude of the effect according to the average of the three model is, 23% increase.

On the other hand, among the covariates: prhandicap_accessible_M, prmale_M & prsalary_M, have negative and significant coefficients. Similar to the GP level exit result, we see that a unit increase in the proportion of GPs with handicap accessible practice, leads to a decrease in proportion of patient switching in a market (prswitch_M), by 13%(as Model III) &17%(as in model II). In contrast to the GP level exit result, a unit increase in the proportion of salaried GPs in municipality, decreases proportion of patient switching in a market(prswitch_M), by 10%(as Model III) and 22% (as Model II). Additionally, at municipality level, unit increase in proportion of male GPs, decreases proportion of patient switching in a municipality (prswitch_M), by 16%-17%.

Subsequently, we illustrate the voice result from table 4.3.2 above: -

Municipality Level Voice Result

In municipality level table 4.3.2 above, the voice results are presented by; assessment (column 4-6) and dissatisfied assessment (column 7-9). Since we have a large number of censored observation, the latent effect of the explanatory variables is higher than the actual effect. We therefore, presented marginal effect of explanatory variables of the truncated sample[33]. That is: given that there is assessment in a municipality, the marginal effect of independent variables, on actual proportion of patient assessment in a market(prassessed_M); and given dissatisfied assessments in a municipality, the marginal effect of independent variable, on actual proportion of dissatisfied assessment in a market(prdisatified_M).

Our prediction of the effect of competition on voice also holds at municipality level. Competition with and without municipality population size adjustment leads to more voice and less voice respectively as indicated by #open and #open/capital. The magnitudes of the competition proxies are also significant (at 1%). Conditional on assessment greater than zero, a unit increase in #open, increases the actual proportion of assessment in market (prassessed_M), by 0.0034. Similarly, conditional on dissatisfied assessment greater than zero, a unit increase in #open, increases the actual proportion of dissatisfied assessment in

[33] Truncated sample means, when we only observe X_{it} for observations where $Y_{it} > 0$. (where 0 is our cencered threshold; X_{it} are our vector of explanatory variables; and Y_{it} is our dependent variable that represent proportion of assessment or dissatisfied assessment in a municipality per 1,000 listed.

market (prdisatified _M), by 0.0014. In contrast, conditional on assessment in a municipality, a unit increase in #Open/capita, decreases actual proportion of assessment in a market (prassessed_M), by 0.29. Conditional on dissatisfied assessment in a municipality, a unit increase in #Open/capita, decreases actual proportion of dissatisfied assessment in a market (prdissatisfied_M), by 0.14.

The opposite effect of #Open and #Open/capita is similar to our finding in descriptive analysis, and GP level voice regression results. Because we have seen that in section 4.2, #Open/capital was higher in very small municipalities with few residents where the public good motive for contributing to online rating is very small. So the regression result aligns with the descriptive analysis in section 4.2. Likewise, Herfindahl also provides similar result with #open. This has also elaborated in the descriptive that, less market concentration in big municipalities, is likely because of the large number of GPs with smaller market share. Hence, the marginal effect of Herfindahl indicates that; a decrease in market competition as measured by a unit increase in Herfindahl, decreases actual proportion of assessment in a market (prassessed_M), by 2.1, given assessment greater than zero; and it also decreases actual proportion dissatisfied assessment in a market(prdissatisfied_M), by 0.77, given dissatisfied assessment greater than zero.

Among the covariates, similar to the GP level voice result, Model II & III support that the increase in the proportion of GPs with patient shortage increases the conditional proportion of assessment in the market (prassessed_M) and the conditional proportion of dissatisfied assessment in the market (prdissatisfied_M) at 1%. This is depicted from the coefficients of both proportion of short and proportion of gray in the table. At GP level, we have seen that higher patient switching and dissatisfied assessment associated with GP's with salary. However, here at market level, a unit increase in proportion of salaried GP, decreases the conditional proportion of assessment in the market (prassessed_M) by 0.32 & 0.37 as observed from the marginal effects in Model I & II respectively. The sign of the effect of proportion of salaried GP's is similar to the market level exit result above.

The significant effect of handicap accessible practice on GP level assessment, still holds at market level as depicted by Model II. Yet, the market level relation is negative. The coefficient in the table means that, a unit increase in the proportion of handicap accessible practice, decreases actual proportion of assessment in market (prassessed_M), by 0.26, given

assessment greater than 0 (at 1%). It also decreases dissatisfied assessment in market (prdissatisfied_M), by 0.087 given dissatisfied assessment greater than 0 (at1%).

The negative effect of old age GP on assessment; and the negative effect of male GP on dissatisfied assessment are still observed at market level result as well (at 1%). This can be seen, in all the three sets of models in the table, by the coefficients for the proportion of old age GP and the proportion of male GPs respectively. Moreover, we see that unlike the GP level voice results, variable related to middle age GPs, have negative and significant coefficients in both market level assessment and dissatisfied assessment (at1%). These are robustly observed in all the three sets of Models.

Generally, we see that our prediction about exit and voice also holds at market level. As the GP market becomes more competitive, we see more patient switching in a market. Besides, as market becomes more competitive, we see more voice with competition proxies that does not specifically adjust for municipality sizes (#Open & Herfindhal). When we adjust for the municipality size effect, by using #Open/capita as a competition proxy, competitive GP market leads to less market level voice. This is similar to our descriptive result in section 4.2 and our GP level result in 4.3.1 above. Among the covariates, similar to the GP level results, variables related to GPs patient shortage still leads to higher assessment and dissatisfied assessment at market level. Patient shortage resulted higher patient exit at both GP and market level results. We also observe that lower patient exit at both GP and market level as a result of GP's handicap accessible practice. However, the GP level result of higher assessment resulted from GP's handicap accessible practice is not seen at market level. Nevertheless, handicap accessible practice, come up with negative effect on dissatisfied assessment (prdissatisfied_M) at market level.

5 Analysis

5.1 Discussion

This paper primarily investigates the influence of GP market competition on dissatisfied patients' choice of exit (switching physician) vs. voice (participating in online rating). It applies the Hirschman's (1970;1980) approach in the context of the Norwegian GP market using both GP-level and municipality-level longitudinal data from January 2010 to January 2014. The GP-level analysis allows us to see how market competition influences patient exit and voice encountered by each providers(GPs). Municipalities are used as the administrative borders and thus as the market boundaries; therefore, the municipality-level analysis provides commensurate evidence by analyzing how the exit and the voice decision made by patients varies at market level as market competition varies.

The results from both perspectives of the analysis support our hypothesis for exit and voice. While Hirschman (1970) sees exit as a clear-cut, either-or decision that depends on alternative providers, he believes that voicing opinions is an art that evolves as the methods for doing so become less costly and more effective, the general readiness of the population increases, and is not always weaken by the possibilities of exit. Moreover, according to Hirschman (1980), when voice is linked to public interest, engaging in it becomes a decision to contribute to the public good, thereby attracting increased participation.

Thus, based on the approach discussed, the hypothesis that we put for exit was straight forward. As the GP market becomes competitive, we predicted to find larger proportion of patients to change their GPs. Both our descriptive results, and GP- & municipality- levels regressions result significantly support this prediction. In the descriptive section, after categorizing the competitive markets into two based on the median of each measure, we saw that the total number of patients switching is higher in a competitive market than in a less competitive one. This finding was also confirmed by the Mann-Whitney test, that tested the difference in patient switching (using median) between market competition below and above the median of each measures. Moreover, at both the GP and municipality level, #Open and #Open/capital have positive and statistically significant coefficients, and Herfindahl has negative and statistically significant coefficient (at 1% significance level). A higher Herfindahl indicates higher market concentration and less competition, while higher #Open

and #Open/capital indicate more GP options for patients, and hence, suggest more competition. Therefore, at both the GP and municipality levels, all three competition proxies strongly support our predication for exit.

The coefficients of the competition measures also provide some sense of magnitude. For instance, at the GP level, using the Herfindahl as an example, we observe that, *ceteris paribus*, if we increase Herfindahl by a unit (which leads to market concentration and less competition) from its mean (0.11), the number of switches (prswitch) is predicted to increase by 34%, (that is by approximately 34 persons) per half-year per list. However, since the units of #Open/capita, #Open, and Herfindahl are very different, comparing the magnitudes of the estimates across regressions is not meaningful. Iversen and Lurås (2011) also observed a positive and significant effect of competition on the proportion of patients switching. This positive relationship is accordance with the concept of the quality elasticity of demand as explained in Appendix 2 in Figure 2.2.1: i. e., in a competitive market, proportional change in demand for a unit change in quality will be higher, implying that the patient quality elasticity of demand is higher. Therefore, with higher market competition, a larger proportion of patients change GPs. This is the case for competition proxies that reflect the municipality size effect (i.e. #Open and Herfindahl) as well as the competition proxy that adjusts for the municipality size effect (i.e. #Open/capita). Hence, in either large or small municipalities, competition leads to higher patient switching (i.e. exit). This result is in support of Hirschman's approach that he explains in the context of product market: "…the presence of a number of competing firms fosters in this case the perpetual illusion that "the grass is always greener on the other side of the fence," that is, that an escape from defectiveness is possible through purchase of the competitor's product." (Hirschman, 1970, p.27). In parallel to this view, the above patient switching result favors that in a competitive market, escaping from a displeasing provider is possible for the patient through attaching to its competitor.

This study has two hypotheses for voice. Without specifically adjusting for the municipality size effect, when the GP market is competitive, we predicted a larger proportion of patients would use the option of rating their GPs (voice), while when the municipality size effect is adjusted with the competition measure that specifically adjusts for population size, higher competition is predicted to weaken voice, meaning that a lower proportion of patients are predicted to use the option of rating their GP. We have seen that our prediction holds

consistently throughout our descriptive analysis and our GP- and municipality-level regression results.

The competition proxies, #Open and Herfindahl, do not specifically adjust for municipality population. As seen in the descriptive results, the municipalities that exhibit higher competition in both measures have large populations and sizes. Iversen and Lurås (2011), had also stated that other things being equal, larger municipalities are likely to have larger values of #Open. Therefore, the higher competition seen in these two measures signifies also the municipality size effect. Hence, this study consistently found that the higher competition exhibited by these two measures led to higher participation of patients in voicing (i.e. a higher proportion of patient in a market, and highly likely that patients rate their GPs as well), supporting the first hypothesis for voice. On the other hand, when using #Open/capita that adjusts for municipality population, larger municipalities did not show higher competition. As seen in the descriptive section, the municipalities that exhibit higher competition with the #Open/capita measure are relatively smaller ones. Iverse and Lurås (2011) have also indicated that #Open/capita can also adjust for the effect of municipality size. The results of #Open/capita also support our second hypothesis for voice that, after adjusting for the municipality size, more competition leads to less voice. Hence, the two hypotheses for voice as measured by their respective competition proxies were confirmed in the descriptive analysis, and the GP- and municipality-level regression results.

In the descriptive section, the bar graph showing the naïve association between competition and voice supports the opposite effect of competition on voice when competition is measured by #Open or #Herfindahl on one hand and #Open/per capita on the other hand. However, the naïve associations present, the mere relation and also cannot take into account confounding factors that need to be handled. After controlling for the relevant available covariates, our estimation from the GP- and municipality-level voice regression results also strongly supports that an increase in GP-market competition as measured by #Open and Herfindahl lead to more voice, whereas an increase in competition as measured by #Open/capita leads to less voice.

The positive influence of competition on voice with the competition proxies (#Open and Herfindahl) not only show the effect of competition but also the municipality size effect. This result is supported by the literature and the analytical approach adopted here. There is higher public interest in online voice in a large market than in a small one. When patients rate a GP

online, they express their opinions to the provider and to the community at the same time, creating knowledge about the GP that is freely available to everyone non-excludable and non-rivalry. In large municipalities, this open knowledge is of particular interest because of the high search cost associated with finding a physician in large market. This supports Pauly and Satterthwaite (1981), who found that the resident search cost for a GP in a large community is higher than in a small one. According to their analysis, in a small market with few GPs or only one monopolizing the market, the reputation of GPs can easily be known and remembered throughout the community. Hence, in such small municipalities the public good motive for contributing to «online rating» is very small. Whereas in a large market with several GPs, the residents cannot easily find a source who knows about a given physician. In addition, individuals cannot easily associate and remember what information matches whom. Thus, as a result of the high community interest for voice in a large market, voice as a public good supersedes any one individual and is maintained and exchanged within the community through mutual support behavior and generalized reciprocity (Wasco and Faraj, 2000). The availability of information about GPs which otherwise might be difficult to obtain because of the large number of providers in a large market will also increase the patient collective power to influence the provider and in doing so increasing the effectiveness of voicing. This increase is an important reason for voice because according to Hirschman (1970), people will use voicing if they are sufficiently convinced that it will be effective. Moreover, voicing to and about providers will also generate public interest beyond individual concerns because it involves a large number of community members who will benefit from it, supporting Hirschman's (1980) conclusion that when there is high public interest and public happiness associated with voicing, the voice become a desired end in and of itself. Hence, the result from the two competition measures at the same time depict the municipality size effect. Therefore, the predicted influence of higher competition without adjusting specifically for municipality size lead to more voice holds.

On the other hand, when municipality size is adjusted using #Open/capita, the positive relationship is no longer seen. This can be understood as mentioned above that in a small market voice, apart from informing the provider about his services, do not generate much public interest, primarily because, the reputations of the GPs are readily known and remembered by the community in a small market. The motive for voicing online to inform the community is, thus minimal. In addition, the voice to and about a provider does not involve

much public interest because any improvement resulting from it will be shared by a relatively small number of community members. Higher competition adjusted for municipality size implies less voice, because people can easily change GPs to create a viable opportunity for themselves whenever they have an option to do so, whereas when competition as measured by the adjusted measure (#Open/capita) is lower, voice can be become a decisive factor in informing the provider because patients have fewer GP options to change. Therefore, this reduced exit opportunity atrophies voice in this case.

To control for the effect of other covariates in the regressions, we have included those supported by related research. Among these covariates, both at the GP- and municipality-level regression, a GP's patient shortage leads to higher exit, this is also supported by the descriptive comparison. This study found in the GP-level result that the occurrence of a patient shortage (particularly a short list) increases the proportion of patients exiting from a GP by approximately 40%. Similarly, Iversen and Lurås (2011) found a comparable amount, 50%, from their data. As they explained, inferior physician quality as perceived by patients implies a patient shortage for the physician, with more patients exiting from such GPs than those with a full list. Moreover, we found that exit is lower for GPs with handicap accessible practices than without. This has been supported by lower proportion of patient switching throughout the descriptive naïve comparison, the GP and market level regression result. Handicap accessible practices imply less dissatisfied patient voice particularly at the municipality-level analysis, a conclusion that is intuitive as such practices are more suitable and in line with patient's preferences, thus resulting in fewer exits and less voice. Handicap accessibility is also likely to correlate with other aspects which is unobservable to us, such as age of building where practice is located., where older buildings less likely to have elevator. A newer building can however appear more attractive to patients who need the elevators. The variable, GP with salary, was also found to have interesting implications. At the GP-level, we found that salaried physicians face higher patient exit and voice than GP's without salaries. This is likely because as in Gosden, et al.'s (2000) systemic literature analysis, salaried GPs know in advance the amount of payment they will receive and, hence, tend to give their patients lower quantity of services in order to contain cost. This can in turn, increase patient dissatisfaction, resulting in a higher proportion of patients switches and /or voice encountered by such GPs than others.

5.2 Limitations and strength

Using relevant literature, this study controlled for the appropriate covariates available in order to obtain a precise estimate of the effect of market competition on exit and voice. However, as for most research, controlling for all kinds of variables that are correlated with our interest variable and dependent variables are hardly possible. Schlesinger and Elbel (2002) suggested characteristics of the problem, of the patients and of the setting in which the problem occurs as factors that influence dissatisfied patients to give voice. Hence, if any variables related to the three categories, correlated with market competition, then they will decrease the precision of our estimate. However, setting and patient problem are likely to be similar in municipalities. We have taken into account some of the concerns related to the characteristics of setting and/or patient problems by controlling for the practice styles of GPs that are particularly different from other practices (for example, GP group practices and handicap accessible practices). Taking into account such GP-level characteristics, simultaneously implies similarities of setting and problems encountered because we are capturing various GP practice features that can be a source of difference for types of patient problems and settings. In addition, missing patient-level information may also decrease the precision of the estimates if this information is correlated with exit and/or voice, and market competition. However, according to Folmo (2014), the population distribution of Norway in terms of patient demographics such as age and gender is similar across counties. Hence, in a market-level regression, missing such demographic information is not a great concern here. Having comparable results at the GP and market level will, therefore, ensure the robustness of our estimation result for the GP level as well. In addition, since municipalities are used as a market border on this study, similar patient distributions across municipalities also mean that different competitive markets have similar patient characteristics (i.e. almost no correlation between patient-level characteristics and market competition). This reduces our concern for biases related to missing patient characteristics even in the GP-level regression. We believe that with further availability of data, the problems associated with variables which were not possible to be obtained during our study period, may provide a more precise estimation in future research.

In our regression, the estimates are evaluated at the mean of the dependent variables. With outliers in the data, as depicted in the box plots of the dependent variables, checking the robustness of the result across different quantiles using quantile regression would offer more

evidence. Because it can provide clear information on the effect of a unit change in market competition measures at different quantiles of the dependent variables. However, since we have undertaken a broad analysis for both exit and voice at GP and municipality levels with different market competition measures, incorporating a robustness analysis at different quartiles are nontrivial in terms of scope and time for this particular study. However, our analyses are fertile ground for future research using quantile regression to cross-check our results.

5.3 Further research

Further comparative analysis based on the additional information suggested in the limitation section as well as the quantile regression would further verify this study. Moreover, our results provided evidence that higher competition before adjusting for municipality size suggests more voice. However, when we adjust for the municipality size, this study found that competition indicated less voice. This result is a crucial point of departure for future research that can show the effect of competition on voice for different municipality sizes, by introducing an interaction term for municipality sizes and market competition measures. Such an analysis would specifically enable one to know, how great is the effect of competition on voice for bigger municipalities than smaller one.

Our results supported our expectation that there is higher interest for online voicing in a large competitive municipality than in small one because of the higher search cost associated with finding GPs in a large municipality. Previous research, using legelisten rating data, also found that the rating provides a judgment about GP quality as with other systemic studies based on survey data, demonstrating that the rating can be a useful information source for patients who search for GPs (Sivertsen, 2014). We suggested that the rating is even more important in big municipalities than small ones as indicated by the positive influence of competition without municipality size adjustment on voice. As mentioned previously, one reason for this is that in large municipalities, people cannot easily know and remember the reputation of any given GP; hence, they are more likely to contribute to online voicing as a public good through a sense of mutual support and generalized reciprocity. Therefore, further research, can also cross check this, by exploring whether larger proportion of people that may or may not contribute to the online voice, visit the channel in big competitive market than small one. This will ascertain that not only contributing (i.e. rating/voice) but also accessing the online patient

voice as a public good are more common in larger municipalities than smaller one; so as verifying our approach.

Moreover, according to Baker and Green (2005), online consumer reviews improve information transfer, thereby increasing the collective consumer influence on the provider. Particularly in large municipalities, online voice increases the collective influence of a larger number of community members by making them better informed about the providers than they would otherwise be. Hence, based on Hirschman (1970), we claimed that when patients believe that their voice is effective, they contribute to it even in situations where there are high exit possibilities. This also agrees with our results that as a market becomes competitive without adjusting for size, higher proportion patients will provide voice. Based on this, we suggest for further research to see if more GPs respond to online ratings in large markets than in smaller one because of the higher influence patients can wield in large markets or because of the higher voice seen in such markets.

6 Conclusions and recommendations

Our analysis, based on data on the Norwegian general practitioner market from 2010 until 2014, provided supporting evidence for the analytical approach followed here.

This study found that when the GP market is competitive, a larger proportion of patient exit from a given GP list/ their GPs in a market[34] by creating a viable opportunity for themselves. This was observed in all cases of the competitive measures that indicate both competition and size of the municipality and in the competitive measure that adjusted for the municipality size effect and indicate only the competitive GP options available to patients. This result indicates that higher GP market competition gives patients more alternatives; hence, they are more likely to change physicians in a competitive market.

On the other hand, the online voicing channel has a unique characteristic that leads to a two-way implication of the effect of competition on voice. Higher exit opportunities weaken the voicing option. However, if a higher competitive market is at the same time in a larger municipality, online voicing will still be largely practiced. Accordingly, when the GP market becomes competitive without adjusting for the municipality size effect, this study observed that it is highly likely that patients in any given GP list voice and also higher proportion of patient voice in a market, about their GP. This can be interpreted from the point of view of informing communities in large markets, as the voice is communicated in non-excludable and non-rival way to all members. Moreover, from the perspective of the higher collective influence resulting from the better information accessed in a large municipality, patient collective influence means higher effectiveness of voice and thereby more use of voice. Additionally, voice to and about the provider will benefit more community members in a large municipality compared to smaller markets, supporting Hirschman (1980) and meaning that when there is high public happiness associated with voice, it becomes a desired end in and of itself. Hence, our results, supporting our analytical approach, indicate that in larger municipalities with more GP options, voice is desired by the community and, hence, practiced more.

In contrast, a competitive market adjusted for municipality size led to, less patients' participations in voice at both GP and market level. Because, competition measure here no

[34]The proportion of patients switch their GPs implies the market level effect. A larger proportion of patients exiting from a given GP list implies the effect at an individual GP level.

more depict the municipality size effect. Hence, we will not see this effect associated with larger competitive municipalities as patients engage in online voicing. Therefore, voicing is seen solely as an option for expressing discontent, one that increases when there are fewer GP options for patients. According to Hirschman (1970), voicing increases when the opportunity for exit declines up to the point where an outside option is not available; then the choice of voice becomes a dominant means for expressing discontentment to the physician. In line with this argument, our study demonstrated that when there is higher GP market competition adjusted for municipality size, it is less likely that patients in a given GP list voice, and also smaller proportion of patient's voice about their GPs in a market.

Knowing the implication of market on exit versus voice is valuable for the administrators of legelisten and for other stakeholders responsible for the regular general practitioners plan at different levels. In designing a user-friendly rating site, legelisten administrators should take into account the differences in patient participation in various markets, mainly due to market condition, particularly because any explicit incentive to encourage online rating interferes with the implicit incentive that patients already have to participate. The patient implicit incentive for participation varies depending on market competition as aforementioned. Hence, policies, particularly on increasing the participation of residents on online rating, should take into account this distinction. Moreover, in a large competitive municipality, we have seen that both exit and voice are higher than in a smaller market. Although exit is less informative in such markets, simultaneously a higher level of patient voice decreases the concern for GPs to get feedback on the patient's reason for exiting in order to improve their practices. Although it may not be the same patient who is switching that is rating a given GP, the overall reason for dissatisfaction can be captured from the voicing channel. However, in small competitive markets as indicated by competition measures that adjust for the municipality size effect, the proportion of patients who exit is larger while those who voice are fewer. These results show a need to design a means of channeling patients voice in such markets to enable GPs to have a feedback mechanism to explain why discontent patients leave.

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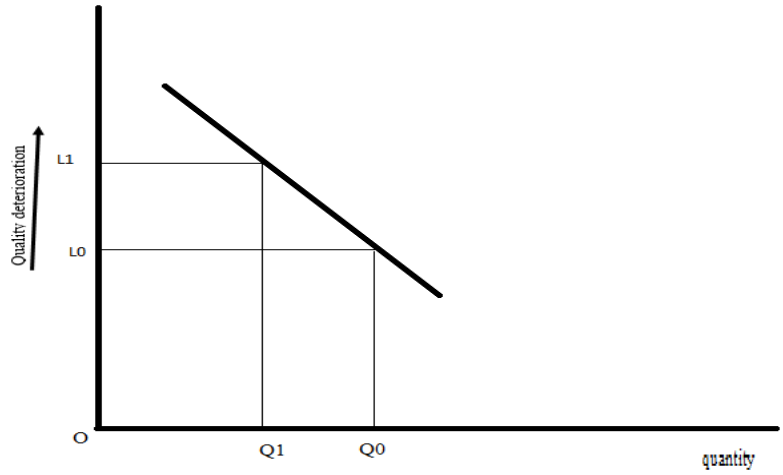
Appendixes

Appendix 2

Figure 2.2.1 Demand curve as a function of quality



Source: Adapted from Hirschman 1970, p.30

Note: Assuming other things including price unchanged, the demand curve as a function of quality is represented as above.

The vertical axis represents quality deterioration instead of price. When we go from the origin up the vertical axis, quality deteriorates so that the demand curve as a function of quality resembles the usual downward sloping demand curve. The horizontal axis represents the quantity demanded at each quality level. When we go from the origin to the right of the horizontal axis, the higher the quantity demanded at each quality level. Here L0 represents the acceptable quality, and L1 a lapse in quality. Quality deteriorates as we go from L0 to L1. With this laps in quality, the quantity demanded decreases from Q0 to Q1, showing an exit of customers (i.e. people stop using the service of the provider). If this demand curve is applied to patients in a GP service in a market where the price is fixed[35] and the demand is a function of quality, then the following can be said concerning the relation between the quality elasticity of demand and the GP market. More GP options in the competitive market makes the demand curve flatter. Higher competition leads to GPs having more or less the same quality. (This is similar to the demand curve as a function of price. In a competitive market,

[35] Similarly, in our study setting, GPs do not set prices. They receive payments in accordance with the payment system that applies in Norway. Some GPs are also contracted and employed by municipalities for a fixed salary. Patients also pay the same no matter which GP from the regular practitioner scheme they see.

the demand curve as a function of price will be flatter as the firm will be more price-taker than maker in a competitive market.)

The above depicted demand curve becomes flatter means, ceteris paribus, proportional change in demand, for a proportional change in quality (i.e. quality elasticity of demand), will be large. It will approach infinity if this demand curve as a function of quality is horizontal (i.e. perfectly elastic). In contrast, lower GP market competition, lowers the available GP options for the patients, hence the demand curve will be less elastic. Hence, ceteris paribus, proportional change in demand, for a proportional change in quality (i.e. quality elasticity of demand) will be smaller. The extreme case of perfectly quality inelastic demand curve can be represented by the vertical line at a certain quantity demand level for all values of GP's qualities.

Overall, the more GP options in the competitive market, the higher the quality elasticity of demand, meaning that patients will be more sensitive to small deteriorations and exit GPs, creating viable opportunities for themselves. While in a less competitive GP market where there are fewer GP options, the demand curve will be more inelastic, meaning that patients are less sensitive to quality deterioration, and, hence, they will have lower quality elasticity, explaining why fewer exit in this market.

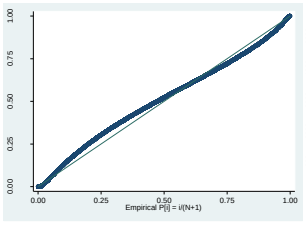
Appendix 3

Normality check

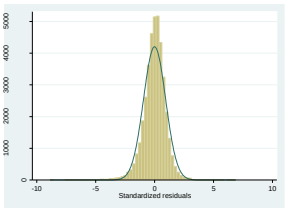
Figure 3.2.3.1 Histogram and Q-Q plot for exit regression residuals

GP level exit

Model - I

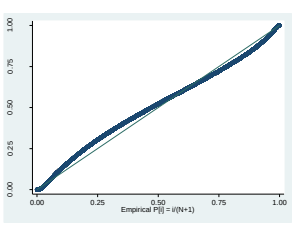


Q-Q plot for residual

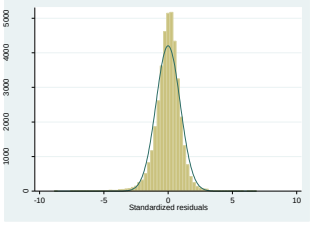


Histogram for residual

Model - II



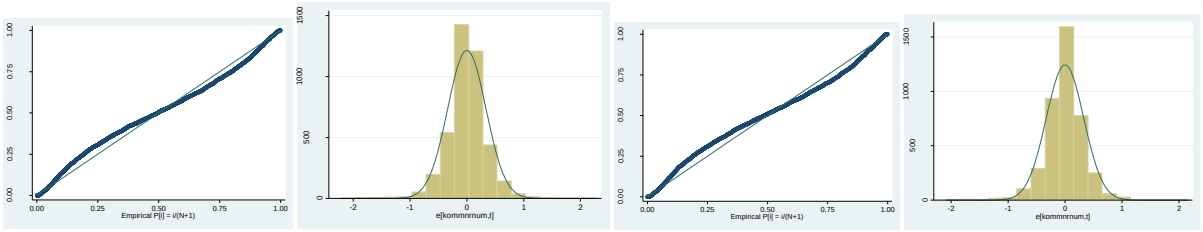
Q-Q plot for residual



Histogram for residual

Market level exit

Model - I Model – II



Q-Q plot for residual Histogram for residual Q-Q plot for residual Histogram for residual

Figure 3.2.3.2Pearson correlation of the variables

GP level

```
. correlate capacity CapPop herfindahl male  Old_age with_speciality handi_accessible groupp salary short gray t
(obs=39,850)
```

	capacity	CapPop	herfin~l	male	Old_age	with_s~y	handi_~e	groupp	salary	short	gray	t
capacity	1.0000											
CapPop	-0.0538	1.0000										
herfindahl	-0.3277	0.4938	1.0000									
male	-0.0302	0.0124	-0.0054	1.0000								
Old_age	0.1011	-0.0067	-0.0726	0.1950	1.0000							
with_speci~y	0.0700	-0.0956	-0.1370	0.1116	0.3271	1.0000						
handi_acce~e	-0.0084	-0.0368	-0.0159	-0.0421	-0.1073	0.0570	1.0000					
groupp	0.0376	-0.1186	-0.1495	-0.0425	-0.1117	0.0949	0.6328	1.0000				
salary	-0.0349	0.2320	0.2673	-0.0332	0.0203	0.0002	-0.0257	-0.0565	1.0000			
short	0.0165	0.2805	0.2273	0.0947	-0.0347	-0.1416	-0.0492	-0.1381	0.0989	1.0000		
gray	0.0442	-0.1093	-0.1151	-0.0504	-0.0435	0.0492	0.0357	0.0743	-0.0516	-0.6443	1.0000	
t	0.0058	0.0383	-0.0352	-0.0276	-0.0406	-0.1010	0.1247	0.0979	-0.0208	-0.0118	0.0124	1.0000

```
.
end of do-file
```

Market level

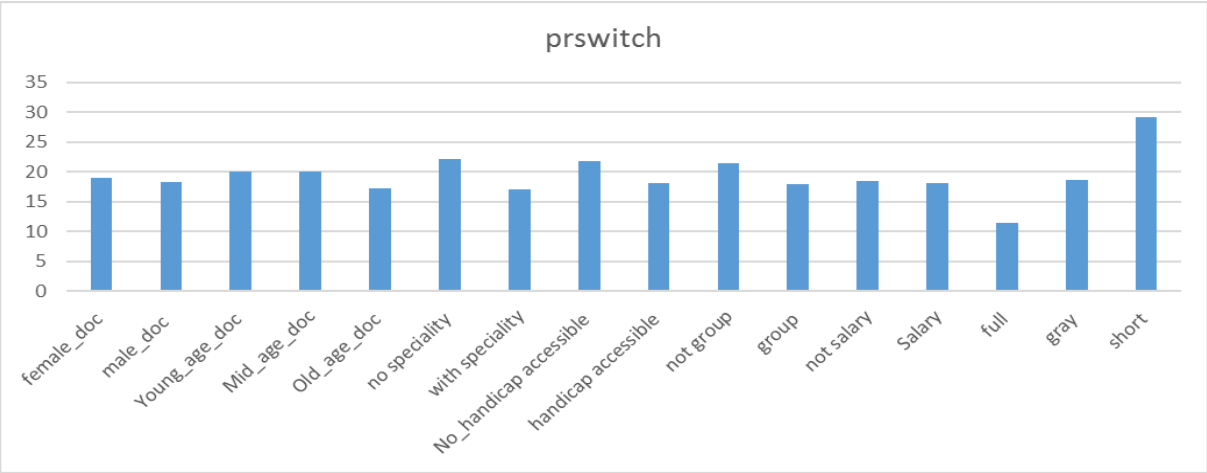
```
. correlate  capacity CapPop herfindahl prmale_M prMedium_age_M  prOld_age_M prwith_speciality_M prhandi_accessible_M prgroupp_M prsalary_M prshort_M prgray_M t
(obs=4,115)
```

	capacity	CapPop	herfin~l	prmale_M	prMedi~M	prOld_~M	prwith~M	prhand~M	prgrou~M	prsala~M	prshor~M	prgray_M	t
capacity	1.0000												
CapPop	-0.0519	1.0000											
herfindahl	-0.2239	0.3580	1.0000										
prmale_M	-0.0327	0.6076	0.0328	1.0000									
prMedium_a~M	-0.0645	0.2081	0.0873	0.0013	1.0000								
prOld_age_M	0.0019	0.5676	0.0306	0.6465	-0.4080	1.0000							
prwith_spe~M	0.0062	0.3732	-0.0465	0.4251	0.1095	0.5126	1.0000						
prhandi_ac~M	-0.0619	0.5886	0.1058	0.4348	0.3689	0.3886	0.4538	1.0000					
prgroupp_M	0.0014	0.1662	-0.2426	0.2488	0.1324	0.1966	0.2777	0.4980	1.0000				
prsalary_M	-0.0706	0.5048	0.2549	0.3254	0.0920	0.4058	0.3842	0.3971	0.1768	1.0000			
prshort_M	-0.0570	0.6364	0.3733	0.3422	0.1073	0.3148	0.0128	0.4020	0.0099	0.3095	1.0000		
prgray_M	-0.0074	0.2467	-0.1627	0.3540	0.2144	0.3087	0.5079	0.3406	0.3006	0.2105	-0.4661	1.0000	
t	0.0181	0.0605	-0.0685	0.0427	0.0801	0.0259	-0.0496	0.2145	0.1615	-0.0182	0.0258	0.0780	1.0000

Appendix 4

Table 4.1.1 Proportion of switching, assessment and dissatisfied assessment per 1,000 listed patients, across different GP attributes

I. Proportion of switching (exit)



II. Proportion of assessment and dissatisfied assessment (Voice)

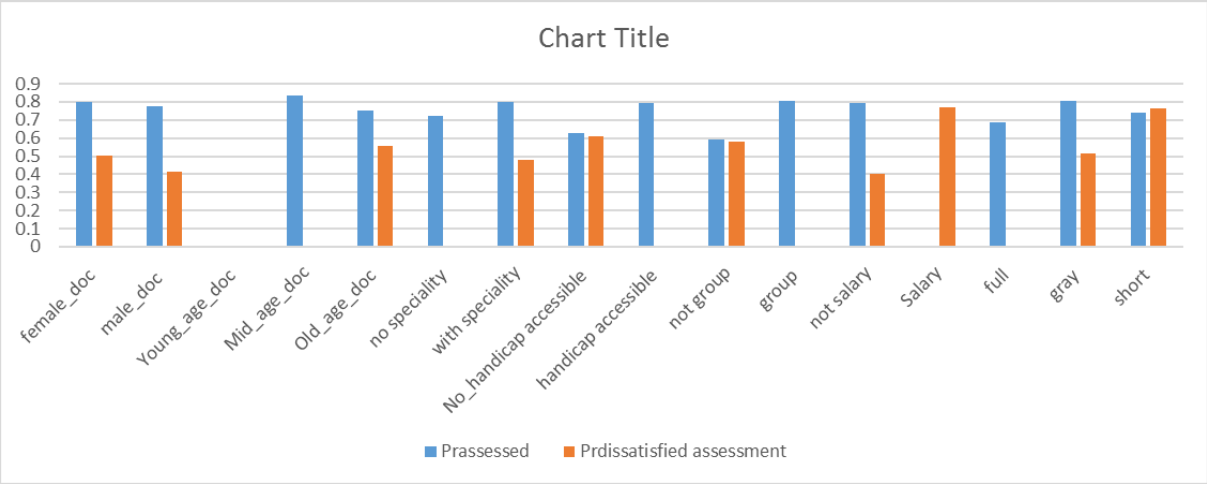


Table 4.2.1 percentiles of GP level patient switching, assessment, and dissatisfied assessment per 1000 listed patients over each half year.

Gp level											
		Period									
		2	3	4	5	6	7	8	9	10	11
Prswitch	25th percentile	8.89	9.45	11.25	10.95	10.67	11.04	11.07	12.01	12.73	12.11
	50th percentile	15.03	16.41	18.98	17.65	18.33	17.91	18.91	19.96	21.32	20.29
	75th percentile	25.10	26.93	30.67	29.17	30.07	28.11	30.32	32.08	34.45	32.50
prassessed	25th percentile				0.00	1.0	0.00	0.00	0.00	0.00	
	50th percentile				0.67	2.5	.63	0.00	0.89	0.51	
	75th percentile				1.64	4.5	1.4	1.10	1.98	1.30	
prdisatisfied	25th percentile				0.00	0.00	0.00	0.00	0.00	0.00	
	50th percentile				0.00	0.72	0.47	0.56	0.00	0.00	
	75th percentile				0.81	1.68	1.01	1.01	1.01	1.00	

Table 4.2.2 percentiles of municipality level patient switching, assessment, and dissatisfied assessment per 1000 GPs list over each half year.

Market level											
		Period									
		2	3	4	5	6	7	8	9	10	11
prswitch_M	25th percentile	9,75	11,08	12,67	13,13	12,92	13,66	13,40	14,87	15,51	15,28
	50th percentile	13,69	15,52	17,95	17,44	17,49	18,10	18,40	19,61	20,70	20,44
	75th percentile	18,77	19,30	22,39	22,27	22,76	22,68	23,97	25,47	26,76	24,94
prassessed_M	25th percentile				0,00	0,83	0,00	0,00	0,14	0,00	
	50th percentile				0,48	1,90	0,40	0,27	0,75	0,41	
	75th percentile				0,86	3,38	0,87	0,62	1,34	0,81	
prdisatisfied_M	25th percentile				0,00	0,22	0,00	0,00	0,00	0,00	
	50th percentile				0,16	0,57	0,25	0,17	0,25	0,17	
	75th percentile				0,37	1,16	0,48	0,36	0,54	0,36	

Table 4.2.3 Semiannual proportion of switching, assessment and dissatisfied assessment per 1,000 listed patients, by 50th percentiles of open Practices, open Practices per 1,000 inhabitants in municipality and Herfindahl

	below 50th percentile	above the 50th percentile	% change in each of dependent variables when competition proxies move from below 50thpercentile to above 50th percentile
GP Level			
By Open Practices			
prswitch	420740.2	519721.3	24 %
Prassessed	14725.69	24222.3	64 %
Prdissatisfied assessment	4750.369	7778.694	64 %
By Open Practices per 1000			
prswitch	433005.2	507456.3	17 %
Prassessed	20710.68	18237.31	-12 %
Prdissatisfied assessment	6837.379	5691.685	-17 %
by herfindahl index			
prswitch	528593.3	411868.2	-22 %
Prassessed	25357.54	13590.45	-46 %
Prdissatisfied assessment	8652.566	3876.497	-55 %
Market level			
By Open Practices			
prswitch_M	37228.08	41256.11	11 %
Prassessed _M	1039.954	1250.434	20 %
Prdissatisfied assessment_M	29.3064	411.8802	1305 %
By Open Practices per 1000			
prswitch_M	37406.63	41077.56	10 %
Prassessed _M	1273.252	1017.136	-20 %
Prdissatisfied assessment_M	409.9622	331.2244	-19 %
by herfindahl			
prswitch_M	41786.63	36697.56	-12 %
Prassessed _M	1334.522	955.8664	-28 %
Prdissatisfied assessment_M	430.6005	310.5861	-28 %