Eila Kankaanpää

Studies on Purchasers and Providers of Occupational Health Services in Finland

UNIVERSITY OF
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ABSTRACT

The research questions of this thesis are all related to the performance of the occupational health services (OHS) system. The first study examined whether a company's expenditure on preventive OHS predicts its economic performance two or four years later. If the OHS is effective it would reduce the costs of ill health and improve productivity, which would finally also lead to a better economic performance of the organization. Although the claim of OHS being profitable for employers is a fairly common statement, we found no proof for the claim. The second study showed that the obligation by law to organize preventive services and the reimbursement from the Social Insurance Institution secure the provision of occupational health services irrespective of the financial situation of the employer.

The Finnish OHS system with different provider types and market structures provides a chance to examine ownership, competition and payment systems. Studies 3 and 4 examine if intensity, productivity, share of medical care, unit price and revenues differ according to the ownership of the provider and the market environment. Competition had only little impact. All provider types increased the share of medical care in a more competitive environment. Only for-profit providers reacted according to the assumptions of economic theory: they had lower unit prices and revenues in a more competitive environment. An interesting result was that the public providers increased their prices and revenues more in a competitive environment after the abolition of their price regulation. Differences due to ownership were greater than what could be achieved with increasing competition – ownership seems to be the means to control or allocate resources to OHS.

Keywords: regulation, incentives, competition, occupational health services

ABSTRAKTI

Suomalainen työterveyshuoltoa koskeva lainsäädäntö velvoittaa työnantajat järjestämään ehkäisevän työterveyshuollon ja korvaa noin puolet kustannuksista. Lainsäädäntö on luonut hyvin vankan järjestelmän, työterveyshuollon toimivuus ei ole riippuvainen yrityksen taloudellisesta tilanteesta (artikkeli 2). Työterveyshuoltoa on myös markkinoitu kannattavana investointina työnantajalle. Tässä tutkimuksessa ei kuitenkaan löytynyt tukea tälle väitteelle: yrityksen investoinnilla ehkäisevään työterveyshuoltoon ei ollut positiivista yhteyttä sen taloudelliseen menestykseen (artikkeli 1).

Lainsäädäntö on mahdollistanut kansainvälisestikin mielenkiintoisen terveyspalvelujärjestelmän. Alueelliset markkinat vaihtelevat julkisesta monopolista erittäin kilpailtuihin markkinoihin ja tuottajatyyppejä on useita. Tämä mahdollistaa omistuksen, maksujärjestelmien ja markkinaympäristön tutkimisen; miten ne vaikuttavat intensiteettiin, sairaanhoidon osuuteen, tuottavuuteen, yksikköhintaan ja tuottajan tuloihin (artikkelit 3 ja 4). Markkinoiden kilpailullisuudella oli yllättävän vähän vaikutusta. Kaikki tuottajat lisäsivät sairaanhoidon osuutta tuotannostaan kilpaillummassa ympäristössä. Vain lääkärikeskukset reagoivat kuten talousteoria olettaa, niillä oli alhaisemmat yksikköhinnat ja tulot kilpaillummassa ympäristössä. Kiinnostava tulos oli se, että kilpaillummassa ympäristössä terveyskeskusten työterveyshuollot nostivat yksikköhintojaan ja siten tulojaan enemmän kuin vähemmän kilpaillussa hinnoittelun vapauduttua. Erot tuottajatyyppien välillä olivat suurempia kuin mitä saataisiin aikaan lisäämällä kilpailua – omistajuus näyttää toimivan keinona rajoittaa tai allokoida resursseja työterveyshuoltoon.

Asiasanat: säätely, insentiivit, markkinat, työterveyshuolto

Foreword

Being a researcher is a hard job. One has to be motivated to be able to put so much effort into a project. The urge to know, or in layman's terms being curious, helps a lot. I had been working for a long time at the Finnish Institute of Occupational Health studying occupational health services. The question why they (occupational health services providers and personnel) do the things that they do started to haunt me. Economics has a very simple answer to this question: economic agents do what they want and can afford, if they are not lured or compelled to do something else. For me it took years to understand (a little) what incentive structure and motivation means in the context of the Finnish occupational health services: what kind of incentive structure was created for employers through the legislation, is obligation the only motivation for arranging/providing services, and how do providers' motivation, ownership, payment systems and market competition affect their behaviour.

The road to this point was long, winding, challenging and rewarding. I want to thank my supervisors, Hannu Valtonen and Ismo Linnosmaa. Hannu never regarded my questions as stupid (I admit sometimes they were) and he, as the most human person that I ever met, gave me the space that I needed to find my own way. Ismo Linnosmaa turned out to have the characteristics of both a search engine and a database; he was able to give me hints of good, even contradictory literature that inspired my own thinking. Sometimes these hints were accompanied with messy drawings and equations (I still have some of them in my archives). Due to these wonderful supervisors the pre-examiners had a hard job. Thank you, Harri Sintonen and Pekka Rissanen, for guiding me with the summary. Seija Ilmakunnas deserves thanks in advance for being the opponent at the public defence. She moreover deserves a big thank-you for teaching me the mathematics needed in economics in the early 1980s. I still remember how interesting it was.

I am very grateful to my colleagues at the Finnish Institute of Occupational Health, especially the "early team", Kaj Husman, Veijo Notkola, Marjatta Peurala and Kimmo Räsänen. I owe you a lot: you made me understand how the Finnish OHS system works and what the practice of OHS is. The help from Maria Hirvonen in compiling the data for Studies 3 and 4 was invaluable. I admire her precision, skills and speed in handling the data. My special thanks are also due to Pirjo Pulkkinen-Närhi, with whom I could share the experiences from public providers' practice and management. Aki Suhonen showed that the next generation is not lost. He had genuine interest, initiative and diligence during Studies 1 and 2. I had the chance to enjoy the excellent services of the research laboratory of Statistics Finland. The Social Insurance Institution (SII)

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ABBREVIATIONS

AMI = acute myocardial infarction
CWA = cost-weighted activity
DRG = diagnoses related group
EPO = exclusive provider organization
EU = European Union
FFS = Fee-for-service
FIOH = The Finnish Institute of Occupational Health
GP = general practitioner
GPFH = general practitioner fund holding (practices)
HA = health authority
HI = Herfindahl index
HMO = health maintenance organization
HRG = health resource group
IV = instrumental variables
NHS = national health service
NIHW = The National Institute for Health and Welfare
OH = occupational health
OHS = occupational health services
OLS = ordinary least squares
OR = odds ratio
RESET = regression specification error test
SCP = Structure-Conduct-Performance paradigm
SII = The Social Insurance Institution
SOE = state-owned enterprise
VIF = variance inflation factors

1 Introduction

Finnish occupational health services (OHS) existed before there were any international or national policies on occupational safety and health. Historically these services have included curative medical services. Finnish occupational health services could be described as services with a strong preventive emphasis provided by a general practitioner (GP) and a nurse for employees. The Occupational Health Care Act was built on existing models for organizing OHS and therefore there is a variety of different kinds of providers in Finland. The legislation obliges each employer to organize preventive services, either by purchasing or providing the OHS itself, or together with other employers. The relationship between the employer and the provider is based on a contract, and different provider types have different payment systems. Occupational health services are mainly provided by private non-profit or for-profit providers. Municipalities are in charge of organizing primary health care, and this obligation also includes the provision of OHS within its region. The market structure for OHS varies geographically from regions with public monopolies to regions with numerous, mainly private providers.

The Finnish occupational health services offer a context and a chance to study the functioning of an incentive structure. The incentive structure - the "sticks and carrots" - market environment, regulations, social codes and payment systems set the limits and creates the opportunities for both employers and providers to achieve their goals. Therefore, the impact of the incentive structure should be interpreted in light of employers' and OHS providers' own objectives. Understanding the functioning of an incentive structure is crucial for the success of health care reforms in health care, also outside OHS.

The research questions of this dissertation are all related to the performance of the occupational health services system. The way performance is assessed does not differ from the objectives set for health care systems in general. Health care reforms have aimed at improving access by removing financial barriers. Then the reforms have been characterized more by the need to control the rise in health care expenditure subsequent to improving access. Later, in addition to equal access and control of total health care expenditure, reforms have aimed at improving the efficiency with which health services are produced and used.

The dissertation is structured as follows. First, Chapter 2 presents a description of the Finnish OHS system: the history and the legislation concerning employers' obligation to organize OHS. In addition, information is presented from registries and surveys on features of the system relevant for the purposes of the dissertation: how employers have organized the OHS and how

provider types differ in their resources and services provided and payment systems. Chapter 3 describes the theoretical framework: how the incentive structure is created by legislation, competition and payment system and the objectives of both employers and OHS providers. Chapter 4 reviews theoretical and empirical research on purchasing and payment systems, and on competition and markets. Based Chapters 3 and 4, the hypothesis will be presented in Chapter 5, together with the research questions. The study design, data and methods are presented in Chapter 6, the results in Chapter 7. Chapter 8 summarizes the results and discusses their relevance for the occupational health services system. In addition, the methodological choices will be discussed and proposals for further research are presented in Chapter 8. Finally, Chapter 9 concludes.

2 Description of the Finnish Occupational Health Services System

2.1 HISTORY AND LEGISLATION

The history of the Finnish occupational health services (OHS) dates back to the 19th century. Big companies started organizing health services for their employees and their families. Employment also provided disability insurance and old age pension. In the 1920s half of employed people were members of employer-specific sickness and pension funds. Thus, in addition to government, municipalities and non-governmental organizations, employers have had a role in social policy. Jaakkola et al. (1994, p. 149-158) regard this shared (or split) responsibility of social policy as a special feature of the Finnish social policy.

Occupational health services developed without any legislative basis until the introduction of compulsory health insurance in 1964, Finland being the last country in Europe to do so (Jaakkola et al. 1994, p. 237). Until then the occupational health services were financed by employers and the services covered only 20 per cent of the employed population (Koskiaho 1987, p. 44). The Social Insurance Institution (SII, Kansaneläkelaitos or KELA in Finnish) was charged with reimbursing the costs of private health services and employers were also entitled to reimbursement for the medical care they provided for their employees. Later, in 1969, preventive occupational services were also included in the services covered by health insurance (Mattila 2006). The occupational health services acquired a more formal status when in 1979 the Occupational Health Care Act made it compulsory for employers to arrange preventive services. The OHS has strong connections to labour market policy. For example, the national planning, approval and implementation of any measures concerning OHS always involve employers' and employees' representatives, and occupational health professionals' representatives in addition to the government (Ministry of Social Affairs and Health 2010).

The legislation obligates employers to organize preventive services. The purpose of the Act is to promote 1) the prevention of work-related illnesses and accidents, 2) the healthiness and safety of the work and the working environment, 3) the health, working capacity and functional capacity of

employees at the different stages of their working careers, and 4) the functioning of the workplace community (2001). Occupational health care professionals conduct workplace surveys and assess health risks at workplaces. They also offer guidance on how to carry out interventions to improve working conditions and well-being at work and assist employees in maintaining their health, for instance through regular checkups. They also carry out interventions themselves, organize groups e.g. for people with neck problems or obesity, participate in the planning and implementation of return-to-work policies, and act as facilitators in organizational development projects. In addition to statutory occupational health care, employers may provide other medical and health care services for their employees. The medical services are general practitioner (GP) services, and occupational physicians may refer employees to specialists for consultation. (Ministry of Social Affairs and Health 2010, 2001, Taskinen 2004). In 2009, 8 per cent of health checkups and 5 per cent of appointments for curative medical care were conducted by specialists (Kansaneläkelaitos (The Social Insurance Institution of Finland) 2011b).

According to a population survey conducted in 2009, 70 per cent of the employees had attended an occupational health checkup, and around half of them had had occupational health personnel assessing their workplace. Although organizing curative medical services is voluntary for employers, over 90 per cent of employees can obtain GP level services from their OHS unit. Over 40 per cent of the primary care level GP visits by these employees take place within OHS (Perkiö-Mäkelä et al. 2010).

Employers can apply for reimbursement of the costs of OHS. The funds for the Social Insurance Institution have been collected from insured, both employed and pensioned persons, and from employers. Before the last reform of the national health insurance in 2006, the percentage of the payment used to be regulated annually by law. It was therefore sensitive to economic trends and politics. The employees' payment varied from 0.75 to 2.2% of their taxable income. The average percentage for all employers varied between 0.45 and 3.25%, but the percentages have varied according to the employer sector. Private employers used to pay much lower percentages than public or Church employers. The percentages were harmonized for municipalities and the Church in the late 1990s and for state employers in the reform of the funding of health insurance in 2006. (Hallituksen esitys (Government bill) 2005a, Hallituksen esitys (Government bill) 2005b).

In 2006 national health insurance was divided into two parts: medical care insurance and earned income insurance. Sickness and parental allowances and the reimbursement of the costs of OHS are paid from the latter fund. The basis for collecting the funds was also changed. The state would no longer support the funds as it had been compelled to do for years. Since 2006 the employees' payment has varied between 0.67 and 0.93% of their taxable income. The payment is tax deductible. The percentage paid by the employers was

harmonized – all employers have had the same percentage since 2006, but the annual percentage has been varying between 1.97 and 2.23 %. One fourth of the funds for earned income insurance have been collected from the employees. The employers' share is close to 70 per cent and the state has been responsible for the rest. The state's share has been used for minimum-rate sickness and parental allowances. (Kansaneläkelaitos (The Social Insurance Institution of Finland) 2010b)

Employers first pay all costs of OHS and apply for reimbursement within six months after closing their accounts. The share of the costs reimbursed has varied during more than 40 years of reimbursement. Until 1995, reimbursement was based on the total costs of OHS. In 1995 the activities were divided into preventive and medical care, each being reimbursed separately. The objective was to channel more resources towards preventive care. The reform also aimed at keeping the costs down and both reimbursement categories got a cap for costs per employee. In addition, the Social Insurance Institution (SII) evaluates the need and appropriateness of the activities in their reimbursement decisions. Nowadays the reimbursement is 60 per cent for preventive and 50 per cent for curative medical services. Thus, despite the reimbursement the employers will always bear a considerable part of the cost themselves.

According to the latest statistics on occupational health services, the employers claimed reimbursement for 612.5 million Euros and the Social Insurance Institution reimbursed 272.5 million Euros for the costs in 2009 (Kansaneläkelaitos (The Social Insurance Institution of Finland) 2011b). The magnitude of occupational health services as a part of primary health care becomes visible by comparing the total costs to the costs of primary health care provided by the municipalities or private health care providers, the other two systems in Finland providing primary health care (Vuorenkoski 2008, p. 1-4). In 2009 the costs of primary care provided by municipal health care centres were 2,090.3 million Euros, the costs of OHS in 2009 representing then 29% of the resources in municipal health centres (Terveyden ja hyvinvoinnin laitos, (National Institute for Health and Welfare) 2011). When people use private medical services they are entitled to reimbursement from the Social Insurance Institution. The total costs of services provided by private health care in 2009 were 524.6 million Euros (including doctors' services and tests, e.g. laboratory and imaging services) showing that OHS costs were 17% higher than the costs of other privately provided health services (Kansaneläkelaitos (The Social Insurance Institution of Finland) 2010a, p. 66, 71.). The total costs of occupational health services have been increasing by 6 per cent annually in the past ten years (Figure 1) (Kansaneläkelaitos (The Social Insurance Institution of Finland) 2010c).
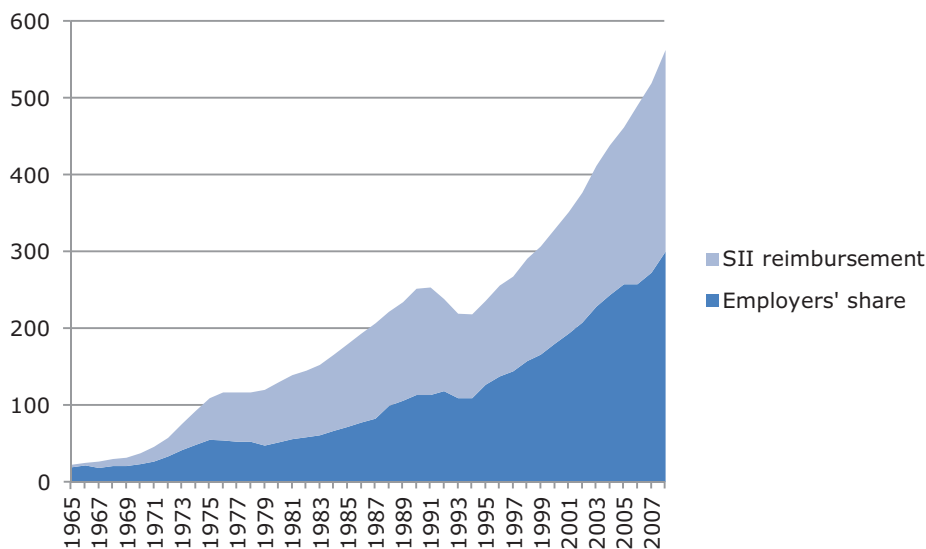
Figure 1: Costs of OHS and reimbursement paid to employers by SII 1965-2007, million Euro (in 2008 real value) (Kansaneläkelaitos (The Social Insurance Institution of Finland) 2010c)

The focus of international conventions and recommendations (World Health Organization 1994, International Labor Organization 1985) has been on the assessment of risks and the prevention of occupational diseases, injuries and accidents (Hämäläinen 2008). The European Union (EU) also aims at improving the safety and health of workers at work with the EU directive 89/391/EEC (Council Directive 1989). In Finland the Occupational Safety and Health Act lays down that employers are obliged to look after the safety and health of employees in line with the international policies. The Occupational Safety and Health Act applies to all paid employment. Employers are responsible for providing and paying for the services of occupational health care and other professionals to prevent the risks and adverse effects that work and working conditions may cause employees. (Ministry of Social Affairs and Health 2010.) The international conventions deal with employers' responsibilities regarding occupational health and safety, not organizing health services for employees.

In most EU Member States, employers are not obliged to organize occupational health services. There are a few exceptions, like Finland, France, Italy and the Netherlands. In most countries the emphasis is more on work than in Finland. This is revealed in the qualifications required of the personnel and the contents of the services. For example, in many countries it is compulsory to have occupational hygienists or occupational psychologists among occupational

health professionals (Hämäläinen et al. 2001). In Finland, it is compulsory to have occupational physicians and nurses only, and they assess the need for other experts. The Finnish occupational health services have their origin in providing medical services. The special nature of the Finnish occupational health services is also revealed in the survey conducted by Hotopp et al. (2008). They describe how disability insurance, health care services for occupational injury and disease, and occupational health and safety systems are organized in six countries (the United States, Canada, the United Kingdom, Denmark, Germany and Austria). None of the countries had a system where the employers acquired the expertise to assess the health risks and to prevent the risks and provide curative medical services from the same provider.

There are various ways of organizing occupational health services in the EU although this is not mandatory for employers (Hämäläinen 2008, Westerholm, Walters 2007). In all EU Member States employers can organize the services internally. In most countries it is possible to organize the services jointly with other employers or to have a company doctor. There are also special national solutions, like industries (e.g. Belgium, Denmark) or regional employees' organizations (France) organizing the services. In some countries, the services are provided by local (Italy, the United Kingdom) or state authorities (France, Spain). In Austria and Germany the services are provided by statutory industrial accident insurance funds. In both countries the resources are also strictly regulated. For example, in Austria there is a time allocation of 0.66 hours per employee per year and rules about the frequency of inspections of workplaces. Internationally, OHS is mainly funded by employers (Hämäläinen 2008, p. 196), the Finnish reimbursement system is a unique exception.

2.2 EMPLOYERS AS PURCHASERS OF OHS

Employers may choose how to organize their OHS. They may provide the services themselves (employer's own OHS) or jointly with other employers (non-profit[1]), or the employer may buy the services from a municipal health

[1] Here non-profit refers to an association or company jointly governed by employers. They differ from the non-profits in the USA. Since 1913 the non-profit hospitals in the USA have been exempt from most revenue and property taxes. In exchange for their tax exemption, not-for-profit hospitals were required to provide free or below-cost medical services, since 1969 provide services that benefit the community in exchange for their tax exemption (Potter 2001, p. 18). The Finnish non-profit OHS providers do have to pay taxes. Therefore there is an incentive not to show profit. If a profit is made they even refund the employers. Theoretically, the US non-profits have been described as altruists, providing higher quality and more charity care (Newhouse 1970), signalling that they will not abuse the informational asymmetry (Arrow 1963), and maximizing joint income for physicians cooperative (Pauly, Redisch 1973). (See Malani et al. (2003) for a summary on non-profit theories.)

centre (public[2]) or from a private medical centre (for-profit[3]). The contract with the provider specifies practical arrangements (addresses, opening hours, invoicing practices and termination of the contract). The contract must contain information on the services provided only in very broad terms: if the contract concerns only preventive services, or if the curative medical services are also included. According to the Occupational Health Care Act (2001) the employer must utilize the expertise of occupational health personnel in the planning of services. Therefore the occupational health personnel conduct a workplace survey to assess the health risks and need for services. According to the Act, there must be an action plan for the services provided. The action plan is intended to improve the target-orientation, follow-up and evaluation of the activities (Taskinen 2004, p. 62-85). The action plan and annual report must also be appended to the reimbursement application.

As on national policy level, employers must collaborate with employees in occupational health and safety issues on the workplace level (Occupational Health Care Act 1383/2001). For example, the employer's decisions on essential matters affecting the organizing of OHS services must be submitted to the occupational safety committee. The committee is mandatory in all organizations with more than 20 employees. If there is no occupational safety committee, the decision must be made together with the occupational safety representative. The annual report must be processed by the occupational safety committee (Taskinen 2004, p. 39).

Most Finnish employers have organized occupational health services for their employees. Only the smallest firms with fewer than ten employees have low coverage (Kankaanpää, Suhonen & Valtonen 2005). According to the population surveys conducted by the Finnish Institute of Occupational Health, about 85 per cent of the employed population had occupational health services (Perkiö-Mäkelä et al. 2010).

Due to the reimbursement system statistics on occupational health from the employers' point of view are available. The statistics provide information on the costs and content of services according to the number of employees, branch and provider type.

The number of reimbursement applications fell by nine per cent from 1992 (almost 23,000) to 1995 due to the economic recession. (Numbers indicated in the annual pillars according the number of employees in Figure 2). Since then the number has been growing and the annual number of applications has doubled from 1992 to 2009 (over 46,000 applications). The number has been growing

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[2] The municipal health centres provide primary care services for the residents of the municipality. The services are organized into units like maternity care, physicians' medical care and occupational health services.

[3] The for-profits also provide medical services for individual customers/patients who mainly pay for the services themselves. At the time of the purchase, the modest reimbursement from the Social Insurance Institution will be taken into account.

mostly among the smallest employers with fewer than 20 employees. (Figure 2). The number of applications seems quite low when compared to the statistics for the number of firms in Finland, 320,000 in 2010. The difference is much smaller taken into account that 58 per cent of all registered firms in Finland had no employees in 2001 (Kankaanpää, Suhonen & Valtonen 2005).

The employer's choice of provider type depends on the size of the organization. Small firms with fewer than 20 employees have usually chosen between a public provider and a for-profit provider. The for-profit provider used to be almost as often the choice among employers with 20-99 employees, nowadays the majority of these employers choose a for-profit provider. For-profit providers increased their share considerably among the bigger employers, especially in the late 2000s. In the early 1990s most of the big organizations with more than 500 employees had their own OHS unit. The share fell during the recession and later the services were outsourced to for-profit providers and to public providers. Employers in manufacturing industries used to have the biggest number of employers' own OHS, 244 providers in 1992. In 2009 only 70 employers in manufacturing had an OHS of their own.

The state reorganized its own OHS units into a state-owned enterprise (SOE) in 1996 and later sold the firm to investors in 2000. In 2007 a for-profit provider bought the shares of the company and the ex-SOE was consolidated with the for-profit provider. The SII has classified the applications of state employers separately in 1995, 1997, 2000 and 2004 and not according to provider type.
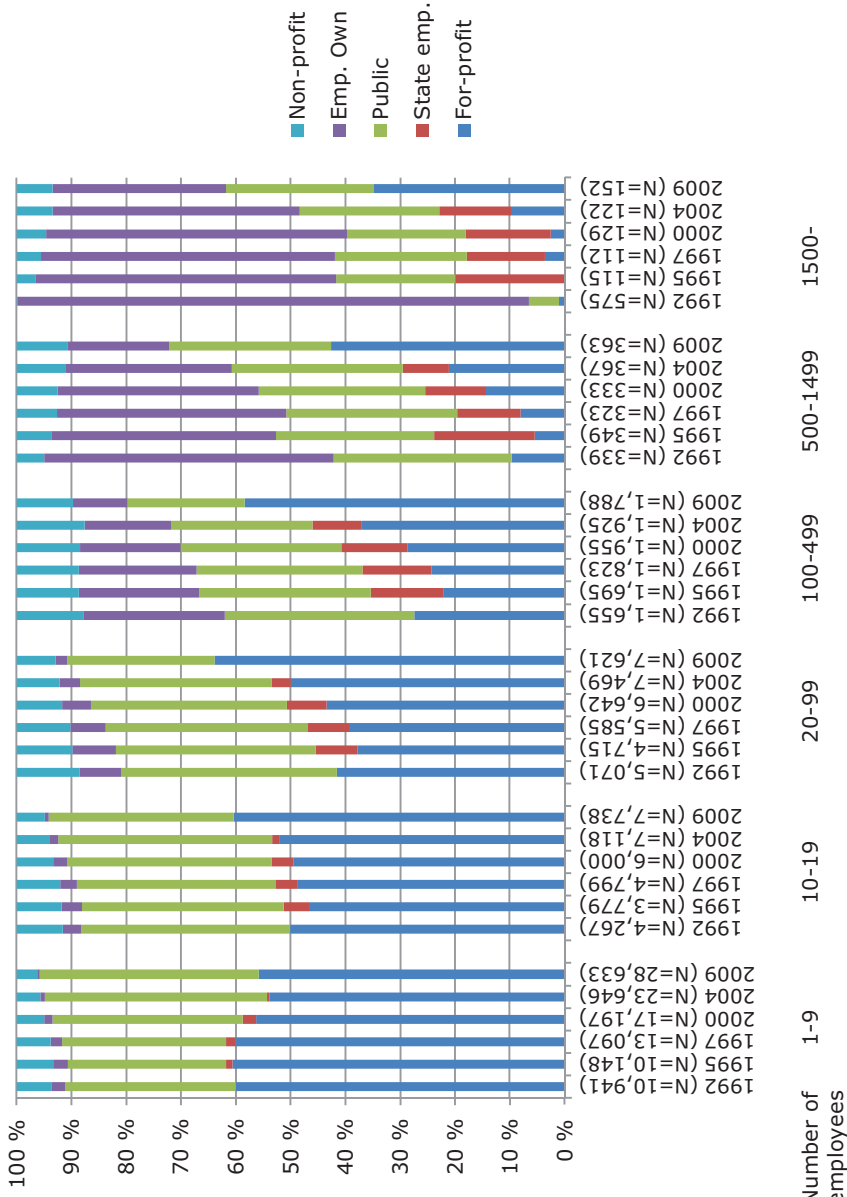
Figure 2: Shares of provider types in OHS reimbursement applications according number of employees of the organization in 1992, 1995, 1997, 2000, 2004 and 2009 (Source: Annual statistics on occupational health services published by the Social Insurance Institution of Finland)

The costs of OHS per employee vary according to the size of the employer (Figure 3). The spread increased during the period 1992-2009. In the smallest firms or organizations the cost per employee was about 70 per cent of the costs in organizations with more than 1,500 employees in 1992, and in 2009 it was about 60 per cent. In general the costs per employee have been rising constantly - fastest in the size groups 20-99, 100-499 and 500-1,499 employees and least for employers with fewer than 10 employees. The maximum costs acceptable per employee has been stable since 1995, about 370 Euros (in 2009 prices) (Kansaneläkelaitos (The Social Insurance Institution of Finland) 2011a, p. 408).
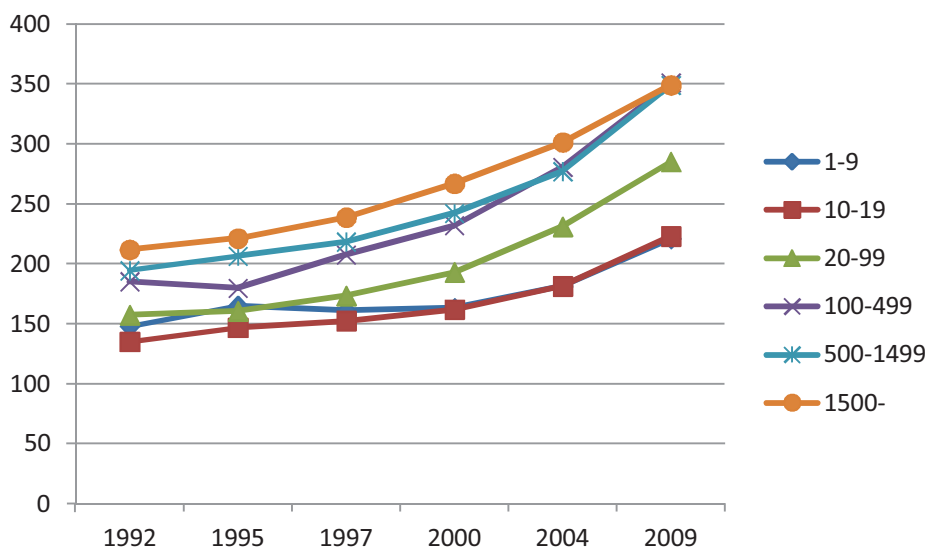
Figure 3: OHS costs per employee according to size (number of employees) of employer in 1992, 1995, 1997, 2000, 2004 and 2009 (in 2009 prices) (Source: Annual statistics on occupational health services published by the Social Insurance Institution of Finland)

The costs of OHS per employee are not only dependent on the number of employees. The differences in costs are even greater according to provider type (Figure 4, all in 2009 prices). The costs per employee more than doubled for public providers. The costs have also been increasing considerably in for-profits and non-profits, more than 60%. Costs per employee have been higher in employers' own OHS than among other providers, and the costs per employee have been increasing moderately compared to other provider types, about 20%.
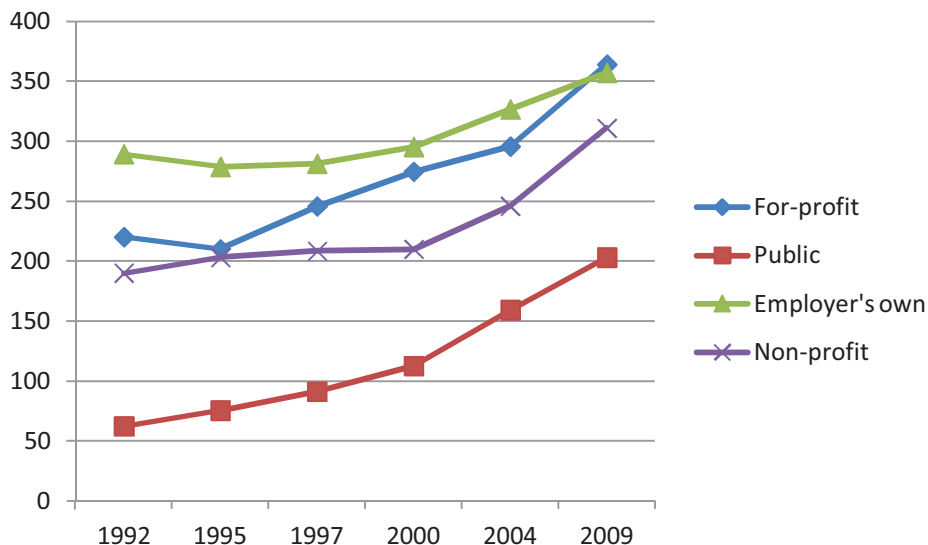
Figure 4: OHS costs per employee according to provider type in 1992, 1995, 1997, 2000, 2004 and 2009 (in 2009 prices) (Source: Annual statistics on occupational health services published by the Social Insurance Institution of Finland)

2.3 PROVIDERS OF OCCUPATIONAL HEALTH SERVICES

The Finnish Institute of Occupational Health (FIOH) started the surveillance of the OHS providers in the early 1990s (Räsänen, Peurala & Husman 2002, Manninen 2009). There are no official statistics on occupational health care providers compiling information on all providers in one register. The National Institute for Health and Welfare (NIHW) collects information from all private health care providers, also from for-profit, employers' own and non-profit providers. For other statistics concerning the services provided by the municipalities the NIHW collects data from the public OHS providers. The statistics provided by the Social Insurance Institution cover employers.

The FIOH surveys provide information on providers, such as their personnel resources, services provided and employers and their employees. The numbers of employers and employees differ from the numbers in the statistics provided by the Social Insurance Institution. For small employers there may be no activity within a year and not all employers apply for reimbursement. On the other hand, an employer with multiple branches may have numerous contracts with various providers across the country but may apply for reimbursement with only one application. The information below is based on two publications by

FIOH (Räsänen, Peurala & Husman 2002, Manninen 2009) presenting the results of the surveys for the years 1992, 1995, 1997, 2000, 2004 and 2007. The first five years also constitute the data for Studies 3 and 4 in this dissertation.

The number of OHS providers has been about 1,000 in the 1990s (Figure 5). Since then the number of providers has decreased, mostly because the number of employers' own units has decreased more than 60 per cent. This was due to the closing down of firms during the Finnish economic recession of the early 1990s and later due to outsourcing. The number of for-profit providers increased until 2000, but thereafter mergers decreased this number. In the late 2000s their number increased again. The number of public providers increased slightly during the 1990s. In recent years consolidation of municipalities and the merging of public providers have decreased their number. The number of non-profits has remained quite stable. The number of providers in the FIOH survey also varies because providers have changed their administrative practices. For some years they could give the data on a city or on regional level, in other years the data was given per office.
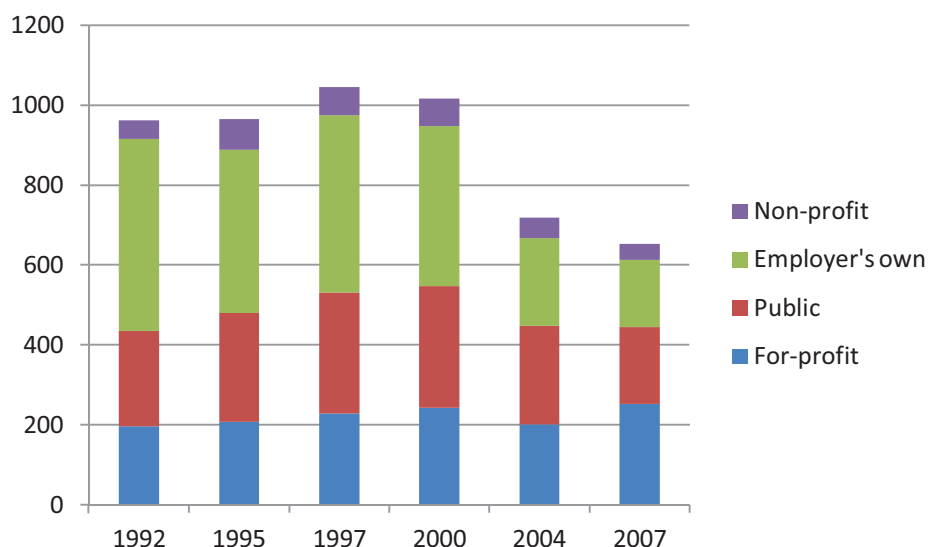
Figure 5: Number of occupational health services providers by provider type in 1992, 1995, 1997, 2000, 2004 and 2007 (Räsänen, Peurala & Husman 2002, Manninen 2009)

The severe economic recession of the early 1990s is also apparent in the number of clients (employees) (Figure 6). The market shares have changed considerably

since 1992 in Finland. The for-profit providers' market share doubled to 48% in 2007. The market share of employers' own units halved to 14% in 2007. The employee clients in employers' own units are not all employed by the employer owning the OHS unit. Employers' own OHS units also sell services to other employers. Since 1992 the employees of these "buying" employers have accounted for one fourth of the clientele in employers' own units. The market share of public providers fell by eleven percentage units to 32% in 2007 and non-profits had a very stable market share of about 5%.
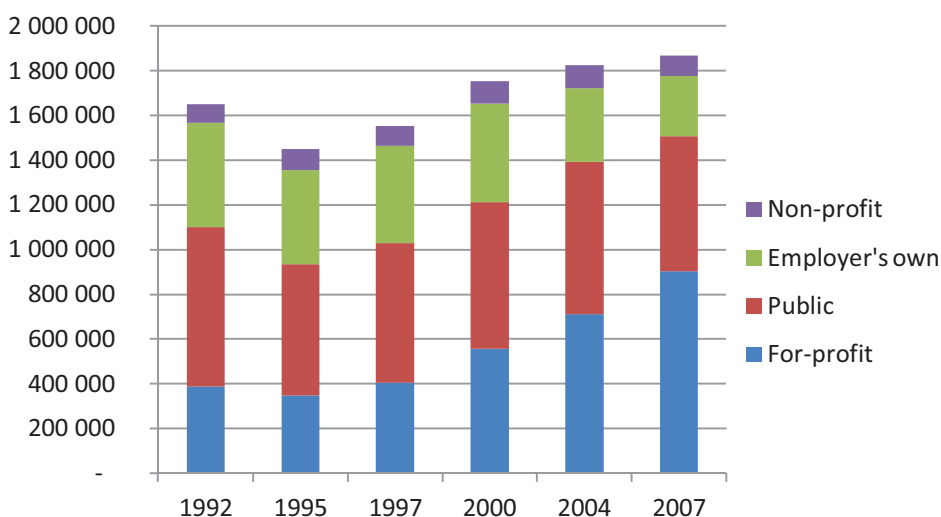
Figure 6: Number of clients (employees) by provider type in 1992, 1995, 1997, 2000, 2004 and 2007 (Räsänen, Peurala & Husman 2002, Manninen 2009)

The market shares calculated from the number of employers in Figure 7 below give quite a different picture than does Figure 6 above. According the surveys, only 1-3% of employers have contracts with an employer's own OHS or non-profit provider. The majority of contracts (over 60%) are with the public provider. The for-profit providers' share of contracts increased from 27% in 1992 to 36% in 2007. Here it is noteworthy that the provider should conduct a workplace survey with every employer, at least when the contract is made. The number of contracts yields an estimate of workplace visits needed and action plans to be made and updated.

The number of contracts by provider type in Figure 7 is not comparable with the number of reimbursement applications by provider type in 1995-2004 (Figure 2) because the SII changed the classification and published state

employers' applications as one category and other employers' applications according provider type. Although a contract reported in the FIOH survey by a provider and employer's applications for reimbursement according to the published statistics do not match completely, it is still useful to compare them. Firstly, it gives an idea of the magnitude of small firms which may not have annually any activities and also an idea of the magnitude of employers who have chosen a provider who does not provide services annually. Both in 1992 and 2007 the number of reimbursement applications for public providers accounted for only about 20% of the number of contracts reported in the survey. The share of for-profit providers has been higher: it was 62% in 1992 and 52% in 2007. Even for the employer's own OHS, the number of reimbursement applications was only 63% of the number of contracts both in 1992 and 2007. Some of the "buying" employers are small firms without annual expenses and big employers with multiple branches and their own OHS units may have only one application for reimbursement. Non-profits had the highest share: 80% in 1992 and 70% in 2007. (Chapter 6.1 addresses the merging of the reimbursement register and the FIOH survey.)
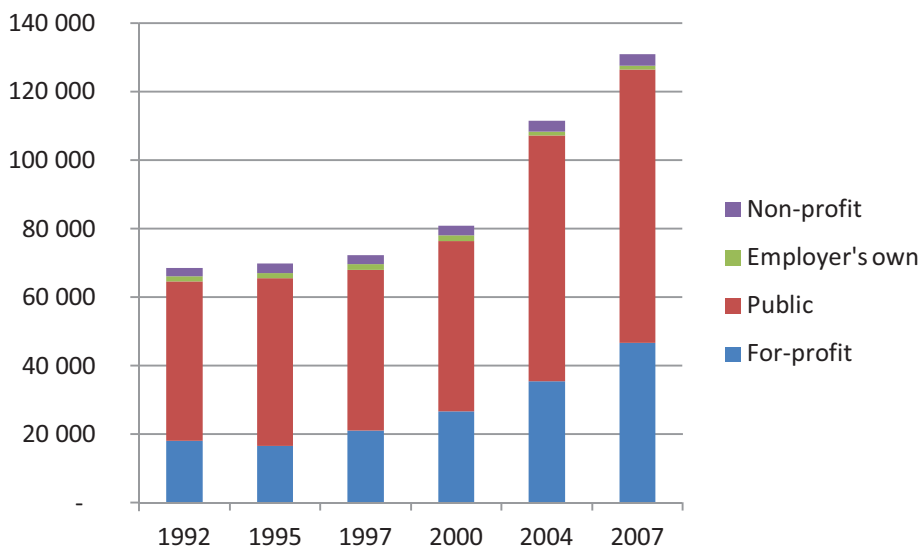
Figure 7: Number of clients (employers) by provider type in 1992, 1995, 1997, 2000, 2004 and 2007 (Räsänen, Peurala & Husman 2002, Manninen 2009)

The provider types have had different payment systems: for-profits and public providers have mainly fee-for-service payments, non-profits have a higher share

of their revenues based on capitation and employers' own OHS has a budget based on costs of resources. When employers' own OHS units sell services to other employers they have both capitation and fee-for-service payments. Non-profits also have a combination of capitation and fee-for-service.

When an employer's own OHS has been selling OHS services to other employers, over half of the payments have consisted of capitation payment (Figure 8, estimated from the statistics). Non-profits used to collect their revenues mainly through capitation payments. When the reimbursement system was reformed in 1995, the costs in an employer's reimbursement application were supposed to be based on the costs of the services. The SII has recommended the use of fee-for-service payments, and since then the share of capitation has decreased from 80% to 50% for non-profit providers. Public and for-profit providers have a much smaller share of capitation than the non-profits or employers' own OHS; in the late 2000s it was about 10%.

The providers may also set the level of the payment per employer, e.g. an employer may negotiate a reduction of x% from the list price of the provider, or get reductions in the lump sum fee per employee. Thus, there are no nationally fixed prices. All providers may charge their own prices and the prices per employer may also vary. Until 1995 the fees for the public provider were set by the Council of State. After the reform of the reimbursement system, public providers were supposed to set their prices themselves, but they were not expected to earn profits. Originally, according to the legislation, the employers were supposed to cover the costs of providing the services in municipal health centres, too. Before the abolition of the price regulation the statutory set fees did not cover the production costs (Kankaanpää et al. 1997). Five years after the reform of the reimbursement system one third of the public providers still applied the statutory prices set in 1992 (Pulkkinen-Närhi 2000).
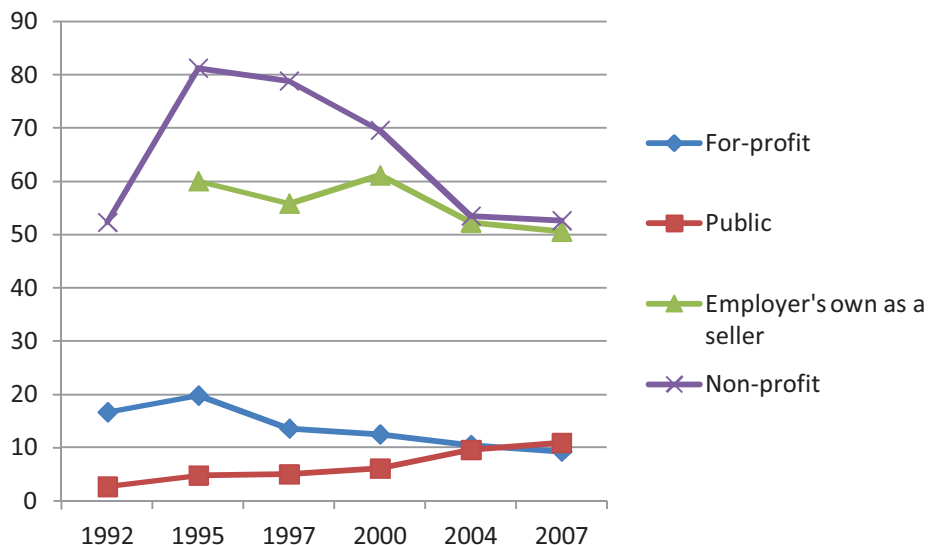
Figure 8: Share of capitation payments from total costs of OHS by provider type (%) in 1992, 1995, 1997, 2000, 2004 and 2007 (Source: Annual statistics on occupational health services published by the Social Insurance Institution of Finland)

Provider types have differed according to the amount of personnel resources (Figure 9). Here the resources have been made comparable by calculating the number of clients (employees) per physician (full-time equivalent). For example, if the unit had 2,700 employees and 3 physicians who altogether worked 72 hours a week the ratio would be 2700/(72/37) = 1387.

The public providers have had meagre resources compared to other provider types, especially in the 1990s. The physician resources have increased, but the physician of a public provider still has twice the number of clients (employees) compared to other provider types. The difference in the physician resources has been smaller between the other provider types, and diminished further during the period 1992-2007.
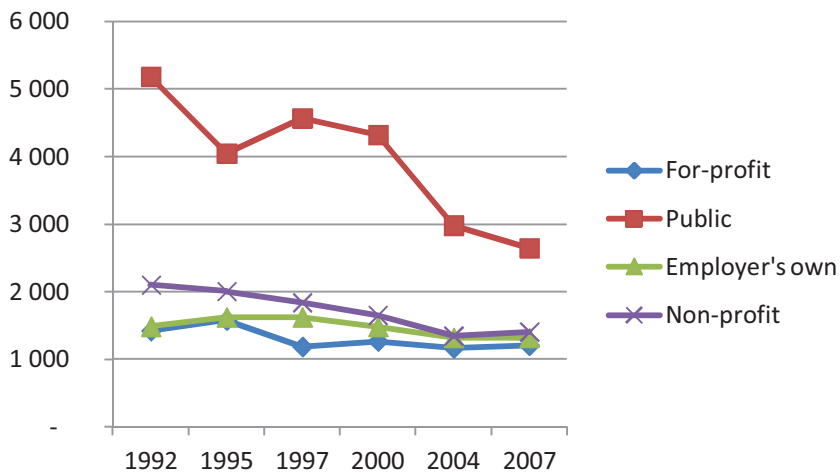
Figure 9: Number of clients (employees) per physician (full-time equivalent), median in OHS units by provider type in 1992, 1995, 1997, 2000, 2004 and 2007 (Räsänen, Peurala & Husman 2002, Manninen 2009)

The difference in physician resources naturally also leads to differences in the number of physician visits per employee (Figure 10). Public providers offered much less medical care than other provider types in the 1990s. The number of physician visits has been constantly growing in OHS provided by public units and has almost reached the level of other providers.
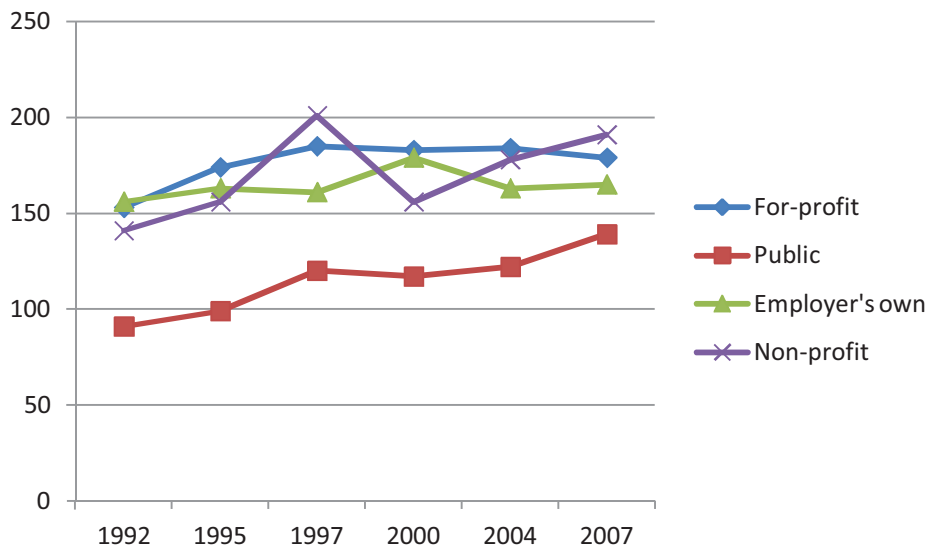
Figure 10: Number of physician visits per 100 clients (employees) per year, mean in OHS units by provider type in 1992, 1995, 1997, 2000, 2004 and 2007 (Räsänen, Peurala & Husman 2002, Manninen 2009)

In general, the OHS providers' services are oriented to individual employees. For example, the annual number of workplace surveys per 100 employees conducted by different occupational health personnel groups is close to zero in all provider types. Only occupational nurses have a ratio of 1.3-2.4 workplace visits per 100 employees. Most of the preventive resources are used for health checkups: annually OHS providers conduct about 1 million health checkups. The annual number of medical care visits was 5 million in 2007 (Kansaneläkelaitos (The Social Insurance Institution of Finland) 2009). All these services provided to about 2.1 million employed people.

The legislation on the provision of OHS is the same for all provider types. There are a few exceptions: public providers have been governed by the Public Health Act, which states that all municipal health centres must provide or organize OHS for employers within their region. All other types may freely enter and exit the market.

3 Incentive Structures for Purchasers and Providers

3.1 LEGISLATION TO ACHIEVE THE SOCIETAL GOALS OF OHS

Society wants employers to protect their employees against health hazards at work. Social objectives and market failures justify the use of rules and regulations. Traditionally and historically, social and ethical arguments have been used to support preventive occupational health services. It has been regarded as a fundamental right of each worker to enjoy the highest attainable standard of health, and workers' health at work should be protected (World Health Organization 1994, International Labor Organization 1985). The legislation on occupational safety and health issues may also reflect a great deal of paternalism (Mattila 2006, Gruenspecht, Lave 1989, p. 1512, 1531, Cohen, Henderson 1988).

The regulation could also be justified by the positive externalities caused by prevention, or by the public good nature of prevention (market failure). There are no positive externalities like those attached to vaccination or the prevention of communicable diseases in OHS. As Gruenspecht and Lane (1989, p. 1522) note, health and safety are not in themselves inherently public goods. In developed countries, social security and health care are usually publicly or collectively funded. Then society has an interest in making employers improve health and safety at work to avoid negative externalities to employees and taxpayers. The obligation to organize preventive occupational health services is one of the tools available to policymakers. When such an ethical code is imposed on employers from the outside (society), an employer can expect that all employers will do the same, and the employer spending in safety and health in production does not have to fear any excessive costs for good behaviour (Arrow 1973, p. 310).

To achieve its goal society has used legislation as an incentive. The concept of incentive has been defined as something that "can induce behaviour" (Maynard, Kanavos 2000, p. 185). This definition incorporates both the fear of punishment and the expectation of reward. According to Yarrow (1999), incentives are jointly determined by a whole range of factors, such as market and policy environments, and the regulatory system. The intensity of competition in the product market, capital markets (e.g. takeover and bankruptcy threats) and

labour markets (e.g. the value of reputation, the transferability of human capital) can all be regarded as incentives (Nickell 1996, Nickell, Nicolitsas & Dryden 1997). Together legislation, politics, society, institutions, competition and even geography set the limits, or give the chances for employers and OHS providers to achieve their objectives.

The legislation on the Finnish OHS applies various policy tools (Figure 11): 1) the funds for the mandatory public health insurance are collected from employers and employees and, 2) the purchasing task has been delegated to employers: preventive services are obligatory and medical service voluntary, 3) the employers may choose how to organize the services: this has created a market including employers' own OHS units, non-profits, and for-profits; municipal health centres have a legal obligation to organize OHS services (public provider) 4) the number of OH personnel is stipulated by the government by regulating the number of licensed physicians; the legislation also includes requirements for OH personnel regarding training and education in occupational health, 5) the purchaser – provider relationship is based on a contract, the payment systems differ depending on the type of provider; the information asymmetry between the provider and the employer is recognised in the legislation: the employer has to use the expertise of an OHS provider in planning the content of the OHS 6) the Social Insurance Institution reimburses about half of the costs of OHS. The government delegates considerable power to control the costs and content of the services to the Social Insurance Institution. The reimbursement system aims at channelling resources to prevention (the services have been divided into two categories: preventive and medical services) and to contain the costs (there is a cap for maximum acceptable costs for both categories of services).

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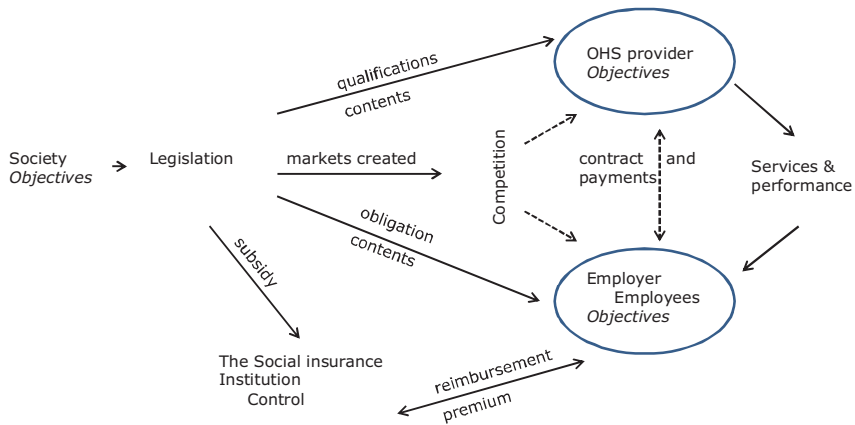
Figure 11: Incentive structure for employers and OHS providers

Insurance, reimbursement, control and obligation create the incentive structure for the employer. How well the employer achieves the objective of society depends on the employer's objectives and motivation. The employer's means to steer the OHS provider are the contract and the payment system, and the threat to change the provider – if another option exists. The behaviour and performance of the OHS provider are then dependent on the payment system and the market structure of the providers, and its own objectives, which in health economics are often represented by the ownership of the provider.

What would explain the choices that the government has made on OHS to achieve its objectives? In general, the way health care provision and funding have been organized nationally is quite varied. According to Newhouse (2002, p. 5-6), the choices in organizing health care reflect "different approaches", whereas Zweifel et al. (2009, p. 379) state that "these differences ultimately reflect basic differences in philosophy." According to Yarrow (1999, p. 158, footnote 2) the regulation and incentives are a result of "the market for regulation". According to this metaphor, the various types of state interventions, like the granting of a subsidy are outputs supplied by some arm of the state, e.g.,

the legislature, a ministry or a regulatory agency. The intervention is a response to explicit or implicit demand from one or more sections of the population, e.g., producers, labour unions, consumers or taxpayers. Depending on the power and influence of these subgroups the regulation could promote more the profit of the industry regulated/subsidised rather than social welfare (Viscusi, Harrington & Vernon 2005, p. 375). At the societal level, both employers and providers want society to lay down the rules of the game (legislation, reimbursement etc.) in the way that is most beneficial for them. The Ministry of Social Affairs and Health is only one actor in the decision-making, and the unions and provider organizations have a say in all issues concerning the national decisions on OHS.

3.2 EMPLOYERS' DECISION-MAKING ON OHS

To be able to understand the objectives of an employer with respect to OHS one has to define what occupational health services are: are they an input in the production process, or a fringe benefit? If OHS is an input, the decisions on how much OHS will be used depend on the price of OHS and its marginal value in the production process.

Pauly (1999, p. 2) objects to the idea that employers and companies bear the costs of health services and other benefits at work. He argues that eventually the health services and insurance based on employment is paid by the employees. Higher medical costs reduce money wages (compensating differential). Offering generous curative medical services would then lead to employees' lower wage demands. Health services are then fringe benefits, that is, the employer offers employees health services in lieu of monetary wages. Actually, the payer of the fringe benefits depends on the elasticity of labour supply and demand. Usually fringe benefits include health insurance and pensions (Jolls 2007). While the theory of compensating differentials is simple and clear it appears to be difficult to prove empirically. For example, most empirical studies show that health insurance is associated with higher, not lower wages. The more productive workers have both higher wages and more extensive health insurance.

The employer's role as a purchaser of health services for the employees can also be beneficial for the employees because of favourable tax treatment and lower administrative and search costs, as Morrissey (2001) justified the buying of a health insurance through an employer. When employers act on behalf of their employees (as in the case of health insurance in the USA) they also take into account the objectives of the employees. Then, as rational consumers, the employees balance the lost monetary wage and the benefit of OHS and mediate this demand to their employers. Even though the fringe benefit option of OHS is recognised, we will stick to the idea of legislation aiming at the promotion of health and safety at work.

Although the legislation on OHS concerns all employers in this dissertation I will concentrate on companies only in Studies 1 and 2. Their decisions on OHS can therefore be examined with their profit maximization objective in mind. In economics, the only reason for the existence of a company is to organize production to satisfy consumer demands in order to gain maximal profit. This profit-maximizing motive is connected to individuals; all shareholders are assumed to prefer more income to less. There is always some good or service which a shareholder would like to have a little more. Therefore, all shareholders favour profit maximization (Milgrom, Roberts 1992, p. 64).

When companies make decisions on OHS, they weigh the marginal benefits against the marginal costs. This rule applies, irrespective of the nature of the OHS for a company: whether it is regarded as an input or a fringe benefit. In addition, the companies have to solve the 'make-or-buy' decision: whether to provide the OHS internally (vertical integration) or buy the services.

3.2.1 Benefits of OHS to a Company

Organizing preventive occupational health services is a legal obligation of an employer. If the benefits of good working conditions were paid into tax payers' or employees' hands, the company's objective could be only to obey the law (and avoid the fine if caught) and the company would aim at minimizing the costs of OHS.

Society is not the only actor to attach moral and ethical objectives to occupational health and safety, employers also mention them as important reasons for attending to occupational safety and health (Miller, Haslam 2009). Many authors of occupational safety and health publications have claimed that occupational health and safety is "a profitable investment" for a company (Mossink 2002, Ahonen 1995, European Agency for Safety and Health at Work 1998). The moral, ethical and financial benefits to employers are closely connected to the effectiveness of the services provided by the OH personnel and the interventions that they propose.

Preventive OHS are supposed to lead to a reduction in number of occupational accidents and diseases, less sickness absence and fewer disability pensions, all of which improve the economic performance of the company (Ahonen 1995, European Agency for Safety and Health at Work. 2008). The financial benefits are due to the lower cost of illness for the company. In Finland, employers pay wages during sick leave according to the collective agreement. Part of the wages is compensated by the SII. The biggest employers are liable for disability pension expenditure - the payment category is based on their disability pensions (Ylinen 2010). In addition, the employers have to insure themselves against occupational accidents and diseases.

The interventions recommended or initiated by occupational health personnel can also improve productivity. When employees are motivated and committed to their work they are keen to improve the services and products.

Better quality will further lead to higher customer satisfaction and faster payment of invoices. This reduces receivable accounts and thus provides higher return on capital employed. Employees' initiatives also concern internal processes. The result will be less rework and smooth processes that lower operating expenses. (Kaplan, Norton 1996.) The gains in productivity could be much greater and be realized faster than the health effects (Miller, Haslam 2009, Fernández-Muñiz, Montes-Peón & Vázquez-Ordás 2009). Fernández-Muñiz et al. (2009) in their survey found a positive relationship between occupational safety management and economic performance.

Curative medical services have been promoted with statements like: "healthy people should be more productive" (Brandt-Rauf, Burton & McCunney 2001, p. 1). The health of employees affects the quality (productivity and performance) and the quantity (absence and exit/turnover) of the labour they provide. This will eventually have an impact on the efficiency and cost of labour (Miller, Haslam 2009).

Many authors of occupational safety and health publications have defended the logic of the positive cycle, e.g. Mossink (2002, p. 12) who has aggregated the argumentation into Figure 12. Yet, the empirical literature has provided little empirical evidence for the argumentation (Fernández-Muñiz, Montes-Peón & Vázquez-Ordás 2009, p. 980). In addition, the published economic evaluations of interventions and business cases have been of low quality (Tompa et al. 2008, Verbeek, Pulliainen & Kankaanpää 2009).
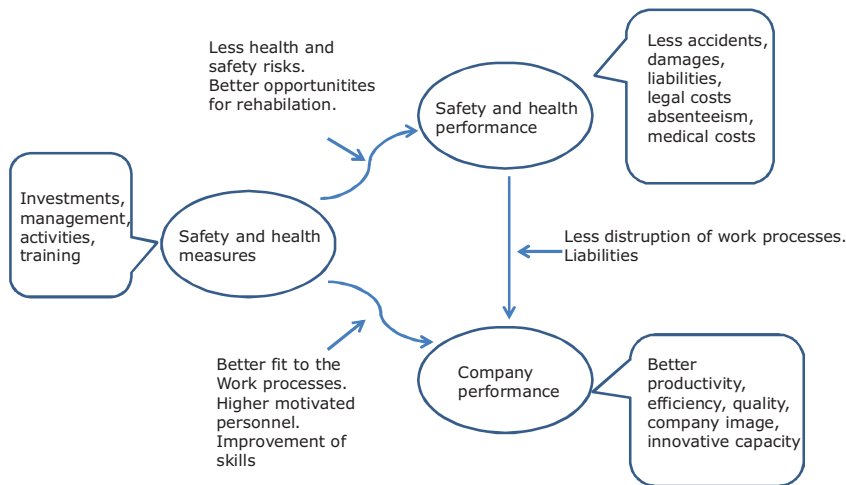
Figure 12: Economic effects of safety and health at company level (Mossink 2002, p. 12)

3.2.2 Costs of OHS to a Company

Mossink in his picture (Figure 12) did not consider other measures affecting company performance. These other measures compete with investments in safety and health in the company. OHS is only one input in the production process. The reimbursement system for OHS changes the relative price of OHS with respect to other inputs.

Filer and Golbe (2003) considered decision-making in firms with respect to safety investments. Although in most cases safety investments in their study meant investments in safety equipment, their discussion is useful for OHS. The benefits of OHS and interventions can accrue over a long time. Then the economic situation of the company (especially the high risk of bankruptcy) could have an impact on the company's decisions regarding OHS expenditure.

In general, a company's financial structure substantially affects its real operating decisions and the amount of risk the company is willing to bear, which has an impact on the firm's input choices. Investments in safety are such inputs. The economic situation and financial structure of the company may affect occupational safety differently from other input decisions (pecking order for investments). Acquiring outside funding for safety investments may be

difficult. Filer and Golbe (2003) assess that there is considerable information asymmetry in safety issues between the firm (manager) and the capital market; it is more difficult to get outside funding for safety investments than, for example, investments in productivity. Therefore investment decisions are dependent on the liquidity of the company (cash flows). Cash flows indicate if there is internal funding available in general, also for investments in safety and health. On the other hand, managers are agents for the owners of the company. In this task they balance their own non-verifiable effort and investments in safety equipment to avoid occupational accidents. Thirdly, workplace safety can also be regarded as one form of rent-sharing with employees. Then, if the capital structure has an impact on the firm's bargaining power with employees, it will also have an impact on safety investments.

Filer and Golbe (2003) observed that, in a wide range of industries, the level of safety in a workplace was related to the firm's operating margin. Particularly at low levels of operating margin, firms doing worse also invested less in safety. Nickell and Nicolitsas (1997) found that declining company finances lead to lower pay and to lower safety levels as indicated by the abolition of "restrictive practices" such as restrictions on working hours, manning ratios on machines, and inflexibility of working practices. The lifting of these restrictions can be interpreted as a lowering of safety levels.

Although occupational health services differ from investments in safety equipment the literature summarized in this chapter helps to understand the connections between expenditure on OHS and a company's economic performance. The costs for occupational health services include only the payments for the OHS providers, which will be paid immediately, while the benefits of good OHS will be derived only in the future. Therefore, we expect that high leverage and the risk of bankruptcy will lower the investment in occupational health services. This is due to shareholders' and bondholders' conflicting interests. Owners bear the costs of OHS, in case of bankruptcy the bondholders become the owners of the company and will receive the fruits of OHS, or the costs of neglect. Therefore, we would expect to see a positive association between the preceding economic performance of a company and its expenditure on preventive care, i.e. companies doing worse would cut down the expenditure on preventive care. On the other hand, companies with good economic performance would presumably share part of the profit with employees, i.e. a company would spend more for both preventive and medical services.

3.2.3 Employer's OHS 'make or buy' Decision

Zweifel et al. (2009, p. 384) proposed that employers can also have a role in organizing health care. But they assumed that the role can be only that of a purchaser of insurance, not the role of a provider. For reasons of confidentiality, they thought that it would not be possible for employers to provide health

services themselves. According to them, exceptions could be remote site, shift-work or factory towns where transaction costs would make it worthwhile for the employer to employ physicians and provide the services. The reasons that Zweifel et al. (2009) listed reasons for the employer to provide the services near the plant or organization are sound, but they are not reasons for providing health services 'in-house', i.e. to maintain an employer's own OHS.

The common argument in economics for organizing production in-house are transaction costs due to information asymmetry and incomplete contracts (Coase 1937, Williamson 1985). The existence of transaction costs is based largely on the assumption of humans behaving opportunistically. The opportunism can take place because contracts are incomplete and therefore high costs would accompany a 'buy' decision: "external service provider [...] requires the firm to incur substantial costs of negotiation, monitoring, and supervising external contractual parties." (Ang, Cummings 1997, p. 239.) This argument is usually accepted without noticing that if a task is so complex that it is difficult to write a contract on it there is room for opportunism and the costs of controlling and monitoring will be high, although the production is organized in-house. Liu and Yang (2000, p. 149) note that if trading involves endogenous transaction costs caused by moral hazard or other types of information asymmetry, trading in labour may involve endogenous transaction costs as well. James (1998) also criticizes transaction cost theory for the reliance on managerial control. If OHS providers and other health care providers are difficult to steer with contracts due to informational problems, it is likewise difficult to steer them hierarchically.

Oliver Hart (1995, p. 5) acknowledges that transaction cost theory puts a lot of emphasis on the costs of drawing up contracts and the consequent contractual incompleteness. Still, the theory pays less attention to how the relationship allocates power among purchaser/owner and provider. Milgrom and Roberts (1992, p. 136-9) describe the hold-up problem connected to asset specificity[4]. The risk is that after the contract has been signed and the investments realized, the other party tries to benefit from the sunk costs by worsening the terms of the contract. Chalkley and Malcomson (2000, p. 875-6) describe a hold-up problem between a National Health Service (NHS) hospital and a Health Authority (HA). When the contract is made and the hospital has invested in equipment the HA is able to capture the return on investment. This leads to a strong disincentive for relation specific investments, be they equipment, skills or processes. Property rights theory formally modelled the hold-up problem, and analysed the costs and benefits of integration in a unified manner. Grossman and Hart (1986, p. 695, footnote 3) regarded "the right to audit" sometimes as a residual right rather than a contractible right. Then the make or buy decision could be

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[4] One party in the relationship has invested in skills, equipment etc. that is most valuable in this specific relationship and valued less in other use.

explained by the need for information and how the availability of information is dependent on ownership patterns. In an employer's own OHS and in non-profits the employers have access to information on services, resources and costs.

The vertical integration of an OHS provider would mitigate the hold-up problem but the lock-in problem could still exist. The lock-in problem arises when both parties in the relationship are stuck with each other (Whinston 2001, Tadelis 2002). The partners are the best possible for each other (otherwise the contract would not exist) - they create additional value, "quasi-rent" (Whinston refers to Klein et al. (1978)). Because contracts are incomplete, both parties try to increase their share of this quasi-rent and this causes inefficiency. "Hold-up" and "lock-in" could both be described as games, and then bargaining power matters a lot. Big employers and their providers may have hold-up and lock-in situations. In an employer's own OHS and in non-profits there may be asset specificity in the relationship: employers have invested in facilities and organizational structures; providers have invested in skills and knowledge needed in a specific workplace, they know how the company "functions", whom to contact etc.

The reason for employers to have their own OHS could also be based on history. When employers started organizing health services in Finland, the services were neither available from the market nor provided publicly (Jaakkola et al. 1994). Health insurance organized by the employers has the same historical background in the USA (Currie, Madrian 1999).

3.3 OWNERSHIP AND THE OBJECTIVES OF THE PROVIDER

The objectives of health care provider organizations are thought to be represented by different ownership types. Then the differences in health care providers' performance would have their origin in owners' different objectives. In Finnish occupational health services there are three different owners: shareowners of for-profit providers, politicians/bureaucrats as owners of public providers and employers themselves when they have their own OHS provider or organize the services jointly (non-profit).

Private for-profit health care providers aim at maximizing profits, as would any firm according to economics. In theoretical models this objective has been refined to take into account that health care providers are multi-tasking firms that maximize revenues less treatment costs and the disutility of efforts to lower costs and improve quality (Ma 1994, Chalkley, Malcomson 1998b, Chalkley, Malcomson 1998a, Levaggi 2005). Non-profits have been claimed to maximize net revenues or profits, but instead of distributing these funds to shareholders, non-profits allocate them to uses selected by firm insiders, such as community

benefit programmes, "contingency funds", or greater employee perks (Eggleston, Zeckhauser 2002, p. 44). This objective could also apply to the employer's own OHS and jointly owned OHS (non-profit) providers. Public health care providers, like all public organizations in general, differ from firms. They may have broad social goals, or totally lack precise goals (Shen et al. 2005). Public providers have also been reported to aim at maximizing the budget (Niskanen 1968).

In health care there are multiple and hierarchical agency relationships. Health care organizations are led by managers and finally the treatment decisions and decisions about the use of resources are made by health care professionals. Although the owners may want to maximize the profit, due to the non-verifiable effort of a manager even for-profit health care provider may not be optimally efficient "Hospitals maximize profits plus utility from slack" (Pope 1989, p. 151).

Eggleston and Zeckhauser (2002, p. 36) oppose the idea that different organizations take different account of the best of the funding organization or that of society by their "nature". Actually, the medical ethics of physicians should also be the same irrespective of the ownership of the health care provider. Arrow (1973, p. 14) regards unnecessary medical expenses or other abuses as violations of medical ethics. Eggleston and Zeckhauser (2002) state that the possible differences are due to different incentives and regulations. Their idea is supported by Barbetta, Turati and Zago (2007, p. 75-6): the differences in economic performances between competing forms of ownership are more the result of the institutional settings in which they operate - e.g. the reimbursement schemes - than the objectives embedded in the various proprietary forms. A totally different explanation for why ownership does not matter is proposed by Pauly and Redisch (1973). They described health care providers as physicians' co-operatives. Whatever the form of ownership, the organizations would aim at maximizing the physicians' joint income.

The ownership of the provider is indeed intertwined with many incentives. Ownership matters, because the financial constraints differ according to the ownership: public providers are more secure and backed up by their principal's ability to raise taxes if funds are needed, and the principal may be unable to commit to hard budget constraints (Kornai, Maskin & Roland 2003). When employers own an OHS unit or are jointly in charge of an OHS, they have to back up the provider. For these providers the softness of the budget constraint is less soft than for public providers. As Segal (1998) stated, the budget constraints can be hardened if competition exists, in employer's own OHS and non-profits the owner (the employer) has the threat of outsourcing its own OHS or changing the provider. A hard budget constraint makes the provider fully accountable for its financial performance. Preker et al. (2007b, p. 96) state that at least theoretically, the chance of liquidation in case of insolvency should exist for a health care provider.

Ownership is also connected to incentives for innovations. Innovations in quality improvement and cost control cannot be articulated explicitly in a purchaser-provider contract ex ante. Important opportunities for innovation will therefore arise after a contract has been negotiated and signed. Incentives for such innovations will depend essentially on who has control rights to implement the innovations, and captures the benefits from those innovations. (Eggleston, Zeckhauser 2002, p. 40). Hart, Schleifer and Vishny (1997) compared theoretically public and private for-profit providers and concluded that a private owner has stronger incentives to invest in innovations, especially to those that reduce production costs. In their model, the costs are always lower in the private for-profit firm. Quality may be higher or lower than in public provision. Eggleston and Zeckhauser (2002) claim that these stunted incentives for innovation can lead to cumulative low levels of innovation, so that such a provider (public) ends up well behind the technical frontier.

In empirical studies contradictory results have been reported regarding the effect of ownership on quality and economic performance. Devereaux et al. (2002) in their meta-analysis compared mortality in private non-profit and for-profit hospitals. They recognised the problems of combining observational studies into one figure, treatment effect, but still concluded that the mortality rate is higher in private for-profit hospitals than in private non-profit hospitals. The empirical literature on the direct effects of ownership has been reviewed by Eggleston et al. (2008) and Shen et al. (2007). They conducted meta-analyses of hospital ownership and performance since 1990. Their aim was to explain variation of the results in different studies but not to calculate the treatment effect. Eggleston et al. (2008) studied the effect of ownership on mortality and other adverse events. Shen et al. (2005, 2007) concentrated on the effect of ownership on the financial performance of hospitals: cost, revenue, profit margin, and both cost and technical efficiency. In both meta-analyses the conclusion was that better quality studies that take into account market environment and patient mix as confounding factors and use longitudinal data reveal smaller differences in performance according to ownership. The results of Shen et al. indicate that ownership played a much less important role in influencing hospital financial performance than other hospital characteristics, even when it was a significant predictor. They did not regard the result as surprising, given that there are so many other factors influencing a hospital's operations.

Although ownership has been regarded to represent different objectives, we prefer to regard it as representing differences in incentive structure. Different ownership types have different payment systems, financial constraints and incentives for innovations that are connected to their performance.

4 Purchasing, Payment Systems and Competition

4.1 ORGANIZATION OF PURCHASING

The purchasing of OHS in Finland is very fragmented. Each employer is responsible for purchasing the services irrespective of the number of employees. According to the Occupational Health Care Act, the worksite of an employer can have only one provider. However, an employer with multiple worksites in different geographical regions may have multiple providers. In non-profits the employers have combined their efforts and organized the provision together. According to Preker et al. (2007b, p. 85) fragmented purchasing may cause cost shifting if the patients can be transferred to another purchaser's purse. If the funds per insured person (individual, employee) between purchasers vary it may have negative equity consequences. The purchasing pool may be too small to bear the risk variation. When purchasing is organized integrating the provider (employer's own OHS) and the pool is small it leads to a narrower clinical network (scope of services) for the employer and too small patient volume for the provider. The optimal scope of purchasing (insuring) often exceeds the geographical scope of a medical group (Preker et al. 2007b, p. 91).

The way in which purchasing of OHS is organized has some characteristics of an exclusive provider organization (EPO) in the USA. The employer (instead of an insurance company in the USA) contracts with one provider and funds only services provided by the EPO. In the USA the insurer pays an access fee to the EPO and gets discounts on the prices. One-contract-only policy seems also to be the lowest cost option when an employer bears all costs. Vistnes, Cooper and Vistnes (2001) studied two-stage competition in the USA: employers first choose the health plans and then employees choose one plan from among those chosen by the employer. The premiums were higher if employers paid the whole premium and offered more than one plan.

4.2 PAYMENT SYSTEMS

4.2.1 Agency, Contract and Informational Problems

Purchasing has been regarded as important in steering the providers (Figueras, Robinson & Jakubowski 2005, Preker et al. 2007a). Langenbrunner et al. (2005, p.

237) describe strategic purchasing as a tool to correct market failures, and payment mechanisms provide an opportunity to affect providers' behaviour. Basically, there are two organizational forms to allocate resources to providers: ownership and purchasing. Ownership is one form of resource allocation mechanism and the purchaser and the provider are then vertically integrated. Purchasing may be based on long-term contracts or spot-market transactions. According to the Occupational Health Care Act, the employer must have a contract with the OHS provider, therefore there is no spot-market for OHS.

The theoretical analysis of payment systems is mainly based on agency theories and incentives. As Varian (2010, p. 730) wrote, the idea is to find means to induce behaviour: "How can I get someone to do something for me?" In an agency relationship, it is often thought that the purchaser is the principal who sets the terms of the contract and the provider (the agent) only has the option to accept or reject: "the purchaser can make credible 'take it or leave it' offers to suppliers" (Chalkley, Malcomson 2000, p. 852). In Finnish OHS, it can be also the provider who has decided upon the structure of the payment system to be applied. Then it is up to the purchaser to accept or reject the contract and the payment system, or, depending on the bargaining power, to negotiate the level of payment (but not the structure of the payment system).

Chalkley (2006) defines a contract as a formal statement of what the purchaser will pay for a task (tasks) and how to assess that the provider has performed that task. Contracts are supposed to be enforced, if necessary, and therefore the judgement whether the terms of the contract have been met must be verifiable by an outsider (the enforcer). It is common in the literature to use the word contract to refer to arrangements for payment even if there is no formal legal contract (Chalkley, Malcomson 2000, p. 851). In Finnish OHS, the contract concerns more the practical arrangements, such as if the services include only preventive services or also curative medical services. The prices will be on the "pricelist" and the tasks will be included in the separate action plan, which usually does not contain a budget. Action plans have been vague and the employer has not had a role in preparing the plan; the provider makes the proposal for the action plan (Laine et al. 2009). The legislation recognises information asymmetry in occupational safety and health issues: according to the Act (Occupational Health Care Act 1383/2001) the employer must consult the OHS provider to assess the needs for OHS and decisions on the services provided.

Informational problems are crucial in agency relationships, as in the purchaser (employer) - provider relationship. If the purchaser's objective is non-contractible, the success of the payment system depends on how well the basis for payment and performance measure relates to the purchaser's objectives (Baker 1992). The objectives of society mediated through the purchaser are difficult to translate into contracts and bases for payment, e.g. the prevention of work-related illnesses and accidents, or the functional capacity of employees

(Occupational Health Care Act 1383/2001). There is uncertainty in the occurrence of diseases and also in the effectiveness of preventive actions. Working capacity is difficult to verify and hardly mainly dependent on the actions of OH personnel. The issues of observability and verifiability matter as to what may constitute the basis of the payment (Beitia 2003).

Another informational problem is created by the fact that from the purchasers' point of view the health care providers can be described as multitasking firms: providers have to expend effort both to keep the costs down and to improve quality[5]. The purchaser prefers high effort to low effort (high quality and low cost). Quality, and the effort to improve it, cannot be observed and verified by the purchaser and therefore cannot be the basis of payment. The effort to lower the production cost would not be observed, either, but the price can be observed. Then the providers would have a stronger incentive to lower production costs and prices than improve quality. This is the common multi-tasking problem when one of the tasks can be observed and verified, and the other one not (Holmström, Milgrom 1991).

Without informational problems, the purchaser would merely specify the quantity and quality of services it desired and pay a price high enough to make the provider to accept the contract. "It [the purchasing agency] would not need to *induce* the supplier to provide the appropriate services by choice of the arrangements for payment." (Chalkley, Malcomson 2000, p. 851, italics original). Chaix-Couturier et al. (2000, p. 139) stress that financial incentives are used to implement change in medical practice that does not stem from professionals' own motivation. This observation raises another issue in agency relationships: the objectives of the principals and agents are not identical. If they were, the imperfect information would not cause problems (Smith, Street 2006).

4.2.2 Payment Systems for OHS Providers

In Finnish OHS the employers first bear all costs and then apply for reimbursement, and the services are free of charge for employees. Therefore only supply-side payments are relevant. Ellis and Miller (2008) analyse payment systems according to four dimensions: breadth of payment, information used for payment, degree of detail in the payment system (fineness) and the generosity of the payment. Their dimensions will be made use of in the following description of payment systems in general, and especially those applied in Finnish occupational health services. According to Ellis and Miller, the three main ways to pay health care providers are budgets, fee schedules and episode-based

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[5] Camerer and Malmendier (2004, p. 8) state that in economics effort stands for "a euphemism for whatever activity agents dislike which is productive for principals".

payments. The payment can be based on patient/citizen characteristics, service characteristics or provider characteristics[6].

The Occupational Health Care Act sets the limits for the extent of purchasing. All employers must purchase their preventive services. Curative medical care is voluntary for employers but most employers have included this in the contract. Occupational health services are restricted to GP level services only. There will therefore not be any services provided by hospitals. Occupational physicians can refer a patient to a specialist for consultation, but that is rare.

Public providers in Finland used to have line-item budgets based on the previous year's expenditure. Information that was needed for funding therefore concerned the resources only, not the services provided or those using the services. The line-item budget locks the provider into existing resources. In addition, it does not provide any incentives to save. Liu and Mills (2007b) have used the name "open-ended budget" when the purchaser provides additional funds if the budget is exceeded; in Finnish municipal health centre (public) it is not the purchaser but the owner who has to provide the additional funds, i.e. a public provider may have a soft budget constraint. In Finnish OHS, the employer's own OHS has a fixed budget and has the same features as global budgets for hospitals: after the amount of the budget has been set it will not be changed. The budget is neither connected to patients served nor to the services provided. In general, a fixed budget is supposed to lower the quality of services. However, payer monitoring could be effective in enhancing quality. Also, if the providers are able to realize savings from preventive care a fixed budget could encourage providers into prevention. (Liu, Mills 2007b, p. 269-270.)

The reimbursement system for OHS has a cap per employee, and, knowing this, the employer could allocate resources to the employer's own OHS as a fixed sum per employee. Then the payment system in employer's own OHS could be regarded as a budget based on capitation[7]. And further, capitation could be regarded as bundling of services. The capitation payment includes all services provided by the employer's own OHS: physician and nurse visits, workplace surveillance, lab tests etc. When the capitation payment is too low, the providers would have an incentive to stint – deliver fewer services than an informed patient would like (Newhouse 2002, p. 82) or lower the quality – skimping on office quality, accepting too many registrants that would lead to

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[6] Langenbrunner et al. (2005, p. 237-8) propose a typology that differs from that of Ellis and Miller. Langenbrunner et al. divide payment systems into time based payments (salary or fixed budget), service based (fee-for-service, fee for patient episode such as diagnoses related group (DRG)) and population based (capitation, block contract) which is close to the information base classification of Ellis and Miller.

[7] A method of payment for health services in which a physician or hospital is paid a fixed amount per enrollee to cover a defined scope of services for a defined population for a defined period of time, regardless of the actual number or nature of services provided; capitation may be used by purchasers to pay for health plans or by plans to pay providers; http://medical-dictionary.thefreedictionary.com/capitation (accessed 4/4/2012).

long waiting times (Liu, Mills 2007b, p. 265). Capitation makes it profitable for the provider to seek cheaper ways of providing the services, e.g. to use nurses instead of physicians, or engage in cost-shifting e.g. increasing the referrals to hospitals (Liu, Mills 2007b, p. 264-5, Ellis, Miller 2008, p. 399).

Non-profits, for-profits and public providers all have much finer categorizations of the payment system than employers' own OHS. They all have both fee-for-service payments and capitation. They differ in the share of capitation: for-profits and public providers earn about 10% of their revenues with capitation payments, non-profits about 50%. Fee-for-service (FFS) payments are a poor means of controlling quantity, and therefore the total costs. FFS induces the provider to concentrate on the most profitable service offerings irrespective of the benefit to patients or purchaser. Overprovision is another likely problem. On the other hand, the steering power of the FFS could be used to encourage the use of cost-effective treatments and discourage the use of inefficient treatments (Liu, Mills 2007b, p. 262).

The fineness of the payment system is connected to the risk that a variation in costs would cause to the providers. For example, the prospective payment system, DRG prices, varies widely in cost per case. This gives an incentive for providers not to treat high-risk (high-cost) patients. The occupational health services have to be grouped into two categories because of the reimbursement system requirements: preventive and curative medical care. Otherwise the providers are allowed to name their service offerings and decide on the degree of detail in the "product list". The services are restricted by law to GP level medical services so the uncertainty connected to the variation of cost per item in the payment system is negligible. The providers can always refer their clients (employees) to public primary and specialised care without any costs to the employers.

The fee-for-service in Finnish OHS deviates from the fixed price systems in the USA and in the UK. In both countries the price is prospectively determined per patient in a certain category, e.g. diagnoses related group (DRG) in the USA or health resource group (HRG) in the UK. They give strong incentives for providers to seek cost savings because the provider will be the residual claimant of all savings (Chalkley 2006, p. 246). Fixed payment systems per patient rely on provider altruism that high-quality services are provided (Ellis, Miller 2008, p. 398). The incentive to prefer low-risk (low-cost) patients and avoid high-risk (high-cost) patients is strong, both for the insurer and the provider (cream skimming). Because the distribution of health care expenditure on individual level is extremely skewed, there may be substantial profits for an insurance company if it can disproportionately enrol good risks and charge premiums equal approximately to the cost of an average risk (Newhouse 2002, p. 147). In Finnish OHS the employer chooses the provider and the provider must accept all the employees of that employer as clients. Because the costly patients can be referred elsewhere there is no need for risk adjustment, which has been

proposed to diminish cream skimming by lowering the risk of financial loss for providers (insurers) (van de Ven, Wynand P.M.M., Ellis 2000).

The level of the payment (generosity) varies with the provider type. The statutory fees of public providers set by the Council of State were too low to cover the production costs in the early 1990s. In an employer's own units the level of capitation payment has been generous, in non-profits likewise (Figure 8, page 31). Ellis and Miller (2008, p. 398) state that in all payment systems too low payment levels reduce the incentive to provide quality.

Performance-based payment systems have not been applied in Finnish OHS. In general, outcomes are often difficult to observe and not totally attributable to services rendered (e.g. a physician visit). The knowledge base for treatments and interventions may be weak, and therefore the medical profession may disagree on the proper treatment. This has led to variation in medical practices (Iversen, Lurås 2006, p. 270). When the agreement on proper treatment is missing it is difficult to set payments for performance. Therefore providers are often paid for their inputs (time spent) or outputs (units of production).

Liu and Mills (2007b) assessed different payment systems according their criteria for an ideal payment system (Table 1). The table includes only those payment systems that are relevant for Finnish OHS. Liu and Mills regard cost containment as the most important requirement for a good payment system. Fee-for-service and open-ended budgets are the worst systems for cost containment; capitation and fixed budgets do it well. The systems that are good for controlling costs do not perform as well in ensuring quality. The payment systems also differ in their incentives for overprovision and under-provision. Those systems that are good for controlling costs will induce under-provision and systems that are not will induce overprovision. The table also makes visible why blending of payment systems is attractive (Robinson et al. 2004) and in some cases also optimal (Chalkley, Malcomson 2000).

Table 1: Payment systems compared by cost containment, quality assurance, overprovision, underprovision, internal efficiency and administrative feasibility (Liu, Mills 2007b, p. 274)

Type of payment	Cost containment	Quality assurance	No incentive for overprovision	No incentive for underprovision	Internal efficiency	Administrative feasibility
Fee for service	---	+++	---	+++	+++	--
Capitation	+++	-	+++	---	+	++
Salary	++	+	++	++	---	++
Open-ended budget	---	+++	+	+	---	-
Fixed global budget	+++	-	+++	--	+++	++

The number of "+" signs refers to the degree of goodness; the number of "-" signs refers to the degree of badness

In health care, it is ultimately the physician who makes the decisions on treatments. Therefore, the objectives of physicians and the way they are paid for their work are crucial in mediating the purchasers' objectives into daily practice.

The physician acts as an agent for the patient while deciding on treatments. Then, again, the multitasking role is noticeable. The physician almost always supplies her own input to the production of health care for the patient. Physicians cannot be paid for effort they spend in acquiring information, and providing the information to the patient (Haas-Wilson 2001), nor for their effort to lower costs and enhance quality (Ma, McGuire 1997) which all may be in the interests of the purchaser. The physicians may still act in their patients' best interests. The social exchange for the professional autonomy which patients and society grant physicians, pride in their work, and enjoyment in providing health care, the satisfaction that physicians derive from improving the health of their patients, reflecting altruism, professional obligation and desire to enhance reputation have been evinced as reasons for acting in the interests of the patients (Arrow 1973, Ma, McGuire 1997, Boadway, Marchand & Sato 2004). The ethical code of the profession is supposed to offer the patient protection against the physician's exploiting his or her superior knowledge (Newhouse 2002, p. 4). The threat of tort liability also creates an incentive to exercise care (Sloan 2001, p. 907, Gal-Or 1999).

Chalkley and Malcomson (1998a, p. 17) presented physicians as having a bias in favour of quality: they would choose higher quality and less cost reducing effort than the administrators would choose. Chaix-Couturier et al. (2000, p. 139) raised the possible conflict that financial incentives might create for physicians between their incomes and quality of care. If the medical staff favours more quality improvement effort and managers favour cost containment effort it might help in balancing the cost reduction and quality enhancing efforts (Chalkley, Malcomson 1998a). Financial incentives might also conflict with intrinsic motivation and therefore cause undesired side-effects (Prendergast (2008) gives "teaching for the test" as an example).

Iversen and Lurås (2006) reviewed the basis for payment for primary care physicians. There are also two systematic reviews on physician remuneration systems conducted by Chaix-Couturier et al. (2000) and Gosden et al. (2000, 2001). All these publications report similar results: fee-for-service payment encourages the provision of services, even above optimal provision might be possible; capitation induces physicians to recruit patients for their lists – rather the low-cost ones. On the other hand, it provides incentives to reduce own workload by compromising quality and prescribing referrals. Salaried physicians have an incentive to minimise their workloads during working hours, which leads to lower productivity. In Finnish OHS, the physicians of for-profit providers are mainly paid on a fee-for-service basis, in all other provider types they are mainly salaried employees.

From the purchaser's point of view the payment systems for individual physicians (professionals) should be aligned with the payment system for the provider organization, but only if the payment system in the purchaser-provider relationship is able to fulfil the objectives of the purchaser (see, e.g. for Boadway et al. (2004)). Robinson et al. (2004) studied how changes in payment systems led to changes in the remuneration systems for physicians in the USA. Physicians used to be paid with fee-for-service payments and insurers reimbursed all costs. Then the HMOs began to reimburse the provider on a prospective, capitated basis. This changed the incentives for the medical group and also led to changes in the payment systems for individual physicians. When HMOs had a market share higher than 20% the medical groups were less inclined to use only fee-for-service payment for physicians and preferred a blended payment system based partly on prospective fees and partly on retrospective payment, either capitation or salary.

Table 2 combines the payment systems for providers and the way the providers remunerate their physicians. For-profit providers have aligned payment systems to (over)provide and be productive. All other provider types have salaried physicians, which would imply lower productivity. The public provider has fee-for-service payments as do for-profits, but it can rely on the taxpayers. Non-profits have a combination of capitation and FFS, which balances the cost containment and quality improvement incentives and should

also keep productivity high. Whether employers' own OHS payment is regarded as a capitation system or fixed global budget the consequences are the same: it will induce cost containment, and underprovision (if not high capitation) and productivity.

Table 2: Payment systems for providers and physicians in the Finnish OHS

		Physician's remuneration		
		Fee-for-service	**Capitation**	**Salary**
Payment system for OHS provider	**Fee-for-service**	For-profit		Public
	Capitation and FFS			Non-profit (Employer's own selling to other employers)
	Fixed budget			Employer's own OHS

4.3 COMPETITION AND MARKET ENVIRONMENT

4.3.1 Competition

Stigler (1987) describes competition: "Competition arises whenever two or more parties strive for something that all cannot obtain." In OHS, the providers compete for the employers. Employers have to choose one provider according to the Occupational Health Care Act, and if the employer also purchases curative medical care for employees, as most of them do, the provider chosen by the employer has to attract the employees.

Studies 3 and 4 deal with the intensity, productivity, share of medical care, unit price and revenue of the provider. I start the discussion on how competition affects these indicators with the review of competition and productivity by Holmes and Schmitz (2010), their review being one those few publications that deal with competition as behaviour. Because they were looking for causality, the impact of competition on productivity, they stressed that there first has to be a change in competition associated with a change in productivity. In addition, there should be an understanding of the mechanism through which competition affects productivity. The productivity increase in an industry could accrue through the closing down of inefficient plants (competition leads to reallocation). If the scale of the remaining producers grows and there are fixed

costs involved in the production, this will also lead to an overall increase in productivity.

Holmes and Schmitz (2010) regarded as more challenging the question of what causes the existing firms to increase their productivity when there is no change in their scale. They wanted to delve into the "black box" and asked, what would diminish "X-efficiency" within a firm? They review case studies on changes in the competitive environment, such as how the railways affected productivity in water transportation (new technology), or how Brazilian iron ore producers challenged the producers in the USA (high prices increasing the likelihood of producers from abroad entering the market). According to Holmes and Schmitz increased competition leads to new management practices: despite the pressure from the unions the work rules that constrained capital productivity were abolished. Increase in competition lowers the opportunity cost of lost production due to strikes or disruptions caused by implementing new technology or practices.

Holmes and Schmitz (2010) were surprised by the result that some firms were reluctant to attain great market power. They explain the result by the fact that employees and other input suppliers (including the community with its taxation interests) had an incentive to invest in their own bargaining power to extract surplus. Consequently, the monopoly would have less incentive to innovate - the suppliers will extract the rent. Nickell (1999, p. 14) also states that investments in cost reducing improvements that also increase productivity are more likely in a more competitive environment, leading to greater increase in profit. On the other hand, Nickell (1999) also refers to Schumpeter: more monopolistic producers have less uncertainty, and larger and more stable cash flows to fund R & D.

Holmes and Schmitz (2010) regarded competition important to induce firms to adopt more efficient management structures. Nickell (1999) connected competition with incentives, together they increase the effectiveness of both management and employees: competition sharpens incentives and therefore improves performance. Competition works through four channels: managers, customers, employees and the financial market (Nickell 1996, Nickell, Nicolitsas & Dryden 1997). The more firms there are, and therefore the more managers, the more opportunity the owners have to compare the performance of managers and therefore competition would decrease slack. Increased competition can also influence customers' demand; both elasticity and amount. Competition can make demand more elastic, which in turn makes the owners sharpen the incentives for managers (which leads to improved performance). Nickell (1999) examined a theory on the effect of product market competition on employees in a union bargaining framework, and showed that increased competition in the product market improved employees' effort. The fourth channel for competition to improve performance is the financial market. For private providers dependence on external funding creates financial pressure, especially if debt

servicing payments are high. Managers are then motivated to try their best to avoid the consequences of bankruptcy and loss of reputation. Competition increases the risk of bankruptcy, which is worse for managers than for owners (Nickell, Nicolitsas & Dryden 1997). As Hart (1983, p. 366) phrased it: " [...] competition is a source of discipline; that is, that it reduces the amount of slack in the system due to individuals' not minimizing costs or being on their production possibility frontiers." Nickell et al. (1997) suggest that strong external shareholder control could substitute for the lack of competition and financial pressure which are regarded as important for managerial effort.

Providers compete for employers with prices and quality, and for the employees with quality (the OHS are free of charge to the employees). Competition with unregulated prices would induce all providers to exert effort to lower the production costs (increase productivity). In health care, quality or at least some of its attributes are non-contractible and providers cannot be paid for all aspects of quality. The incentives to control costs are strong, at least among for-profit providers and therefore the impact of competition on their quality is ambiguous (Shen et al. 2005). The competition for quality in Finnish OHS would induce providers to improve service quality, especially the quality perceived by the employees.

Provider's revenue is dependent on the prices and the amount of services used by the employees. Therefore the impact of competition on revenue is indeterminate: competition lowers prices, but may increase the use of curative medical services (through increased quality). Nickell (1997, p. 785) states that "demand elasticities tend to be higher under competition". If the competition increases the use of curative medical care it will also increase the share of medical care (preventive care is more stable).

4.3.2 Market Structure

Competition is essential in achieving optimal allocation of resources in society. Nevertheless, competition as behaviour has been studied theoretically and empirically much less than markets as structures. In economic theory one market consists of one homogenous product. Then what a supplier can compete on is the price (and quantity). In this kind of analysis the markets are usually categorised according to the number of providers (perfect competition, monopoly, oligopoly), and the market structure is supposed to represent the level of competition. The only explanation in neoclassical economics for why a monopoly continues to exist without competitors is that the technology has increasing returns to scale. A single firm can then produce at a lower average cost than any number of competitors would.

Oligopoly theories and monopolistic competition both belong under the heading of imperfect competition and are therefore at the core of industrial economics. In oligopoly theories the number of firms is small. An important characteristic of oligopoly (or duopoly) markets is the strategic interdependence

between competitors. (Cabral 2002, p. 101.) The models can explain both fierce price competition and collusive behaviour (Lipczynski, Wilson & Goddard 2005, p. 4-5, Waldman, Jensen 2007, p. 230-265). The oligopoly theories concentrate on one market (partial equilibrium approach) and firms do not create new products. Competition is almost synonymous with the number of firms, and the equilibrium market structure is determined in a long-run equilibrium. Since the number of firms is important, the entry and exit of firms become an important aspect of market analysis (Viscusi, Harrington & Vernon 2005, p. 165). The theory concentrated on barriers to entry to be able to explain why concentration and high profits could sustain (Sutton 2007).

The composition of an industry - number of firms and their size distribution – has been regarded as crucial in understanding the processes and outcomes of competition (van Witteloostuijn, Boone 2006, p. 409). In the Structure–Conduct–Performance (SCP) paradigm, an industry is characterized by its structure, conduct and performance. The focus of the paradigm is on the market power - profitability relationship, market power measured by the concentration of the industry. The paradigm was developed by Edward Mason and Joe Bain in the 1940s and 1950s (George, Joll & Lynk 1992). The theory led to a "short cut analysis": since structure determined conduct and conduct determined performance, one could ignore conduct and look directly at industry structure when trying to explain performance (Douma, Schreuder 2002, p. 187).

Industry does not take into account that markets may be regional or that the competition may be international. A more serious problem is that SCP does not take into account that firms' conduct may have an effect on the structure of the industry (Cabral 2002, p. 157). Nowadays it is increasingly recognized that the conduct of firms can also affect industry structure. Therefore an industry's market structure can be regarded as both a consequence and outcome of competition (van Witteloostuijn, Boone 2006, p. 409). Nevertheless, the SCP studies developed the understanding of market power and created indicators for measuring it.

In economics, it is well known that market structure affects the price of a product. A monopoly has the highest price, a firm in a competitive market has the lowest price, and prices in oligopolistic markets are somewhere in between (Cabral 2002). There is extensive empirical evidence, mainly from the USA that higher market concentration of hospitals is connected to higher prices (Gaynor, Haas-Wilson 1999, Keeler, Melnick & Zwanziger 1999, Gaynor, Town 2011).

Holmes and Schmitz (2010) and Nickell (1999) concluded that competition will also lead to increased productivity, especially if the scale of the remaining producers grows and there are fixed costs involved in the production. The scope of services may also be associated with the output of the provider and therefore with the productivity of a firm. In health care, scope inefficiencies have been found in multi-speciality groups compared to single-speciality groups by Rosenman and Friesner (2004) and in HMOs providing both insurance and

health services (Wholey et al. 1996). On the other hand, for small-scale providers such as nursing homes, scope can help in achieving economies of scale (Christensen 2004). Rosenman and Friesner (2004) found economies of scale in both primary care and speciality care practices.

The quality of a product is not an issue in the standard models based on the market structure because the product is assumed to be homogenous. Theoretically different qualities can be defined as different goods (Newhouse 2002, p. 82), but in practice consumers may have problems in assessing the quality of health care. Dranove et al. (2003, p. 434) claim that the theoretical basis for the use of the Herfindahl index is a Cournot equilibrium with homogeneous firms competing with quantities and therefore would not suit well for assessing the extent of competition among differentiated sellers. Still, inconsistent with this argument, the structure of the market has also represented competition in studies where the providers have been competing for patients on quality (Gaynor, Town 2011, p. 60). There is evidence both from the USA and the UK that competition (measured as market structure) improves quality when patients choose the hospital and prices are fixed (hospitals have to compete on quality for patients) (Kessler, McClellan 2000, Gaynor, Moreno-Serra & Propper 2010). Gaynor et al. (2011, p. 63) conclude that it is clear that concentration affects hospital quality, but that the mechanism by which this occurs is not. As Jack (2005) pointed out, fixed prices are good for controlling the costs. Only, when consumers themselves are good judges of quality and can threaten to switch to a higher quality provider will the providers be induced to compete on quality. Thus, if there is a chance, information and motivation to choose, there will be competition that spurs on quality.

When prices are market determined, the results have reflected theoretical indeterminancy. In the UK, Propper et al. (2004, 2008) found that quality was lower in a more competitive environment: the death rates from emergency admissions for acute myocardial infarction were higher in areas subject to hospital competition than in those which were not. The hospitals were competing for the purchasers. Sari (2002) found that higher hospital market share and concentration were associated with lower quality of care in the USA. Both Propper et al. and Sari used a vast variety of quality indicators but all related to clinical quality, like obstetric complications, mortality, or inappropriate surgery.

Economists have defined quality in health care in quite a variety of ways. For example, Pope (1989, p. 159) has defined quality as "whatever increases demand for admissions to a hospital" and Chalkley and Malcomson (1998b, p. 1093) as "any aspect of service that benefits patient". Sometimes quality has been defined as strictly related to health only, like Allen and Gertler (1991, p. 363): "The quality of medical care is its expected efficacy (marginal product) in terms of health." Levaggi (2005, p. 329) classifies the definitions in the literature as either related to the appropriateness of care, or to those who regard quality as a "cost

driver". She writes of quality "[…] as multidimensional vector that includes medical and non-medical variables which affect outcome of health care and have a positive relationship with costs" (ibid. p. 330). In occupational health services the competition for employees through quality probably leads to competition with quality as perceived by employees, not through clinical effectiveness. Thus our quality indicator – intensity of services – is appropriate to study the impact of competition on quality. Those providers that are most productive in producing quality would win the employees. Again, one might assume that competition increases quality productivity.

4.3.3 Market Mix

Most of the theories and empirical studies deal with market structure. The providers are assumed to be firms with a profit maximizing objective. Various not-for-profit providers operate in health care. If their behaviour deviates from that of for-profits, then the ownership structure of the market, the market mix, could affect the performance of a health care provider (competitive spillovers). In the USA, the presence of non-profits has been deemed important in keeping service quality high and the presence of for-profits in keeping service costs low.

Kessler and McClellan (2002) in their longitudinal study found that even a 10% for-profit share of first heart attack admissions was enough to lower the expenditure on all heart attack patients by 2.4% with the same patient outcomes. Quality spillovers from non-profits can be expected only if at least some of the consumers are ill-informed. Grabowski and Hirth (2003) examined the role of non-profits in the USA nursing home market. They claim that only well-informed customers can push the for-profit nursing homes to provide the promised quality. The ill-informed customers would prefer to choose a non-profit nursing home which is motivated by its non-distribution constraint to provide the promised quality. The bigger the market share of the non-profit nursing homes, the poorer the chances of for-profits to abuse the ill-informed customers. Then an increase in the non-profit market share will improve both for-profit and overall market quality, as found in USA nursing homes by Grabowski and Hirth (2003). Santerre and Vernon (2006) studied the welfare implications of ownership mix in the USA and concluded that it would improve welfare to increase the share of for-profits in inpatient care and the share of non-profits in outpatient care. In the USA, market mix has also had an impact on the service offerings of providers. Horwitz and Nichols studied hospitals in metropolitan statistical (2009) and rural areas (2011). Non-profits with low market share of for-profit providers were more likely to offer unprofitable services such as psychiatric, hospice, substance abuse, and social work services than non-profits in markets with high market share of for-profit providers.

4.3.4 Purchasers' and Consumers' Behaviour in Health Care

In the oligopolistic models the consumers/purchasers are assumed to be numerous and small enough, so that their decision-making would not change the quantity or the price in the market. An important aspect of the SCP, oligopolistic and monopolistic competition, is that decisions on the use of resources are left to the individual consumers and firms (Milgrom, Roberts 1992, p. 72). The only role of government is to facilitate the functioning of the private markets. The state legislates on contracts, supports the judicial system for reinforcing the contractual base of markets and protects private property rights (Dasgupta 1993, p. 138).

Health care differs greatly from the assumptions of competitive markets (Dranove, Satterthwaite 2000). The consumers are neither well informed nor allowed to make the decisions regarding their use of health care. Likewise, they do not pay the price of the services. Finnish OHS includes only primary care services, therefore employees can influence the use of the services themselves. As consumers they would use the services as long as the marginal cost of doing so would equal the marginal benefits of OHS. The services being free of charge for employees probably leads to excessive usage from society's point of view.

Due to the uncertainty connected to health and to the costs of health care, in most countries people have pooled the risks and organized insurance either through private or public insurance, or taxation. This has led to "third party purchasing". Another difference is that health care providers are not all firms; depending on the country and service, the market may consist of a mixture of providers with various owners, not only of for-profit providers (see Chapter 3.3).

Political and legal decisions create the market for purchasing in health care. The purchaser needs skills (information) and incentives to do the purchasing well. If purchasing is left to individuals and insurance reimburses the costs, the purchasing will not be price-sensitive. When managed care, health maintenance organizations (HMOs) in particular, was introduced in the USA in the 1990s, the purchasing decisions were shifted away from relatively price-insensitive consumers towards more cost-conscious health plans (Dranove et al. 2008). The HMO experiences support the idea that the purchaser's role matters: hospitals had lower total margins in markets with higher levels of HMO penetration. Managed care has been shown also to improve efficiency in production (Brown 2003, Sari 2003). The UK experiences from the general practitioner fund holding (GPFH) practices 1991-1999 show that they were willing and able to challenge hospitals (Glennerster 1998). They 'shopped around' in search of lower costs because they were allowed to retain the savings. Moreover, the waiting times were shorter for the patients referred to hospitals by the GPFHs. When the GPHFs were replaced by primary care groups, later primary care trusts, they were clearly less eager to shop around and commissioning concentrated (Dusheiko et al. 2008).

The structure of the purchasing of OHS in Finland is very fragmented, so the purchasers are numerous. The size of the employer may affect negotiation power. A high concentration of the labour market based on the employer's market shares of all employees in the region could then signal that there are some employers with market power. There are no statistics on regional concentration of all employers in Finland, but Statistics Finland has published regional concentration figures on firms. In ten regions out of 68, the biggest firm employed more than 30% of all employees recruited by firms in 2004. In more than 20 regions the share was above 20%. The regions with very high concentration are regions with moderate numbers employed in firms in general, and one paper, pulp or steel factory is located in the region (Rajaniemi 2006). Nevertheless, employer's size (number of employees) may not be a sign of bargaining power. Barros and Martinez-Giralf (2006) collected empirical evidence on negotiations between third party purchasers and providers. Evidence shows that the availability of alternatives for the purchaser is more significant for bargaining power than the size of the purchaser. Then, depending on the market for OHS, large size of an employer (purchaser) may lead to hold-up or lock-in problems and not to bargaining power.

4.4 PAYMENT SYSTEMS AND COMPETITION

Liu and Mills (2007a) compared different economic models of hospital behaviour to be able to analyse how hospitals react to different payment systems. Most of the models rest on agency relationship and present providers "as if they existed in isolation" (Hirth 1999, p. 220). Therefore, they concluded that it is difficult to draw conclusions on how competition affects providers' behaviour. Contrary to Liu and Mills, Eggleston and Zeckhauser (2002) concluded in their theoretical study that if the environment is competitive, public and non-profit providers resemble private for-profit providers although their objectives differ when they have a similar prospective fixed fee. Eggleston and Zeckhauser referred to Vining's 'primacy of competition versus ownership' argument (see Vining, Boardman 1992).

Kessler and McClellan (2000) summarised studies on the effects of competition in the USA that revealed the importance of the payment system for the impact of competition. Until the mid-1980s the "cost-plus" reimbursement system, when hospitals were competing on quality, competition among hospitals led to excess capacity, higher production costs and prices. After the implementation of prospective payment in 1983 competition had the opposite effect.

The type of the payment system also defines if there is space for differences according to the ownership of a hospital. Potter (2001) studied the relationship between hospital type and expenses per admission in a panel setting (years 1980,

1985, 1990 and 1994) in the USA. Her findings show that the differences in efficiency measured as expenses per adjusted admission between non-profit, for-profit and public hospitals diminished after the introduction of a prospective payment system in 1983. Yet, non-profit hospitals continued to provide a higher level of community services than for-profits. Neo-institutionalists have given a name, institutional isomorphism, to this phenomenon when regulatory change forces different type of organizations to pursue similar strategies regardless of their objectives (Horwitz, Nichols 2009, Potter 2001).

5 Hypotheses and Research Questions

The theoretical framework for all the studies of this dissertation is the incentive structure and the objectives of employers and providers of OHS (Chapter 3). In Studies 1 and 2 all employers are companies and will make the decisions on OHS with their profit maximization objective in mind taking into account the incentive structure created by the legislation. They must organize the OHS, use the expertise of the providers in planning the contents of the services, and pay the costs of OHS. The use of OHS is subsidized, and the employers can apply for reimbursement for the cost of the services.

The history of Finnish OHS and the legislation have created OHS markets that regionally vary widely, from public monopolies to highly competitive areas with numerous for-profit providers. In addition, employers have a role as providers of OHS services, some employers have an OHS of their own, or employers together govern the OHS provider (non-profit). This creates an opportunity to study how market structure and ownership are connected to the performance of the OHS provider (Studies 3 and 4).

Study 1

We assume that the OHS and the interventions OH professionals propose or initiate at workplaces are effective. Then the interventions lower sickness and the ensuing costs, and improve productivity. Eventually, this will lead to improvement in the economic performance of the company. We examine the hypothesis that when a company invests in preventive occupational health services there will be an impact on the profitability of the company. The empirical research question is: Does a company's expenditure on preventive OHS either in 1997 or 1999 predict its economic performance in 2001.

Study 2

The costs of occupational health services include only the payments to the OHS providers and will be paid immediately, whereas the benefits of good OHS will be realized in the future. Owners bear the costs of OHS, in the case of bankruptcy the bondholders become the owners of the company and will reap the benefits of OHS, or suffer the costs of neglect. Studies on firms' investments in safety equipment have shown that investments in occupational safety and health do not succeed in competing for funding from financial markets

(information asymmetry in safety issues); the expenditure on OHS must be financed from the cash flows of the company. Therefore, we assume that a company's expenditure on preventive care is positively associated with its economic performance. Companies doing worse cut their expenditure and companies with good economic performance share part of the profit with employees, i.e. a company incurs higher expenses for both preventive and medical services. We studied if the company's economic performance in 1999 predicts its OHS expenditure in 2001, separately for preventive and curative medical care.

Studies 3 and 4

The ownership of a health care provider has often been interpreted to represent different objectives. In Studies 3 and 4 we rather regard ownership to represent differences in the incentive structure, in the payment systems and financial constraints (soft/hard budget constraints and the risk of insolvency). Therefore, when we study differences in the performance of providers according to ownership in different market environments, we study how competition is connected to performance through payment systems and financial constraints. If the providers have similar payment systems, financial constraints and market environment there should not be differences in performance according the ownership.

For-profit providers have aligned provider and physician payment systems to (over)provide and be productive. All other provider types have salaried physicians, which would imply lower productivity. The public provider has fee-for-service payments like the for-profit provider but may rely on the taxpayers' purse and charge lower prices from employers and have lower productivity than for-profits (soft budget constraint). Non-profits have a blend of capitation and FFS, which balances the cost containment and quality improvement incentives and should also keep productivity high. Whether employers' own OHS payment is regarded as a capitation system or fixed global budget the consequences are the same: it will induce cost containment, and under-provision (if not high capitation) and productivity.

We expect the for-profit providers to provide more services, exhibit greater intensity, higher share of medical care and better productivity than public providers (although public providers also have an FFS payment system, the physicians are mainly salaried); Employers' own OHS and non-profits may be as productive, the unit price should be lower, but the quality depends on the level of capitation and budget. If the level is "high" the intensity may be as high as in for-profits, if it is "low" it may be lower.

The prices in OHS are market determined. Therefore competition is supposed to lead to lower prices. The effect on quality may be ambiguous. In our study, intensity represents quality assessed by clients (employees). For them access to care is an important quality characteristic, and the easier the access, the

more services are used. Preventive care is more stable, and intensity can be raised by increasing curative medical services. Therefore we expected competition to increase intensity and the share of curative medical services. Increasing intensity increases provider's revenues. Because competition increases productivity, it may lead to lower unit prices. On the other hand, increasing intensity may lead to higher unit prices. Hence we had no expectations regarding the possible effect of competition on unit price. Competition increases demand (both magnitude and elasticity) therefore it increases the revenue of providers.

We studied the effect of different market environments on the performance of OHS providers in a panel setting that covers the years 1992, 1995, 1997, 2000 and 2004. The performance of a provider was measured as intensity of services, productivity, share of medical care, unit price and revenues. The research questions in Studies 3 and 4 were the following: Are changes in the market environment of the OHS providers associated with change in providers' performance? Do provider types differ in their reactions according to ownership?

6 Data and Methods

6.1 REGISTERS AND SURVEYS

Companies and OHS

The data for studying the companies and their OHS is based on data from two registers. Statistics Finland collects the financial statements of all Finnish firms from the tax authorities. This register also contains data such as the number of persons employed by the firm, number of blue- and white-collar workers, year of establishment, registered office and industry.

The Social Insurance Institution of Finland (SII) registers employers' reimbursement applications for OHS. This register contains data on services and costs. We chose to use registers from the years 1997, 1999 and 2001. In 1999, the reformed reimbursement system had been in operation for four years. As this project was launched in 2004, the year 2001 was the last year for which all reimbursement applications had been processed. Four years should be a long time enough to reveal the benefits. In studies on occupational health and safety, a follow-up time of one to two years is common (Ozminkowski et al. 2002); in case studies reporting company level results the follow-up times have also been quite short (Verbeek, Pulliainen & Kankaanpää 2009).

At Statistics Finland the Social Insurance Institution register was merged with the Statistics Finland data using firm-specific identification codes (Figure 13). The data was at our disposal at the research laboratory of Statistics Finland so that we could neither identify the firms, nor their OHS providers.

	Financial statements		Employers' reimbursement applications
Year	N		N
1997	205,802	merging	25,739
1999	220,746	by firm	29,993
2001	226,255	ID	34,960

Companies operational 1997-2001   64,597

Other exclusion criteria   6,271

Figure 13: Composition of data for the study on company's economic performance and OHS (Studies 1 and 2)

In 2001, 40% of a total of 226,000 firms were actually self-employed private persons and 15% had limited or unlimited liabilities. These and all other legal forms except companies were excluded. Companies are defined as clearly for-profit organizations, and the legislation on bookkeeping and financial statements guarantees a high quality of economic performance data. To assess whether the preceding investment in preventive OHS had affected company's economic performance, the companies had to have been continually in business 1997–2001 (financial statements were available for this period). The same rule of staying in business is needed when the opposite question is studied: does the company's previous economic performance affect if it is able and willing to organize OHS or how high its expenses in preventive and curative medical services will be.

Because of the special features of the Finnish reimbursement system, we measured the company's investments in OHS per employee both in monetary and temporal terms. The time variable was calculated from the SII register data. Workplace and group activities had originally been registered in hours. We converted the number of health checkups into minutes based on information from earlier studies or an expert assessment of the contents of OH personnel's work in different provider models. All activities were summed up into the variable occupational health (OH) personnel's time per employee. In the companies' own OHS units, the costs of preventive and curative medical services in reimbursement applications were often divided according to the

shares of maximum reimbursement (40% for preventive and 60% for curative medical services) and not according to the resources used. This was revealed when we checked the correlations between the time resource (minutes per employee) and costs (Euros per employee). These two variables correlated strongly in all other provider models (0.6-0.8), but not in the companies' own units. The investment in OHS measured in Euros did not represent the resources for OHS in municipal health centres, either. The price level in municipal OHS units was about 40% lower than in other provider models (Euros per OH personnel minute). Thus time resource is a better measure for investment in preventive OHS for both the companies' own units and municipal OHS units. Therefore we did not use the costs per employee in the analysis. To be able to compare investment in preventive OHS between companies, we used two different variables: resources measured as OH personnel minutes per employee and the share of total costs of preventive services per turnover.

In Study 2 we assessed the influence of a company's lagged economic performance on the amount of spending, separately for prevention and curative medical services. Then Euros per employee were used as independent variables and not the time resource. The expenditure measured in Euros represents exactly what the employer had to pay for the services before reimbursement.

OHS providers

In the data for studying whether competitiveness of the market among providers affected the performance of OHS providers we combined survey and register data. The Finnish Institute of Occupational Health (FIOH) sent a questionnaire to all OHS providers and collected data on employers and their employees, services and occupational health (OH) professionals from the providers for the years 1992, 1995, 1997, 2000 and 2004. The questionnaire was sent in the spring of the following year. The response rate was high (over 90% per survey) but not all providers supplied information on all items in the questionnaire.

Due to the reimbursement system, records on services provided by the OHS units are well standardized. The FIOH questionnaire collected the number of hours of workplace activities (workplace surveillance, meetings, lectures, groups and counselling) and the number of health checkups and medical visits separately for physicians, nurses, physiotherapists and psychologists over a whole year.

An employer-based register of the provider, content and costs of OHS is available as a result of the reimbursement system. This employer-based data was combined per provider code at the SII, and merged with FIOH's data using the provider's name and address. Thus the state employers' reimbursement applications were also placed on the provider reported in the reimbursement application. Yet, the problem remains of employers who applied for reimbursement of the costs of OHS and had used multiple providers (this

implies having multiple workplaces around Finland). The application only allows space for one provider. The advice is to report the provider whose services constitute the greatest share of the costs. Because we used only the cost information from the SII register, the outlier check of unit price would have revealed the most serious problems (see also Chapter 6.2.2)

We had at our disposal unidentified data. The first FIOH survey in 1992 was based on the provider register of the SII. Later FIOH updated the provider register itself and the fit of the survey and the SII provider register declined. In 1992 almost all providers in the FIOH survey could be linked to the SII register, Later the percentage fell: in 1997 it was 90%, descending to 75% in 2000 and 67% in 2004. Almost 90% of all providers in the FIOH survey could be matched with the SII register.

The merged data contains about 230 public providers, 350 employers' own and 40 non-profits, and 180 for-profit medical centres, altogether 4,094 observations during the period 1992 to 2004. Because of entry and exit of providers, the data forms an unbalanced panel data set. A subset of this data was used to study how the performance of public providers was connected to the competitiveness of the market (Study 3). (Figure 14)

	Social Insurance Institution		
	Employers reimbursement		FIOH
	applications		questionnaire
Year	N		N
1992	22,848		964
1995	20,801		855
1997	25,739	merging by	1,041
2000	32,262	provider's	1,016
2004	40,646	name and address	719

4,094 observations, unbalanced panel

only public providers, 1,164
observations, unbalanced panel
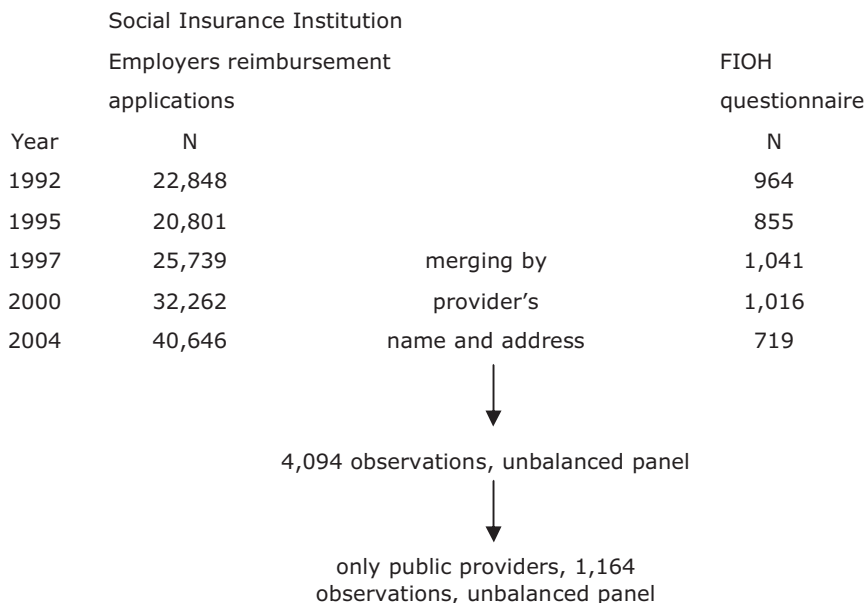
Figure 14: Composition of data for the studies on OHS providers' performance and competitiveness of the market (Studies 3 and 4)

6.2 PERFORMANCE INDICATORS

6.2.1 Economic Performance of a Company

Key ratios are widely used in assessing the performance of a company, e.g. by banks and investors. Definitions for key ratios can be found in Table 3 grouped into profitability, solidity and liquidity, as usual. Key ratios for profitability are calculated from the profit and loss account by deducting costs from turnover and dividing this margin by turnover. The difference between the ratios results from the variation in costs deducted. The three first key ratios for solidity relate the annual profit to different capital titles. The two other key ratios for solidity, relative indebtedness and equity ratio, give an idea of the accumulated wealth of the company. Key ratios for liquidity indicate how large a share of its debts the company could pay with its liquid assets. Statistics Finland calculated the key ratios for all companies in the study.

Table 3: Definitions of key ratios of economic performance

Profitability

Operating margin %	Company's earnings that is left over after paying for variable costs of production (wages, raw material, etc) divided by net sales.
Operating profit %	Earnings before interest and taxes (EBIT) divided by net sales.
Net result %	(Total revenues – total expenses) divided by net sales, tells if a company has earned or lost money in an accounting period with its business.
Total result %	Net result + extraordinary incomes – extraordinary expenses divided by net sales
Profit/loss for the accounting period %	
	The profit / loss result after the company has paid the taxes divided by net sales.

Solidity

Return on Capital Assets %	
	Tells how profitable the company is relative to its total assets. = Net income / total assets
Return on investment %	Evaluates the efficiency of an investment = (gain from investment – cost of investment) / cost of investment.
Return on equity %	Tells how much profit is generated relative to the owners' investment in the company = Net income / shareholders equity
Relative indebtedness %	Company's liabilities divided by its turnover. Less than 40%: Good 40–80%: Satisfactory More than 80%: Poor
Equity ratio %	The percentage of equities from the balance sheet Over 40%: Good 20-40%: Satisfactory Less than 20%: Poor

Liquidity

Quick ratio	Company's ability to meet its short term liabilities (debt and payables) with its most liquid assets (excludes inventory). (Current assets – Inventories)/Current liabilities Over 1: Good 0.5−1: Satisfactory Less than 0.5: Poor
Current ratio	Company's ability to meet short term liabilities. Current assets/Current liabilities Over 2: Good 1−2: Satisfactory Less than 1: poor

In Study 1 we studied if the extent of preventive OHS influences a company's economic performance, which is dependent on many other things than investment in preventive OHS alone. We included various other explanatory variables in the model. We assumed that "the past predicts the future": that firms that did well in the past would continue to do better. We included the equity ratio in 1999 in the model to represent a company's past economic performance; higher equity ratio indicated greater opportunity to make investments. The other variables taken into account were company size, age, industry and location. Industry was included in the model because key ratios differ according to industry. Geographical regions were included to represent booming or declining regional economies (6 provinces in Finland, reference region Uusimaa, the province around the capital city Helsinki). The type of municipality is an indicator of the size of the local market, for both the company's products and for OHS. Municipalities were classified into three groups: city, semi-urban and rural. There was hardly any correlation of variables in the models except the self-evident positive correlation between number of employees and turnover. In addition, investment in OHS measured as OH personnel minutes per employee correlated positively with company size measured either by turnover or number of employees. Correlations for the variables in Study 1 can be found in Appendix 1.

Companies' own units are generally believed to be able to integrate their activities more efficiently into the company than other providers. We assumed that the provider model could affect company performance. However, in this study, the OHS provider model had no effect on the key ratios and was thus excluded from the models.

In Study 2 we studied if the economic performance of a company affected expenditure on preventive and curative medical services. From the reimbursement statistics published by the SII it is known that expenditure varies by employer size and provider type. In addition, the industry could indicate the health risks at work and would affect expenditure, at least on preventive services. The proportion of blue-collar workers could also be related to expenditure on OHS due to socio-economic differences in health. The markets for OHS differ greatly and the options available to companies to buy or organize services are dependent on their location (city, semi-urban or rural). Therefore all these variables were included in the models for studying companies' expenditure on OHS. There were no correlations among the variables. Naturally there were correlations between the key indicators, but these were always included in the models one at a time. Correlations for the variables in Study 2 can be found in Appendix 2.

6.2.2 Performance of an OHS Provider

The performance of a provider was measured as intensity of services, productivity, share of medical care, unit price and revenues. OHS providers are

multi-professional multi-product providers and therefore we calculated a cost-weighted activity (CWA) output (Oliver 2005). The first four indicators are computational indicators based on this CWA output. Performance indicators are presented in Table 4.

We calculated all services in minutes and summarized them by occupational health (OH) professional group (physicians, nurses, physiotherapists, psychologists). In order to make the output of different professional groups comparable, the minutes of each OH professional group were weighted by group wage, in relation to physicians' wages in 2004. The wages are national averages provided by the Commission for Local Authority Employers. We checked the salary ratios in the private sector and they were similar to the public ones. CWA output is the sum of the wage-adjusted output of all OH professional groups. In occupational health the division of resources into preventive and medical services is important. For example, the reimbursement system aims at steering more resources into preventive work. The service mix could also reveal the differences in the objectives of provider types. Therefore we wanted to study the service mix and calculated the share of curative medical services of CWA output.

The indicator for productivity was calculated from CWA output. The weekly working hours of OH professionals were weighted by wage of each group in relation to physicians' wages in 2004. Then these weighted hours were summed into one figure that measured personnel resources. The productivity measure is the ratio of CWA output to personnel resources.

We used intensity of OHS as an indicator of quality. Intensity was measured as CWA output per client (employee). Intensity represents process quality perceived by the client (employee). Quality is assumed to be higher if there are more services per employee, or if a more highly qualified professional provides the service, e.g. a physician instead of a nurse.

At the Social Insurance Institution, employers' reimbursement applications were summed up per provider. The sum of the employers' expenditure equals the total of the provider's revenue. Nominal values were converted to 2004 real values applying the health care cost index. Unit price was calculated by dividing the revenue of a provider by its CWA output. Due to the obligation for public providers and the small size of Finnish municipalities running a health centre the correlation between market concentration and revenues was negative (-0.35), likewise the correlation with the share of medical care (-0.35) and intensity (-0.32). The highly concentrated markets represented public monopolies. The scope of the provider correlated with the number of OH professionals (0.64) which correlated with the revenue of the provider (0.38). There were correlations between the number of providers and share of medical care (0.37), unit price (0.36) and intensity (0.32), and the for-profit market share and unit price (0.32). Correlations for the variables in Studies 3 and 4 can be found in Appendix 3.

Table 4: Indicators of OHS performance

Indicator	Formula	Keys
CWA output	$Output_{pt} = \sum_i w_i \sum_j q_{ijpt} min_{ij}$	j = workplace visits, meetings, lectures, health checkups, medical visits i = physician, nurse, physiotherapist, psychologist min_{ij} = time that a professional group i uses to produce service j q_{ijpt} = number of services j, provided by professional group i, in provider p, in year t w_i = weight for each professional group i, average salary of a professional group i in relation to physicians' salary in the municipal sector in 2004 p = provider id t = 1992, 1995, 1997, 2000, 2004
Intensity	$Intensity_{pt} = Output_{pt}/number\ of\ employees_{pt}$ (clients)	p, t as above
Productivity	$Prod_{pt} = Output_{pt}/\sum_i w_i hours_{ipt}$	$hours_{ipt}$ = weekly working hours of a professional group i, in year t, i, t, p and w_i as above
Share of medical care	$Med_{pt} = \sum_i w_i qmed_{ipt} medmin_i / Output_{pt}$	$qmed_i$ = number of curative medical visits provided by professional group i $medmin_i$ = time that professional group i uses to produce one curative medical visit i, t, p and w_i as above
Revenue	$Revenue_{pt} = \sum_e TC_{pet}$	TC_{pet} = total expenditure on OHS for employer e, provided by provider p, in year t p, t as above Revenue in 2004 real value
Unit price	$Price_{pt} = Revenue_{pt}/Output_{pt}$	p, t as above

Most of our indicators are ratios and often based on summing data. The survey had different time frames for different data, for example the number of services concerned a whole year and the number and working hours of personnel one month the following spring. If there were changes in the number of personnel during the first months of the year of the survey the output-personnel ratios were flawed. In addition, if one professional group had missing data on some of its services it could create problems in calculating the output. Therefore we examined the studentized residuals exceeding +2 or -2 for identifying outliers, and recoded the indicator values missing for the providers whose outlier values were due to the mismatch of timing or missing data. The share of missing data

was highest in the calculation of unit price (26%) and the lowest in provider's revenue (15%).

6.3 MARKET ENVIRONMENT OF AN OHS PROVIDER

The geographical market areas where the providers are expected to compete with each other is a classification provided by Statistics Finland and based on commuting and close collaboration of municipalities in regional development. The regions also have the advantage of reflecting topographical features and travel time (Horwitz, Nichols 2009). Every provider was located to a municipality based on its post-code. There were 428 municipalities in 2004, which formed 76 geographical regions[8]. We excluded the Åland Islands with 16 municipalities and only one provider.

Competition was measured by 1) the number of providers in the region and either 2) market concentration (Herfindahl index - the sum of squares of the market shares, 0=minimum concentration, 1=maximum concentration (Cabral 2002)) or 3) market share of for-profit providers calculated from the number of clients (employees) representing the market mix (Table 5).

Table 5: Indicators of market structure and mix

Indicator	Formula	Keys
Number of providers within a region	$Providers_{rt} = Count(p_{rt})$	p = provider id r = geographically defined local market t = 1992, 1995, 1997, 2000, 2004 p_{rt} = provider id in region r, year t
Herfindahl index	$HI_{rt} = \sum_{p} s_{prt}^2$	s_{prt} = provider p's market share from the number of employees (clients) in region r, year t, range for HI_{rt} 0-1 r, t as above
For-profit providers' market share within a region	$FPshare_{rt} = \sum_{FPp} clients_{FPprt} / \sum_{p} clients_{prt}$	$clients_{prt}$ = provider p's number of clients (employees) $clients_{FPprt}$ = For-profit provider p's number of clients (employees) in region r, year t r, t as above

In Study 3 we applied the number of providers and Herfindahl index (HI) and in Study 4 the number of providers and the market share of for-profit providers. The correlations between the variables representing the provider structure and also the number of purchasers in the region were high (Table 6).

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[8] The number of regions has diminished since 2004 and was 68 (without Åland) in 2010.

Table 6: Correlations of variables representing market structure and mix

	Number of providers	Number of providers (log)	HI	Market share of for-profit providers	Number of employers
Number of providers	1.00				
Number of providers (log)	0.92	1.00			
Herfindahl index (HI)	-0.63	-0.81	1.00		
Market share of for-profit providers	0.54	0.62	-0.59	1.00	
Number of employers	0.96	0.95	-0.67	0.66	1.00

Wong et al. (2005) compared empirically the results with different definitions for the market and the intensity of competition. They used geopolitical boundaries (administratively defined geographical areas), fixed radius methods, variable radius, and market areas based on patient flows. The intensity of competition in the market area was measured either by the number of providers or Herfindahl index. They conclude that the effects of competition remain qualitatively the same irrespective of the measure for competition. In their study the magnitude of the impact of competition based on number of providers and HI was also similar on county level, the definition of market closest to our geographical market definition.

6.4 STATISTICAL METHODS

The following table summarizes the study design and statistical methods used. We were able to use longitudinal study design in all research tasks for this dissertation. Studies 1 and 2 are prospective studies and Studies 3 and 4 panel studies (Table 7).

This chapter presents a description of the way we applied the statistical methods and what tests we used to assess the suitability and robustness of the models. In addition, we did some analysis to compare the magnitude of the effect of competition and ownership on the performance of OHS providers (Study 4).

Regression analysis is about statistical dependence, not functional or deterministic dependence. A statistical relation cannot per se logically imply causation. Causality should come from the theory (Gujarati 1995, p. 19-20). The theories we applied in constructing the models have been described earlier in this dissertation: theories that explain how a company's investment in preventive care would be profitable for a company (Chapter 3.2.1 in this

dissertation), theories that assess how financial structure of the firm impact its investments in safety (Chapter 3.2.2 in this dissertation, especially the study by Filer and Golbe (2003)). In the studies on OHS providers performance we applied economic theory on the market structure and performance and how it has been used in health economics to explain how ownership and payment systems are connected/interact with market structure and mix (Chapter 4 in this dissertation).

We did not know which way the causality would run in Studies 1 and 2. The economic performance of a company and its spending on OHS could be determined simultaneously. Actually, the way we modeled the problem, using lagged variables mitigates the possible simultaneity problem. The models in Study 1 can produce a reliable forecast of the impact of a company's investment in preventive OHS on the economic performance of a company two or four years later. And the same applies to the opposite question in Study 2.

In Studies 3 and 4 we had to assess if the market environment was truly endogenous. In Study 3 we had only the public providers. Public providers entered the market in the 1970s when public provision was made compulsory for municipal health centres. Municipalities do not buy or sell OHS units. Therefore, in Study 3 we could regard the market as an exogenous variable. In Study 4 we examined the potential endogeneity of the market structure and compared fixed effects panel model and instrumental variables (IV) panel model. We used number of employees, number of employers (both from our data) and median household income (provided by the Statistics Finland) to predict the number of providers and the share of for-profit providers in a region. Unfortunately, we did not have access to household income data for 1992. Therefore, we only used the years 1995, 1997, 2000 and 2004 in this analysis. We applied STATA's xtivreg2 (available from Statistical Software Components (SSC) archive) and Hausman test to examine if the fixed effect panel model is preferred to IV (see e.g. (Dougherty 2007) and (Baltagi 2008)).

Table 7: Study design and statistical models applied to research questions

Research question	Study	Stydy design	Model	Dependent variable	Independent variable
Does company's expenditure on preventive OHS either in 1997 or 1999 predict its economic performance?	1	Prospective	Ordinary least squares (OLS) regression	Key indicators for profitability in 2001	OH personnel minutes per employee or Share of expenditure on preventive OHS per company turnover
Does company's economic performance have an impact on its probability to apply for reimbursement for OHS expenditure ("organize OHS")?	2	Prospective	Logistic OLS	Dichotomous yes/no applying for reimbursement	All key indicators for company in 1999
Is company's expenditure on preventive and curative medical services in 2001 dependent on its economic performance in 1999?	2	Prospective	OLS	Euros per employee separately for preventive services and curative medical care in 2001	All key indicators for company in 1999
Are the changes in the market structure and mix connected to changes in the performance of OHS providers?	3 and 4	Panel study	OLS, pooled OLS, fixed effects, random effects	Performance indicators on intensity, productivity, share of medical care, unit price and revenue	Number of providers Market concentration (HI) Market mix – market share of for-profit providers
Do provider types react differently to market structure and market mix?	4	Panel study	OLS, pooled OLS, fixed effects, random effects	Performance indicators as above	Provider type interactions with variables representing market structure and mix

We checked whether the coefficients in OLS models can be regarded as unbiased and consistent. The models were tested using the regression specification error test (RESET test). This can be used for testing the functional form of a model, especially to detect nonlinearities and omitted variables (Kennedy 1998). Nonlinearities make OLS estimator biased (Stock, Watson 2007, p. 319). If the RESET test and data plots revealed that the relationship between dependent and independent variable was logarithmic rather than linear, these variables were log transformed. Earlier studies have shown that the relation between competition and e.g. productivity may not be linear (Studies 3 and 4). Therefore we also ran models with a squared number of providers, but their performance was poorer.

In addition to checking for the consistency of the OLS estimator there is a need to check the conditions that ensure consistent standard errors (Stock, Watson 2007, p. 325-6). Heteroscedasticity of the models was tested with the Breusch-Pagan/Cook-Weisberg test. In a pooled data model the standard errors obtained are better, more efficient, than in models for separate years, but only if the separate years have the same variance. If the variances are different, then the standard errors obtained from the pooled regressions are wrong. In Study 3 for pooled OLS models we applied robust standard errors and in Study 4 panel corrected standard errors for those pooled OLS models with heteroscedasticity. The panel models also had heteroscedasticity problems. In the panel models concerning only public providers (Study 3) we applied robust standard errors; in Study 4 we applied cluster robust correction for standard errors.

Another problem could be the correlation of the error term across observations, especially when the sampling process is not random. It is common to have correlation of error terms when 1) the observations are repeated measures of the same entity over time, 2) sampling is based on a geographical unit. Correlation of the error term violates one of the OLS assumptions: that Xis are independently and identically distributed (i.i.d.) draws from their joint distribution. The data used in Studies 1 and 2 of this dissertation had only three time points and the data in Studies 3 and 4 had only five time points. Therefore we did not correct for autocorrelation. In addition, in Study 4 we used cluster robust option for correcting heteroscedasticity. Then the standard errors are robust to both heteroscedasticity and intra-group correlation.

We examined the variance inflation factors (VIF) for signs of multicollinearity. When the models have multicollinearity problems there is a linear relationship between the explanatory variables (Gujarati 1995, pp. 59-68). In Study 4, the models that included provider type interactions with the variables representing market competition and time, there was naturally multicollinearity. We did not add interaction terms to increase the R square but to study if the provider types reacted differently to the competitiveness of the market. Therefore we did not use "rules of thumb" for variance inflation factors

either (O'Brien 2007). Otherwise there were no problems with multicollinearity in the models.

In Studies 3 and 4 we applied various methods in our analysis: ordinary least square regression analysis for pooled data, and both fixed and random panel models. We compared the models in the following way. To compare the pooled OLS and the fixed models we applied the F test, which is based on loss of goodness-of-fit (Stata .xtreg command by default conducts the F test). In all cases the fixed model was better than the pooled OLS. To compare the pooled OLS models and random effects models we applied the Breusch-Pagan Lagrange multiplier test, which follows chi-squared distribution with one degree of freedom. Again, for all models the random model was better than the pooled OLS. Then we compared fixed and random panel models. Statistically, using fixed effects models is always a reasonable thing to do with panel data (they always give consistent results) but they may not be the most efficient models to run. This may be especially true in our data covering almost all OHS providers in Finland. The Hausman test showed that for almost all indicators the fixed effects model turned out to be better than the random effects model. (Park 2009.) Fixed effects models are viewed as appropriate tools for eliminating bias arising from time-invariant unobserved factors (Shen et al. 2007, Greene 2003).

In Study 4 we also studied if different provider types reacted differently to market competition and if they differed in their trajectories. Therefore we included interactions of the variables "type of provider" and number of providers, market share of non-profits and time (continuous) in all models. We computed the F-statistic to test a) if the coefficients for the variables representing competition (number of providers, market share of for-profit providers) or time and the interaction terms jointly differed from zero and b) if the interaction terms of the public, employers' own and non-profit providers differed from those of for-profit providers (Stock, Watson 2007).

We used two different software packages in the analysis. The SAS software package was used for excluding and recoding the data in Studies 1 and 2; all analyses were conducted with STATA software packages.

For this dissertation the magnitude of the association between the company's investment in preventive care in 1997 and the operating profit in 2001 was illustrated with an example - what would be the impact on operating profit in 2001 if the company had doubled the share of preventive care costs per turnover (other things being equal). In Study 4 we compared changes in our performance indicators associated with a huge change in competition in the panel model and ownership type. Change in market structure was assessed as a change from the 25% percentile to the 75% percentile in 2004 both in the number of providers (logarithm) or the market share of for-profit providers. The dummies in the pooled OLS models represent the differences between ownership types.

In Study 4 we checked the robustness of our results to the weights used in constructing the cost-weighted output, the base for most of our performance indicators. We also estimated the models with proportional wages for private providers obtained from trade union statistics and the municipal wages for public providers. In our models the structure of the market was measured as the number of all providers in the region. We constructed two other measures for market structure: 1) a variable based on the number of providers without employers' own units and 2) a dummy variable based on the number of providers: a market with less than six providers, a market with six to 19 providers, and a market with 20 or more providers. The reason for excluding employers' own units from the number of providers in the region was that they may not compete for employers in the same way as the other provider types. On average, three fourths of the clients (employees) in employer owned units were employed by the organization that also owned the OHS provider. A cut-off point of 6 was also used by Santerre and Vernon (2006). They justify this cut-off of 6 by the fact that equally sized hospitals would lead to a HI of 1,800 which would be regarded as highly concentrated by the Federal Trade Commission and Department for Justice. Cabral (2002) also calculated that seven providers in a Cournot model would be enough to achieve the price level of a competitive market. The correlation between the number of providers in the region and the number of providers without the employers' own units was 0.92 and the correlation with the dummy was 0.86.

7 Results

7.1 COMPANY'S INVESTMENT IN PREVENTION DOES NOT IMPROVE ITS ECONOMIC PERFORMANCE AFTER TWO OR FOUR YEARS

In the first study we started from the assumption that if a company invests more in preventive occupational health services this would mean more interventions and, consequently, more favourable outcomes in the future. Finally, there would be an impact on the profitability of the company. The objective was to determine whether preventive occupational health services influence on a company's economic performance.

The company's investment in prevention per employee was not high. On average, the 6,721 companies invested in preventive OHS 39.50 Euros per employee in 1997 and 46.00 Euros in 1999. This sum bought the companies some 22 minutes of OH personnel time per employee for each of the two years. The costs per employee varied according to the provider (Table 8). Among the companies which had applied for reimbursement, the costs were the highest in the companies' own OHS units and lowest in municipal health centres.

Table 8: Companies' costs of occupational health services in 2001 by provider type in Euros per employee per year, mean (standard deviation)

Provider	Preventive services	Curative medical services
Employer's own OHS unit (N=454)	91.60 (44.90)	138.10 (67.15)
Employers' joint OHS unit (N=470)	72.95 (37.80)	107.30 (60.70)
Municipal health centre (N=1603)	43.35 (35.25)	27.10 (43.20)
Private medical centre (N=2422)	62.90 (41.55)	120.40 (78.25)
Other (N=35)	69.60 (46.10)	125.50 (74.90)

The average annual turnover of the companies in the study was around 24 million Euros, and the average age of a company was 18 years. The average share of total costs for preventive OHS per turnover was 0.0334%.

Prevention as investment

The five key indicators of the profitability of the company in 2001 were the dependent variables, each in turn. The independent variables in the model were investment in preventive OHS either in minutes per employee (log) or as the total cost of prevention per turnover, all in 1997 or in 1999. Therefore we conducted twenty regression analyses to study the connection between investment in preventive OHS and company profitability two or four years after the investment in preventive care.

Table 9 presents the results for operating profit. The preceding investment in preventive OHS measured as OH personnel time per employee in 1997 had a negative coefficient which was statistically non-significant. When the share of total preventive OHS costs per turnover represented investment, the coefficient was negative and statistically significant. The results of the models for other key indicators were very similar. All coefficients for time per employee variables were non-significant, and negative in 9 out of 10 models. For the costs per turnover variable, the coefficient was negative in all ten models, and statistically significant in nine out of ten models.

Table 9: Regression models for operating profit in 2001, investment in preventive OHS measured by two variables (N=6,271)

	Dependent: operating profit in 2001			
	Coefficient	**P>|t|**	**Coefficient**	**P>|t|**
Constant	7.44	***	8.04	***
Preventive OHS in 1997				
Minutes per employee (log)	-0.05			
Total costs/turnover			-349.55	*
Equity ratio in 1999	0.06	***	0.06	***
Equity ratio in 1999*2	0.00	***	0.00	***
Log number of employees in 2001	-0.08		-0.02	
Log turnover in 1999	-0.35	**	-0.40	**
Age of company	-0.02	*	-0.02	*
Industry, ref. wholesale and retail trade				
Agriculture, hunting and forestry, fishing	3.88	***	3.89	***
Mining and quarrying, manufacturing	2.22	***	2.25	***
Electricity, gas, and water supply	0.79		0.78	
Construction	2.08	***	2.11	***
Hotels and restaurants	1.48	**	1.51	**
Transport, storage, and communication	1.11	**	1.11	**
Real estate, renting, and business activities	2.45	***	2.49	***
Education	-3.74	*	-3.71	*
Health and social work	2.91	***	2.98	***
Other community, social and personal service activities	-0.44		-0.41	
Region, ref. Uusimaa (province around Helsinki)				
South	0.12		0.11	
East	0.18		0.18	
Central	-0.11		-0.12	
North	0.59		0.58	
Åland	0.88		0.88	
Municipality, ref. city				
Semi-urban	0.20		0.18	
Rural	0.20		0.18	
Adjusted R^2	0.12		0.12	
Reset F(3, 6244)	5.10	p=0.0016	5.25	p=0.0013

* $p<0.05$, ** $p<0.01$, *** $p<0.001$

The average operating profit of the companies was 6.5% (median 5.67%). The magnitude of the association between the company's investment in preventive

care 1997 and the operating profit in 2001 can be described by calculating the impact on operating profit in 2001 if the company had doubled the share of preventive care costs per turnover (other things being equal). On average, the companies used 0.0334% of their turnover for preventive occupational health services (ratio 0.000334). According to the model, doubling this ratio would lower the operating profit by 0.1 percentage units ((0.000668-0.000334)*(-349.55) = 0.11675).

7.2 COMPANYS'S EXPENSES IN PREVENTIVE AND MEDICAL OHS DO NOT FLUCTUATE ACCORDING TO THE PROFITABILITY OF THE COMPANY

According to the registers, almost one in five companies had not applied for reimbursement. Therefore we first used logistic regression analysis to examine if this was due to the company's economic situation. The analysis revealed that the probability of applying for reimbursement (having OHS expenses) in 2001 was not related to company's economic performance two years before in 1999. (Table 10). The results were similar to those presented in table 10 for other key indicators in 1999.

Table 10: Logistic regression on a company's economic performance in 1999 for a company's probability to apply for reimbursement in 2001 adjusted for age of the company, turnover in 2001, industry, region and urbanisation (N = 6,155)[1]

	Variables in the model	Coefficient	P>|z|
	Constant	-12.67	***
Economic performance	Operating margin in 1999	-0.00	
Other variables	Log turnover in 2001	0.85	***
	Age of company	0.03	***
	Blue-collar workers % in 2001	-0.35	
Industry	Reference: Wholesale and retail trade		
	Agriculture, hunting and forestry, fishing	0.29	
	Mining and quarrying, manufacturing	0.84	***
	Electricity, gas and water supply	1.24	*
	Construction	0.39	**
	Hotels and restaurants	0.50	**
	Transport, storage and communication	0.36	*
	Real estate, renting and business	1.06	***
	Education	0.38	
	Health and social work	1.14	**
	Community, social and personal service activities	0.99	**
Region	Reference: Uusimaa (province around Helsinki)		
	South	0.29	**
	East	0.28	*
	Central	0.11	
	North	0.07	
	Åland	-1.03	*
Municipality	Reference: Rural		
	Urban	0.81	***
	Semi-urban	0.29	*
	Pseudo R^2	0.15	

[1] The results here are presented in the same form as in the preceding table, with regression coefficients and asterisks for statistical significance, not with odds ratios (OR) and 95% confidence intervals as in the published article.
* $p<0.05$, ** $p<0.01$, ***$p<0.001$

We applied ordinary linear regression analysis to assess the influence of a company's economic performance on the amount of spending, separately for preventive care and curative medical services. Economic performance was measured by all key ratios: the annual profitability of a firm, the accumulated wealth representing the performance of a company throughout its history and liquidity. We varied the models and all key indicators were included in the model as independent variables, each in turn. None of the key ratios for profitability, solidity and liquidity in 1999 was related to the costs for curative medical services neither to costs for preventive OHS per employee in 2001 (Table 11). Here only the results for the operating profit in 1999 are presented.

There were differences between industries, regions and OHS providers. In this study companies with a higher percentage of white-collar workers spent more on curative medical services than in blue-collar dominated companies.

Table 11: Regression models of a company's economic performance for costs of curative medical services and preventive care (log Euros per employee) in 2001 adjusted for age of the company, turnover in 2001, share of blue-collar workers, OHS provider, industry, region and urbanisation (N = 4,958) [1]*.*

Variables in the model	Curative medical services, Euros per employee (log)		Preventive care, Euros per employee (log)	
	Coeffi-cient	P>|t|	Coeffi-cient	P>|t|
Constant	0.66		2.57	***
Operating profit in 1999	-0.001		-0.001	
Age of company	0.00		0.00	
Log turnover in 2001	0.20	***	0.10	***
Blue-collar workers % in 2001	-0.31	**	0.05	
Provider model Ref. company's own OHS Joint OHS unit	0.02		-0.06	
Municipal OHS	-2.32	***	-0.75	***
Private medical centre	0.02		-0.23	***
Other provider	0.18		-0.23	
Industry Reference: Wholesale and retail trade Agriculture, hunting and forestry, fishing	-0.87	**	0.16	
Mining and quarrying, manufacturing	0.09		0.38	***
Electricity, gas and water supply	0.32		0.38	***
Construction	-0.33	***	0.32	***
Hotels and restaurants	0.07		0.02	

Transport, storage and communication	-0.18		0.02	
Real estate, renting and business activities	0.36	***	0.24	***
Education	0.44		0.29	
Health and social work	0.20		0.25	*
Other community, social and personal service activities	0.49	**	0.25	**
Region Reference: Uusimaa (region around Helsinki)				
South	0.18	**	-0.11	***
East	-0.14		-0.11	**
Central	-0.09		-0.18	***
North	-0.05		0.20	***
Åland	-0.27		0.22	
Municipality Reference: Rural				
Urban	0.82	***	-0.09	*
Semi-urban	0.51	***	-0.10	*
Adjusted R^2	0.46		0.19	
Reset F(3, 4955)	27.28	0.0000	0.47	0.7062

[1] The results here are presented in the same form as in the preceding table, the statistical significance is presented with asterisks not with 95% confidence intervals as in the published article.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

7.3 COMPETITIVENESS OF REGIONAL OHS MARKETS VARIES A LOT

During the study period 1992-2004 the total number of providers diminished. At the same time the market share of for-profit providers increased.

The number of all OHS providers decreased during the study period from 1,006 to 621, mostly because the number of employers' own units decreased by almost 60%. This was due to the closing down of the companies during the Finnish economic recession of the early 1990s and later due to outsourcing. The number of for-profit providers increased until 2000, but since then mergers have decreased this number. The number of public providers and non-profit providers increased slightly during the study period. (Table 12.) The market shares in Finland changed during the study period. For-profit providers' market share more than doubled to 37% in 2004. The market share of employers' own units halved to 18% in 2004. The market share of public providers fell by five percentage units to 39% in 2004 and non-profits had a very stable market share of about 6%.

Table 12: Number of providers by provider type 1992-2004

	For-profit	Public	Employers' own	Non-profit
1992	224	226	552	42
1995	164	234	410	41
1997	179	237	325	42
2000	190	237	291	39
2004	155	230	192	49

Due to these changes the average number of providers diminished in the regions used to define the geographical market (Table 13). This development did not lead to more concentrated markets on average. On average, the market share of for-profit providers doubled in the regions.

Most regions can be considered competitive, but the local markets for OHS varied widely. The for-profit providers and employers' own units are located in more competitive regions. For them, the average number of providers in the region was almost 50 and the for-profit market share 35% in 2004. The non-profits and public providers faced less competition. On average, the non-profit providers had 30 competitors and the market share of for-profit providers was 29% in 2004; public providers had 14 competitors and the market share of for-profit providers was 19% on average in 2004.

Table 13: Competitiveness of the market measured by number of providers, market share of for-profit providers (%), concentration of market (Herfindahl index) and number of employers in a region (N=76), mean and (standard deviation)

	Number of providers	For-profit market share	Herfindahl index	Number of employers
1992	13.8	7.2	0.36	897
	(29.7)	(8.9)	(0.24)	(1632)
1995	11.2	8.2	0.35	977
	(21.9)	(9.6)	(0.26)	(1634)
1997	10.3	12.4	0.34	947
	(18.9)	(13.1)	(0.24)	(1461)
2000	9.9	14.0	0.34	1062
	(18.9)	(14.3)	(0.24)	(1746)
2004	8.6	15.1	0.35	855
	(14.7)	(15.5)	(0.23)	(1445)

7.4 PERFORMANCE OF OHS PROVIDERS IN 1992–2004

Four of the indicators measuring the performance of a provider are ratios and comparable between provider types. Figure 15-Figure 18 present the averages of these indicators by provider type during the study period. Public providers were catching up with the other provider types in intensity and share of medical care (Figure 15 and Figure 17). However, they provided fewer services per employee (lower intensity) and used a greater share of the resources for preventive care. The variation in productivity between provider types disappeared almost completely (Figure 16). The unit price in employers' own units and non-profits was higher than in for-profits and in public units. Their price also rose throughout the study period, but in for-profits the unit price was quite stable. The unit price of public providers reached the level of for-profits in 2004 (Figure 18).
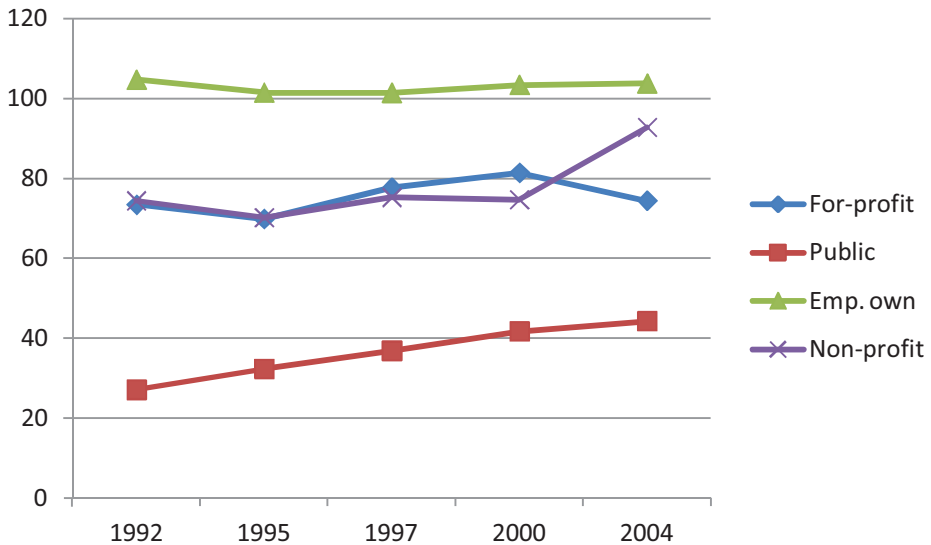
Figure 15: Intensity of the services (CWA output/employee) according to type of provider 1992-2004, mean
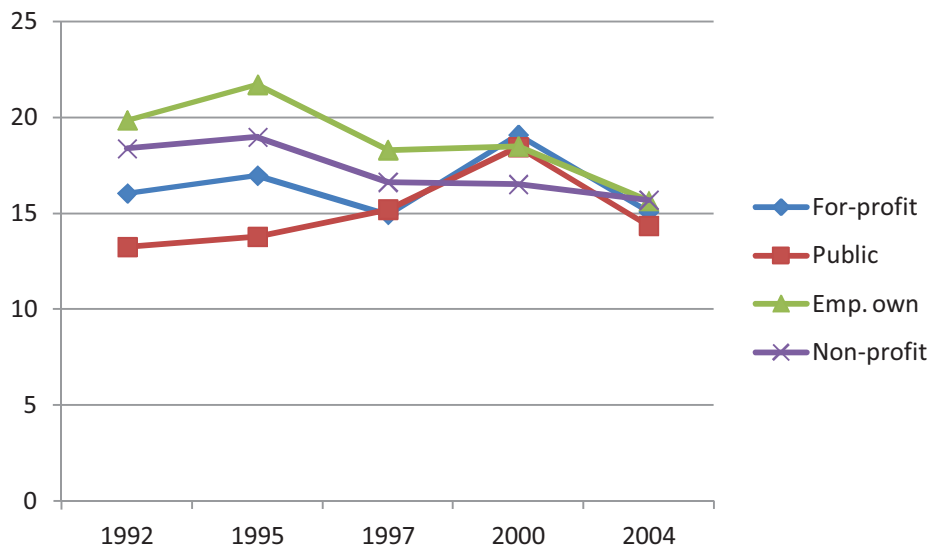
Figure 16: Productivity (CWA output/salary weighted weekly working hours) by type of provider 1992-2004, mean
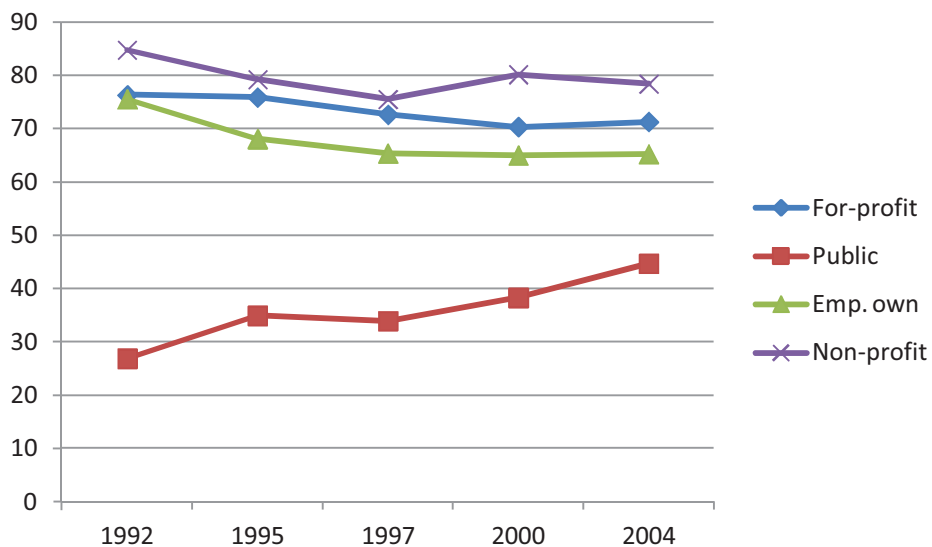
Figure 17: Share of medical care (%) by type of provider 1992-2004, mean
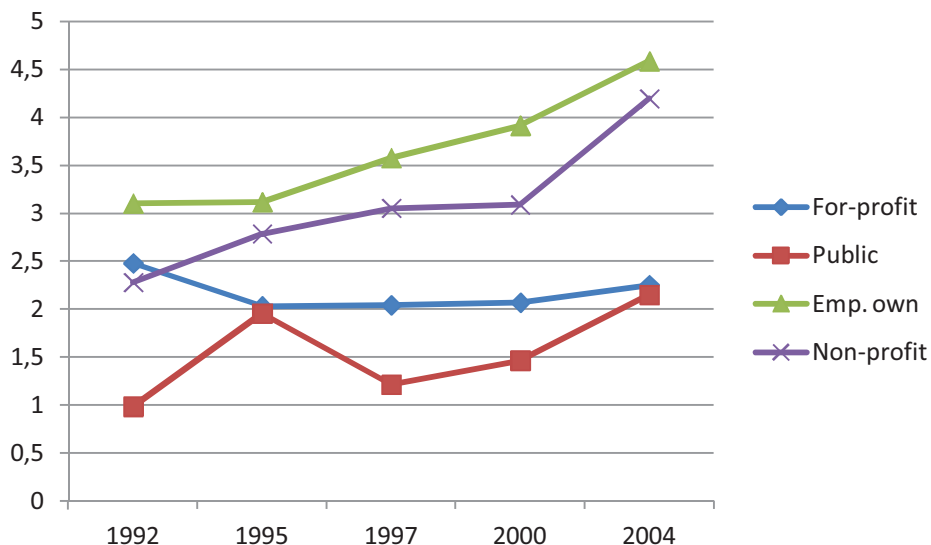
Figure 18: Unit price (provider's revenue/CWA output) by type of provider 1992-2004, mean, 2004 real value

7.5 OWNERSHIP, INCENTIVES AND COMPETITION ALL MATTER FOR THE PERFORMANCE OF AN OHS PROVIDER

First we studied how competitiveness of the market affected the performance of public providers (Study 3). The results were surprising and contrary to expectations based on economic theory. In Finland public OHS providers raised their prices, which led to increased revenues when the competitiveness of the market increased. But the market competition did not affect the production decisions, i.e. intensity, productivity and share of medical care. When we studied competitiveness and public providers, the number of providers and Herfindahl index represented the structure and competitiveness of the market. In this dissertation only the results from the models including all provider types are reported (Study 4). Table 14 below presents the results of the panel models from Study 4. The results of Study 3 are in line with those presented here when we used market share of for-profit providers instead of the HI.

A change in the total number of all providers in the region was statistically significantly associated with a change in three indicators: share of medical care, unit price and revenue. The association was positive for the share of medical care and similar for all provider types, i.e. if the number of providers increased the share of medical care also increased. For unit price and revenue, the association differed by ownership. For for-profit providers the increase in the

number of providers was associated with a decrease in the unit price. The interaction terms reveal that for public providers the association of change in the number of providers with unit price was altogether positive (-0.159 + 0.397 = 0.238). For employer's own units and non-profits the association was negative as for for-profits, but the magnitude was much smaller (about -0.04 for both, only one fourth of the coefficient for for-profits). The association of a change in the number of providers with a change in the revenue was negative for for-profit providers (-0.161). For non-profits the association was also negative but much weaker than for for-profits (-0.161 + 0.157 = -0.004). Change in revenue in employer's own and public units was positively associated with a change in the number of providers (-0.161 + 0.419 = 0.258 for public providers and -0.161 + 0.119 = 0.042 for employer's own).

A change in market mix (the market share of for-profit providers) was associated only with productivity. The spillover effect was negative. The provider types did not differ in their reaction to change in the market mix (interactions were not statistically significant).

Number of OH professionals indicates the scale of the provider. A change in the scale was negatively associated with a change in productivity and positively associated with a change in the share of medical care and revenue. A change in the scope of the services was not associated with a change in any of our indicators.

The models took into account market structure and mix, scope and scale economies. Usually in a fixed effect panel model a time trend is included in the model to capture the impact of omitted variables that change during the study period but whose impact is the same for all providers. In our study the provider type interactions with time show that the provider types had different paths over time.

Table 14: Panel models for performance indicators among Finnish OHS providers (N=954) 1992-2004, coefficient (standard deviation)

	Intensity (log)	Productivity (log)	Share of medical care	Unit price (log)	Revenue (log)
Number of all providers (log)	0.053 (0.045)	0.024 (0.055)	0.035 * (0.016)	-0.159 * (0.068)	-0.161 * (0.079)
Public*number of providers (log)				0.397 * (0.176)	0.419 ** (0.145)
Emp.own*number of providers (log)				0.119 ** (0.037)	0.203 *** (0.037)
Non-profit*number of providers (log)				0.116 * (0.048)	0.157 *** (0.044)
For-profit market share	-0.229 (0.144)	-0.447 ** (0.167)	-0.067 (0.048)	0.300 (0.164)	-0.084 (0.143)
Number of OH professionals (log)	0.051 (0.031)	-0.239 *** (0.042)	0.029 ** (0.011)	0.009 (0.043)	0.232 *** (0.042)
Scope: ref. only nurses and physicians					
In addition physiotherapist or psychologist	-0.009 (0.031)	0.008 (0.036)	-0.019 (0.011)	-0.028 (0.037)	-0.039 (0.034)
All four OH professionals	0.003 (0.042)	0.029 (0.048)	-0.023 (0.016)	-0.036 (0.053)	-0.066 (0.045)
Time	0.017 * (0.007)	0.028 ** (0.009)	-0.004 * (0.002)	-0.014 (0.008)	0.063 *** (0.009)
Public*time	0.028 *** (0.007)	-0.003 (0.009)	0.017 *** (0.002)	0.078 *** (0.010)	0.050 *** (0.009)
Emp. own*time	-0.019 ** (0.006)	-0.030 *** (0.008)	-0.002 (0.002)	0.034 *** (0.008)	-0.036 *** (0.007)
Non-profit*time	-0.005 (0.007)	-0.032 ** (0.009)	0.005 * (0.002)	0.052 *** (0.010)	-0.016 (0.009)
Constant	3.825 *** (0.150)	2.998 *** (0.193)	0.473 *** (0.055)	0.402 * (0.193)	10.952 *** (0.198)

	Intensity (log)	Productivity (log)	Share of medical care (%)	Unit price (log)	Revenue (log)
Interactions: F-statistics and p-values					
A1) Number of providers and interactions = 0				3.18 (0.0129)	9.44 (0.0000)
A2) Interactions = 0				4.23 (0.0055)	11.64 (0.0000)
B1) FP market share and interactions = 0					
B2) Interactions = 0					
C1) Time and interactions = 0	27.93 (0.0000)	10.01 (0.0000)	25.45 (0.0000)	35.41 (0.0000)	123.01 (0.0000)
C2) Interactions = 0	28.53 (0.0000)	12.13 (0.0000)	33.87 (0.0000)	21.40 (0.0000)	58.39 (0.0000)
R^2	within = 0.0890	within = 0.0532	within = 0.0944	within = 0.1655	within = 0.4048
	$F_{(9,2165)} = 15.11$ Prob > F = 0.0000	$F_{(9,2058)} = 9.37$ Prob > F = 0.0000	$F_{(9,2184)} = 18.08$ Prob > F = 0.0000	$F_{(12,2047)} = 26.86$ Prob > F = 0.0000	$F_{(12,2455)} = 98.05$ Prob > F = 0.0000

*p<0.05, **p<0.01, ***p<0.001

F-statistics for the test that the number of providers (A), the market share of the for-profit providers (B) or time (C) and the provider type interactions 1) differ jointly from zero and 2) that the coefficients of the public, employers' own and non-profit providers differ from for-profits.

We compared the direct effects of ownership (statistically significant provider type dummies in pooled OLS models, available in Appendices 3-6 of Study 4) on the indicators with the changes in those indicators statistically significantly associated with changes in the market structure (number of providers) and in the market mix (market share of for-profit providers). We varied the number of providers (logarithm) or the market share of for-profit providers from the 25% percentile values (Q1) to the 75% percentile values (Q3) in 2004. The quartiles for the number of providers were Q1=7 and Q3=27 and for the market share of for-profit providers Q1=0.14 and Q3=0.42 in 2004.

When the magnitude of change in market structure and mix is compared with provider type differences the possible provider type interactions must be taken into account. For example, in the pooled OLS model for unit price the public providers had a dummy coefficient of -0.346. This coefficient means that public providers had a 0.346 lower unit price than for-profit providers when all other variables in the model are similar. A change in the number of providers from Q1 to Q3 would lead to a change of 1.350 (in the logarithm). Taking into account the coefficient for the number of providers (-0.159) and the public provider's interaction coefficient (0.397) this would lead to a change of 0.3212 units ((-0.159+0.397)*1.350 = 0.3212). This change is slightly smaller than the difference due to ownership.

Changes in productivity were negatively associated with changes in the market share of for-profits. Only employers' own OHS differed statistically significantly from for-profit providers in productivity (employers' own OHS were more productive). The difference was greater than the change in productivity associated with a huge change in the for-profits' market share (negative association). Changes in share of medical care were positively associated with changes in number of providers. Public providers differed statistically significantly from for-profit providers in the pooled OLS model (they had a lower share of medical care than for-profits). For public providers, the magnitude of the change in the share of medical care positively associated with the change in the number of providers was smaller than the difference due to ownership.

All not-for-profits differed statistically significantly from for-profits in the pooled OLS models for unit price and revenue (there is a difference in "level" due to ownership). Public providers had lower unit price and employer's own OHS and non-profits had higher unit price than for-profits. All not-for-profits had higher revenue than for-profits. For employer's own OHS and non-profits the change in unit price and revenue associated with a huge change in the number of providers in the region was much smaller than the difference due to ownership. The magnitude of change in unit price and revenue for public providers associated with change in number of providers was much greater than for employer's own OHS and non-profits and almost of the same magnitude than the differences due to ownership.

To check the consistency of the results in Study 4 we applied private sector wage ratios for private providers in constructing the cost-weighted activity output, but the

results did not change. We also applied two different measures for the structure of the market. The results of the panel models with the number of providers excluding employers' own units or dummies (less than six, six to 19, and 20 or more providers) were similar to those presented here for productivity and unit price. The results differed slightly for other performance indicators. Higher intensity was positively associated with higher number of providers excluding employer's own units for for-profit providers and negatively associated for public and non-profit providers. In the model with all providers there was no association between a change in the structure of the market and intensity. We also measured market structure with a dummy: a market with less than six providers (during the study period 12% of all OHS units), a market with six to 19 providers (47% of all OHS units), and a market with 20 or more providers (41% of OHS units). There was no association between a change in the dummy and a change in intensity, share of medical care and revenues of the provider.

We compared fixed effects panel models with IV panel models to examine the possible endogeneity of market structure and mix. In this comparison the models differed from the ones presented here: variable scope and interactions were not included in the model and we did not have data on household income for 1992. We used number of employees, number of employers (both from our data) and the median household income to predict number of providers and share of for-profit providers in the region. For the dependent variables share of medical care, unit price and revenue the Hausman test revealed that the fixed effects panel model is preferred to IV. For intensity and productivity the test recommended IV modeling. For intensity the market variables were not statistically significant in the fixed effects panel model, in the IV model intensity was negatively associated with the FP market share. Also for productivity the results of the two models differed. In the IV model the number of providers was positively and statistically significantly associated with productivity, the coefficient for the FP market share was also positive but not statistically significant. In the fixed effects panel model the coefficient for the number of providers was not statistically significant and the coefficient for the FP market share was negative and statistically significant.

8 Discussion

8.1 SUMMARY OF RESULTS

We found no support for the hypothesis that a company's investment in preventive OHS has a positive effect on the company's profitability after two or four years (Study 1). We used two different measures to represent preceding investment in preventive OHS: occupational health personnel time per employee or the ratio total costs of preventive services per turnover. The coefficients for the variables in the regression models were negative in almost all models. Those for OH personnel time per employee variable were always non-significant. When the investment was measured as the total costs of preventive OHS as a share of turnover, the coefficients were all negative, and statistically significant in nine out of ten models.

From a company's point of view, and compared to other investments in intangibles (16% of turnover), such as R&D, marketing and investments in tangibles (13% of turnover), such as equipment, investment in OHS is minimal, less than 0.5% of turnover on average (Maliranta, Rouvinen 2007). The economic performance of a company is much more dependent on other factors than preventive occupational health care services.

Company's economic performance is too distant from preventive OHS to measure the effectiveness of prevention. Ahonen et al. (2001) addressed the problem of ascertaining the impact of occupational health and safety interventions on economic performance. First there should be an intervention that has a health effect. This health effect should lead to decreased disability and improved productivity. Furthermore, these should improve the economic performance of the firm. Outcome measures applied in research should be specific (Verhoeven 1997), also in occupational health and safety. Evaluation studies have shown that economic evaluation and argumentation can be adequately combined with intervention studies, see e.g. Tompa et al. (2008) and Taimela et al. (2008) for examples of effective and profitable interventions for the company.

The importance of preventive care could be validated with other arguments than company profitability. Sometimes preventive care can be valuable from the viewpoint of society, even though it may not be profitable for the company. Legislation (Torén, Sterner 2003) is one way to impose obligations for employers to avoid negative externalities to society and employees, i.e. the costs of ill health due to work. To promote the consumption of preventive services, the society can also subsidize employers: the reimbursement system in Finland is one example of this.

The results of Study 2 show that the Finnish OHS system is very stable. Companies' expenditure on preventive and curative medical care do not fluctuate according the economic performance of the company. The economic performance over the preceding two years was not statistically related to expenditure on preventive or curative medical OH services in 2001. Economic performance was measured by firm's annual profitability, the accumulated wealth that represents the performance of a company throughout its history and liquidity.

The result differs from those in safety studies (Filer, Golbe 2003, Nickell, Nicolitsas 1997, Dionne et al. 1997), where a firms' investment in safety is affected by economic success, especially the financial structure and liquidity. Safety investments are often equipment and non-current spending, whereas OHS are services and consumption of a more stable nature. In Finland, employees continue to use the services and providers continue to provide the services apparently irrespective of a company's economic performance. The employer has to use the expertise of the provider in deciding upon the services and the action plans for the content of services are devised by the provider. This leaves less room for the company to decide on the content and cost of OHS. From a purchaser's point of view OHS has a minor role in a company. Organizing health care services is not a core business for employers.

Although the economic performance of a company did not affect the amount of money spent per employee on curative medical services and preventive care in a particular company, there were differences between industries, regions and OHS providers. The OHS system is not entirely successful in the optimal allocation of resources according to needs. Expenditure on preventive care is not highest in the riskiest industries (Grönqvist, Räsänen 2004, Riihimäki, Kurppa & Karjalainen 2004). In companies with a higher percentage of white-collar workers, the costs of medical services were higher than in blue-collar dominated companies. The white-collar workers benefitted more in terms of free use of curative medical services, so there is inequality within OHS in Finland. Previously it has been reported that OHS increases inequity in the use of physician services at population level (van Doorslaer, Masseria & OECD Health Equity Research Group, 2004, Häkkinen, Nguyen 2010). In addition, the differences in expenditure were connected to provider type and region, which also is connected to the supply of OHS services.

Studies 1 and 2 used data from 1997, 1999 and 2001. Given such a stable system, we believe that the results would be the same if more recent data were used. The content of the services has been the same according the statistics on OHS.

According to Studies 3 and 4, the market competition measured as the number of providers showed no strong or clear association with the performance indicators. The share of medical care was positively associated with the number of providers and similarly for all provider types. Competition measured by number of providers was associated with unit price and revenues but the provider types differed. For for-profit providers, the association was as economic theory posits: the unit price and

provider's revenue both decreased when the number of providers increased in the region. Contrary to the result for for-profits, the public providers had higher unit prices and revenues when the number of providers increased. For the two other provider types, employers' own units and non-profits, the association between the monetary indicators was weaker than for for-profits. Their provider type interactions with competition almost offset the coefficient of for-profit providers.

The extraordinary results for the public providers are understandable because of the changes in their regulatory environment. Firstly, in 1995 the regulation of their prices was abolished. In a more competitive environment, the public providers were more sensitive to react to the abolition of price regulation and raise their prices. Secondly, during the study period, the public providers got more power to decide upon their resources and were more dependent on the payments by employers and less on politicians (Maarse et al. 2005). These two changes may explain why the public providers started to increasingly resemble for-profit providers (institutional isomorphism (Horwitz, Nichols 2009, Potter 2001)).

Market mix was not associated with the indicators. The only statistically significant and negative association in the panel models was between market mix and productivity. Our result contradicts the conventional wisdom that the presence of for-profit providers increases productivity and lowers costs and prices. Shen et al. (2007) reported a similar result in their meta-analysis: there was no consistent support for for-profit hospitals operating more efficiently.

Grabowski and Hirth (2003) regarded the existence of spillover effects as proof of information asymmetry in the nursing home markets. In our study, the share of for-profit providers had no impact on the performance indicators (except for the negative association with productivity). The absence of spillovers could then be a sign that the differences that existed and persisted between provider types were due to heterogeneity of employers and employees and monopolistic competition. On the other hand, market shares changed considerably in the past ten years (Manninen 2009, Kansaneläkelaitos (The Social Insurance Institution of Finland) 2007). This implies that the segments are not totally separate and there must be some competition.

All performance indicators also showed a time trend that differed by provider type. We interpret this result as a path dependency: providers have a tendency to continue the same behaviour. Path dependency has previously been found on system level (Oliver, Mossialos 2005).

Ownership was a more important determinant of the differences in performance than what could be achieved through more competition (considerable increase in the number of providers). Only in unit prices and revenues of public providers was the change associated with competition close to the differences due to ownership.

The relative importance of ownership and competition can be interpreted through the incentives and/or objectives of providers represented in the ownership types. Public ownership is a means both to steer resources in occupational health

care, and municipalities have the legal obligation to provide or organize the services for the employers in their region. On the other hand, public ownership is a means to take wider societal objectives into account and restrict the resources for OHS. Although the lifting of price regulation and control in general has led to an increase in the resources in public OHS, the resources are still meagre compared to those of other providers. The change in public OHS is also connected to the special Finnish characteristic of multiple channels for funding primary care. After the reform of the state allowance system in 1992 it has also been in the municipality's interest to increase the funding for health care by increasing the resources for OHS funded by employers and the SII. Soft budget constraint was reality for public OHS providers in the early 1990s, when public providers had regulated prices that did not cover the production costs and tax revenue was used to cover the costs of OHS. When the politicians relaxed their control of resources and public units started setting their prices on a level that would cover the production costs (Kankaanpää, Pulkkinen-Närhi 2009) the performance started to resemble that of for-profit providers.

In general, the health care providers and professionals have a great deal of power, being on "the short side of a non-clearing market" (Bowles, Gintis 2008). In other words, the demand for health care exceeds what the regulated number of providers can or will offer. Then one could question the existence of competition measured by the number and mix of providers. The substituting pressure would come from strong external ownership and from financial markets (Nickell, Nicolitsas & Dryden 1997). Indeed, the for-profit providers have aligned their incentives best: employers are charged fee-for-service payments, and most of their physicians are also paid on a fee-for-service basis. A fee-for-service payment system is known to induce (over)provision and increase the total costs of health care. In Studies 3 and 4 intensity indicated quality and easy access is connected to intensity. For-profit providers had the best incentives to be productive in quality measured with intensity and access. The data available in the studies does not enable to assess how performance is connected to welfare. From the RAND health insurance experiment it is known that there were no negative health effects when the co-payments reduced the number of physician visits (Manning et al. 1987). The present OHS have created good earning opportunities for health care providers and professionals. This had led to an increase in the number of physicians working in OHS, and there is shortage of physicians in many municipal health centres. The parallel and differently funded systems may lead to a socially undesirable distribution of resources.

For most employers the structure of the payment system in Finnish OHS is not set by the purchaser but by the provider. It seems that the payment systems act more for the benefit of the provider than the purchaser. Even in employer governed provider types, employer's own OHS and non-profits, the unit prices were higher than in other provider types. High unit price in employer's own OHS and non-profits could be a signal of rent earned by the provider. There could be a hold-up

problem in employers' own OHS which would lead to higher prices: the provider has relation specific information on collaborating with the right people, knows the management and processes. Employer's own OHS and non-profits were also most productive and had higher intensity than for-profits and public providers. They were serving bigger employers in which employees' organizations have established participation structures. They could better present employees' demands with respect to occupational health care. According to Temin and Maxwell (Temin, Maxwell 2003), the unions in the USA have a great deal of power in employers' decisions about organizing health services, especially in outsourcing decision.

In general, market competition is not only about providers. The purchasing of OHS is very fragmented in Finland. Most employers are small (in number of employees) and cannot be regarded as powerful in bargaining for the prices or content of occupational health services. Although the legislation obliges employers it simultaneously guarantees the flow of clients (both employers and employees) to providers. OHS providers have succeeded well in "the market for regulation".

8.2 METHODOLOGICAL CONSIDERATIONS

The data used in Studies 1 and 2 was unique. In Finland we had a opportunity to combine key indicators calculated from the financial accounts of companies with data on OHS. The power of the study and the follow-up time were sufficient to yield significant relevant results. Exclusion criteria for continuous business and having more than 10 employees may bias the results in the direction of apparently diminishing the impact of economic performance on a company's OHS expenditure. Entering and exiting companies and companies of small size may be in a more unfavourable financial situation.

A strength of Studies 3 and 4 is that the panel data included a large number of observations and covered almost all OHS providers in Finland. Defining the boundaries of a market is always difficult. We used the geographical regions defined by Statistics Finland based on regional collaboration and commuting. The number of providers in the region represented the market structure. We checked the robustness of the results by constructing alternative measures for competition and obtained mainly similar results.

There are limitations in our study, too. We did not have data on clients (employees), which has proven important in comparing providers. The data was obtained from surveys to providers and a register which did not include information on the quality of the services as perceived by employers and employees or on the impact on health. The simultaneous determination of the market structure and the performance of providers causes a potential endogeneity problem, especially in studies with cross sectional data (Evans, Froeb & Werden 1993). We applied Hausman test in the comparison of fixed effects and IV panel models. For

the variables share of medical care, unit price and revenue the Hausman test revealed that fixed effects panel model is preferred to IV. For intensity and productivity the test recommended IV modeling, so the results for these two indicators should be interpreted with caution. Nor could we take into account the structure of the employers. According to the statics on regional concentration of firms, most regions are not concentrated. On the other hand, the availability of alternative providers matters more for the bargaining power than the size of the purchaser (Barros, Martinez-Giralf 2006).

8.3 FUTURE RESEARCH

The health care market deviates from the assumptions of well functioning markets: there are informational problems in contracting, purchasers may not have power to apply incentives to counterbalance the power of providers, and consumers do not use market-determined prices as guides in their decision-making. Therefore it would be interesting to model and empirically study the consequences of competition in the labour market for the performance of health care providers.

Purchasing and payment systems as incentives are regarded as important instruments in steering health care providers. Economists' analyses of payment systems are overwhelmingly principal agent models that do not take competition into account. The conclusions of the models are based on the assumption of providers' objectives and effort. Both these concepts would deserve more effort from economists being so crucial for the recommendations of economists.

9 Conclusions

The conclusion of our study is that there is no evidence to support the positive effect of investment in preventive OHS on the economic performance of a company.

However, it cannot be concluded that preventive OHS has no positive effects. We would rather recommend that all prevention be judged on its success in achieving its specific objectives that are related to its core activities. The discussion as to whether OHS is beneficial should move towards more specific outcomes, such as sickness absence, disability pension and productivity, when applicable, both in occupational health service research and in practice at workplaces. What is not effective cannot be profitable for the company, either.

Expenditure on OHS seems to be independent of a company's economic performance in Finland. Legislation obligating the employers and the reimbursement system both contribute to this.

Market competition did not greatly influence the performance of providers. In OHS, as is common elsewhere in health care, many crucial elements of market competition are missing from the demand side of the market.

In our study only the for-profit providers' unit prices and revenues behaved as expected according to economic theory: unit prices in for-profits and revenue were lower in more competitive market. The differences due to ownership were greater in most performance indicators. Ownership as representing different objectives did not as such matter much, either; the differences were more due to the differences in incentive structures and the ability to allocate or restrict the resources of the provider. The public providers and for-profit providers had a similar contractual relationship with the purchasers and similar structure in their payment system. The public providers' performance was converging with the for-profits' performance after their price regulation was abolished in 1995. When employers themselves organized the provision of the services, either integrating the provider hierarchically or jointly with other employers governing a non-profit provider the employers and employees got more services, productivity was higher, but so was the unit price, and indeed the costs per employee. The employers seemed to purchase capacity, and the performance of the provider was almost immune to competition.

Steering health care providers is difficult. In the Finnish OHS the legislation has made a purchaser of every employer. This has created a very fragmented purchasing structure. In addition, the employers are not motivated purchasers in terms of the share of OHS of company turnover. Providers compete with access, probably leading to overprovision. The providers do not face any financial risks, they are fully reimbursed. The cap for costs per employee concerns only the

employer. The legislation has created incentive structures for employers and providers that are not powerful to steer the providers to perform according the wishes of society. Strong external interest, the power of shareholders in for-profits, seems to compensate the low power of market environment and purchaser's steering ability.

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Appendices

Appendix 1 CORRELATIONS FOR THE VARIABLES IN THE STUDY 1

	Operating margin 2001	Operating profit 2001	Net result 2001	Total result 2001	Profit/ loss 2001	Age of company	Equity ratio 1999	Equity ratio 1999*2	Number of employees 2001 (log)	Turn-over 1999 (log)	Current ratio 1999	Minutes per employee 1999 (log)	Minutes per employee 1997 (log)	Turn-over 1999	Turn-over 1997
Operating margin 2001	1.00														
Operating profit 2001	0.89	1.00													
Net result 2001	0.80	0.94	1.00												
Total result 2001	0.72	0.82	0.79	1.00											
Profit/loss 2001	0.71	0.81	0.77	0.97	1.00										
Age of company	0.01	-0.02	-0.01	-0.01	0.00	1.00									
Equity ratio 1999	0.27	0.28	0.32	0.31	0.33	0.10	1.00								
Equity ratio 1999*2	0.26	0.27	0.30	0.31	0.34	0.08	0.75	1.00							
Number of employees 2001 (log)	-0.03	-0.06	0.00	-0.07	-0.07	0.11	0.06	0.02	1.00						
Turnover 1999 (log)	-0.12	-0.10	-0.03	-0.10	-0.10	0.14	0.08	0.03	0.80	1.00					
Current ratio 1999	-0.06	0.03	0.02	0.04	0.05	0.09	0.22	0.22	0.01	0.14	1.00				
Minutes per employee 1999 (log)	0.01	-0.01	0.01	-0.02	-0.02	0.11	0.09	0.07	0.36	0.38	0.01	1.00			
Minutes per employee 1997 (log)	0.00	-0.02	0.01	-0.03	-0.02	0.14	0.09	0.06	0.37	0.39	0.03	0.54	1.00		
Turnover 1999	0.03	-0.01	-0.01	-0.01	0.00	0.01	0.01	0.02	0.12	-0.04	-0.08	0.40	0.18	1.00	
Turnover 1997	0.03	0.00	0.01	-0.01	-0.01	0.03	0.01	0.01	0.18	0.02	-0.08	0.27	0.51	0.31	1.00

Appendix 2 CORRELATIONS FOR THE VARIABLES IN THE STUDY 2

	Costs of OHS, €/employee (log)	Prev. Costs/emp. (log)	Med.care cost/emp. € (log)	Operating margin 1999	Operating profit 1999	Net result 1999	Total result 1999	Relative indeb-tedness 1999	Equity ratio 1999	Quick ratio 1999	Current ratio 1999	Return on capital assets 1999	ROI 1999	Return on equity 1999	Blue collar worker (%)	Turn over 2001	Age of company
Costs of OHS, €/employee (log)	1.00																
Prev. Costs/emp. (log)	0.77	1.00															
Med.care cost/emp. € (log)	0.93	0.49	1.00														
Operating margin 1999	-0.03	0.00	-0.05	1.00													
Operating profit 1999	-0.04	-0.02	-0.04	0.90	1.00												
Net result 1999	-0.02	-0.01	-0.02	0.65	0.77	1.00											
Total result 1999	0.01	0.01	0.01	0.14	0.14	-0.46	1.00										
Relative indebtedness 1999	0.05	0.06	0.04	0.04	-0.14	-0.43	0.46	1.00									
Equity ratio 1999	0.06	0.04	0.05	0.38	0.42	0.28	0.21	-0.24	1.00								
Quick ratio 1999	-0.04	-0.04	-0.04	0.20	0.23	0.16	0.10	-0.11	0.38	1.00							
Current ratio 1999	-0.04	-0.03	-0.03	-0.06	0.03	0.02	0.03	-0.07	0.22	0.11	1.00						
Return on capital assets 1999	-0.07	-0.06	-0.07	0.60	0.76	0.53	0.21	-0.22	0.38	0.21	0.00	1.00					
ROI 1999	-0.02	-0.01	-0.03	0.19	0.25	0.19	0.06	-0.08	0.05	0.03	-0.04	0.45	1.00				
Return on equity 1999	0.01	0.02	0.01	0.03	0.02	0.02	0.00	0.02	-0.03	-0.01	-0.02	0.02	0.06	1.00			
Blue collar worker (%)	-0.04	-0.05	-0.02	-0.08	0.01	0.04	-0.03	-0.10	-0.04	-0.06	0.12	0.07	0.00	0.01	1.00		
Turn over 2001	0.09	0.08	0.07	-0.14	-0.16	-0.65	0.82	0.48	0.03	-0.01	0.00	-0.03	-0.01	0.00	-0.03	1.00	
Age of company	0.09	0.04	0.09	0.01	-0.02	-0.01	0.01	0.04	0.09	-0.02	0.09	-0.10	-0.05	0.00	-0.03	0.01	1.00

Appendix 3 CORRELATIONS FOR THE VARIABLES IN THE STUDY 3

	Time	Revenue (log)	HI (employees)	Number of providers (log)	FP market share	Number of OH professionals (log)	Scope	Share of medical care	Productivity (log)	Unit price (log)	Intensity (log)
Time	1.00										
Revenue (log)	0.13	1.00									
HI (employees)	0.05	-0.35	1.00								
Number of providers (log)	-0.15	0.38	-0.81	1.00							
FP market share	0.31	0.39	-0.62	0.69	1.00						
Number of OH professionals (log)	0.19	0.53	-0.03	0.03	0.15	1.00					
Scope	0.21	0.20	0.09	-0.12	0.03	0.64	1.00				
Share of medical care	-0.07	0.45	-0.35	0.37	0.29	0.05	-0.21	1.00			
Productivity (log)	-0.05	0.35	-0.17	0.16	0.11	-0.05	-0.11	0.36	1.00		
Unit price (log)	0.11	0.48	-0.28	0.36	0.32	-0.12	-0.17	0.27	-0.11	1.00	
Intensity (log)	0.01	0.44	-0.32	0.32	0.27	-0.04	-0.17	0.66	0.57	0.17	1.00

Articles

STUDY 1:

PROMOTING PREVENTION WITH ECONOMIC ARGUMENTS – THE CASE OF FINNISH OCCUPATIONAL HEALTH SERVICES

Kankaanpää, Eila, Suhonen, Ari & Valtonen, Hannu 2008, *BMC Public Health*, [Online], vol. 8: 130, 1-8. Available from: http://www.biomedcentral.com/1471-2458/8/130.

STUDY 2:

DOES THE COMPANY'S ECONOMIC PERFORMANCE AFFECT ACCESS TO OCCUPATIONAL HEALTH SERVICES?

Kankaanpää, Eila, Suhonen, Ari & Valtonen, Hannu 2009, *BMC Health Services Research*, [Online], vol. 9: 156, 1-8. Available from: http://www.biomedcentral.com/1472-6963/9/156.

STUDY 3:

PUBLIC HEALTH CARE PROVIDERS AND MARKET COMPETITION: THE CASE OF FINNISH OCCUPATIONAL HEALTH SERVICES

Kankaanpää, Eila, Linnosmaa, Ismo & Valtonen, Hannu 2011, *European Journal of Health Economics*, vol. 12, no. 1, pp. 3-16.

STUDY 4:

MARKET COMPETITION, OWNERSHIP, PAYMENT SYSTEMS AND THE PERFORMANCE OF HEALTH CARE PROVIDERS – A PANEL STUDY AMONG FINNISH OCCUPATIONAL HEALTH SERVICES PROVIDERS

Kankaanpää, Eila, Linnosmaa, Ismo & Valtonen, Hannu 2012, Accepted manuscript *Health, Economics, Policy and Law*.

Study 1

Kankaanpää, Eila, Suhonen, Ari & Valtonen, Hannu (2008): Promoting Prevention with Economic Arguments – the Case of Finnish Occupational Health Services. BMC Public Health, [Online], vol. 8: 130, 1-8. Available from: http://www.biomedcentral.com/1471-2458/8/130.

BMC Public Health

Research article

Promoting prevention with economic arguments – The case of Finnish occupational health services

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Abstract

Background: Both social and ethical arguments have been used to support preventive occupational health services (OHS). During the 1990s it became more common to support political argumentation for occupational health and safety by converting the consequences of ill health at work into monetary units. In addition, OHS has been promoted as a profitable investment for companies, and this aspect has been used by OHS providers in their marketing.

Our intention was to study whether preventive occupational health services positively influence a company's economic performance.

Methods: We combined the financial statements provided by Statistics Finland and employers' reimbursement applications for occupational health services (OHS) costs to the Social Insurance Institution. The data covered the years 1997, 1999 and 2001 and over 6000 companies. We applied linear regression analysis to assess whether preventive OHS had had a positive influence on the companies' economic performance after two or four years.

Results: Resources invested in preventive OHS were not positively related to a company's economic performance. In fact, the total cost of preventive OHS per turnover was negatively correlated to economic performance.

Conclusion: Even if OHS has no effect on the economic performance of companies, it may have other effects more specific to OHS. Therefore, we recommend that the evaluation of prevention in OHS should move towards outcome measures, such as sickness absence, disability pension and productivity, when applicable, both in occupational health service research and in practice at workplaces.

Background

Both social and ethical arguments have been used to support preventive occupational health services (OHS). It has been regarded as a fundamental right of each worker to reach the highest attainable standard of health, and workers' health at work should be protected [1,2]. Prevention

was perceived as valuable, at any rate better and cheaper than a cure [3], and therefore economic analyses were not required.

During the 1990s it became more common to reinforce political argumentation for occupational health and

safety by converting the consequences of ill health at work into monetary units [4-6]. Moreover, OHS has been promoted as a profitable investment for companies [7,8], a viewpoint that has been used by OHS providers in their marketing.

Occupational health personnel have a role in assessing the health risks at the workplace – both environmental risks and problems in the functioning of the working community. They offer guidance on how to carry out interventions to improve working conditions and well-being at work and assist employees in maintaining their health. They also carry out interventions themselves, organize groups e.g. for persons with neck problems or obesity, participate in the planning and implementation of return-to-work policies, and act as facilitators in organizational development projects [9,10].

The interventions also have an economic dimension. Through improvement of working conditions, the costs of occupational accidents and diseases can be lowered. More importantly, these improvements can also lead to increased productivity [8,11]. If employees are motivated and committed to their work, they are willing to improve the services and products, which leads to higher customer satisfaction and faster payment of invoices. This reduces receivable accounts and thus provides higher return on capital employed. Employees' initiatives also concern internal processes. The result will be less rework and smooth processes that lower operating expenses [12]. The costs of sickness absence and disability pensions can be lowered with health related interventions [13], which has immediate positive financial effects for a company. In the long run, this will mean reductions in the company's health and insurance pension premiums due to lowered social security costs [8].

We study the assumption that if a company invests more in preventive occupational health services this would mean more interventions and, consequently, more favourable outcomes. Finally, there would be an impact on the profitability of the company.

We wanted to study the above described previously unexplored relationship between a company's economic performance and its investment in preventive occupational health services. The small amount of research in this area may be due to insufficient data. The circumstances in Finland, however, enable examination of this relationship, as it has been obligatory for employers to arrange preventive occupational health services for their employees since 1979. Preventive services include both individual and workplace activities. Employers can voluntarily organize GP level medical services, and they are entitled to reimbursement for the costs of preventive and medical serv-

ices. Because of the reimbursement system, there is an employer-based register of the contents and costs of OHS. In this study, we combined this register with the firms' financial statements gained from Statistics Finland. Firm-specific identification codes were used in the processing of the financial statement data.

Our objective was to determine whether preventive occupational health services positively influence a company's economic performance.

Methods

We examined the relationship between companies' investment in preventive OHS in 1997 and 1999 and the companies' economic performance four or two years later in 2001. We had the opportunity to use micro-level data from the companies.

Statistics Finland collects the financial statements of all Finnish firms from tax authorities. The register also contains data such as number of persons employed by the company, year of establishment, registered office, and industry.

The Social Insurance Institution (SII) registers employers' reimbursement applications for OHS. This register contains data on the service mix and the costs incurred. We chose to use registers from the years 1997, 1999 and 2001. In 1997, the reformed reimbursement system for the promotion of activities supporting work ability had been in force for two years. As this project was launched, 2001 was the last year for which all reimbursement applications had been processed. Companies apply for reimbursement within six months of closing their accounts, after which it takes over a year to process all the applications at the SII. We then merged this register with the Statistics Finland data, using firm-specific identification codes.

Finnish firms are a heterogeneous group. Table 1 presents the exclusion criteria. In 2001, 40% of a total of 226,000 firms were actually self-employed private persons and 15% had limited or unlimited liabilities. These and all other juridical forms except companies were excluded. Companies are defined as clearly for-profit organizations, and the legislation on bookkeeping and financial statements guarantees high quality of economic performance data. To enable assessment of whether the preceding investment in preventive OHS has had an impact on the company's economic performance, the companies had to have been in business continually through 1997–2001 (financial statements were available for this period).

Statistics Finland has graded the quality of the financial statements into three categories. It only uses financial statements from firms when the quality of the data is

Table 1: Exclusion criteria and number of companies in study

Number of firms in 2001	226 000
Number of companies in 2001	99 428
Financial statements for 1997, 1999 and 2001	64 597
Quality of the data rated good or excellent in 2001	32 522
Turnover > €50 000 for each of the three years	24 380
Personnel > 10 in 2001	7 013
Trimming of the key ratios for 2001 (1% both tails)	6 271

graded excellent or good in its own publications and analysis. We used the same criteria, as in the third category many of the rows in the income statements have to be estimated.

The Act on Occupational Health Services applies only to firms that have employees. We assumed that a company's turnover had to exceed a certain level in order for it to be able to employ someone. With this in mind, we excluded companies with a turnover of less than €50,000 p.a. The number of employees in the Statistics Finland register also includes all short-term contracts, which might have been valid for a couple of hours only. Thus we left out companies with less than ten employees in 2001. By trimming both tails of all key ratios we were left with 6271 companies for the analysis.

After the exclusions, the number of companies fell from almost 100,000 to 6271. However, with view to average Finnish companies in 2001, the companies included in the study were rather typical in their location in terms of region and type of municipality. Regionally, the companies were mainly located in the south: 37% in Uusimaa, the region around the capital city of Helsinki, 36% in Southern Finland, 8% in Eastern Finland, 12% in Central Finland, 7% in Northern Finland, and less than 1% in Åland. Most of the companies were situated in urban municipalities (74%), and the rest were split between semi-urban (14%) and rural municipalities (12%).

The size distribution of the companies in the study naturally differed from that of all Finnish companies as those with less than ten employees were excluded.

The industry distribution of the included companies differed from that of total Finnish companies in three industries: the share of companies in real estate, renting, and business activities was smaller in the study population than in all Finnish companies (28%). These companies were small: 92% employed less than ten persons and were therefore excluded from the study. The financial intermediation industry disappeared completely, as this industry has special regulations concerning financial statements and cannot be compared with companies from other industries. The share of companies from the combined

industry group of mining and quarrying plus manufacturing was higher than in all Finnish companies (14%). The size and industry distribution of the companies included in the study is presented in Additional file 1.

The average turnover of the companies in the study was about €24 million, and the average age of a company was 18 years.

Statistics Finland calculated the key ratios for all companies (Table 2). They are all derived from financial statements and commonly used in assessing companies' economic performance. We used the five key indicators for profitability as an outcome measure for company economic performance. Key indicators for industries differ [14], and there are also geographical and regional differences, mainly due to differences in competitiveness [15]. The size of the company is also a factor in economic performance [16].

In Finland preventive occupational health services cover almost all employed persons; only in micro firms with less than 10 employees the employers has not always organized OHS services for the workplace. According to a population survey conducted in 2006, two out of three employees had attended an occupational health examination in the past three years, and around half of them had had occupational health personnel assessing their workplace in the past three years. Although organizing medical services is voluntary for employers, over 90% of employees can obtain GP level services from their OHS unit. Around half of the primary care level GP visits of these employees take place within OHS [17].

To be able to compare investment in preventive OHS between companies, we chose two different points of view: resources per employee and OHS's share of total costs per turnover (importance compared to other uses of resources in the company, comparable e.g. to costs of prevention per gross national product, GNP).

Because of the specific features of the Finnish reimbursement system, we measured the company's investment in OHS per employee both in monetary and temporal terms. Until 1995, the prices in municipal health centres were set by the State Council and did not cover the costs of providing these services [18]. Many municipal units have been slow in changing their pricing policy: in 2000 one in three were still using the regulated prices from 1994. In the companies' own OHS units, the costs of preventive and medical services in reimbursement applications are often divided according to the shares of maximum reimbursement (40% for prevention and 60% for medical services) and not according to the resources used.

Table 2: Key ratios of companies in 2001 (N = 6 271)

Key ratio	Mean	Median	Standard Deviation
Profitability			
Operating margin, % What is left over from the company's earnings after paying for variable costs of production divided by net sales.	10.03	8.73	8.29
Operating profit, % Earnings before interest and taxes (EBIT) divided by net sales.	6.5	5.67	7.15
Net result, % (Total revenues - total expenses) divided by net sales = Shows whether a company has earned or lost money with its business in the accounting period.	4.25	3.65	6.15
Total result, % Net result + extraordinary revenues - extraordinary expenses divided by net sales	4.05	3.27	5.76
Profit/loss for the accounting period, % The profit/loss result after tax payments divided by net sales.	4.11	3.25	5.57
Solidity			
Return on capital assets, % Shows how profitable the company is relative to its total assets. = Net income/total assets	14.05	12.43	13.59
Return on investment, % Evaluates the efficiency of an investment = (gain from investment - cost of investment)/cost of investment.	26.83	21.5	32.28
Return on equity, % Shows how much profit is made relative to the owners' investment in the company = Net income/ shareholders equity	24.71	21.01	59.87

Relative indebtedness, %
 Company's liabilities divided by its turnover.
    Less than 40%: Good
    40–80%: Satisfactory
    More than 80%: Poor
	32.18	23.92	28.39

Equity ratio, %
 The percentage of equities from the balance sheet
    Over 40%: Good
    20–40%: Satisfactory
    Less than 20%: Poor
	43.43	43.13	23.37

Liquidity			

Quick Ratio
 Company's ability to meet its obligations.
    Over 1: Good
    0.5–1: Satisfactory
    less than 0.5: Poor
	0.51	0.23	0.73

Current Ratio
 Company's ability to meet short term debt obligations.
    Over 2: Good
    1–2: Satisfactory
    less than 1: Poor
	0.54	0.38	0.61

The time variable was calculated from the SII register data. Workplace and group activities had originally been registered in hours. We converted the number of health examinations into minutes based on information from previous studies or an expert assessment of the contents of OH personnel's work in different provider models. All activities were summed up into the variable Occupational Health (OH) Personnel's Time per Employee. The time resource and costs correlated strongly in all other provider models (0.6–0.8), but not in the companies' own units. The price level in municipal OHS units was about 40% lower than in other provider models (euros per OH personnel minute). Thus time resource is a better measure for investment in preventive OHS for both the companies' own units and municipal OHS units. Therefore, the decision was made to leave the costs per employee out of the analysis.

On average, the 6721 companies invested in preventive OHS €39.50 per employee in 1997 and €46.00 in 1999. This sum bought the companies some 22 minutes of OH personnel time per employee for each of the two years. Among the companies who had applied for reimbursement, the costs were the highest in the companies' own OHS units (€91 for prevention and €138 for medical services per employee) and lowest in municipal health centres (prevention €62 and medical services €42 per employee).

The average share of total costs for preventive OHS per turnover was 0.04%.

We assumed that the provider model could have an impact on company performance. The companies' own units are generally believed to be able to integrate their activities more efficiently into the company than other providers. However, in this study, the OHS provider model had no effect on the key ratios and was thus excluded from the models.

The connection between investment in OHS and the companies' economic performance was analyzed using linear regression analysis. The investment in preventive occupational health services was not dependent on the company's previous economic success. The correlations between the investment in 2001 and the key ratios in 1997 or 1997 were all small (absolute values were less than 0.1).

We tested the models using the regression specification error test (RESET test). It can be used for testing the functional form of a model, especially to detect non-linearities and omitted variables [19]. RESET test revealed that the relationship between dependent and some independent variables was logarithmic rather than linear. The models were also tested for multicollinearity.

We used two different software packages in the analysis. The SAS software package was used in excluding and recoding and the STATA for the analysis.

Results
Model
The five key indicators of the profitability of the company were the dependent variables, each in its turn. The independent variables in the model were investment in preventive OHS either in minutes per employee (log) or as the total cost of prevention per turnover (%), all in 1997 or in 1999. Therefore, we conducted twenty regression analyses to study the connection between investment in preventive OHS and company profitability.

The other independent variables were the company's past economic performance (equity ratio in 1999, with higher equity ratio indicating greater opportunity to make profitable investments), size of the company (log number of employees in 2001, log turnover in 1999), and age of the company.

Some of the confounding variables were dummies, and the coefficients are meaningful only when compared to the reference group. Industry was included in the model because key ratios differ according to industry; in this study the reference group was wholesale and retail trade. Geographical regions were included to represent booming or declining regional economies (6 counties in Finland, reference region Uusimaa). The type of municipality is an indicator of the size of the local market, for both the company's products and for OHS. Municipalities were classified into three groups: city, semi-urban, and rural.

We checked the correlations between independent variables (see Additional file 2), and found no multicollinearity.

Company's economic performance
Operating profit represents here the economic performance of the company in 2001. Table 3 includes two different models for operating profit, one for each indicator of the company's investment in preventive occupational health services in 1997.

The preceding investment in preventive OHS measured as OH personnel time per employee in 1997 had a negative coefficient which was statistically non-significant.

When the share of total preventive OHS costs per turnover represented investment, the coefficient was negative and statistically significant.

The results of the models for other key indicators were very similar to those presented in Table 3. All coefficients for time per employee variables were non-significant, and negative in 9 out of 10 models. For the costs per turnover variable, the coefficient was negative in all ten models, and statistically significant in nine out of ten models.

Success seems to follow success: a higher equity ratio in 1999 was connected with better key indicators for profitability in 2001. The age of the company and turnover were negatively related to profitability but no correlation was found between profitability and the geographical or regional location of the company.

The adjusted R^2s were low in general, highest in the models for operating margin (18%), and about 12% for other key indicators of profitability.

Table 3: Regression models for operating profit in 2001, investment in preventive OHS measured with two variables

	Dependent: operating profit in 2001			
	Coefficient		Coefficient	
Constant	7.439	***	8.040	***
Preventive OHS in 1997				
Minutes per employee (log)	-0.050			
Total costs/turnover			-349.552	*
Equity ratio in 1999	0.060	***	0.060	***
Equity ratio in 1999*2	0.000380	***	0.000381	***
Log number of employees in 2001	-0.080		-0.020	
Log turnover in 1999	-0.348	**	-0.401	**
Age of company	-0.018	*	-0.018	*
Industry				
Agriculture, hunting and forestry, fishing	3.875	***	3.888	***
Mining and quarrying, manufacturing	2.216	***	2.249	***
Electricity, gas, and water supply	0.788		0.781	
Construction	2.081	***	2.107	***
Hotels and restaurants	1.482	**	1.507	**
Transport, storage, and communication	1.109	**	1.109	**
Real estate, renting, and business activities	2.448	***	2.494	***
Education	-3.739	*	-3.710	*
Health and social work	2.910	***	2.984	***
Other community, social and personal service activities	-0.436		-0.406	
Reference: Wholesale and retail trade				
Region				
South	0.119		0.114	
East	0.181		0.178	
Central	-0.109		-0.118	
North	0.590		0.582	
Åland	0.884		0.882	
Ref. Uusimaa				
Municipality				
Semi-urban	0.198		0.182	
Rural	0.199		0.180	
Ref. city				
Adjusted R^2	0.12		0.12	
Reset F(3, 6244)	5.10	p = 0.0016	5.25	p = 0.0013

* $p < 0.05$, ** $p < 0.01$, ***$p < 0.001$

Discussion

In this study, we could not find support for the hypothesis that a company's investment in preventive OHS would have a positive effect on the company's profitability after two or four years. The coefficients for the variables representing preceding investment in preventive OHS in the regression models were negative in almost all models. Those for OH personnel time per employee variable were always non-significant. When the investment was measured as the total costs of preventive OHS as a share of turnover, the coefficients were all negative, and statistically significant in nine out of ten models.

The power of the study and the follow-up time were sufficient to yield significant relevant results. In Finland, we had the unique opportunity of combining economic indicators from companies with data on OHS.

Economic performance of a company is a complex phenomenon, and difficult to decipher exhaustively with this kind of data. The explanatory power of the regression model for the economic performance of the company was low, but not deviant from other studies with similar design explaining a firm's economic performance [20,21]. Some independent variables that might affect economic performance were lacking, which was also shown in the RESET tests. Had we had information on matters such as management, marketing and research and development, the explanatory power of the models would have been higher. However, if these omitted variables are uncorrelated with our key variables (as tested by RESET test, in fact), the results relevant for our study questions are unaffected by these omitted variables.

From a company's point of view and compared to other investments in intangibles (16% of the turnover), such as R&D and marketing, and investments in tangibles (13% of the turnover), such as equipment, the investment in OHS is minimal, less than 0.5% of turnover on average [22]. The economic performance of a company is much more dependent on other factors than preventive occupational services, and as an outcome measure economic performance is too distant to actually correlate with preventive OHS. If one wants to show that occupational health services are profitable for the company cost-benefit and cost-effectiveness analysis should be used. Good examples of such studies are Tompa et al. and Taimela et al. [13,23]. In addition, occupational health services units can be an economical way to provide medical curative care [24].

A line of argumentation based on a viewpoint quite separate from profitability for the company could also be used to advocate the importance of prevention. Sometimes prevention can be valuable from the viewpoint of society even though it would not be profitable for the company. Legislation [25] is one way to impose obligations for employers to avoid negative externalities to the society and the employees, i.e. the costs of ill health due to work. To promote the consumption of preventive services, the society can subsidize employers: the reimbursement system in Finland is one example of this.

Conclusion

The conclusion of our study is that there is no evidence to support the positive effect of investment in preventive OHS on the economic performance of a company.

However, it cannot be concluded that preventive OHS has no positive effects. We would rather recommend that all prevention would be judged on it success in achieving its specific objectives that are related to its core activities. The discussion as to whether OHS is beneficial should move towards more specific outcomes, such as sickness absence, disability pension and productivity, when applicable, both in occupational health service research and in practice at workplaces. What is not effective cannot be profitable for the company either.

In general, it might be quite difficult to prove that prevention has some impact on the economy (see [3], p. 13–23). This means the discussion about the relationship between health and productivity, or the wealth of a nation, will continue [26] within occupational health. However the first step, the link between prevention and health should be given priority when planning new research on the area.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

EK and HV planned the study. AK carried out the analysis under supervision by HV and EK. EK drafted the manuscript, and the other authors have read and approved it.

Additional material

Additional file 1

Companies by number of employees and industry in 2001.
Click here for file
[http://www.biomedcentral.com/content/supplementary/1471-2458-8-130-S1.pdf]

Additional file 2

Correlations of variables.
Click here for file
[http://www.biomedcentral.com/content/supplementary/1471-2458-8-130-S2.pdf]

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Pre-publication history

The pre-publication history for this paper can be accessed here:

http://www.biomedcentral.com/1471-2458/8/130/prepub

Study 2

Kankaanpää, Eila, Suhonen, Ari & Valtonen, Hannu (2009): Does the Company's Economic Performance Affect Access to Occupational Health Services. BMC Health Services Research, [Online], vol. 9: 156, 1-8. Available from: http://www.biomedcentral.com/1472-6963/9/156.

BMC Health Services Research

Research article

Does the company's economic performance affect access to occupational health services?

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Abstract

Background: In Finland like in many other countries, employers are legally obliged to organize occupational health services (OHS) for their employees. Because employers bear the costs of OHS it could be that in spite of the legal requirement OHS expenditure is more determined by economic performance of the company than by law. Therefore, we explored whether economic performance was associated with the companies' expenditure on occupational health services.

Methods: We used a prospective design to predict expenditure on OHS in 2001 by a company's economic performance in 1999. Data were provided by Statistics Finland and expressed by key indicators for profitability, solidity and liquidity and by the Social Insurance Institution as employers' reimbursement applications for OHS costs. The data could be linked at the company level. Regression analysis was used to study associations adjusted for various confounders.

Results: Nineteen percent of the companies (N = 6 155) did not apply for reimbursement of OHS costs in 2001. The profitability of the company represented by operating margin in 1999 and adjusted for type of industry was not significantly related to the company's probability to apply for reimbursement of the costs in 2001 (OR = 1.00, 95%CI: 0.99 to 1.01). Profitability measured as operating profit in 1999 and adjusted for type of industry was not significantly related to costs for curative medical services (Beta -0.001, 95%CI: -0.00 to 0.11) nor to OHS cost of prevention in 2001 (Beta -0.001, 95%CI: -0.00 to 0.00).

Conclusion: We did not find a relation between the company's economic performance and expenditure on OHS in Finland. We suppose that this is due to legislation obliging employers to provide OHS and the reimbursement system both being strong incentives for employers.

Background

Occupational health services (OHS) are regarded as a fundamental right of every worker. In order to reach the highest attainable standard of health, workers' health at work should be protected [1,2]. Therefore, employers in Finland and in many other countries are obliged by legislation to organize OHS [3]. Because employers cover the costs of OHS it could be that in spite of this requirement OHS expenditure is more determined by economic performance of the company than by law.

Filer and Golbe [4] have described how company's investment in workplace safety is connected to company's economic performance. In general, a company's financial structure substantially affects its real operating decisions and the amount of risk the company is willing to bear, which have an impact on firm's input choices. Both safety and occupational health services are such inputs for a company.

In making decisions on OHS investments the company is balancing the costs and benefits of OHS. Preventive services are supposed to lead to lower occupational accidents and diseases, lower sickness absence and disability pensions which all improve the economic performance of the company [5-7]. Curative medical services within OHS have similar objectives. In addition, curative medical services can be regarded as fringe benefits, that is, the employer offers employees health services (or health insurance) in place of or as an additional monetary wage [8]. Offering generous curative medical services would then lead to employees' lower wage demands.

Investments in safety and health compete with other investments in the company. While companies make decisions on resource allocation the economic situation of the company might affect OHS differently than other input decisions. Acquiring outside funding for OHS investments will be difficult and therefore investment decisions on OHS are dependent on the liquidity of the company (cash flows). Cash flows indicate if there is internal funding available in general, also for investments in OHS.

Filer and Golbe [4] studied investments in safety which also includes investments in capital goods, like equipment. They summarize various models and conclude that the impact indebtedness has on safety investments is ambiguous, mainly due to the capital nature of safety investments. In our study, the costs for occupational health services include only the payments for the OHS providers that will be paid immediately, and the benefits of good OHS will be received in the future. Therefore, we expect that high leverage and the risk of bankruptcy will lower the investment in occupational health services. This is due to share owners' and bondholders' conflicting interests. Owners bear the costs of OHS, in case of bankruptcy the bondholders become the owners of the company and will receive the fruits of OHS, or the costs of neglect.

There is some evidence to support these assumptions but there are only few studies. Nickell and Nicolitsas found in their study that declining company finances lead to lower pay and to lower safety levels as indicated by abolishment of "restrictive practices" such as restrictions to hours of work, manning ratios on machines, and inflexibility of working practices [9]. Abolishment of these restrictions

can be interpreted as lowering of safety levels. Filer and Golbe also observed that, in a broad range of industries, the level of safety in a workplace was related to the firm's operating margin and indebtedness [4]. Particularly at low levels of operating margin, firms doing worse also invested less in safety.

The small amount of research in this field may be due to a lack of data. In Finland, however, it is possible to study the relationship between economic performance and OHS expenditure because employers are entitled to reimbursement for about half of the costs of preventive and curative medical occupational health services. Based on the reimbursement claims, the National Social Insurance Institution keeps an employer-based register of the contents and costs of OHS. In addition, Statistics Finland keeps a register with the firms' annual financial statements. These financial statements allow the calculation of key ratios that measure a company's economic performance. Firm specific identification codes made it possible to combine the information in both registers at the firm level.

Based on these administrative sources, we studied if key ratios for a company's economic performance were associated with the OHS expenditure two years later.

Methods
Occupational health services
It has been obligatory for employers to organize preventive occupational health services for their employees since 1979. According to a population survey conducted in 2006, two out of three employees had attended an occupational health examination in the past three years, and around half of them had had occupational health personnel assessing their workplace in the past three years. Although organizing curative medical services is voluntary for employers, over 90% of employees can obtain GP level services from their OHS unit. Around half of the primary care level GP visits of these employees take place within OHS [10]. A more detailed description of the Finnish OHS can be found in [3,11]. At the moment, OHS is the only health care system in Finland that provides curative medical services for users without out-of-pocket payments. Therefore, the curative medical services can be regarded as fringe benefits.

Finland introduced public health insurance to reimburse the costs of curative medical care in the private sector in 1964. Since then employers have got reimbursement for the costs of OHS. Employers first pay all costs of OHS and apply for reimbursement within six months after closing their accounts. The share of the costs reimbursed has varied during the over 40 years of reimbursement. In 2001 and still nowadays, the reimbursement is 60% for preventive and 50% for curative medical services. So, despite of

the reimbursement the firms will always bear a considerable part of the cost themselves.

Study design

In a prospective design, data for economic performance of companies from 1999 were used to predict their expenditure on OHS in 2001.

Statistics Finland collects the financial statements of all Finnish firms from the tax authorities. The register also contains data such as the number of persons employed by the company, number of blue- and white-collar workers, year of establishment, registered office, and industry.

The Social Insurance Institution (SII) registers employers' reimbursement applications for OHS. This register contains data on service mix and costs. We chose to use registers from the years 1999 and 2001. In 1999, the renewed reimbursement system where the costs for prevention and curative medical services are reported separately had been in force for four years. As this project was launched, 2001 was the last year for which all reimbursement applications had been processed. Companies apply for reimbursement within six months of closing their accounts. After this, it takes over a year to process all the applications at the SII.

The Social Insurance Institution register was merged with the Statistics Finland data at the Statistics Finland by using firm-specific identification codes. To protect the privacy of the companies we had at our disposal only the merged unidentifiable data.

The companies

Firms are a heterogeneous group, e.g. differences in the legal construction affect the regulations about bookkeeping. To be sure that the firms in the study would employ personnel and would therefore be obliged to provide OHS we had to restrict our sample (Figure 1). For this reason we excluded firms that

- were not companies

- had not been in business continually through 1999-2001

- had financial statements of insufficient quality as assessed by Statistics Finland (quality is rated low when the firm had not reported many rows in the profit and loss account and this missing information has to be estimated by Statistics Finland)

- had a turnover of less than €50,000 per annum

- had less than ten employees in 2001

- had values in either 1% tail of any key ratio. (Trimming is commonly used with key ratios to help to comply with the normality assumption [12].)

- had very high values of prevention costs (> 240 euro per employee, 61 cases) and curative medical service costs (> 360 euro, 55 cases) in 2001. This indicates that expenditure has been beyond the normal limits because of exceptional circumstances.

This resulted in 6,155 firms that had valid data for both economic performance and OHS expenditure and that could be included in the analysis.

Economic Performance

Key ratios for profitability are calculated from the profit and loss account by deducting costs from turnover and dividing this margin by turnover. The difference between the ratios results from the variation in costs deducted. The three first key ratios for solidity proportionate the annual profit to different capital titles. The two other key ratios for solidity, relative indebtedness and equity ratio, give an idea about the accumulated wealth of the company. Key ratios for liquidity indicate how large a share of its debts the company could pay with its liquid assets. Definitions for key ratios can be found in the appendix 1 (Table5.

Statistical analysis

The association between a company's economic performance and investment in OHS was analyzed using regression analysis. The independent variable was economic

Restriction criteria	Number after restriction
Total number of firms in 2001	226,000
Not a company in 2001	↓
	99,428
No financial statements for both 1999 and 2001	↓
	64,597
Quality of the data not rated good or excellent in 2001	↓
	32,522
Turnover < €50,000	↓
	24,380
Personnel < 10 in 2001	↓
	7,013
1% of either tail of the key ratios in 2001	↓
	6,271
Exceptionally high OHS costs	↓
	6,155

Figure 1
Construction of the study sample.

performance of the company as represented by key indicators for profitability, solidity and liquidity. All indicators were each in its turn modelled and analysed.

Because almost one in five companies had not applied for reimbursement, we first used logistic regression analysis with a dichotomous dependent variable of yes or no spending on OHS. The dependent variable of spending on OHS was constructed from yes or no applying for reimbursement. In a separate analysis we applied linear regression analysis to assess the influence of a company's economic performance on the amount of spending, separately for prevention and curative medical services.

We tested the models using the regression specification error test (RESET test). It can be used for testing the functional form of a model, especially to detect nonlinearities and omitted variables [13]. The test revealed that the relationship between dependent and some independent variables was logarithmic rather than linear. Therefore, these variables were log transformed. The models were also tested for multicollinearity, and there was no multicollinearity.

We assumed that industry, the proportion of blue collar workers, age of the company, geographical region and grade of urbanisation of the area could all be related to the economic performance and to the expenditure of OHS. These variables were therefore introduced as confounders in all models.

We used the STATA software packages for the analysis.

Results
Study Sample
The companies included in the study were a representative sample in terms of region and the type of the municipal-

ity. The size distribution of the companies in the study naturally differed from that of all Finnish companies as those with less than ten employees were excluded. For the same reason of exclusion of small firms, the industry distribution of the included companies differed from that of all Finnish companies. 'Real estate, renting, and business activities' and 'financial intermediation' were underrepresented and 'mining and quarrying plus manufacturing' slightly overrepresented. (See additional file 1 for the size and the industry distribution of the companies.)

The key ratios for economic performance were about the same as for all Finnish firms (including also other firms, not only companies) except for relative indebtedness and quick ratio which were lower in the companies included in the study (table 1). The correlations between key ratios for profitability and solidity were big within a year (absolute values 0.4-0.9) and small for the key ratios for liquidity (0.2). Between the time periods the correlations got smaller.

The average turnover of the companies in the study was about €24 million, and the average age of a company was 18 years.

Of the companies included in the study, 19% had not applied for reimbursement in 2001. Among the companies who had applied for reimbursement, the costs were the highest for the companies' own OHS units and lowest for municipal health centres (table 2). The magnitude of OHS expenditure was relatively small: the total OHS costs represented about 0.1% of turnover on average.

Economic performance and applying for reimbursement for the OHS costs
In table 3 the odds ratio for operating margin in 1999 indicates that the relation with OHS is negligible and non-

Table 1: Key ratios for economic performance of companies in 2001 (N = 6,271)

Key ratio	Mean	Median	Standard Deviation
Profitability			
Operating margin, %	10.0	8.7	8.3
Operating profit, %	6.5	5.7	7.2
Net result, %	4.2	3.6	6.2
Total result, %	4.0	3.3	5.7
Profit/loss for the accounting period, %	4.1	3.2	5.6
Solidity			
Return on capital assets, %	14.0	12.4	13.6
Return on investment, %	26.8	21.5	32.3
Return on equity, %	24.7	21.0	59.9
Relative indebtedness, %	32.2	23.9	28.4
Equity ratio, %	43.4	43.1	23.4
Liquidity			
Quick Ratio	0.51	0.23	0.73
Current Ratio	0.54	0.38	0.61

Table 2: Companies' costs for occupational health services in 2001 by provider in euro per employee per year

Provider	Preventive services		Curative medical services	
	Mean	Standard deviation	Mean	Standard deviation
Employer's own OHS unit (N = 454)	91.60	44.90	138.10	67.15
Employers' joint OHS unit (N = 470)	72.95	37.80	107.30	60.70
Municipal health care centre (N = 1,603)	43.35	35.25	27.10	43.20
Private medical centre (N = 2,422)	62.90	41.55	120.40	78.25
Other (N = 35)	69.60	46.10	125.50	74.90

significant after adjustment for the various confounders. The results of the models with other key ratios for economic performance were similar to operating margin and also not significant (data not shown).

Costs of curative medical and preventive services

Operating profit in 1999 was not related to the costs for curative medical services nor to costs for preventive OHS per employee in 2001 (table 4). The results were similarly non-significant for the other key rations for profitability, solidity and liquidity (data not shown). There were differences between industries, regions and OHS providers.

The costs of preventive OHS were higher in companies with higher turnover and for companies in the industries 'manufacturing and mining', 'electricity, gas and water

supply', 'construction', 'real estate, renting and business activities', 'health and social work' and 'other community, social and personal service activities' compared to 'wholesale and retail trade'.

Discussion

The preceding economic performance two years earlier was not statistically related to expenditure on preventive or curative medical OH services in 2001. Economic performance was measured by the annual profitability of a firm, the accumulated wealth that represents the performance of a company through its whole history and liquidity.

The strength of our study was that the data we used was of good quality and covered a vast subgroup representative

Table 3: Logistic regression on a company's economic performance in 1999 for a company's probability to apply for reimbursement in 2001 (N = 6,155).

	Variables in the model	OR	95% Confidence interval
Economic Performance Confounders	Operating margin in 1999 (%)	1.00	0.99 to 1.01
	Log turnover in 2001 (€)	2.34	2.16 to 2.53
	Age of company (years)	1.03	1.02 to 1.03
	Share of blue-collar workers in 2001 (%)	0.71	0.50 to 1.01
Industry (categorical)	Reference: Wholesale and retail trade		
	Agriculture, hunting and forestry, fishing	1.33	0.63 to 2.84
	Mining and quarrying, manufacturing	2.32	1.84 to 2.92
	Electricity, gas, and water supply	3.45	1.13 to 10.54
	Construction	1.48	1.16 to 1.89
	Hotels and restaurants	1.65	1.16 to 2.34
	Transport, storage and communication	1.43	1.03 to 1.99
	Real estate, renting, and business	2.89	2.19 to 3.80
	Education	1.47	0.29 to 7.39
	Health and social work	3.14	1.58 to 6.24
	Community, social and personal service activities	2.70	1.50 to 4.84
Region (categorical)	Reference: Uusimaa (region around the capital city)		
	South	1.33	1.12 to 1.58
	East	1.32	1.00 to 1.74
	Central	1.12	0.88 to 1.42
	North	1.07	0.81 to 1.41
	Åland	0.36	0.15 to 0.85
Municipality (categorical)	Reference: Rural		
	Urban	2.26	1.82 to 2.80
	Semi-urban	1.33	1.05 to 1.70

Pseudo R^2 = 0.15

Table 4: Regression models on company's economic performance for costs of curative medical services and prevention (log euros per employee) in 2001 (N = 4,958).

Variables in the model	Curative medical services, euros per employee (log)		Prevention, euros per employee (log)	
	Coefficient	95% Confidence interval	Coefficient	95% Confidence interval
Constant	0.66	-0.00 to 1.33	2.57	2.22 to 2.93
Operating profit in 1999	-0.001	-0.01 to 0.00	-0.001	-0.00 to 0.00
Age of company	0.00	-0.00 to 0.00	0.00	-0.00 to 0.00
Log turnover in 2001	0.20	0.17 to 0.21	0.10	0.08 to 0.11
Blue-collar workers % in 2001	-0.31	-0.50 to -0.12	0.05	-0.05 to 0.15
Provider model				
Ref. company's own OHS	0		0	
Joint OHS unit	0.02	-0.17 to 0.21	-0.06	-0.16 to 0.04
Municipal OHS	-2.32	-2.49 to -2.15	-0.75	-0.84 to -0.66
Private medical centre	0.02	-0.14 to 0.17	-0.23	-0.31 to -0.14
Other provider	0.18	-0.33 to 0.68	-0.23	-0.50 to 0.04
Industry				
Ref.: Wholesale and retail trade	0		0	
Agriculture, hunting and forestry, fishing	-0.87	-1.44 to -0.31	0.16	-0.14 to 0.46
Mining and quarrying, manufacturing	0.09	-0.04 to 0.22	0.38	0.31 to 0.45
Electricity, gas and water supply	0.32	-0.05 to 0.69	0.38	0.18 to 0.58
Construction	-0.33	-0.48 to -0.18	0.32	0.24 to 0.40
Hotels and restaurants	0.07	-0.17 to 0.31	0.02	-0.11 to 0.15
Transport, storage and communication	-0.18	-0.38 to 0.02	0.02	-0.08 to 0.13
Real estate, renting and business activities	0.36	0.21 to 0.52	0.24	0.16 to 0.32
Education	0.44	-0.55 to 1.44	0.29	-0.24 to 0.83
Health and social work	0.20	-0.18 to 0.59	0.25	0.05 to 0.46
Other community, social and personal service activities	0.49	0.16 to 0.82	0.25	0.08 to 0.43
Ref.: Wholesale and retail trade				
Region				
Reference Uusimaa	0		0	
South	0.18	0.08 to 0.28	-0.11	-0.16 to -0.05
East	-0.14	-0.31 to 0.02	-0.11	-0.20 to -0.03
Central	-0.09	-0.24 to 0.06	-0.18	-0.26 to -0.10
North	-0.05	-0.22 to 0.12	0.20	0.10 to 0.29
Åland	-0.27	-0.89 to 0.35	0.22	-0.11 to 0.55
Municipality				
Reference rural	0		0	
Urban	0.82	0.68 to 0.97	-0.09	-0.16 to -0.01
Semi-urban	0.51	0.35 to 0.68	-0.10	-0.19 to -0.01
Adjusted R^2	0.46		0.19	
Reset F(3, 4955)	27.28	0.0000	0.47	0.7062

of Finnish companies. We were the first ones to be able to combine financial statements and OHS data for a company. In addition, we were able to take into account various confounders that affect both the economic performance and the OHS expenditure of a company. Exclusion criteria for continuous business and having more than 10 employees might bias the results into the direction of apparently diminishing the impact of economic performance on a company's OHS expenditure. Entering and exiting companies and companies of small size might be in a more unfavourable financial situation.

Almost one fifth of the companies did not apply for reimbursement although preventive OHS is compulsory for all of them. This could be due to the following reasons. First, the company might not have obeyed the law, and did not organize OHS. This, however, is quite rare as Finnish employers do. The coverage among employees is one of the highest in the world, about 90% [14]. Only small enterprises with less than 20 employees do not always have a contract with a provider. Secondly, in small companies, it is possible to have years with no need for OHS activities, and therefore without costs. And sometimes

Table 5: Definitions for key ratios of economic performance

Profitability	
Operating margin %	Company's earnings that is left over after paying for variable costs of production divided by net sales.
Operating profit %	Earnings before interest and taxes (EBIT) divided by net sales.
Net result %	(Total revenues -- total expenses) divided by net sales = tells if a company has earned or lost money in an accounting period with its business.
Total result %	Net result + extraordinary incomes -- extraordinary expenses divided by net sales
Profit/loss for the accounting period %	
	The profit/loss result after the company has paid the taxes divided by net sales.
Solidity	
Return on Capital Assets %	Tells how profitable the company is relative to its total assets. = Net income/total assets
Return on investment %	Evaluates the efficiency of an investment = (gain from investment -- cost of investment)/cost of investment.
Return on equity %	Tells how much profit is made relative to the owners investment in the company = Net income/shareholders equity
Relative indebtedness %	Company's liabilities divided by its turnover. Less than 40%: Good 40--80%: Satisfactory More than 80%: Poor
Equity ratio %	The percentage of equities from the balance sheet Over 40%: Good 20-40%: Satisfactory Less than 20%: Poor
Liquidity	
Quick ratio	Company's ability to meet its obligations. Over 1: Good 0.5-1: Satisfactory Less than 0.5: Poor
Current ratio	Company's ability to meet short term debt obligations. Over 2: Good 1-2: Satisfactory less than 1 poor

companies just do not apply for reimbursement, as the costs of OHS might be low and filling in the application might constitute a more significant expenditure.

Our results differ from those in safety studies [4,9,15] where a firms' investment in safety is affected by economic success, at least in firms performing most poorly. A difference with safety measures is that OHS are of a more stable nature. Employees continue to use the services and providers continue to provide the services apparently irrespective of a company's economic performance. In addition, in occupational health services, like in general in health care, information asymmetry exists between the provider and both the payer (employer) and the user (employee). Therefore, the employer has to use the expertise of the provider in deciding upon the services. This leaves less space for the company to decide on the contents and the costs of OHS. Moreover, the total costs are about 0.1% of a company's turnover. This means that the expenditure on OHS has only a minor impact on a company's finances. This was also confirmed in our article based on the same data [16]. Company's investment in

preventive OHS did not have a positive impact on company's economic performance.

Although the economic performance of a company did not affect the amount of money spent per employee in curative medical services and prevention in a particular company, there were differences between regions, industries and OHS providers. The OHS system is not entirely successful in optimal allocation of resources according to needs. Expenditure on prevention is not the highest in the riskiest industries [17,18] and white-collar workers benefit more in terms of free use of curative medical services [19]. In addition, regional differences are connected to the supply of the OHS services.

Conclusion
Expenditure on OHS seems to be independent of a company's economic performance in Finland. Legislation obligating the employers and the reimbursement system both contribute to this.

Competing interests
The authors declare that they have no competing interests.

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Authors' contributions
EK and HV planned the study. AK carried out the analysis under supervision by HV and EK. EK drafted the manuscript, and the other authors have read and approved it.

Appendix 1
Definitions for key ratios of economic performance 5.

Additional material

Additional file 1
Companies in the study by number of employees and industry in 2001. The size and industry distribution (number of firms, %) of the companies included in the study.
Click here for file
[http://www.biomedcentral.com/content/supplementary/1472-6963-9-156-S1.doc]

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Pre-publication history
The pre-publication history for this paper can be accessed here:

http://www.biomedcentral.com/1472-6963/9/156/prepub

Study 3

Public health care providers and market competition: the case of Finnish occupational health services

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Abstract

Background As reforms in publicly funded health systems rely heavily on competition, it is important to know if and how public providers react to competition. In many European countries, it is empirically difficult to study public providers in different markets, but in Finnish occupational health services, both public and private for-profit and non-profit providers co-exist. We studied possible differences in public providers' performance (price, intensity of services, service mix—curative medical services/prevention, productivity and revenues) according to the competitiveness of the market.

Materials and methods The Finnish Institute of Occupational Health (FIOH) collected data on clients, services and personnel for 1992, 1995, 1997, 2000 and 2004 from occupational health services (OHS) providers. Employers defray the costs of OHS and apply for reimbursement from the Social Insurance Institution (SII). The SII data was merged with FIOH's questionnaire. The unbalanced panel consisted of about 230 public providers, totalling 1,164 observations. Local markets were constructed from several municipalities based on commuting practices and regional collaboration. Competitiveness of the market was measured by the number of providers and by the Herfindahl index. The effect of competition was studied by ordinary least square regression analysis and panel models.

Results The more competitive the environment was for a public provider the higher were intensity, productivity and the share of medical care. Fixed panel models showed that these differences were not due to differences and changes in the competitiveness of the market. Instead, in more competitive markets public providers had higher unit prices and higher revenues.

Keywords Market competition · Public provider · Performance · Productivity · Intensity · Price

JEL Classification I11 · L11 · L25

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Introduction

Product market competition plays a significant role in the policy recommendations of economists. The competitive market is thought to be superior to other market arrangements because it allocates scarce resources efficiently. Moreover, it is often believed that product market competition also improves quality and lowers unit costs [1]. Public production, on the other hand, is considered more of a policy instrument, introduced only if the private market fails to allocate scarce resources optimally.

Competitive market arrangements have also been introduced to health care in countries where health services have traditionally been produced by the public sector. The purchaser–provider split and the greater involvement of the private sector are examples of these changes in the UK's National Health Service [2]. Competition has also been introduced as a stimulus to efficiency in other

publicly funded health care systems, such as those of Sweden, Finland, the Netherlands, Germany, Italy and New Zealand [3].

As public providers differ from private profit-maximizing firms, the fundamental question is whether public producers react to competition and, if so, is the response similar to that observed in private markets. Results from the US health care system show that public providers react to market competition, and that their performance is more dependent on other hospital and market characteristics than ownership [4, 5]. However, less is known about the impact of competition on public health care providers in countries where health care is produced mainly in the public sector. Therefore, it is interesting to study public providers in different market settings. In this study, the behaviour of the public provider is modelled as responsive to the market. In addition, if ownership is interpreted as differences in incentives for the providers, it could be that public providers in non-US contexts react differently to competition.

In most countries it is difficult to study how market circumstances affect the performance of the public provider. It is common to have one dominant way of organizing the production of health care services, either public or private, or they may each serve different populations (client segments). Finnish occupational health services provide the opportunity to study how public providers in different market conditions differ (or not) with respect to quality, and the mixture of services, prices, revenues and productivity. In Finland, occupational health services (OHS) are provided mainly by private non-profit or for-profit providers. Municipalities are in charge of organizing primary health care, and this obligation also includes the provision of OHS within its region. This was set to guarantee that OHS would be available for employers in the whole country. The public provider produces the same services as the private provider. Geographically, market structure for OHS varies from public monopolies to regions with many private as well as public providers. Until 1995, the prices in municipal health centers were set by the State Council, whereas private providers were allowed to set their prices freely. Abolishment of price regulation gave public providers the ability to influence their revenue, and therefore also their resources, which had been scant compared to those of private providers.

We studied possible differences in public providers' performance (price, intensity of services, productivity and revenues) according to the market environment, in a panel setting that covered the years 1992, 1995, 1997, 2000 and 2004. In addition, we studied whether the market environment affected the service mix (curative medical and preventive services).

Markets, incentives and public providers

It is well known in economics that market structure affects the price of a product. A monopoly firm has the highest price, a firm in a competitive market has the lowest price, and oligopolistic firms are somewhere in between [6]. Quality is not an issue, because the product is assumed to be homogenous.

The impact that market competition has on a provider can be described by the principal agent relationship. Competition sharpens incentives and therefore improves the performance of the provider. It works through four channels: managers, customers, employees and the financial market [1, 7]. The more firms there are, and therefore managers, the more opportunity the owners have to compare the performance of managers. Increased competition can also influence customers' demand; both its elasticity and amount. Competition can make demand more elastic, which in turn makes the owners sharpen incentives for managers (which leads to improved performance). Nickell [8] examined a theory for the effect of product market competition on employees in a union bargaining framework, and showed that increased competition in the product market improved employees' effort. The fourth channel for competition to improve performance is the financial market. For private providers, the dependency on external funding creates financial pressure, especially if debt service payments are high. Managers are then motivated to try their best to avoid the consequences of bankruptcy and ruining their personal career. Competition increases the risk of bankruptcy, which is worse for managers than for owners (limited liability) [7]. As Hart phrased it: "…competition is a source of discipline: that is, that it reduces the amount of slack in the system due to individuals' not minimizing costs or being on their production possibility frontiers" [9].

Based on this, competition in the market is thought to increase productivity and lower unit cost, which in turn leads to lower prices. The results concern homogenous products. Property rights theorists [10] state that for-profit firms have strong incentives to invest in innovations, which would imply that competition increases quality. In health care, quality is (or at least some attributes of it) non-contractible. Once the incentives for cost-controlling are strong for for-profit providers, the impact competition might have on quality is ambiguous [11].

The predictions of market competition are based on well-informed, utility-maximizing consumers and profit-maximizing providers. Health care providers have also been described as minding patient benefits. In their theoretical comparison between public, for-profit and non-profit

health care organizations, Eggleston and Zeckhauser [12] concluded that public providers resemble private for-profit providers if the environment is competitive (the 'primacy of competition versus ownership' argument [13]) although their objectives differ.

In addition, it is stated that public organizations in general differ from firms. They have different objectives to for-profit firms, such as broad social goals, or the lack of precise goals [11]. Their financial constraints are different: public providers are more secured and backed up by their principal's ability to raise taxes if funds are needed, and the principal may be unable to commit to hard budget constraints [14]. Segal [15] stated that budget constraints can be hardened if competition exists. We believe that market competition will have an impact on public providers via the markets for managers, purchasers, clients, and health care personnel.

The empirical literature on both competition and ownership is mainly from the US. There is extensive evidence that higher market concentration is connected to higher prices [16–18]. Empirical studies have offered conflicting results regarding the effect of ownership on quality and on the provider's economic performance. This mixed evidence has been studied recently by Eggleston et al. [5] and Shen et al. [4], who both applied meta-analytic methods to literature existing since 1990 on hospital ownership and performance. Eggleston et al. [5] studied quality (mortality and other adverse events) and found that the majority of the studies did not find a statistically significant difference between non-profit and for-profit hospitals.

Shen et al. [4] studied the effect of ownership on the financial performance of hospitals (cost, revenue, profit margin, and both cost and technical efficiency). Ownership appeared to play a much less important role in influencing hospital performance than other hospital characteristics. Studies that compared revenues all found that either for-profit providers earn greater revenue and higher profits or that there is no difference between for-profit and non-profit providers. However, the conventional wisdom that for-profit hospitals operate more efficiently (i.e., at lower cost) was not consistently supported in this review [4].

In the UK, market circumstances have been described as "competition created by policy" by Propper et al. [19]. The outcome of competition has been an improved responsiveness on the part of the NHS, measured by waiting lists and waiting times [2]. Propper et al. [19, 20] found that quality is lower in a more competitive environment: the death rates from emergency admissions for acute myocardial infarction (AMI) were higher in areas subject to competition than in those which were not.

Materials and methods

Finnish occupational health services

In Finland, employers are obliged to organize preventive OHS for their employees. Employers may choose whether they produce the services themselves (employers' own units and jointly owned units; 'non-profit') or buy the services from either municipal health care centers ('public') or private medical centers ('for-profit'). Employers defray the costs of occupational services and can apply for reimbursement from the Social Insurance Institution (SII). Although they receive reimbursement—60% for preventive and 50% for curative medical services—the employer is nonetheless left with a considerable part of the costs. Thus the competition among providers is "buyer driven". The total costs of organizing OHS were € 425 million in 2005, and the SII reimbursed € 188 million to employers. The average cost was € 262 per employee in 2005 [21].

According to a population survey conducted in 2006, two out of three employees had undergone an occupational health examination in the last 3 years, and occupational health personnel had assessed around half of their workplaces in the last 3 years. Although organizing curative medical services is voluntary for employers, over 90% of employees can obtain GP level services from their OHS unit. About half of the primary care level GP visits of these employees take place within OHS [22].

Figure 1 shows the shares of employers, employees and OHS units by different provider type in 2004.

There are several features that differentiate municipal OHS units from its private competitors. First, the municipality has to provide the services according to the Act on public health services. Although the public OHS provider charges employers for the services, and has revenues, the soft budget syndrome might still affect a budget unit of the municipal health care center. On the other hand, public OHS providers are not allowed to keep the profit. Until 1995, the prices for public providers were set by the State Council; private providers were allowed to set prices themselves. Although the public provider had regulated prices, the justification was not to avoid excess prices but to set prices for public providers who had no experience in price-setting. They also had no budgeting or accounting practices to support cost calculations. The reason for abolishing the regulation was that municipalities complained that prices did not cover costs, and it was thought that all providers should be treated the same way. Public providers were supposed to set the prices according to the production costs without subsidizing them [24].

Finland suffered a serious recession during the early 1990s, which lead to the tightening of municipal budgets. New governance structures were introduced; for instance,

Fig. 1 Shares of enterprises (employers, purchasers), employees (clients) and occupational health services (OHS) units by provider type in 2004 [23]

Employers 64%
Employees 37%
OHS units 34%

Employers 1%
Employees 18%
OHS units 31%

Employers 3%
Employees 6%
OHS units 7%

Employers 32%
Employees 39%
OHS units 28%
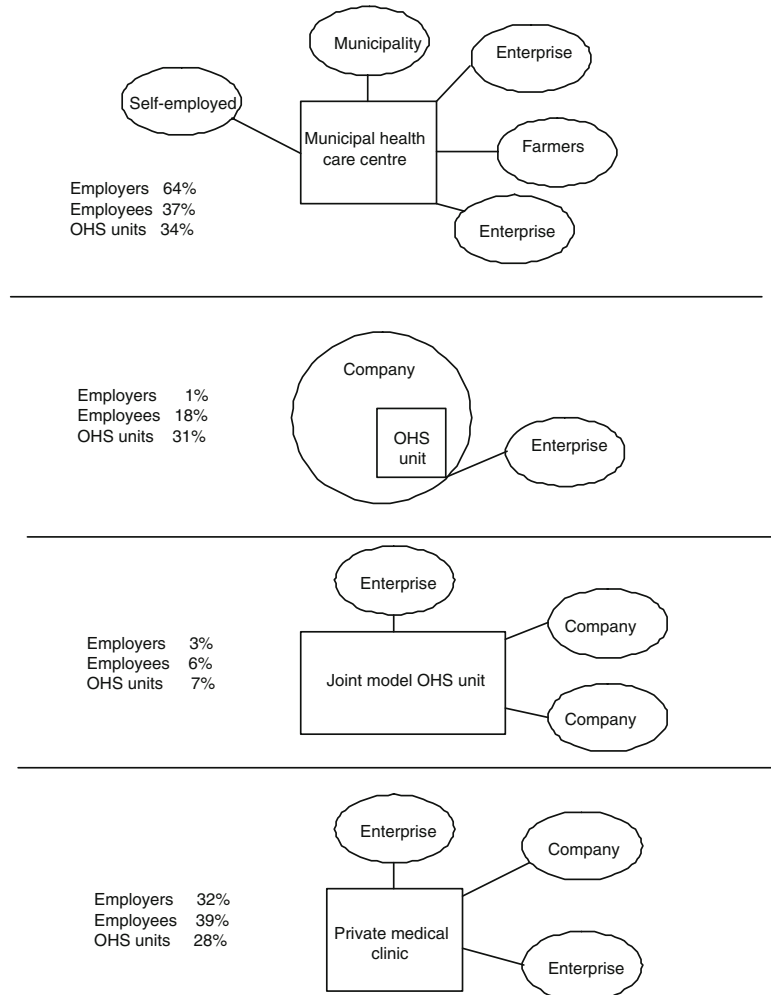
instead of separately controlling costs and revenues, steering concerned net profit/loss. This change in municipalities, followed by the abolishment of price regulation, enabled OHS units to make strategic decisions more easily.

Data construction

The Finnish Institute of Occupational Health (FIOH) sent a questionnaire to all OHS providers and collected data on clients, services and occupational health (OH) professionals from the providers for the years 1992, 1995, 1997, 2000 and 2004. The questionnaire was sent in the spring of each following year. The response rate was high (over 90% per survey) but not all providers provided information on all items in the questionnaire. An employer-based register of the provider, contents and

costs of OHS exists as a result of the reimbursement system. This employer-based data was combined per provider code at the SII, and merged with FIOH's data using the provider's name and address.

The merged data contains about 230 public providers, and 1,164 observations (unbalanced panel).

Due to the reimbursement system, records on services provided by the OHS units are well standardized. The FIOH questionnaire collected the number of hours of workplace activities (workplace surveillance, meetings, lectures, groups and counselling) and the number of health examinations and medical visits separately for physicians, nurses, physiotherapists and psychologists over a whole year.

The service mix varies between OHS units. Therefore, we constructed an indicator—cost-weighted activity

(CWA)[1]—to represent the output. All services were converted into minutes and summarized by OH professional group. The minutes of each OH professional group was then weighted by its wage, proportioned to physicians' wage in 2004. The wages are national averages provided by the Commission for Local Authority Employers. Cost-weighted output is the sum of the wage-adjusted output of all OH professional groups. In addition, we calculated curative medical services' share of the CWA output.

We calculated an indicator for productivity from the CWA output indicator. OH professionals' working hours per week were collected as a monthly average in the spring of the year the survey was conducted (March or April). Working hours were weighted by each group's wage proportioned to physicians' wages in 2004, then summed up into one figure measuring personnel resources. The productivity measure is the ratio of CWA output per personnel resources.

We use the intensity of OHS as an indicator for quality. Intensity is measured as CWA output per employee (client). It represents process quality perceived by the employee (client). Quality is higher if there are more services per client, or if a more qualified person provides the service, e.g., a physician instead of a nurse. The number of employees and employers was calculated from 31 December of the respective year.

At the SII, employers' reimbursement applications were summed up per provider. The sum of the employers' expenditure equals the total of the provider's revenue. Nominal values were converted to 2004 real values by the health care cost index. Unit price was calculated by dividing the revenue of a provider by its CWA output. The price can differ if there are differences in production costs, or if intensity differs due to different personnel structure or to different amounts/prices for laboratory tests and imaging services. We did not have sufficiently detailed information on the number and costs of laboratory tests and imaging services, and they are not included in the CWA output measure, but employers' expenditure on these costs is included in the revenue measure. The expenditure on laboratory tests and imaging services was about 26% of the OHS revenues in public OHS units in 2005 [21].

Public providers only serve employers located in their own municipality. Nevertheless, we defined the market as a geographical area consisting of several municipalities. Many Finnish municipalities are so small that they have no providers. On the other hand, employers can and do buy OHS from private providers across municipality boundaries. Statistics Finland provides several regional definitions for grouping municipalities. We chose regions that are based on commuting and municipalities' close collaboration in regional development. We did not take other substituting health care services into account in our market definition [25]. Every provider was located to a municipality based on its zip-code. There were 428 municipalities in 2004, which formed 76 geographical regions (Åland, with 16 municipalities, is not included in the study). Competition was measured by (1) the number of providers in the region, and (2) market concentration as the Herfindahl index (HI)—the sum of squares of the market shares, 0 = minimum concentration, 1 = maximum concentration [6]. We calculated the HI for the market shares of the CWA output, revenues, and the number of employees (clients). The correlations for these different HIs were high, over 0.9. Throughout the study, we used the index based on the number of employees. The higher the number of providers, or the lower the HI, the more competitive the local market.

The scale and scope of services might affect the output of the provider and therefore many other indicators in our study. Rosenman and Friesner [26] compared single speciality and multi speciality groups in their study, and found that scope inefficiencies existed. Based on previous literature, this can be caused by different attitudes, objectives and patterns towards group practice, using staff differently and therefore causing a co-ordination problem. Members of the practice may compete, but at the same time refer patients to each other. Scope inefficiencies have also been found in Health Maintenance Organizations (HMOs) providing both insurance and health services [27]. On the other hand, for small scale providers such as nursing homes, scope can help in achieving economies of scale [28]. In this study, the professions available in the unit describe the scope of the provider. Scope was measured using a dummy: 0 = OH professionals consisted of nurses and physicians only; 1 = nurses, physicians, and also either a physiotherapist or psychologist; or 2 = all four professional groups. Scale was measured by the number of OH professionals. Rosenman and Friesner [26] found economies of scale in both primary care and speciality care practices. Although the empirical evidence in hospitals has been conflicting, higher quality studies seem to support a finding of constant returns or diseconomies of scale [29].

Table 1 presents the formulae for the performance and market indicators.

The data collected by the questionnaire concerns three different timeframes: the number of employees and employers for 1 day, occupational health professionals for a month, and the number of services provided per annum. Therefore we examined the studentized residuals that

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[1] The cost-weighted activity index (CWAI) has been used to measure overall NHS hospital efficiency. Many of the problems and flaws connected to this measure reported by Oliver [2] are less serious in the more homogenous Finnish OHS.

Table 1 Indicators for occupational health services (OHS) and competition

Indicator	Formula	Keys
CWA output	$\text{Output}_{pt} = \sum_i w_i \sum_j q_{ijpt} \min_{ij}$	j = workplace visits, meetings, lectures, health examinations, medical visits
		i = physician, nurse, physiotherapist, psychologist
		$\min_{ij}$ = time that a professional group i uses in producing service j
		q_{ijpt} = the number of services j, provided by professional group i, in provider p, in year t
		w_i = weight for each professional group i, the average salary of a professional group i proportioned to physicians' salary in the municipal sector in 2004
		p = provider id
		t = 1992, 1995, 1997, 2000, 2004
Intensity	$\text{Intensity}_{pt} = \text{Output}_{pt}/\text{number of employees}_{pt}(\text{clients})$	p, t as above
Productivity	$\text{Prod}_{pt} = \text{Output}_{pt}/\sum_i w_i \text{hours}_{ipt}$	hours_{ipt} = weekly working hours of a professional group i, in year t
		i, t, p and w_i as above
Share of medical care	$\text{Med}_{pt} = \sum_i w_i q \text{med}_{ipt} \text{medmin}_i/\text{Output}_{pt}$	$q\text{med}_i$ = number of curative medical visits provided by professional group i
		medmin_i = time that professional group i uses to produce one curative medical visit
		i, t, p and w_i as above
Revenue	$\text{Revenue}_{pt} = \sum_e \text{TC}_{pet}$	TC_{pet} = total expenditure on OHS for employer e, provided by provider p, in year t
		p, t as above
		Revenue in 2004 real value
Unit price	$\text{Price}_{pt} = \text{Revenue}_{pt}/\text{Output}_{pt}$	
Number of providers within a region	$\text{Providers}_{rt} = \text{Count}(p_{rt})$	p_{rt} = provider id in region r, year t
		r = geographically defined local market
		t as above
Herfindahl index	$\text{HI}_{rt} = \sum_p s_{prt}^2$	s_{prt} = provider p's market share from the number of employees (clients) in region r, year t, range for HI_{rt} 0–1
		r, t as above

CWA cost-weighted activity

exceed $+2$ or -2 for identifying outliers, and recoded the indicator values missing for the providers whose outlier values were due to the mismatch of timing.

Methods

We concentrated on public providers that cannot exit the market. Public providers entered the market in the 1970s when public provision was made compulsory for municipal health care centers. Municipalities do not buy or sell OHS units. Therefore we regarded the market as an exogenous variable.

We started with ordinary least square (OLS) regression analysis and ran models separately for each year, and for the pooled data (with dummies for the years). We tested the model specification using the Ramsey RESET test, based on which we log transformed the following variables: number of OH professionals and providers, intensity, productivity, unit price and revenue. Previous studies have

shown that the relation between competition and, e.g., productivity might not be linear. Therefore, we also ran models with a squared number of providers, but their performance was worse. The RESET-test still showed that there were problems in the model specification in some cases. It was more of a problem in models with pooled data and number of providers as an independent variable. We examined the variance inflation factors (VIF) for signs of multicollinearity, but found none. The Breusch–Pagan/Cook–Weisberg test showed heteroskedasticity in the models for intensity, productivity and unit price with pooled data, we took this into account and applied robust standard errors for these models.

With the pooled data we examined the interaction of time (year dummy) and market variables. Those models had multicollinearity problems. None of the coefficients for interaction variables was statistically significant. We also tested if they were different from zero, or different from each other, and they were not.

We had planned to study the effect of competition by fixed effects models, which are viewed as appropriate tools for eliminating bias arising from time-invariant unobserved factors [4, 30]. Statistically, fixed effects are always a reasonable thing to do with panel data (they always give consistent results) but they may not be the most efficient model to run. The Hausman test checks a more efficient model against a less efficient but consistent model to make sure that the more efficient model also gives consistent results. Therefore, we estimated both panel models:

(1)   fixed effects model:

$$\text{indicator}_{pt} = (\alpha + \mu_p) + \beta_1\text{competition}_{rt} + \beta_2\text{scale}_{pt} \\ + \beta_3\text{dummyscope}_{pt} + \beta_4\text{dummy}_t + v_{pt},$$

(2)   random effects model:

$$\text{indicator}_{pt} = \alpha + \beta_1\text{competition}_{rt} + \beta_2\text{scale}_{pt} \\ + \beta_3\text{dummyscope}_{pt} + \beta_4\text{dummy}_t \\ + (\mu_p + v_{pt}),$$

where $v_{pt} \sim \text{IID}(0,\sigma_v)$. In fixed effects model μ_p is allowed to correlate to other regressors. In a random effects model it is a part of the error term and therefore should not correlate with the other regressors and v_{pt}. In addition, in the random effects model it is assumed that $\mu_p \sim \text{IID}(0,\sigma_\mu)$. Index r refers to the regional market.

The variables in the models are as follows:

indicator$_{pt}$	log intensity$_{pt}$ (intensity), log prod$_{pt}$ (productivity), med$_{pt}$ (share of medical care), logprice$_{pt}$ (unit price) or log revenue$_{pt}$ each in its turn
competition$_{rt}$	either log providers$_{rt}$ (number of providers in the region) or HI$_{rt}$ (Herfindahl index based on the number of employees for the region)
scale$_{pt}$	the number of OH professionals (log)
dummyscope$_{pt}$ was measured using the dummy:	0 = OHS personnel consisted of nurses and physicians only, 1 = nurses, physicians, and either a physiotherapist or a psychologist, or 2 = all four personnel groups
dummy$_t$	a dummy for the year, 1992=0

In the fixed effects model the intercept varies across public providers. A random effects model assumes the same intercepts and slopes. The difference among groups lies in the variance of the error term. We compared both models with the pooled OLS. For fixed models the null hypothesis is that all $\mu_p = 0$. This hypothesis is tested by the F test, which is based on loss of goodness-of-fit, Stata .xtreg command by default conducts the F test. In all fixed models the null hypothesis was rejected, so the fixed model is better than the pooled OLS.

For random effects model the null hypothesis is that the cross-sectional variance components are zero, H_0: $\sigma_\mu = 0$. This hypothesis is tested by the Breusch–Pagan Lagrange multiplier (LM) test which follows chi-squared distribution with one degree of freedom. For all random effects models the hypothesis was rejected, i.e., the random model is also better than pooled OLS [31].

Year dummies control for time trends and shocks common to all providers. We did not use a lagged variable of the scale in estimating productivity, although one could argue that adjustment to changes in resources would take some time. The resources did not change much within a unit, and the lagged variable would have been from a time period 2–3 years back. Service production adjusts more quickly [1].

We will present both pooled OLS and panel model results. We used STATA Version 9 for the analysis.

Hypotheses

As described in the chapter "Markets, incentives and public providers" of this article, competition increases productivity, but might have an ambiguous effect on quality. In our study, intensity represents quality assessed by employees (clients). For them, the access to care is an important quality characteristic, and the better the access, the more services are used. Prevention is more stable, and intensity can be raised by increasing the amount of curative medical services. Therefore, we expected competition to increase intensity and the share of curative medical services. Increasing intensity will increase provider's revenues. Because competition increases productivity, it might lead to lower unit prices. On the other hand, increasing intensity might lead to higher unit prices. Hence we had no expectations regarding the effect competition might have on unit price.

Previous empirical studies have shown that diseconomies of scope and scale exist. We expected both scope and scale to increase intensity.

Results

The number of all OHS providers decreased during the study period from 1,006 to 621, mostly among non-profit providers (decrease 57%), where outsourcing has taken place, but also among for-profit providers (decrease 31%), where merging affects the number of providers. The number of public providers remained the same. Although the overall number of providers diminished, the concentration of the market has not changed (Table 2). Most regions can be considered competitive, but the local markets for OHS differed greatly.

Table 2 Regional market competition measured by the number of providers and Herfindahl index (HI), mean and standard deviation, $N = 76$

	Number of providers		HI (employees/clients)	
	Mean	Standard deviation	Mean	Standard deviation
1992	13.8	29.7	0.36	0.24
1995	11.2	21.9	0.35	0.26
1997	10.3	18.9	0.34	0.24
2000	10.1	19.2	0.34	0.24
2004	8.6	14.7	0.35	0.23

Table 3 shows that the public providers in different markets also differed in other respects. In 2004 there was a total of 230 public providers that we classified into four groups according the number of providers in the region. The last row in Table 3 illustrates how the indicators for public providers developed during the study period. Revenues and unit price (real value) increased most during the study period—they more than doubled. Intensity and the share of medical care, personnel resources and output increased at the same rate, all by about 60%. Productivity also grew, but the increase was modest compared to other indicators. The number of clients fell by 5%. The data consisted of 1,164 observations, so the last row also reveals the magnitude of missing data.

The scope of the services changed during the study period. In 1992, one-third of the units had only physicians and nurses; less than one-tenth had both physiotherapists and psychologists available. In 2004, all four professions belonged to the staff in over 40% of the public units, and about 10% had only a physician-nurse team.

We grouped the indicators into two groups: those related to output—intensity, productivity and the share of medical care (Tables 4, 5)—and to monetary indicators—unit price and revenue (Tables 5, 6). For both groups, the first table presents the results for the model where the number of providers in the region represents competition, and in the second table the HI has its turn. For each indicator we present the results for the pooled OLS and panel model.

Pooled OLS models revealed that there was an association between market competitiveness and public providers output: the more providers or the less concentrated the market, the higher the intensity, productivity and the share of medical care. Panel models that take into account unobserved heterogeneity showed that the differences were not due to differences or changes in the competitiveness of the market.

Scale had a positive and statistically significant impact on intensity and the share of medical care in both model versions. The association between competitiveness and productivity changed, and was negative and statistically

Table 3 Descriptives for public OHS providers according to the number of providers in the region in 2004, mean and standard deviation

Number of providers (N = number of public providers)	Intensity	Productivity	Share of medical care	Unit price, €	Revenue, €	CWA output	OHS personnel resources	Number of clients (employees)	Share of units with all four professionals (scope), %
1-4 (N = 64)	35.6 (18.7)	13.5 (8.4)	36 (26)	2.13 (1.58)	135,600 (167,000)	86,400 (89,800)	6,500 (7,100)	2,100 (1,600)	38
5-9 (N = 80)	43.9 (22.7)	13.4 (7.1)	42 (25)	1.96 (1.05)	245,500 (288,700)	150,800 (176,700)	10,700 (11,600)	2,800 (2,300)	40
10-19 (N = 55)	48.4 (23.0)	16.4 (13.7)	51 (28)	2.03 (1.35)	393,000 (836,000)	241,200 (455,200)	15,800 (34,800)	3,300 (4,300)	50
>20 (N = 31)	56.5 (24.0)	15.2 (5.5)	53 (24)	2.44 (1.63)	630,600 (797,900)	264,200 (239,300)	19,600 (18,200)	4,900 (4,400)	48
Change 1992–2004, %	64 (N = 956)	10 (N = 922)	61 (N = 970)	113 (N = 951)	184 (N = 1,133)	63 (N = 970)	69 (N = 1,069)	−5 (N = 1,127)	

Table 4 Number of providers and intensity, productivity and share of medical care among Finnish public OHS providers in 1992–2004, pooled ordinary least squares (OLS) and fixed effects panel models

	Intensity (log)		Productivity (log)		Share of medical care (%)	
	Pooled OLS, robust	Fixed effects	Pooled OLS, robust	Fixed effects	Pooled OLS	Fixed effects
Number of providers (log)	0.127 (0.019) ***	−0.010 (0.108)	0.054 (0.017) **	0.146 (0.120)	0.051 (0.007) ***	0.037 (0.042)
Number of OH professionals (log)	0.364 (0.035) ***	0.131 (0.060) *	0.152 (0.033) ***	−0.132 (0.065) *	0.201 (0.016) ***	0.074 (0.023) **
Scope: ref. only nurses and physicians						
Additional physiotherapist or psychologist	−0.113 (0.049) *	−0.096 (0.056)	−0.119 (0.047) *	−0.122 (0.060) *	−0.081 (0.022) ***	−0.071 (0.021) **
All four OH professionals	−0.184 (0.058) **	−0.079 (0.069)	−0.173 (0.052) **	−0.114 (0.075)	−0.139 (0.027) ***	−0.084 (0.026) **
Year: ref. 1992						
1995	0.224 (0.061) ***	0.163 (0.050) **	0.100 (0.055)	0.121 (0.053) *	0.122 (0.026) ***	0.090 (0.019) ***
1997	0.366 (0.056) ***	0.342 (0.053) ***	0.202 (0.055) ***	0.255 (0.056) ***	0.091 (0.026) **	0.090 (0.020) ***
2000	0.482 (0.057) ***	0.458 (0.053) ***	0.358 (0.057) ***	0.413 (0.058) ***	0.126 (0.025) ***	0.125 (0.020) ***
2004	0.450 (0.061) ***	0.460 (0.063) ***	0.084 (0.059)	0.234 (0.067) **	0.137 (0.026) ***	0.158 (0.024) ***
Constant	2.341 (0.078) ***	3.013 (0.282) ***	2.154 (0.071) ***	2.343 (0.315) ***	−0.101 (0.032) **	0.121 (0.109)
R^2	25.0	20.3 within	7.9	10.1 within	22.5	12.3 within
	$F_{(8,940)} = 36.61$; Prob $> F = 0.0000$	$F_{(8,690)} = 21.91$; Prob $> F = 0.0000$	$F_{(8,913)} = 9.95$; Prob $> F = 0.0000$	$F_{(8,664)} = 9.35$; Prob $> F = 0.0000$	$F_{(8,954)} = 35.99$; Prob $> F = 0.0000$	$F_{(8,704)} = 12.38$; Prob $> F = 0.0000$
Number of public providers	949 observations	251	922 observations	250	963 observations	251

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$

Table 5 Concentration and intensity, productivity and share of medical care among Finnish public OHS providers in 1992–2004, pooled OLS and fixed effects panel models

	Intensity (log)		Productivity (log)		Share of medical care (%)	
	Pooled OLS, robust	Fixed effects	Pooled OLS, robust	Fixed effects	Pooled OLS	Fixed effects
HI (number of employees)	−0.593 (0.107) ***	−0.093 (0.349)	−0.315 (0.098) **	−0.092 (0.336)	−0.285 (0.041) ***	−0.210 (0.118)
Number of OH professionals (log)	0.390 (0.035) ***	0.134 (0.061) *	0.162 (0.033) ***	−0.137 (0.066) *	0.211 (0.016) ***	0.078 (0.023) **
Scope: ref. only nurses and physicians						
In addition physiotherapist or psychologist	−0.110 (0.049) *	−0.098 (0.056)	−0.115 (0.047) *	−0.120 (0.060) *	−0.078 (0.023) **	−0.074 (0.021) ***
All four professionals	−0.190 (0.059) **	−0.081 (0.069)	−0.174 (0.052) **	−0.111 (0.075)	−0.140 (0.028) ***	−0.087 (0.026) **
Year: ref. 1992						
1995	0.196 (0.061) **	0.164 (0.048) **	0.087 (0.055)	0.099 (0.050)	0.110 (0.026) ***	0.084 (0.018) ***
1997	0.325 (0.056) ***	0.342 (0.049) ***	0.183 (0.055) **	0.225 (0.051) ***	0.074 (0.026) **	0.079 (0.019) ***
2000	0.437 (0.057) ***	0.459 (0.048) ***	0.338 (0.057) ***	0.379 (0.052) ***	0.108 (0.026) ***	0.114 (0.018) ***
2004	0.393 (0.060) ***	0.463 (0.052) ***	0.061 (0.059)	0.186 (0.055) **	0.115 (0.026) ***	0.145 (0.020) ***
Constant	2.773 (0.071) ***	3.010 (0.119) ***	2.356 (0.065) ***	2.730 (0.121) ***	0.086 (0.031) **	0.263 (0.044) ***
R^2	24.1	20.3 within	8.1	9.9 within	23.0	12.6 within
	$F_{(8,940)} = 36.34$; Prob $> F = 0.0000$	$F_{(8,690)} = 21.92$; Prob $> F = 0.0000$	$F_{(8,913)} = 10.19$; Prob $> F = 0.0000$	$F_{(8,664)} = 9.15$; Prob $> F = 0.0000$	$F_{(8,954)} = 36.84$; Prob $> F = 0.0000$	$F_{(8,704)} = 12.71$; Prob $> F = 0.0000$
Number of public providers	949 observations	251	922 observations	250	963 observations	251

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$

Table 6 Number of providers, unit price and revenue among Finnish public OHS providers in 1992–2004, pooled OLS and panel models

	Unit price (log)		Revenue (log)	
	Pooled OLS, robust	Random effects	Pooled OLS	Fixed effects
Number of providers (log)	0.083 (0.018) ***	0.099 (0.026) ***	0.317 (0.025) ***	0.261 (0.101) *
Number of OH professionals (log)	0.117 (0.037) **	0.098 (0.044) *	1.670 (0.052) ***	0.266 (0.057) ***
Scope: ref. only nurses and physicians				
In addition physiotherapist or psychologist	−0.011 (0.054)	0.017 (0.052)	−0.532 (0.073) ***	−0.059 (0.052)
All four OH professionals	0.010 (0.066)	0.006 (0.065)	−0.750 (0.088) ***	−0.093 (0.065)
Year: ref. 1992				
1995	0.140 (0.062) *	0.122 (0.051) *	0.239 (0.084) **	0.270 (0.048) ***
1997	0.237 (0.061) ***	0.228 (0.052) ***	0.445 (0.084) ***	0.567 (0.049) ***
2000	0.395 (0.062) ***	0.387 (0.051) ***	0.702 (0.083) ***	0.886 (0.049) ***
2004	0.742 (0.063) ***	0.737 (0.054) ***	0.774 (0.087) ***	1.310 (0.059) ***
Constant	−0.559 (0.081) ***	−0.560 (0.090) ***	7.747 (0.104) ***	9.549 (0.264) ***
R^2	20.6	26.9 within	62.9	59.1 within
	$F_{(8,936)} = 32.79$; Prob > F = 0.0000	Wald $\chi^2(8) = 298.41$; Prob > χ^2 = 0.0000	$F_{(8,1084)} = 232.34$; Prob > F = 0.0000	$F_{(8,831)} = 150.38$; Prob > F = 0.0000
Number of public providers	945 obs.	250	1,093 obs.	254

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$

significant in the fixed effects panel model. Multiprofessionalism had an impact on intensity, productivity and the share of medical care consistently in all models. The widening of the scope of services was negatively associated to all three indicators. For intensity, the dummy coefficients were not statistically significant in the fixed effects panel model.

After taking into account competition, scope and scale economies, a time trend still remained. Intensity of services grew constantly during the period 1992–2004. Productivity was clearly on a higher level during 1997 and 2000 compared to 1992. The share of medical care has been growing constantly except for the slowdown in 1997.

All fixed models were better than pooled OLS (xtreg standard F-test). The magnitude of the pooled OLS and fixed effect panel models that accounted for the total variance of intensity and productivity were very similar, except that in the fixed effects panel model for the share of medical care, the goodness-of-fit fell by ten percentage units compared to the pooled OLS.

Tables 6 and 7 present the results for the monetary indicators.

In pooled OLS models the unit price and the revenue of the public provider were higher in the more competitive environment. These results also remained in the panel models, except for the fixed effects panel model for revenue and concentration.

The scale of the public provider increased both unit price and revenue. Scope was negatively associated with the revenue of the public provider in the pooled OLS

model, but it disappeared in the fixed effects panel model. Unit price was not affected by the scope of the services.

Both unit price and revenue had a time trend. They both more than doubled during the study period (Table 3). Prices were regulated until the end of 1994. The first year the providers could set the prices themselves was 1995 and already then the prices rose, but moderately.

Pooled OLS and fixed effects panel models explained a considerable part of the total variance of revenue of the provider. Unit price was the only dependent variable for which the Hausman test recommended the use of a random effects panel model. It also had higher explanatory power than the pooled model.

Discussion

The competitiveness of the market was connected to public providers' performance. The results of pooled OLS models showed that public providers in a more competitive environment had more intensive services, higher productivity and share of medical care. Fixed effects panel models that take into account time-invariant omitted variables reveal that the differences were not due to differences and changes in the regional market structure (number of providers and concentration). The monetary indicators were also connected to market competition: the more providers in the region the higher the unit price and revenue of the public provider. The association between concentration and both unit price and revenue was negative—the higher the

Table 7 Concentration, unit price and revenue among Finnish public OHS providers in 1992–2004, pooled OLS and panel models

	Unit price (log)		Revenue (log)	
	Pooled OLS, robust	Random effects	Pooled OLS	Fixed effects
Herfindahl index (number of employees)	−0.358 (0.100) ***	−0.379 (0.132) **	−1.440 (0.135) ***	−0.502 (0.294)
Number of OH professionals (log)	0.135 (0.037) ***	0.115 (0.044) **	1.734 (0.052) ***	0.266 (0.057) ***
Scope: ref. only nurses and physicians				
In addition physiotherapist or psychologist	−0.008 (0.055)	0.014 (0.052)	−0.525 (0.074) ***	−0.060 (0.052)
All four professionals	0.005 (0.067)	−0.002 (0.065)	−0.760 (0.090) ***	−0.089 (0.065)
Year: ref. 1992				
1995	0.124 (0.063)	0.105 (0.051) *	0.177 (0.086) *	0.229 (0.045) ***
1997	0.211 (0.061) **	0.201 (0.052) ***	0.345 (0.085) ***	0.506 (0.045) ***
2000	0.366 (0.062) ***	0.357 (0.050) ***	0.599 (0.084) ***	0.821 (0.044) ***
2004	0.705 (0.062) ***	0.697 (0.054) ***	0.627 (0.087) ***	1.218 (0.049) ***
Constant	−0.285 (0.080) ***	−0.241 (0.080) **	8.815 (0.100) ***	10.318 (0.105) ***
R^2	20.0	26.6 within	61.8	58.9 within
	$F_{(8,936)} = 31.66$; Prob $> F = 0.0000$	Wald $\chi^2_{(8)} = 290.80$; Prob $> \chi^2 = 0.0000$	$F_{(8,1083)} = 218.94$; Prob $> F = 0.0000$	$F_{(8,830)} = 148.74$; Prob $> F = 0.0000$
Number of public providers	945 observations	250	1,092 observations	254

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$

concentration the lower the unit price and revenue. Contrary to the results for output-related indicators, the association for monetary indicators also remained in panel models (except for concentration and revenue). When a public provider operates in a market with many providers it is more inclined to raise unit price. Although we took into account the scale of the provider there remained an impact for the size of the market (number of providers), which raised the revenue of the public provider. In Finland, public OHS providers seem to react to market conditions by raising their prices, which leads to increased revenues. But the market competition did not affect production decisions, i.e., intensity, productivity and share of medical care.

Most public OHS providers in Finland are small, and economies of scale could be found in the study. Scale increased all indicators: intensity, productivity, share of medical care, unit price and revenue. Opportunities still probably exist to make use of economies of scale—there are plans to merge public providers or collaborate in provision [32], which is in line with the government's policy to push municipalities to form bigger entities to provide health care services.

Taking into account competition and scale of production, scope lowered productivity and share of medical care. The results on productivity are in line with earlier results [26]. Physiotherapists' and psychologists' services are mainly preventive and therefore widening the scope of services decreased a provider's share of medical care.

There was a time trend common to all public providers for all indicators. In the beginning of the 1990s Finland went through a severe recession. This lead to tightening of municipal budgets and increased productivity later during that decade. Productivity growth has slowed down in the twenty-first century. Not all public providers reacted immediately to the abolishment of price regulation, and price rises were moderate in 1995—the first year in which providers were allowed to set their prices themselves.

The panel data we had at our disposal had a high number of observations and covered almost all OHS providers in Finland. It included information from both a survey and an official register, which is shown to give better results in studying performance [11]. Defining the geographical market is always difficult. Here we used regions defined by the Statistics Finland that are based on commuting and regional collaboration, which we suppose are in line with the OHS clientele.

We discuss our results from the following points of view: (1) the way we measured competitiveness of the OHS market, (2) if health care markets in general can be regarded as competitive, and (3) why public providers would react differently to competition.

The number of providers in the region would not be a good measure for competition if the three provider groups (public, for-profit, non-profit) had different client segments and the OHS market resembled monopolistic competition. High search costs can lead to monopolistic competition [33]. Although the three groups have different kind of employers as their clients (Fig. 1) their market shares have changed considerably in the past 10 years [21, 34]. This implies that the segments are not separate. The HI measures concentration, and therefore the existence of market power. A common result of US concentration studies is that

the more concentrated the market, the higher the prices, for both for-profit and other providers. In our study, concentration lowered the unit price. The most concentrated markets consisted of public providers only, and these did not use their monopoly position in price setting. Concentration has also improved productivity in the US, but this might be due to excess capacity that existed before the merging wave took place. Sari [35] found that the association between cost inefficiency and market concentration changes depending on the level of competitiveness in the market: at low levels of concentration, an increase improves efficiency but, after a certain range the increase in concentration causes inefficiencies.

The market for OHS, as in health care in general, deviates from the assumptions of a competitive market [36]. Competition in OHS is not driven by consumer demand—employers decide where to buy services. Public supply does not always adjust to consumer demand. Suppliers might have an impact on demand; many public providers have monopoly power and increasing returns to scale. In addition, asymmetric information and costly searches violate the requirements of perfect competition [37]. If the buyer/user side deviates from the assumptions of the market, the market structure—the number of providers and the HI—may not completely grasp the behavior of the providers [38].

Competition concerns not only the providers—purchasers also have an important role. Dusheiko et al. [18] showed that purchasers were not eager to switch providers, and commissioning concentrated within the NHS. Purchasers need an incentive to do their job well. In the NHS, fundholding practices were willing and able to challenge hospitals [3]. The HMO experiences also support the idea that the purchaser's role matters. In US managed care, HMOs in particular have increased the price sensitivity of shopping since the 1990s. Purchasing decisions have been shifted away from relatively price insensitive consumers towards more price sensitive health plans [39]. Hospitals had lower total margins in markets with higher levels of HMO penetration. Managed care has been shown to also improve efficiency in production [35, 40]. In this data, most of the employers were small (in terms of number of employees) and cannot be regarded as powerful in bargaining for the prices or contents of services. The biggest client—the municipality—being in charge of local administration and the provision of many public services might not have the incentive to look for other providers.

In our study, the public providers differed according the competitiveness of their environment. During the study period all our performance indicators changed; productivity changed least but even that increased about 10%. The changes in output-related indicators were not due to changes in competition. Monetary indicators were connected to

market competition: public providers in a more competitive environment raised their prices more and also had higher revenues. Public providers mimicked the prices of private providers but did not change their production processes. This discrepancy can be explained by the incentive structure of the public provider, as claimed by property rights theorists [41]. For example, the payment system in the public sector is mainly salary, whereas in for-profits the physicians, physiotherapists and psychologists are paid fee-for-service, which clearly has implications for productivity [42]. In addition, the soft budget constraint, or at least the backup the municipal health care center offers with taxpayers' money, differs from that of for-profit companies. Both purchaser behavior and public provider specific incentives dampen the effect of market competition on public providers. The effects of competition on welfare were not studied.

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Study 4

Market competition, ownership, payment systems and the performance of health care providers – a panel study among Finnish occupational health services providers

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Abstract

Many health care reforms rely on competition although health care differs in many respects from the assumptions of perfect competition.

Finnish occupational health services provide an opportunity to study empirically competition, ownership and payment systems and the performance of providers. In these markets employers (purchasers) choose the provider and prices are market determined. The price regulation of public providers was abolished in 1995. We had data on providers from 1992, 1995, 1997, 2000 and 2004. The unbalanced panel consisted of 1,145 providers and 4,059 observations.

Our results show that in more competitive markets providers in general offered a higher share of medical care compared to preventive services. The association between unit prices and revenues and market environment varied according to the provider type. For-profit providers had lower prices and revenues in markets with numerous providers. The public providers in more competitive regions were more sensitive to react to the abolishment of their price regulation by raising their prices. Employer governed providers had weaker association between unit prices or revenues and competition. The market share of for-profit providers was negatively associated with productivity, which was the only sign of market spillovers we found in our study.

Keywords: competition, ownership, health care providers, performance, Finland, occupational health services, panel data

Introduction

Product market competition plays a significant role in the policy recommendations of economists. The competitive market is thought to be superior to other market arrangements because it allocates scarce resources efficiently. Moreover, it is often believed that product market competition also improves quality and lowers unit costs (Nickell, 1996).

Competitive market arrangements have been introduced to health care in countries where health services have traditionally been produced by the public sector (Glennerster, 1998; Magnussen et al., 2009; Oliver, 2005). On the other hand, in the US, where health care providers are mainly private, there exists also a vast number of non-profit providers (Horwitz and Nichols, 2009). While using competition in health care to improve its performance, the fundamental question is whether health care providers react to competition and, if the reaction differs according the ownership of the provider or the ownership mix in the market.

In most countries it is difficult to study how different market circumstances affect the performance of providers. It is common to have one dominant mode of organising the production of health care services, public or private, or they may each serve different populations. Finnish occupational health services provide an unique opportunity, to study the impact of market structure and mix on health care providers' performance. In Finland, occupational health services (OHS) are mainly provided by private non-profit and for-profit providers. Municipal health care centres represent the public provider. They differ from each others by ownership and payment systems. For-profit providers have a fee-for-service system, so do the public providers, too. But due to the public ownership they have a soft budget constraint. Some employers have an integrated OHS provider, 'employer's own OHS', which has an expenditure budget. Employers have also together established non-profit associations to provide OHS services for the member companies. These providers have a combination of capitation and fee-for-service payments. The market structure for OHS varies geographically with regions with public monopolies to regions with numerous, mainly private providers and the market share of for-profit providers in Finland doubled during the study period 1992-2004.

We studied the effect of different market environment on the performance of OHS providers in a panel setting that covers the years 1992, 1995, 1997, 2000 and 2004. The performance of a provider was measured as intensity of services, productivity, the share of medical care, unit price, and revenues. OHS providers are multi-professional multi-product providers and therefore we calculated a cost-weighted activity (CWA) output (Oliver, 2005). The first four indicators are computational indicators based on this CWA output.

Market competition and health care providers

In economics, it is well known that the market structure affects the price of a product. A monopoly has the highest price, a firm in a competitive market has the lowest price, and prices in oligopolistic markets are somewhere in between (Cabral, 2002). There is extensive empirical evidence mainly from the US that higher market concentration is connected to higher prices (Gaynor and Haas-Wilson, 1999; Gaynor and Town, 2011; Keeler et al., 1999).

The quality of a product is not an issue in standard models, because the product is assumed to be homogenous. The theory of property rights (Hart, 1995) states that for-profit firms have strong incentives to invest in innovations, which would imply that for them competition increases quality. In health care, quality or at least some attributes of it are non-contractible and providers cannot be paid for all aspects of quality. On the other hand, the incentives to control costs are strong for for-profit providers and therefore the impact of competition on their quality is ambiguous (Shen et al., 2005). There is evidence both from the US and UK that competition improves quality when patients may choose the hospital and prices are fixed (Gaynor et al., 2010; Kessler and McClellan, 2000). When prices are market determined the results have reflected the theoretical indeterminacy. In the UK, Propper et al. (Propper et al., 2008; Propper et al., 2004) found that quality was lower in a more competitive environment whereas Sari (2002) found that higher hospital market share and concentration were associated with lower quality of care in the US.

The predictions of market competition are based on profit-maximizing providers. Health care providers are often assumed to also have other objectives than, or instead of, the profit motive. These objectives are represented by different ownership types. Most of the empirical literature concentrates on direct effects of ownership reviewed by Eggleston et al. (2008) and Shen at al. (2007). In both meta-analyses the conclusion was that higher quality studies that take into account market environment and patient mix as confounding factors and use longitudinal data reveal smaller differences in performance according to the ownership. Much less has been studied the market mix, how the ownership structure affects the performance of a health care provider (competitive spillovers). The presence of non-profits has been regarded important for keeping the quality of the services high and the presence of for-profits to keep the costs of services low. Kessler and McClellan (2002) found in their longitudinal study that already a 10% for-profit share of first heart attack admissions was enough to lower the expenditure of all heart attack patients by 2.4% with same patient outcomes. Quality spillovers from non-profits can be expected only if at least some of the consumers are ill-informed. Then an increase in the non-profit market share will improve both for-profit and overall market quality as found in US nursing homes by Grabowski and Hirth (2003). Santerre and Vernon (2006) studied the welfare implication of ownership mix and concluded that it would be welfare improving to increase the share of for-profits in inpatient care and the share of non-profits in outpatient care. Market mix has an impact also on the service offerings of providers. Horwitz and Nichols studied hospitals within metropolitan statistical (2009) and rural areas (2011). Non-profits with low share of for-profit competitors were more likely to offer unprofitable services such as psychiatric, hospice, substance abuse, and social work services than non-profits in markets with higher share of for-profit providers.

Both competition and the revenue generating process of providers such as budget funding and payment systems has influence on providers' performance (Chalkley and Malcomson, 2000; Kornai et al., 2003). Kessler and McClellan (2000) summarised studies on the effects of competition in the USA that revealed the importance of the payment system for the impact of competition. Until the mid-1980s the "cost-plus" reimbursement system and competition among hospitals led to excess capacity, higher production costs and prices. After the implementation of the prospective payment in 1983 competition had the opposite results. The payment system matters also for the differences between different provider types. Potter (2001) studied the relationship between the hospital type and expenses per admission in a panel setting (years 1980, 1985, 1990 and 1994) in the USA. Her findings show that the differences in efficiency measured as expenses per adjusted admission between non-profit, for-profit and public hospitals diminished after the introduction of a prospective payment system in 1983. The market environment has an impact on providers' response to changes in the payment system. When the profitability of the home health care and skilled nursing services decreased the non-profits in markets with higher for-profit market share diminished more the provision of these services than non-profits in markets with lower for-profit market share (Horwitz and Nichols, 2009; Horwitz and Nichols, 2011).

In addition to market structure and mix, ownership and payment system the scale and scope of services may be associated with the output of the provider. Scope inefficiencies have been found in multi-speciality groups compared to single-speciality groups by Rosenman and Friesner (2004) and in HMOs providing both insurance and health services (Wholey et al., 1996). On the other hand, for small scale providers such as nursing homes, scope can help in achieving economies of scale (Christensen, 2004). Rosenman and Friesner (2004) found economies of scale in both primary care and speciality care

practices. Although the empirical evidence in hospitals has been conflicting, higher quality studies seem to support the finding of constant returns or diseconomies of scale (Aletras, 1999).

Material and methods

FINNISH OCCUPATIONAL HEALTH SERVICES

In Finland, employers are required by law to arrange preventive occupational health services for their employees. Employers may choose whether they produce the services themselves ('employers' own units'), found an association to provide the services ('non-profit') or buy the services from either municipal health care centres ('public') or from private medical centres ('for-profit'). The Finnish OHS system deviates from many other countries (Hämäläinen et al., 2001). In addition to health examinations and workplace assessments 90% of employees can also obtain general practice (GP) level curative medical services from their OHS unit although organising curative medical services is voluntary for employers. All occupational health services are free of charge for employees. The two other options to seek for GP level services for employees in Finland, private and public services, both involve co-payments and the access to public services is not as good as in OHS. About half of the primary care level GP visits of employees takes place within OHS (Peurala et al., 2007).

Employers bear the costs of occupational health services but can apply for reimbursement from the Social Insurance Institution (SII). Although the employers receive reimbursement, 60% for preventive and 50% for curative medical services, the employer is nonetheless left to bear a considerable part of the costs. The employees can not choose the provider, thus the competition among providers is "buyer driven". The total costs of organising OHS were € 508 million in 2007, and the SII reimbursed € 237 million to employers. The average cost was € 267 per employee in 2007 (Kansaneläkelaitos, (The Social Insurance Institution), 2009).

In Table 1 we have summarised the main characteristics of different OHS providers in Finland. The provider types differ according to the ownership and purchaser-provider relationship. Private medical centres are firms themselves, mainly owned by shareholders whereas the public provider is owned by the local municipality. Still, they have a similar purchaser-provider relationship based on a contract and revenues based on fees and services provided. In employers' own and non-profit units, employers govern the provider, but these providers have different payment systems. Employers' own unit has a budget based on costs and non-profits have a mixture of capitation and fee-for-service payments. Employers' own units also sell services to other employers. During the study period the employees of these "buying" employers represented one fourth of the clientele in employers' own units. The non-profits in Finnish OHS differ from the USA non-profits. In this study the non-profits are associations governed by the employers whereas in the USA they are supposed to provide services to the community in exchange for the exemption from most revenue and property taxes (Potter, 2001). The Finnish non-profit OHS providers do have to pay taxes. Therefore, there is an incentive not to show profit. In case there would be profit they even refund the employers. The payment scheme for occupational health professionals in all three not-for-profit providers is mainly a salary whereas in for-profits the physicians, physiotherapists and psychologists are paid on a fee-for-service basis (Gosden et al., 2001). In addition, the not-for-profit providers may have a soft budget constraint, employers have to backup their own units and non-profits and the municipal health care centre can support the public provider with taxpayers' money.

The legislation concerning the provision of OHS is the same for all provider types with few exceptions. Only public providers have been required by the Public Health Act to provide OHS within their region. All other types may freely enter and exit the market. The fees for the public provider were set by the State Council until 1995, after that these providers were free to set prices themselves, but they

were not expected to earn profits. Before the price regulation abolition the statutory set fees did not cover the production costs. So, since 1995 all prices have been market determined.

Table 1: Organisational characteristics and incentives of Finnish occupational health services providers

	For-profit (private medical centre)	Public provider (municipal health care centre)	Employer's own OHS	Non-profit (employers' joint OHS)
Organisation	Part of a for-profit firm, biggest ones are companies	Part of the municipal health care centre that is responsible for providing primary health care services	Part of the firm (employer's organisation)	Employers govern the independent OHS organisation
Principal (purchaser) - provider relationship	Contractual	Contractual	Hierarchic	Employers govern the provider and purchase the services
Funding	Revenues from the clients and employers; owners cover losses, earn profits	Budget based on costs - municipality in charge of funding (soft budget constraint); revenue estimate	Budget for the total costs - employer in charge of funding	Budget based on revenues - employers in charge of funding
Payment system	Lump-sum per employee and fee-for-service	Fee-for-service, also lump-sum per employee (client) payments	Budget	Fixed lump-sum (high) and fee-for-service; employers aware of the production costs
Physicians' payment scheme	Most physicians are entrepreneurs, fee-for-service	Salary, minor role for fee-for-services	Salary	Salary

DATA CONSTRUCTION

We used data on clients, services and occupational health (OH) professionals from a survey conducted by the Finnish Institute of Occupational Health (FIOH) for the years 1992, 1995, 1997, 2000 and 2004. The response rate was high, over 90% per survey. Due to the reimbursement system, records on services provided by the OHS units are well standardised and the quality of the data is good. The FIOH questionnaire collected the number of hours of workplace activities (workplace surveillance, meetings, lectures, groups and counselling) and the number of health examinations and medical visits separately for physicians, nurses, physiotherapists and psychologists over a whole year.

Data on providers' revenues we obtained from the Social Insurance Institution which maintains an employer-based register of the provider, content and costs of OHS. The register exists as a result of the reimbursement system. This employer-based data was combined per provider code and merged with FIOH's data using the provider's name and address at the SII. We had at our disposal an unidentified data. The first FIOH survey in 1992 was based on the provider register of the SII. Later FIOH updated the provider register itself and the fit of the survey and the SII provider register fell. In 1992 almost all of the providers in the FIOH survey could be linked to the SII register, Later the percentage fell: in 1997 it was 90%, and further dropped to 75% in 2000 and 67% in 2004. The merged data contains during the study period on average 230 public providers, 350 employers' own and 43 OHS associations governed by several employers and 180 for-profit medical centres, altogether 4,059 observations. Because of entry and exit of providers, our data is an unbalanced panel data set.

To represent the output we constructed an indicator, the cost-weighted activity (CWA) output (Oliver, 2005). We calculated all services in minutes and summarised them by occupational health (OH) professional group. In order to make the output of different professional groups comparable, the minutes of each OH professional group was weighted by its wage, proportional to physicians' wages in 2004. The

wages are national averages provided by the Commission for Local Authority Employers. We checked the salary ratios in the private sector and they were similar to the public ones. Cost-weighted output is the sum of the wage-adjusted output of all OH professional groups. In occupational health the division of resources into prevention and medical services is important. For example, the reimbursement system aims at steering more resources into prevention. The service mix could also reveal the differences in the objectives of provider types. Therefore, we wanted to study the service-mix and calculated the curative medical services' share of the CWA output.

The indicator for productivity was calculated from the CWA output indicator. The weekly working hours of OH professionals were weighted by wage of each group proportioned to physicians' wages in 2004, then summed into one figure that measured personnel resources. Productivity measure is the ratio of CWA output per personnel resources.

We used intensity of OHS as an indicator for quality. Intensity was measured as CWA output per client which in our study is the same as an employee. It represents process quality perceived by the employee (client). Quality is assumed to be higher if there are more services per client, or if a more qualified person provides the service, e.g. a physician instead of a nurse.

At the Social Insurance Institution, employers' reimbursement applications were summed up per provider. The sum of the employers' expenditure equals the total of the provider's revenue. Nominal values were converted to 2004 real values by the health care cost index. A Unit price was calculated by dividing the revenue of a provider by its CWA output.

The geographical market areas where the providers are expected to compete with each others are based on a classification provided by Statistics Finland and based on commuting and close collaboration of municipalities in regional development. Every provider was located to a municipality based on its zip-code. There were 428 municipalities in 2004, which formed 76 geographical regions. We excluded Åland Islands with 16 municipalities and only one provider. Market structure was measured by the number of providers in the region and market mix by the market share of for-profit providers calculated from the number of clients (employees). Another option to measure market structure would have been to use Herfindahl-Hirshman index (HHI) that represents the concentration of the market. Wong et al. (2005) have empirically shown that the effects of competition remain qualitatively the same irrespective of the measure. In their study also the magnitude of the impact of competition based on number of providers and HHI was similar on the county level, the definition of market closest to our geographical market definition. In our study there was an association between both concentration and the number of providers (correlation -0.80) and the market share of the for-profit providers (-0.62).

In this study, the professions available in the unit describe the scope of the provider. Scope was measured using a dummy: 0 = OH professionals consisted of nurses and physicians only, 1 = nurses, physicians, and also either a physiotherapist or psychologist, or 2 = all four professional groups. Scale was measured by the number of OH professionals.

Appendix 1 presents the formulae for the performance and market indicators.

Most of our indicators are ratios and often based on summing up data. The survey had different time frames for different data, for example the number of services concerned a whole year and the number and working hours of personnel one month the following spring. If there were changes in the number of personnel during the first months of the year of the survey the output-personnel ratios were flawed. In addition, if one professional group had missing data on some of it services it could create problems in calculating the output. Therefore, we examined the studentized residuals exceeding +2 or -2 for identifying outliers, and recoded the indicator values missing for the providers whose outlier values were due to the mismatch of timing or missing data. The share of missing data was highest in the calculation of the unit price (26%) and the lowest in the revenue of the provider (15%).

METHODS

We applied ordinary least squares regression analysis to find out how ownership type was associated with the performance and panel models to study how changes in the market structure (number of

providers) or changes in the market mix (market share of for-profit providers) were associated with changes in performance.

We started the analysis with ordinary least squares regression analysis and with separate models for each year and for the pooled data. Model specification was tested using the Ramsey RESET test. Based on the test, logarithmic transformations were made for the following variables: number of OH professionals and providers, intensity, productivity, unit price and revenue. Earlier studies have shown that the relation between competition and various performance indicators might not be linear. To check this, models with a squared number of providers were made, but their performance was poorer. Heteroskedasticity of the models was tested with the Breusch-Pagan/Cook-Weisberg test and it showed heteroskedasticity in all models. Therefore, we applied cluster-robust standard errors for pooled OLS models.

The pooled OLS model:

$$\text{indicator}_{pt} = \alpha + \text{type}_{pt} + \beta_1 \text{ providers}_{rt} + \beta_2 \text{ type}_{pt} \times \text{providers}_{rt} + \beta_3 \text{ FPshare}_{rt} + \beta_4 \text{ type}_{pt} \times \text{FPshare}_{rt} + \beta_5$$

$$\text{scale}_{pt} + \beta_6 \text{ dummyscope}_{pt} + \beta_7 \text{ time} + \beta_8 \text{ type}_{pt} \times \text{time} + \mu_{pt}$$

where $\mu_{pt} \sim \text{IID}(0,\sigma_\mu)$. The variables in the models can be found in the Appendix 1, p refers to the provider, r to the region and t to the year. The variable time controls for time trends and shocks common to all providers.

To take advantage of our panel data fixed effects models were applied, which are viewed as appropriate tools for eliminating bias arising from time-invariant unobserved factors (Greene, 2003; Shen et al., 2007). Statistically, fixed effects models are always a reasonable thing to do with panel data (they always give consistent results) but they may not be the most efficient models to run. The Hausman test showed that for all indicators the fixed effects model turned out to be better than the random effects model. We applied robust standard errors. Having only five time points in our data we did not take possible autocorrelation into account.

The fixed effects model:

$$\text{indicator}_{pt} = (\alpha + \mu_p) + \beta_1 \text{ providers}_{rt} + \beta_2 \text{ type}_{pt} \times \text{providers}_{rt} + \beta_3 \text{ FPshare}_{rt} + \beta_4 \text{ type}_{pt} \times \text{FPshare}_{rt} + \beta_5 \text{ scale}_{pt}$$

$$+ \beta_6 \text{ dummyscope}_{pt} + \beta_7 \text{ time} + \beta_8 \text{ type}_{pt} \times \text{time} + v_{pt},$$

where $v_{pt} \sim \text{IID}(0,\sigma_v)$. In fixed effects model μ_p is allowed to correlate with other regressors.

We studied whether different provider types' performance had different associations with market structure and if they differed in their trajectories. Therefore, we included interactions of the variables "type of provider" and the number of providers, the market share of non-profits and time (continuous) to all models. We computed the F-statistic to test a) if the coefficients for the variables representing competition (number of providers, the market share of for-profit providers) or time and the interaction terms jointly differed from zero and b) if the interaction terms of the public, employers' own and non-profit providers differed from that of for-profit providers (Stock and Watson, 2007).

We compared changes in our performance indicators associated with a huge change in competition in the panel model and ownership type. Change in market structure was assessed as a change from the 25% percentile to 75% percentile in 2004 both in the number of providers (logarithm) or the market share of for-profit providers. The dummies in the pooled OLS models represent the differences between the ownership types.

We checked the robustness of our results to the weights that we used in constructing the cost-weighted output, the base for most of our performance indicators. We estimated the models also with proportional wages for private providers obtained from trade union statistics and the municipal wages

for public providers. In our models the structure of the market was measured as the number of all providers in the region. We constructed two other measures for the structure: 1) a variable based on the number of providers without employers' own units and 2) a dummy variable based on the number of providers: a market with less than six providers, a market with seven to nineteen providers, and a market with more than twenty or more providers. The reason to leave employers' own unit out of the number of providers in the region is that they might not compete for employers the same way as the other provider types. In average, three thirds of the clients (employees) in employer owned units were employed by the organisation that owned also the OHS provider. The cut-off point of 6 has also been used by Santerre and Vernon (2006). They justify this cut-off by 6 by the fact that equally sized hospitals would lead into a HHI of 1800 which would be regarded highly concentrated by the Federal Trade Commission and Department for Justice. Also Cabral (2002) calculated that seven providers in Cournot model would be enough to achieve a price level of a competitive market. The correlation between the number of providers in the region and the number of providers without the employers' own units was 0.92 and the correlation with the dummy was 0.86.

Finally, we examined the potential endogeneity of the market structure and compared fixed effects panel model and instrumental variables (IV) panel model. We used the number of employees, the number of employers (both from our data) and the median household income (provided by the Statistics Finland) to predict the number of providers and the share of for-profit providers in the region. Unfortunately, we did not have access to household income data for 1992. Therefore, we only used the years 1995, 1997, 2000 and 2004 in this analysis. We applied STATAs xtivreg2 (available from SSC archive) and Hausman test to examine if the fixed effect panel model is preferred to IV.

We used STATA Version 9 for the analysis.

Results

The number of all OHS providers decreased during the study period from 1,006 to 621, mostly because the number of employers' own units decreased with almost 60%. This was due to closing down of the companies during the Finnish recession of the early 1990's and later due to outsourcing. The number of for-profit providers increased until 2000, but since then mergers have decreased this number. The number of public providers and non-profit providers slightly increased during the study period. (Table 2.) The market shares in the whole of Finland changed during the study period. For-profit providers' market share more than doubled to 37% in 2004. The market share of employers' own units halved to 18% in 2004. The market share of public providers fell by five percentage units to 39% in 2004 and non-profits had a very stable market share of about 6%.

Table 2: Number of providers by provider type 1992-2004

	For-profit	Public	Employers' own	Non-profit
1992	224	226	552	42
1995	164	234	410	41
1997	179	237	325	42
2000	190	237	291	39
2004	155	230	192	49

Most regions can be considered competitive, but the local markets for OHS varied greatly (Table 3). The for-profit providers and employers' own units are concentrated in more competitive regions. For them, the average number of providers in the region was almost 50 and the for-profit market share 35% in 2004. The non-profits and public providers faced less competition. On average the non-profit providers had 30 competitors and the market share of for-profit providers was 29% in 2004; public providers had 14 competitors and the market share of for-profit providers was 19% on average in 2004.

Table 3: Competitiveness of the market measured with the number of providers and the market share of for-profit providers (%) in a region (N=76), mean and (standard deviation)

	Number of providers	For-profit market share
1992	13.8	7.2
	(29.7)	(8.9)
1995	11.2	8.2
	(21.9)	(9.6)
1997	10.3	12.4
	(18.9)	(13.1)
2000	9.9	14.0
	(18.9)	(14.3)
2004	8.6	15.1
	(14.7)	(15.5)

The provider types did not only differ according to the market structure and mix but also according their size and clientele. In general, Finnish OHS units are small when measured in terms of number of clients and revenue. For-profit and public providers serve also small and medium-sized employers. Municipalities as employers usually buy their OHS from the municipal health care centre, being the biggest employer client for the public provider. (Table 4.)

Table 4: Number of clients (employees), employers and occupational health personnel and revenues (€) in 2004, mean and (standard deviation)

	For-profit (N=192)	Public (N=230)	Employers' own (N=155)	Non-profit (N=49)
Number of clients	3972	3009	1647	2104
	(4597)	(3201)	(3654)	(3444)
Number of employers	213	178	6	50
	(260)	(188)	(10.4)	(57.5)
Number of OH personnel	14.9	8.8	6.0	7.3
	(14.8)	(8.3)	(9.0)	(11.1)
Revenue (turn over), €	620,679	299,818	554,546	731,180
	(980,324)	(555,826)	(1,055,686)	(1,389,785)

The scope of the services changed during the study period. In 1992, the personnel mainly consisted of nurses and physicians only. In 2004 less than one fifth of for-profit and public units had only nurses and physicians and almost half of them had four professions available: nurses, physicians, physiotherapists and psychologists. In the employer's own units and the non-profit units it was still common in 2004 to

have only nurses and physicians (40-50% of the units), and only less than one fifth had all four professions present.

Four of our indicators are ratios and comparable between the provider types. Figures 1-4 show the averages of these indicators by the provider type during the study period. Public providers have been catching up with the other provider types in intensity and the share of medical care (Figures 1 and 3). The variation in productivity between the provider types has disappeared almost completely (Figure 2). The unit price in employers' own units and non-profits has been rising the whole study period but in for-profits the unit price has been quite stable and the unit price of public providers has reached the level of for-profits in 2004 (Figure 4).
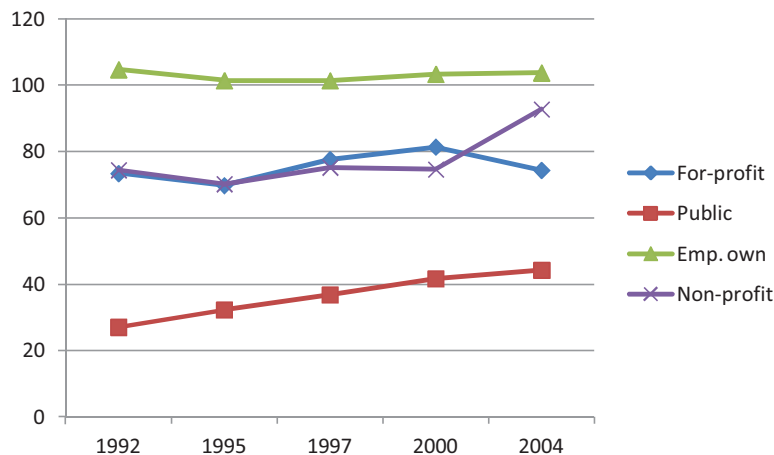
Figure 1: Intensity of the services (CWA output/client) according the type of the provider in 1992-2004, mean
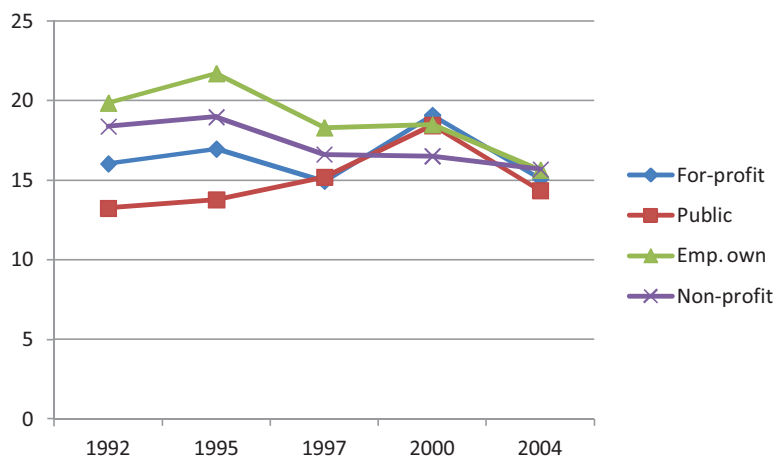
Figure 2: Productivity (CWA output/(salary weighted weekly working hours)) according the type of the provider in 1992-2004, mean

11
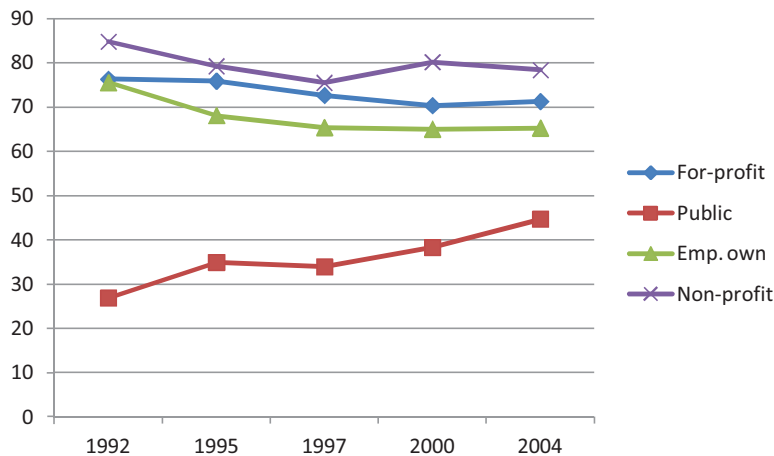
Figure 3: Share of medical care (%) according to the type of the provider in 1992-2004, mean
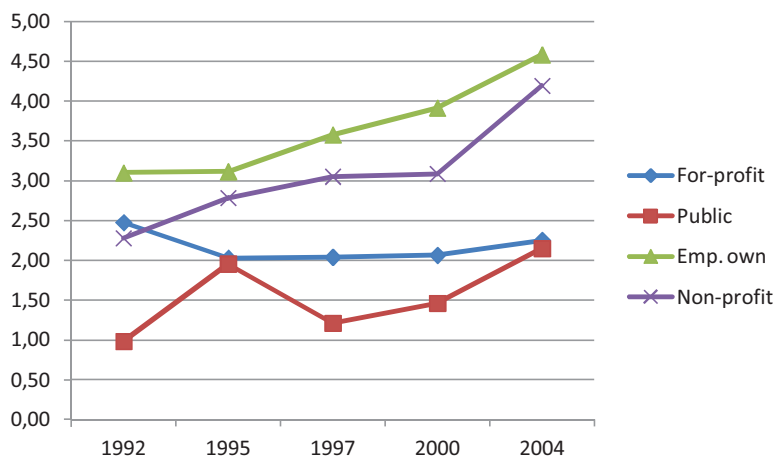
Figure 4: Unit price (provider's revenue/CWA output) according the type of the provider in 1992-2004, mean, 2004 real value

For each indicator, we present the results for the pooled OLS and panel model. Both models include interactions when they are statistically significant. The pooled OLS models show if the market variables, the number of providers and the for-profits' market share, are associated with performance indicators. The fixed effects panel models reveal if changes in the performance indicators are associated with the changes in the market variables.

We grouped the indicators to two tables: those related to output – intensity, productivity and the share of medical care (Table 5) – and the monetary indicators – unit price and revenue (Table 6). All models include also scale and scope variables. The results of these variables are not shown in the tables 5 and 6, but available in the appendices 2-6 where we present also the F-statistics for the interactions, and the models without interactions.

The share of medical care was positively associated with the number of providers both in the pooled OLS and the panel model. The positive association between the market share of for-profits and productivity in the pooled OLS model changed into a statistically significant negative association in the panel model. Otherwise the variables representing market structure and mix were not associated with intensity, productivity and the share of medical care.

For output related indicators none of the interaction terms with the variables representing competition were statistically significant in the panel models which we regard more important than the pooled OLS. Instead, provider type interactions with time show that the different provider types had different time trajectories. All together provider types increased intensity during the study period. But the development was different for the not-for-profits: public providers increased intensity and the employers' own and the non-profits decreased intensity compared to for-profits. Also the overall productivity increased during the study period, although productivity in the employers' own and non-profits units decreased compared to for-profits. The share of medical care was decreasing in time, but here again the trend differed according the provider type. Especially the public providers increased the share of medical care during the study period compared to for-profits.

	Intensity (log), N=946		Productivity (log), N=940		Share of medical care (%), N=948	
	Pooled OLS, cluster-robust	Fixed effects, robust	Pooled OLS, cluster-robust	Fixed effects, robust	Pooled OLS, cluster-robust	Fixed effects, robust
Provider type: ref. for-profit						
Public provider	-1.357 ***		0.062		-0.490 ***	
	(0.138)		(0.091)		(0.027)	
Employers' own	0.339 **		0.451 ***		-0.016	
	(0.126)		(0.086)		(0.021)	
Non-profit	0.083		0.420 ***		0.061 *	
	(0.181)		(0.093)		(0.028)	
Number of providers (log)	-0.042	0.053	0.002	0.024	0.017 **	0.035 *
	(0.032)	(0.045)	(0.017)	(0.055)	(0.006)	(0.016)
Public*number of providers (log)	0.163 **					
	(0.050)					
Emp.own*number of providers (log)	0.066					
	(0.040)					
Non-profit*number of providers (log)	-0.004					
	(0.059)					
For-profit market share (%)	0.533	-0.229	0.384 **	-0.447 **	-0.123	-0.067
	(0.319)	(0.144)	(0.145)	(0.167)	(0.086)	(0.048)
Public*FP market share	-0.313				0.514 ***	
	(0.395)				(0.115)	
Emp.own*FP market share	-0.891 *				0.153	
	(0.373)				(0.089)	
Non-profit*FP market share	0.197				0.049	
	(0.540)				(0.138)	
Time	-0.003	0.017 *	0.003	0.028 **	-0.078 ***	-0.004 *
	(0.009)	(0.007)	(0.010)	(0.009)	(0.017)	(0.002)
Public*time	0.046 ***	0.028 ***	0.006	-0.003	-0.003	0.017 ***
	(0.010)	(0.007)	(0.010)	(0.009)	(0.003)	(0.002)
Emp. own*time	0.008	-0.019 **	-0.024 *	-0.030 ***	0.012 ***	-0.002
	(0.010)	(0.006)	(0.010)	(0.008)	(0.003)	(0.002)
Non-profit*time	0.005	-0.005 *	-0.023 *	-0.032 **	-0.007 *	0.005 *
	(0.013)	(0.007)	(0.010)	(0.009)	(0.003)	(0.002)
R^2	0.4701	0.0890 within	0.0812	0.0532 within	0.4676	0.0944 within
	$F(18, 945) = 67.22$	$F(9,2165) = 15.11$	$F(12, 939) = 15.31$	$F(9,2058) = 9.37$	$F(15, 947) = 66.39$	$F(9,2184) = 18.08$
	Prob > F = 0.0000	Prob > F = 0.0000	Prob > F = 0.0000	Prob > F = 0.0000	Prob > F = 0.0000	Prob > F = 0.0000

*p<0.05, **p<0.01, ***p<0.001

All models include also scale and scope variables and a constant (data shown in Appendices 2-4)

Table 6 presents the results for the monetary indicators. The fixed effect model shows that for for-profit providers changes both in the unit price and the revenue of the provider were negatively associated with a change in the number of providers in the region. The interactions show that for the public providers the association was positive. Also employers' own and non-profit providers differed from for-profit providers: their interaction coefficients with the number of providers almost offset the coefficient of for-profit providers for the unit price and the revenue. Changes in the market mix were not associated with changes in providers' unit price and revenue. The coefficients for the for-profit market share were not statistically significant in the panel models.

The not-for-profit providers increased their prices compared to for-profits during the study period (interactions with time in the panel model), especially the public providers. The revenues in real terms had a positive time trend due to the fact that for-profit providers and the public providers increased their revenues.

Table 6: Number of providers, for-profit providers' market share, unit price and revenue among Finnish OHS providers in 1992-2004, pooled OLS and panel models (standard error of the coefficient in the parenthesis)

	Unit price (log), N=924		Revenue (log), N=954	
	Pooled OLS, cluster-robust	Fixed effects, robust	Pooled OLS, cluster-robust	Fixed effects, robust
Provider type: ref. for-profit				
Public provider	-0.346 * (0.150)		-0.625 * (0.277)	
Employers' own	0.717 *** (0.148)		1.217 *** (0.271)	
Non-profit	0.976 *** (0.213)		1.816 *** (0.449)	
Number of providers (log)	0.168 *** (0.032)	-0.159 * (0.068)	0.001 (0.072)	-0.161 * (0.079)
Public*number of providers (log)	-0.094 * (0.039)	0.397 * (0.176)	0.275 ** (0.091)	0.419 ** (0.145)
Emp.own*number of providers (log)	-0.077 * (0.035)	0.119 ** (0.037)	0.223 ** (0.081)	0.203 *** (0.037)
Non-profit*number of providers (log)	-0.210 ** (0.064)	0.116 * (0.048)	0.096 (0.159)	0.157 *** (0.044)
For-profit market share (%)	0.250 (0.155)	0.300 (0.164)	4.020 *** (0.784)	-0.084 (0.143)
Public*FP market share			-3.262 *** (0.892)	
Emp.own*FP market share			-4.305 *** (0.853)	
Non-profit*FP market share			-5.323 *** (1.361)	
Time	0.002 (0.008)	-0.014 (0.008)	-0.035 (0.018)	0.063 *** (0.009)
Public*time	0.061 *** (0.009)	0.078 *** (0.010)	0.100 (0.020)	0.050 ** (0.009)
Emp. own*time	0.022 * (0.009)	0.034 *** (0.008)	0.059 (0.020)	-0.036 * (0.007)
Non-profit*time	0.037 *** (0.010)	0.052 *** (0.010)	0.070 (0.029)	-0.016 (0.009)
R^2	0.4175	0.1655 within	0.6111	0.4048 within
	$F(15, 923) = 71.51$ Prob > F = 0.0000	$F(12,2047) = 26.86$ Prob > F = 0.0000	$F(18, 953) = 141.20$ Prob > F = 0.0000	$F(12,2455) = 98.05$ Prob > F = 0.0000

*$p<0.05$, **$p<0.01$, ***$p<0.001$
All models include scale and scope variables and a constant (data shown in Appendices 5 and 6)

The models took into account market structure and mix, scope and scale economies. Usually, in a fixed effect panel model a time trend is included in the model to capture the impact of omitted variables that change during the study period but whose impact is the same for all providers. In our study the Figures 1-4 and the provider type interactions with time show that the provider types had different paths over time.

We compared the direct effects of ownership with the changes in the market structure (the number of providers) and market mix (the market share of for-profit providers). The differences in intensity, unit price and revenues due to the provider type were greater than the differences associated with a huge change in the competitiveness of the market we estimated based on the panel models. We varied the

number of providers (logarithm) or the market share of for-profit providers form the 25% percentile values (Q1) to the 75% percentile (Q3) in 2004.

A change in competition mattered more than the provider type in productivity and in the share of medical care. The change in productivity that was negatively associated with the change from Q1 to Q3 in the market share of for-profit providers was bigger than the differences due to ownership. Also the magnitude of the change in the share of medical care associated positively with the change in the number of providers was bigger than the differences due to ownership. The public providers were an exception: historically they have had much lower share of medical care than the other providers. For them the change in the share of medical care associated to a huge increase in the number of providers was smaller than the difference due to the ownership.

To check the consistency of the results we applied private sector wage ratios for private providers in constructing the cost-weighted activity, but the results did not change. We applied also two different measures for the structure of the market. The results of the panel models with the number of providers excluding employers' own units or dummies (less than six, six to nineteen and twenty or more providers) were similar to the ones presented here for productivity and unit price. The results differed slightly for other performance indicators. A change in the number of providers excluding employers own units was positively associated with a change in intensity for for-profit providers and negatively for public and non-profit providers. In the model with the number of all providers there was no association between a change in the structure of the market and intensity. We measured the market structure also with a dummy: a market with less than six providers (during the study period 12% of all OHS units), a market with seven to nineteen providers (47% of all OHS units), and a market with more than twenty or more providers (41% of OHS units). There was no association between a change in the dummy and a change in intensity, share of medical care and revenues of the provider.

We compared the fixed effects panel models with IV panel models. The models differed from the ones presented here: variable scope and interactions are not included in the model and we did not have data on household income for 1992. We used the number of employees, the number of employers (both from our data) and the median household income to predict the number of providers and the share of for-profit providers in the region. For the dependent variables share of medical care, unit price and revenue the Hausman test revealed that the fixed effects panel model is preferred to IV (see eg. (Dougherty, 2007) and (Baltagi, 2008)). For intensity and productivity the test recommended IV modeling. For intensity the market variables were not statistically significant in the fixed effects panel model, in the IV model intensity was negatively associated with the FP market share. Also for productivity the results of the two models differed. In the IV model the number of providers was positively and statistically significantly associated with productivity, the coefficient for the FP market share was also positive but not statistically significant. In the fixed effects panel model the coefficients for these two variables were negative and not statistically significant.

Discussion

As fixed effect panel models show if a change in the market structure or market mix was associated with a change in the performance of a provider the discussion here is mainly based on the results of the panel models.

In general, the market competition measured as the number of providers did not have a strong and clear association with the performance indicators related to the output: intensity, productivity and the share of medical care. Only the share of medical care was positively associated with the number of providers both in the pooled OLS and the panel models and similarly for all provider types. Also intensity was positively associated with the number of providers in the panel model without interactions.

When provider type interactions were included in the model the association was not statistically significant. A change in the number of providers was not associated with changes in productivity.

Market mix was not associated with the output related indicators either. The only statistically significant association existed between market mix and productivity: the positive association between the market share of for-profits and productivity in the pooled OLS model changed into a negative association in the panel model.

There were no differences in the associations between competition and performance in output related performance indicators according to the ownership: interactions in the panel models for intensity, productivity and the share of medical care between provider types and both the number of providers and the market share of for-profit providers were not statistically significant.

Competition measured with the number of providers had an association with the monetary indicators but the provider types differed. For for-profit providers, the association was as the economic theory presumes: the unit price and provider's revenue both decreased when the number of providers increased in the region. Opposite to the result for for-profits, the public providers had higher unit prices and revenues when the number of providers increased. For the two other provider types, employers' own units and non-profits, the association between the monetary indicators was weaker than for for-profits. Their provider type interactions with competition almost offset the coefficient of for-profit providers.

Change in market mix had an association only with productivity, and a negative one. Our result is against the conventional wisdom that the presence of for-profit providers would increase productivity and lower costs and prices. Shen et al. (2007) found a similar result in their meta-analysis: there was not consistent support for for-profit hospitals operating more efficiently. Changes in the unit price of providers did not have an association with changes in the market mix in the panel models. The three other indicators, intensity, share of medical care and revenue, had first a negative association with the market share of for-profit providers. But when the interactions were included in the model, it turned out that the changes were due to provider type interactions with time rather than due to changes in market mix. The associations between changes in all five indicators and market mix were similar for all provider types: there were no provider type interactions with the market share of for-profit providers.

All performance indicators also showed a time trend that differed according to provider type. We interpret this result as a path dependency: providers have a tendency to continue the same behaviour. Path dependency has been found on system level (Oliver and Mossialos, 2005). The magnitude of difference in performance was more associated with ownership type than with changes in market structure and market mix. Only in productivity (negative association with market share of for-profit providers) and in the share of medical care (positive association with the number of providers) the change associated with competition was bigger than the differences due to ownership.

A strong feature of our study is that the panel data included a large number of observations and covered almost all OHS providers in Finland. The meta-analysis by Shen et al. (2005) showed that including data from both a survey and an official register and logarithmic transformations of variables improve the quality of a study comparing the performance of health care providers. Defining the geographical market is always difficult. Here we used regions defined by Statistics Finland based on regional collaboration and commuting, which also have the advantage of reflecting topographical features and travel time (Horwitz and Nichols, 2009). We checked the robustness of the results by constructing alternative measures for competition and received mainly similar results.

There are limitations in our study, too. We did not have data on clients (employees) which has proven important in comparing providers. The data was received from surveys to providers and a register which did not include information on the quality of the services as perceived by clients or on the impact on health. The simultaneous determination of the market structure and the performance of providers causes a potential endogeneity problem, especially in studies with cross sectional data (Evans et al., 1993). We applied Hausman test in the comparison of fixed effects and IV panel models. For the variables share of medical care, unit price and revenue the Hausman test revealed that the fixed effects panel model is preferred to IV. For intensity and productivity the test recommended IV modeling, so the results for these two variables should be interpreted with caution. Our data did not enable to take into account the structure (bargaining power) of the employers.

Grabowski and Hirth (2003) regarded the existence of spillover effects as a proof for information asymmetry in the nursing home markets. In our study, the share of for-profit providers did not have an impact on the performance indicators (except the negative association with productivity). The non-existent spillovers could then be a signal that the differences that existed and remained between the provider types were due to heterogeneity of employers and employees. On the other hand, the market shares have changed considerably in the past ten years (Kansaneläkelaitos, (The Social Insurance Institution), 2007; Manninen, 2009). This implies that the segments are not totally separate and there must be some competition.

The monetary indicators of for-profit providers reacted as the economic theory presumes: a change in competition (higher number of providers) was associated negatively with unit price and revenue. Although the results were the opposite for the public provider the result is understandable. Public providers experienced a change in the regulatory environment. First in 1995 the regulation of their prices was abolished. In a more competitive environment, the public providers were more sensitive to react to the abolishment of the price regulation and raise their prices. During the study period, the public providers got more power to decide upon their resources and were more dependent on the payments by employers and less on politicians (Maarse et al., 2005). These two changes can explain why the public providers started to resemble more and more for-profit providers (institutional isomorphism (Horwitz and Nichols, 2009; Potter, 2001)).

Employers' own units and non-profits had higher intensity and productivity but higher unit costs. The payment system, expenditure budget in employers' own units and mainly capitation payments in non-profits, can be interpreted as that employers were purchasing capacity. When purchasers face uncertainty, ie. they do not know what kind of services will be needed, they buy an option for the capacity. Uncertainty connected to the demand (need) of the services creates a market for the option to use the services. In option demand markets, the providers are able to earn rent due to the uncertainty (Capps et al., 2003). This phenomenon could be one reason why employers' own units and non-profits can sustain their price level.

The Finnish OHS services and markets differ from hospitals in the US. Firstly, consumers do not choose the provider. Secondly, the provider types have different payment systems and the prices are market determined – there is no prospective payment system. Thirdly, the entry and exit in the OHS market is easier than starting or closing a hospital. However, it is of interest outside the Finnish OHS that also public providers are more sensitive to react to regulatory changes in more competitive environments. We found competitive spillovers only in productivity; information asymmetry and heterogeneity of consumers are both important issues in understanding and empirically testing market spillovers. And finally, public providers had lower intensity and share of medical care than the other provider types. Publicly ownership is a tool to regulate resources and capacity. Those employers who most valued high capacity seemed to be willing pay higher prices, too.

Acknowledgements

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Appendices

APPENDIX 1 - INDICATORS FOR OHS AND COMPETITION

Indicator	Formula	Keys
CWA output	$Output_{pt} = \sum_i w_i \sum_j q_{ijpt} min_{ij}$	j = workplace visits, meetings, lectures, health examinations, medical visits i = physician, nurse, physiotherapist, psychologist min_{ij} = time that a professional group i uses in producing service j q_{ijpt} = the number of services j, provided by professional group i, in provider p, in year t w_i = weight for each professional group i, the average salary of a professional group i proportioned to physicians' salary in the municipal sector in 2004 p = provider id t = 1992, 1995, 1997, 2000, 2004
Intensity	$Intensity_{pt} = Output_{pt}/$number of $employees_{pt}$ (clients)	p, t as above
Productivity	$Prod_{pt} = Output_{pt}/\sum_i w_i hours_{ipt}$	$hours_{ipt}$ = weekly working hours of a professional group i, in year t, i, t, p and w_i as above
Share of medical care	$Med_{pt} = \sum_i w_i qmed_{ipt} medmin_i/Output_{pt}$	$qmed_i$ = number of curative medical visits provided by professional group i $medmin_i$ = time that professional group i uses to produce one curative medical visit i, t, p and w_i as above
Revenue	$Revenue_{pt} = \sum_e TC_{pet}$	TC_{pet} = total expenditure on OHS for employer e, provided by provider p, in year t p, t as above Revenue in 2004 real value
Unit price	$Price_{pt} = Revenue_{pt}/Output_{pt}$	
Number of providers within a region	$Providers_{rt} = Count(p_{rt})$	p_{rt} = provider id in region r, year t r = geographically defined local market t as above
For-profit providers' market share within a region	$FPshare_{rt} = \sum_{FPp} clients_{FPprt}/\sum_p clients_{prt}$	$clients_{prt}$ = provider p's number of clients (employees) $clients_{FPprt}$ = For-profit provider's number of clients in region r, year t r, t as above

APPENDIX 2. MODELS FOR INTENSITY AMONG FINNISH OHS PROVIDERS (N=946) IN 1992-2004, POOLED OLS AND PANEL MODELS WITHOUT AND WITH INTERACTIONS

	Pooled OLS, cluster-robust		Fixed effects, robust	
	no inter-actions	with inter-actions	no inter-actions	with inter-actions
Provider type: ref. for-profit				
Public provider	-0.725 ***	-1.357 ***		
	(0.049)	(0.138)		
Employers' own	0.387 ***	0.339 **		
	(0.044)	(0.126)		
Non-profit	0.132 *	0.083		
	(0.053)	(0.181)		
Number of providers (log)	0.031	-0.042	0.149 **	0.053
	(0.017)	(0.032)	(0.046)	(0.045)
Public*number of providers (log)		0.163 **		
		(0.050)		
Emp.own*number of providers (log)		0.066		
		(0.040)		
Non-profit*number of providers (log)		-0.004		
		(0.059)		
For-profit market share (%)	-0.020	0.533	-0.522 ***	-0.229
	(0.133)	(0.319)	(0.146)	(0.144)
Public*FP market share		-0.313		
		(0.395)		
Emp.own*FP market share		-0.891 *		
		(0.373)		
Non-profit*FP market share		0.197		
		(0.540)		
Number of OH professionals (log)	0.104 ***	0.102 ***	0.072 *	0.051
	(0.028)	(0.026)	(0.032)	(0.031)
Scope: ref. only nurses and physicians				
In addition physiotherapist or psychologist	0.019	0.018	-0.024	-0.009
	(0.035)	(0.034)	(0.031)	(0.031)
All four OH professionals	-0.036	-0.048	0.014	0.003
	(0.047)	(0.044)	(0.043)	(0.042)
Time	0.015 ***	-0.003	0.025 ***	0.017 *
	(0.003)	(0.009)	(0.003)	(0.007)
Public*time		0.046 ***		0.028 ***
		(0.010)		(0.007)
Emp. own*time		0.008		-0.019 **
		(0.010)		(0.006)
Non-profit*time		0.005		-0.005
		(0.013)		(0.007)
Constant	3.812 ***	4.034 ***	3.522 ***	3.825 ***
	(0.071)	(0.104)	(0.054)	(0.150)
Interactions: F-statistics and p-values				
A1) Number of providers and interactions = 0		3.38		
		(0.0093)		
A2) Interactions = 0		4.15		
		(0.0062)		
B1) FP-market share and interactions = 0		2.48		
		(0.0426)		
B2) Interactions = 0		3.21		
		(0.0223)		
C1) Time and interactions = 0		15.08		27.93
		(0.0000)		(0.0000)
C2) Interactions = 0		11.96		28.53
		(0.0000)		(0.0000)
VIF	2.16	16.50		
R^2	0.4473	0.4701	within = 0.0437	within = 0.0890
	$F(9, 945) =$ 109.46 Prob > F = 0.0000	$F(18, 945) =$ 67.22 Prob > F = 0.0000	$F(6,2168) =$ 12.51 Prob > F = 0.0000	$F(9,2165) =$ 15.11 Prob > F = 0.0000

*p<0.05, **p<0.01, ***p<0.001

F-statistics for 1) the test that the number of providers (A), the market share of the for-profit providers (B) or time (B) and the provider type interactions differ jointly from zero and 2) for the test that the coefficients of the public, employers' own and non-profit providers differ from for-profits.

APPENDIX 3. MODELS FOR PRODUCTIVITY AMONG FINNISH OHS PROVIDERS (N=940) IN 1992-2004, POOLED OLS AND PANEL MODELS WITHOUT AND WITH INTERACTIONS

	Pooled OLS, cluster-robust		Fixed effects, robust	
	no inter-actions	with inter-actions	no inter-actions	with inter-actions
Provider type: ref. for-profit				
Public provider	0.097 (0.052)	0.062 (0.091)		
Employers' own	0.309 *** (0.051)	0.451 *** (0.086)		
Non-profit	0.267 *** (0.055)	0.420 *** (0.093)		
Number of providers (log)	0.010 (0.017)	0.002 (0.017)	0.067 (0.056)	0.024 (0.055)
Public*number of providers (log)				
Emp.own*number of providers (log)				
Non-profit*number of providers (log)				
For-profit market share (%)	0.290 * (0.144)	0.384 ** (0.145)	-0.561 ** (0.163)	-0.447 ** (0.167)
Public*FP market share				
Emp.own*FP market share				
Non-profit*FP market share				
Number of OH professionals (log)	0.058 * (0.026)	0.055 * (0.025)	-0.214 *** (0.042)	-0.239 *** (0.042)
Scope: ref. only nurses and physicians				
In addition physiotherapist or psychologist	-0.109 (0.031) **	-0.105 (0.031) **	0.002 (0.036)	0.008 (0.036)
All four OH professionals	-0.121 ** (0.042)	-0.134 ** (0.042)	0.046 (0.049)	0.029 (0.048)
Time	-0.007 (0.004)	0.003 (0.010)	0.014 ** (0.004)	0.028 ** (0.009)
Public*time		0.006 (0.010)		-0.003 (0.009)
Emp. own*time		-0.024 * (0.010)		-0.030 *** (0.008)
Non-profit*time		-0.023 * (0.010)		-0.032 ** (0.009)
Constant	2.440 *** (0.073)	2.386 *** (0.097)	2.845 *** (0.196)	2.998 *** (0.193)
Interactions: F-statistics and p-values				
A1) Number of providers and interactions = 0				
A2) Interactions = 0				
B1) FP-market share and interactions = 0				
B2) Interactions = 0				
C1) Time and interactions = 0		10.88 (0.0000)		10.01 (0.0000)
C2) Interactions = 0		11.54 (0.0000)		12.13 (0.0000)
VIF	2.19	5.19		
R^2	0.0721	0.0812	within = 0.0337	within = 0.0532
	$F(9, 939) = 15.78$ Prob > F = 0.0000	$F(12, 939) = 15.31$ Prob > F = 0.0000	$F(6,2061) = 7.72$ Prob > F = 0.0000	$F(9,2058) = 9.37$ Prob > F = 0.0000

*p<0.05, **p<0.01, ***p<0.001

F-statistics for 1) the test that the number of providers (A), the market share of the for-profit providers (B) or time (B) and the provider type interactions differ jointly from zero and 2) for the test that the coefficients of the public, employers' own and non-profit providers differ from for-profits.

APPENDIX 4. MODELS FOR SHARE OF MEDICAL CARE AMONG FINNISH OHS PROVIDERS (N=948) IN 1992-2004, POOLED OLS AND PANEL MODELS WITHOUT AND WITH INTERACTIONS

	Pooled OLS, cluster-robust		Fixed effects, robust	
	no inter-actions	with inter-actions	no inter-actions	with inter-actions
Provider type: ref. for-profit				
Public provider	-0.312 ***	-0.490 ***		
	(0.018)	(0.027)		
Employers' own	-0.010	-0.016		
	(0.013)	(0.021)		
Non-profit	0.090 ***	0.061 *		
	(0.018)	(0.028)		
Number of providers (log)	0.020 **	0.017 **	0.078 ***	0.035 *
	(0.006)	(0.006)	(0.018)	(0.016)
Public*number of providers (log)				
Emp.own*number of providers (log)				
Non-profit*number of providers (log)				
For-profit market share (%)	0.067	-0.123	-0.203 ***	-0.067
	(0.056)	(0.086)	(0.049)	(0.048)
Public*FP market share		0.514 ***		
		(0.115)		
Emp.own*FP market share		0.153		
		(0.089)		
Non-profit*FP market share		0.049		
		(0.138)		
Number of OH professionals (log)	0.068 ***	0.068 ***	0.035 **	0.029 **
	(0.010)	(0.009)	(0.011)	(0.011)
Scope: ref. only nurses and physicians				
In addition physiotherapist or psychologist	-0.052	-0.050	-0.026	-0.019
	(0.012)	(0.012) ***	(0.011) *	(0.011)
All four OH professionals	-0.070 ***	-0.078 ***	-0.023	-0.023
	(0.018)	(0.017)	(0.016)	(0.016)
Time	-0.002	-0.003	0.005 ***	-0.004 *
	(0.001)	(0.003)	(0.001)	(0.002)
Public*time		0.012 ***		0.017 ***
		(0.003)		(0.002)
Emp. own*time		-0.007 *		-0.002
		(0.003)		(0.002)
Non-profit*time		0.001		0.005 *
		(0.004)		(0.002)
Constant	0.566 ***	0.631 ***	0.341 ***	0.473 ***
	(0.024)	(0.026)	(0.062)	(0.055)
Interactions: F-statistics and p-values				
A1) Number of providers and interactions = 0				
A2) Interactions = 0				
B1) FP-market share and interactions = 0		5.97		
		(0.0001)		
B2) Interactions = 0		7.29		
		(0.0001)		
C1) Time and interactions = 0		15.17		25.45
		(0.0000)		(0.0000)
C2) Interactions = 0		19.09		33.87
		(0.0000)		(0.0000)
VIF	2.16	6.79		
R^2	0.4349	0.4676	within = 0.0263	within = 0.0944
	F(9, 947) = 84.82	F(15, 947) = 66.39	F(6,2187) = 7.07	F(9,2184) = 18.08
	Prob > F = 0.0000	Prob > F = 0.0000	Prob > F = 0.0000	Prob > F = 0.0000

*p<0.05, **p<0.01, ***p<0.001

F-statistics for 1) the test that the number of providers (A), the market share of the for-profit providers (B) or time (B) and the provider type interactions differ jointly from zero and 2) for the test that the coefficients of the public, employers' own and non-profit providers differ from for-profits.

APPENDIX 5. MODELS FOR UNIT PRICE AMONG FINNISH OHS PROVIDERS (N=924) IN 1992-2004, POOLED OLS AND PANEL MODELS WITHOUT AND WITH INTERACTIONS

	Pooled OLS, cluster-robust		Fixed effects, robust	
	no inter-actions	with inter-actions	no inter-actions	with inter-actions
Provider type: ref. for-profit				
Public provider	-0.224 *** (0.055)	-0.346 * (0.150)		
Employers' own	0.624 *** (0.050)	0.717 *** (0.148)		
Non-profit	0.589 *** (0.072)	0.976 *** (0.213)		
Number of providers (log)	0.113 *** (0.019)	0.168 *** (0.032)	0.145 * (0.069)	-0.159 * (0.068)
Public*number of providers (log)		-0.094 * (0.039)		0.397 * (0.176)
Emp.own*number of providers (log)		-0.077 * (0.035)		0.119 ** (0.037)
Non-profit*number of providers (log)		-0.210 ** (0.064)		0.116 * (0.048)
For-profit market share (%)	0.039 (0.155)	0.250 (0.155)	-0.195 (0.166)	0.300 (0.164)
Public*FP market share				
Emp.own*FP market share				
Non-profit*FP market share				
Number of OH professionals (log)	0.006 (0.027)	-0.009 (0.027)	-0.013 (0.044)	0.009 (0.043)
Scope: ref. only nurses and physicians				
In addition physiotherapist or psychologist	-0.047 (0.033)	-0.030 (0.033)	-0.038 (0.039)	-0.028 (0.037)
All four OH professionals	0.029 (0.053)	0.043 (0.052)	-0.052 (0.056)	-0.036 (0.053)
Time	0.038 *** (0.004)	0.002 (0.008)	0.044 *** (0.004)	-0.014 (0.008)
Public*time		0.061 *** (0.009)		0.078 *** (0.010)
Emp. own*time		0.022 * (0.009)		0.034 *** (0.008)
Non-profit*time		0.037 *** (0.010)		0.052 *** (0.010)
Constant	-0.160 * (0.076)	-0.137 (0.133)	0.042 (0.229)	0.402 * (0.193)
Interactions: F-statistics and p-values				
A1) Number of providers and interactions = 0		9.97 (0.0000)		3.18 (0.0129)
A2) Interactions = 0		4.18 (0.0059)		4.23 (0.0055)
B1) FP-market share and interactions = 0				
B2) Interactions = 0				
C1) Time and interactions = 0		43.32 (0.0000)		35.41 (0.0000)
C2) Interactions = 0		20.55 (0.0000)		21.40 (0.0000)
VIF	2.16	9.84		
R²	0.3975	0.4175	within = 0.0990	within = 0.1655
	F(9, 923) = 104.33 Prob > F = 0.0000	F(15, 923) = 71.51 Prob > F = 0.0000	F(6,2053) = 31.97 Prob > F = 0.0000	F(12,2047) = 26.86 Prob > F = 0.0000

*p<0.05, **p<0.01, ***p<0.001

F-statistics for 1) the test that the number of providers (A), the market share of the for-profit providers (B) or time (B) and the provider type interactions differ jointly from zero and 2) for the test that the coefficients of the public, employers' own and non-profit providers differ from for-profits.

APPENDIX 6. MODELS FOR REVENUE AMONG FINNISH OHS PROVIDERS (N=954) IN 1992-2004, POOLED OLS AND PANEL MODELS WITHOUT AND WITH INTERACTIONS

	Pooled OLS, cluster-robust		Fixed effects, robust	
	no inter-actions	with inter-actions	no inter-actions	with inter-actions
Provider type: ref. for-profit				
Public provider	-0.024 (0.096)	-0.625 * (0.277)		
Employers' own	1.232 *** (0.089)	1.217 *** (0.271)		
Non-profit	1.378 *** (0.124)	1.816 *** (0.449)		
Number of providers (log)	0.178 *** (0.030)	0.001 (0.072)	0.253 *** (0.068)	-0.161 * (0.079)
Public*number of providers (log)		0.275 ** (0.091)		0.419 ** (0.145)
Emp.own*number of providers (log)		0.223 ** (0.081)		0.203 *** (0.037)
Non-profit*number of providers (log)		0.096 (0.159)		0.157 *** (0.044)
For-profit market share (%)	0.800 ** (0.269)	4.020 *** (0.784)	-0.766 *** (0.150)	-0.084 (0.143)
Public*FP market share		-3.262 *** (0.892)		
Emp.own*FP market share		-4.305 *** (0.853)		
Non-profit*FP market share		-5.323 *** (1.361)		
Number of OH professionals (log)	1.285 *** (0.049)	1.253 *** (0.048)	0.239 *** (0.042)	0.232 *** (0.042)
Scope: ref. only nurses and physicians				
In addition physiotherapist or psychologist	-0.196 ** (0.057)	-0.182 ** (0.056)	-0.030 (0.037)	-0.039 (0.034)
All four OH professionals	-0.273 ** (0.083)	-0.270 ** (0.081)	-0.030 (0.049)	-0.066 (0.045)
Time	0.026 *** (0.006)	-0.035 (0.018)	0.080 *** (0.004)	0.063 *** (0.009)
Public*time		0.100 *** (0.020)		0.050 *** (0.009)
Emp. own*time		0.059 ** (0.020)		-0.036 *** (0.007)
Non-profit*time		0.070 * (0.029		-0.016 (0.009)
Constant	8.554 *** (0.134)	8.719 *** (0.251)	10.362 *** (0.224)	10.952 *** (0.198)
Interactions: F-statistics and p-values				
A1) Number of providers and interactions = 0				9.44 (0.0000)
A2) Interactions = 0		3.50 (0.0152)		11.64 (0.0000)
B1) FP-market share and interactions = 0		7.80 (0.0000)		
B2) Interactions = 0		15.62 (0.0000)		
C1) Time and interactions = 0		21.89 (0.0000)		123.01 (0.0000)
C2) Interactions = 0		10.98 (0.0000)		58.39 (0.0000)
VIF	2.11	15.15		
R^2	0.5898	0.6111	within = 0.3206	within = 0.4048
	$F(9, 953) = 219.77$ Prob > F = 0.0000	$F(18, 953) = 141.20$ Prob > F = 0.0000	$F(6,2461) = 137.55$ Prob > F = 0.0000	$F(12,2455) = 98.05$ Prob > F = 0.0000

*p<0.05, **p<0.01, ***p<0.001

F-statistics for 1) the test that the number of providers (A), the market share of the for-profit providers (B) or time (B) and the provider type interactions differ jointly from zero and 2) for the test that the coefficients of the public, employers' own and non-profit providers differ from for-profits.

Eila Kankaanpää

Studies on Purchasers and Providers of Occupational Health Services in Finland

Employers are obliged to organize preventive occupational health services (OHS). Most employers offer also medical care services to their employees. This dissertation studies the performance of the OHS: are the services effective (do their have an impact on a company's profitability), does the reimbursement system guarantee access to OHS irrespective of the economic situation of a company, do ownership, payment systems and market structure have an impact on the performance of the OHS providers.

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