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Does information on quality affect patients' choice of health care provider?

A synthetic control study of the information mechanism in the Swedish quasi-market for primary care

Master's Thesis 1 (15 hp)

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Abstract

A condition for patient choice in health care to promote quality is that patients act in accordance with information about quality and change to better care providers. In this paper I examine the relation between quality information and patient choice of care provider in the primary care of the county Scania in Sweden. As a natural experiment I use a quality-related award given to the best health care center in Scania. The award can be understood as an exogenous information shock. To estimate the effect from the award I reproduce the counterfactual situation with no information shock by using the synthetic control method. The results show that there is no significant effect from the information shock on the number of listed patients for the award-winning care provider. Therefore improved availability of information on quality seems to have limited effect on patients' choice of care provider. This suggests that the information-mechanism in the quasi-markets for primary care is not functioning properly, which implies that the incentives for care providers to improve quality are weak.

Keywords: patient choice, quasi-market, information shock, health care, primary care, information mechanism, information asymmetry, quality, synthetic control method, LOV, Region Skåne, health care center, care provider, Glasäpplet

Table of content

1 Introduction

With the purpose to improve quality and efficiency in the welfare sector quasi-market reforms have been introduced in many countries since the 1980s, in line with New Public Management theories that promote market-based ideas to develop the public welfare sector (Hood, 1991; Meinow et al., 2011; Thomson & Dixon, 2006; Zia & Khan, 2015). In Sweden this kind of quasi-market regulations have gradually been introduced on county level in the primary health care since 2007. In 2010 Sweden adopted the regulations nationally, which made it mandatory for all county councils to introduce quasi-market systems in the primary care (Anell, 2015). The new law was called *The Act on System of Choice* (Lag (2008:962) om Valfrihetssystem, LOV) and regulates the public procurement of primary health care and social services. The regulations in LOV are characterized by the possibility for patients to choose health care provider freely, unrestricted establishment for private care providers and publicly financed payments that follows the patient (*Ibid.*).

One of the central purposes of the regulations was to create competition between care providers and thereby generate economic incentives for care providers to raise quality in order to attract more patients. The reform was also motivated with claims that people want to choose care provider freely and that efficiency will increase due to more focus on cost-efficiency. The opponents to these reforms argue that care providers will focus more on profits than on quality and that more competition instead could create incentives to reduce costs through lower quality and cream-skimming.

However there is quite weak empirical evidence that more competition has given neither positive nor negative effects on quality and efficiency. Often studies have problems to find valid measures of clinical quality that are not too specific and many times it is difficult to identify exogenous variations in the level of competition. Another standard problem is the lack of randomization and thereby the risk for unobserved heterogeneity. Instead of

examining the direct relationship between the degree of competition and health care quality, this study therefore is focusing on the information mechanism behind patient choice.

A criterion for competition to function properly and actually generate higher quality is that patients do have access to information about the quality at different health care centers and that patients act rational and change care provider if they could enjoy higher quality at another health care center, supposed that transaction costs are sufficiently low. If the information mechanism does not work, it would be unprofitable for health care centers to put more resources on quality-enhancing measures and the allocation of patients to health care centers with higher quality will not function as intended. Therefore it is an essential question whether people really act in accordance with the available information on quality.

1.1 Purpose and research question

The main purpose of this study is to find out if the information mechanism in the Swedish quasi-market for primary care works as intended. More precisely the aim is to answer the following research question:

Does improved availability of information about the quality at a given primary health care center affect citizens' choice of that care provider?

This question is highly relevant since it contributes to the more general economic issue of whether it is possible to construct well functioning quasi-markets in the health care sector. This relates to Kenneth Arrow's groundbreaking article from 1963 about the specific characteristics of welfare economics in the field of health care. One of the special characteristics in health care mentioned by Arrow is the information asymmetry between medical professionals and patients, with an obvious difficulty for patients to assess the quality of medical care. A parallel question is whether patients are able to acquire and compare information on quality at different health care centers and change care provider when this is motivated.

To examine if patients in the Swedish primary care act in accordance with available quality-information this study use an approximately exogenous information shock represented by an award from the regional council in Scania (Region Skåne). This award is annually given to the best health care center in Scania County. The award is called the Glass Apple (Glasäpplet) and the criteria for winning are creativity, high quality (clinical), accessibility, continuity, safety and health promoting efforts (Region Skåne, 2015). In a broad sense all these criteria together constitute some indicator of high quality, both as experienced by patients and as clinical quality. In 2012 the Glass Apple Award was given to Sjöbo Health Care Center (HCC), which in this study is used as the "treated unit" out of 153 health care centers in Scania County. The idea is to examine if Sjöbo HCC got a significant increase in the number of listed patients after winning the award. If that is the case, it suggests that the information mechanism is functioning properly in the quasi-market for primary care.

There are reasons to believe that the Glass Apple Award can be understood as an information shock to citizens nearby Sjöbo. Something that strongly indicates this is the fact that the news about the awarding of Sjöbo HCC was reported both in radio and in several newspapers[1]. For those people living nearby Sjöbo HCC it is not unreasonable to assume that the information also reached them through informal and interactive channels. This kind of information spreading can be assumed to have its origin especially from persons that are listed at Sjöbo HCC and thereby are more likely to know about the award.

Furthermore it is reasonable to assume that people interpret the information about the award as an indication of high quality at Sjöbo HCC since this is explicitly mentioned in almost all news reporting about the awarding of Sjöbo HCC. It is also plausible to assume that people in general think the award is a trustworthy indicator of quality since the regional council likely is perceive as a reliable information source.

[1] The news about the Glass Apple Award to Sjöbo HCC in 2012 was sent out in a press release by the regional council in Scania (Region Skåne) and thereafter written about in the following newspapers; *Skånska Dagbladet* (two articles), *Laholmstidningen*, *Lokaltidningen, Helsingborgs Dagblad*, *Ystads Allehanda* and it was also reported about in the radio station *P4 Malmö* (also as a news item on their website).

Since there is only one treated unit, standard regression methods are not feasible and the effect from the information shock is instead estimated with a comparative matching method called *synthetic control method*. This method can be understood as a difference-in-difference approach where a control unit is created synthetically by combining information from all comparison units that have similarities with the treated unit in the period before the treatment. The synthetic control unit is constructed to be as similar as possible to the real treated unit and should thus indicate how the patient flows would have changed in the counterfactual situation without the information shock from the award (Abadie & Gardeazabal, 2003; Abadie et al. 2010 and Abadie et al. 2015).

The quasi-market regulations in Scania County, *Health- and Care Choice Scania* (Hälso- och Vårdval Skåne), were introduced in the end of 2009, before the national mandatory law, LOV. During the first year after the reform many new private providers established and this affected the patient flows much. To avoid this initial volatility in patient flows it is motivated to not choose an award winner from 2010 or 2011 as the "treated" unit. Therefore the winner from 2012, Sjöbo HCC, is chosen as the treated unit of analysis. Another reason for choosing Sjöbo HCC is that inhabitants in Sjöbo on average have relatively good socioeconomic conditions (see CNI-value in Table 1, chapter 5). From the assumption that persons with good socioeconomic conditions generally are better informed and also possess the necessary social and economic resources to change care provider, the choice of Sjöbo HCC as the treated unit is motivated as a *most likely case* (Dixon & Le Grand, 2006; Fotaki et al., 2008). This means that if quality-related information has any effect at all on citizens' choice of care provider this should at least be seen in the case with Sjöbo HCC.

1.2 Disposition

In the next chapter I present the previous research with focus on patient choice. Thereafter I describe the theoretical perspectives on economic characteristics in health care in general and more specifically in quasi-market systems. Following that, I introduce the method and data

that is use. Particularly the synthetic control method is described with a sketch of the econometric model and the placebo analysis that enables statistical inference. After that I present and analyze the results from the synthetic control estimations. Then I discuss how the results can be interpreted and related to theory and previous research, and what scope there is for future research. At last I draw the main conclusions about the connection between quality-related information and patient choice in quasi-markets for health care.

2 Previous research

Research regarding patient choice in quasi-markets for health care has become a quite extensive research area in the field of welfare policies as more and more market-oriented reforms are being implemented in the welfare sectors across many countries. Much of the previous research has focused on patient choice within the UK National Health Service (NHS). For example Sanderson et al. (2013) discuss different types of patient choices in the NHS and that a cultural shift is needed to guarantee that general practitioners really present all available choices for patients. Some theoretical studies problematize what people actually obtain from their free choice. Botti and Iyengar (2006) argue that people are not always better off by making their own choices. They also state that more alternatives make people less willing to choose and increase the risk of feeling unsatisfied with one's choice (Botti and Iyengar, 2006:26).

The more empirical research has mostly focused on citizens' attitudes towards patient choice and the effects of a higher degree of patient choice on quality, efficiency, health care access and equity in access. As an example Rosen et al. (2001) study what preferences patients in the Swedish primary care have towards choosing care provider. They find that younger patients (18-30 years old) do not advocate their free choice of care provider as much as older patients. Younger patients do also feel that they do not have enough information to enable a choice of care provider, while older patients to a larger extent feel that they do have sufficient information. Robertson et al. 2008 conclude from patient survey data that the most important aspect for patients in the primary care is the quality in the relationship to their doctor, and thus this should be the main objective in choosing care provider. Another study by Goldman and Romley, (2008) concludes that amenities like attentive staff, nice surroundings and pleasant food is highly effective in attracting patients.

In the Swedish context the Agency for Health and Care Services Analysis (Myndigheten för Vårdanalys) has written a report based on a comprehensive survey study on citizens'

preferences for choosing provider in the primary care. These results are highly relevant and show that 76 percent of the respondents consider it important to have the possibility to choose care provider, 95 percent know that they are free to choose provider, 24 percent have actually changed provider in the previous three years, 11 percent are considering changing provider and 64 percent have neither changed or considered changing provider (Myndigheten för Vårdanalys, 2013). Of the 24 percent that have changed provider half of them changed because they had moved, 19 percent of all who changed provider changed because they were dissatisfied with their previous provider and 12 percent because another health care center appeared to be better. The report also shows that citizens in general seek quite little information before changing care provider. A third of those who have changed or consider changing provider had not searched for any information at all. At the same time about a third of all respondents state that they avoid changing provider due to a lack of sufficient information about other health care centers (*Ibid.*). These results indicate that the information mechanism for allocating patients to better health care centers does not function properly.

The effects of patient choice on equity within the NHS has been examined by Dixon and Le Grand (2006), whom affirm that there are socioeconomic inequalities in the utilization of patient choice and health care in the NHS. They mean that socioeconomically deprived groups have a need for more help in choosing relevant care providers and with compensations for transport- and travel costs (*Ibid.*). The national audit in Sweden, Riksrevisionen, has examined the effects from the Swedish quasi-market reforms in 2010. They report that the quasi-market regulations has resulted in the pattern that private health care centers establish significantly more in areas with socioeconomically favored citizens, that generally have lower health care needs (Riksrevisionen, 2014:10).

In a literature review of the research findings on patient choice Fotaki et al. (2008) concludes that patient choice in general is not highly prioritized by citizens except where the service is bad, for example with long waiting times. Fotaki et al. also observe that well-educated citizens are better informed and utilize their patient choice to a higher degree than citizens with less education. Further they conclude that there is little evidence in the literature implying that more patient choice by itself would improve quality and efficiency in health care (Fotaki et al., 2008). Thomson and Dixon (2006) examine policy changes in the degree

of patient choice in some western European health care systems. They find that the use of patient choice is generally surprisingly low except when the choice of care provider to a large degree is driven by long waiting times. Otherwise Thomson and Dixon concludes that factors which are related to culture and norms seems to influence how much citizens use their patient choice. In a study by Varkevisser et al. (2012) the connection between hospital quality and patient choice is examined. They find that patients have a tendency to choose hospitals with good reputation and low readmission rates after being treated for heart failure. They also address the problem that imperfect information on quality might cause patients to make bad choices of care providers (*Ibid.*).

To sum up the previous research on patient choice some factors that seem important for patients in their choice of care provider is the relationship to their doctor, amenities, good reputation, low readmission rates and short waiting times. The main factor that causes people to change care provider seems to be dissatisfaction with the current care provider, especially related to bad service like long waiting times. The previous research also shows that people in general are quite bad in utilizing their patient choice and that it is rather unusual to search for information about care providers. However well-educated citizens seems to be better informed and to utilize their patient choice to a higher degree.

3 Theory

3.1 Theoretical foundation for health care economics

Kenneth Arrow (1963) founded the theoretical framework for how to analyze and understand health care in terms of the competitive model and how health care differ substantially from other goods and services in competitive markets. Arrow (1963:946) identifies uncertainty, risk and information as the most important characteristics of health care. The main point that Arrow express is that some markets differ considerably from the competitive model and cannot fulfill all conditions for Pareto efficiency, and if this is the case it could be impossible to separate resource allocation and social policies for redistribution (*Ibid*.). Arrow indicates that health care is one such market, where there are severe problems for the market forces to deal with uncertainty, information and risk. The main problem is the non-marketability of these characteristics in health care. For example it is very difficult for patients to assess the value of information received from physicians, how qualified physicians are and how effective the treatment is. With all these uncertainties there is no well-functioning insurance to deal with risk bearing.

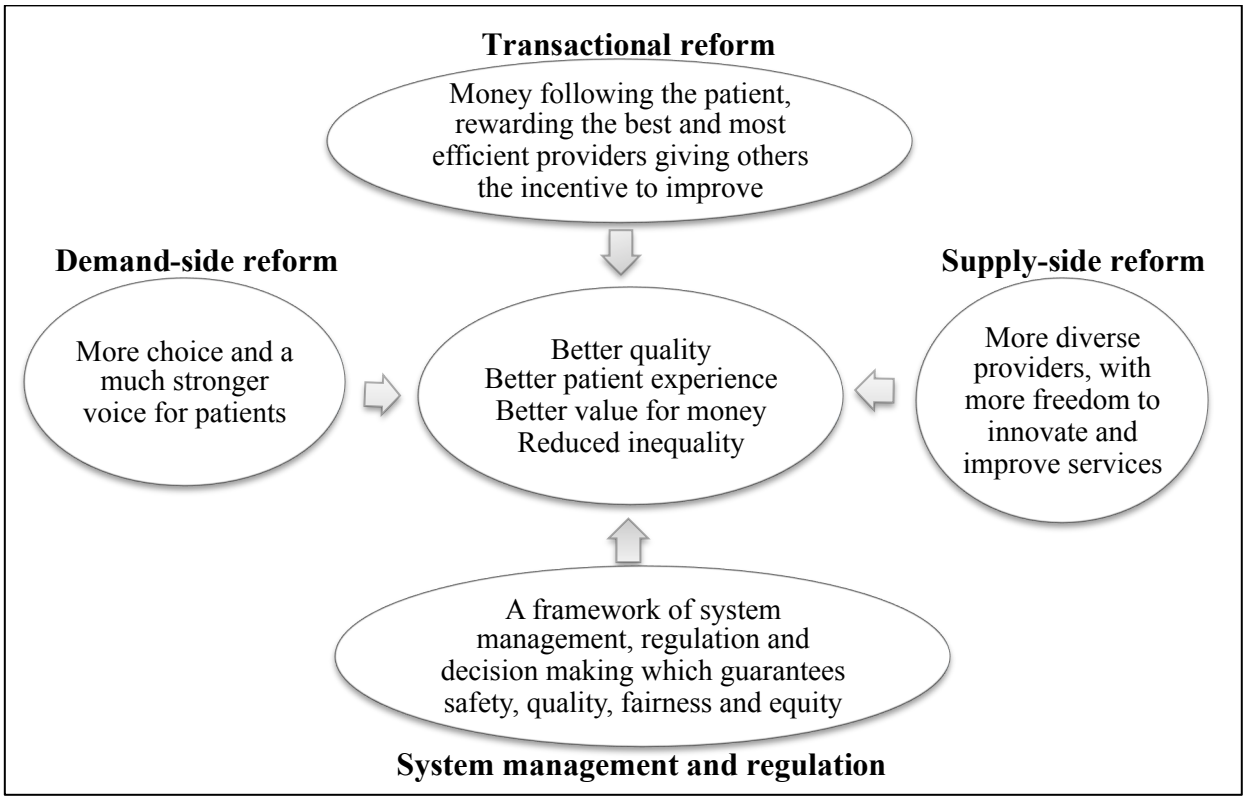
These problems concerning the non-marketability of risk bearing, information asymmetry and uncertainty motivates special structural configurations of the health care sector (Arrow, 1963). Accordingly Arrow's theoretical framework facilitates our understanding of why there are needs for regulations in the health care sector, which is important to have in mind when assessing recently introduced market mechanisms in health care. There is also a further theoretical aspect of regulations in the health care sector; this is the fairness perspective that goes beyond Arrow's theoretical framework that is mostly based on efficiency as the end goal. But Pareto efficiency does not imply anything about the fairness of the allocation. If the initial distribution of financial resources is unequal, the unequal

purchasing power will affect persons' abilities to satisfy their needs on unregulated markets for health care (Allen, 2013).

3.2 Theory on quasi-markets for health care

Quasi-market reforms can be understood as a central component in the broader theoretical framework of New Public Management (NPM) (Zia & Khan, 2015:433*ff*). Besides introducing market mechanisms in welfare services, NPM is typically characterized by a focus on evaluating and controlling outputs, desegregating and decentralizing bureaucratic systems, and organizing public administration with the business model as template, in which citizens are treated like customers (*Ibid.*). Quasi-market systems in health care can be designed in various ways but are often characterized by the combination of public funding, patient choice, payments that follows the patient, competition and diversification among providers, and some regulatory system (Allen, 2013; Niemietz, 2015). The idea of quasi-markets can be understood as an attempt to combine the expected benefits of competition with the gains of public funding in terms of fairness and equal access to health care (Allen, 2013:3). Figure 1 shows Allen's (2013) theoretical systematization of the four interrelated pillars of quasi-market reforms and the supposed outcomes.

Figure 1. The four interrelated pillars of quasi-market reforms



Source: Figure is constructed from Allen, 2013:4.

On the demand side of quasi-market reforms the patient's free choice of care provider is central to the idea of creating competition. According to the quasi-market theory the patient choice must be combined with some sort of transactional reform to generate competition (Allen, 2013). The transactional reform consists in the introduction of a payment schedule where money follows the patient, and thereby generates incentives for care providers to attract more patients (Niemietz, 2015:100). The theory asserts that care providers will improve quality and generally be more patient-friendly since they want to attract as many patients as possible. On the supply side quasi-market reforms are often characterized by policies aimed at promoting diversification of different types of providers (Allen, 2013:4*ff*). In the theory this would generate new innovative ideas of how to improve health care services. One typical way of diversifying, that is often used when quasi-markets are introduced in health care sectors that formerly had mostly public providers, is to open up for private providers and to privatize

public providers. This also creates another form of competition, based on the quantity of providers in related to the quantity of patients.

The last pillar in quasi-market reforms is the introduction of a framework for system management and regulation, which should guarantee safety, quality, fairness and equity in the health care (Allen, 2013:4*ff*). Such regulatory frameworks often contain rules for pricing, contracting and standards for health care services. As an example the quasi-market regulations in Scania County use the variables Care Need Index (CNI) and Adjusted Clinical Group (ACG) to weight the remunerations to care providers based on socioeconomic factors and former diagnoses (Region Skåne, 2015 b). By this remuneration scheme health care is supposed to be distributed more fair and equal, so that health care centers with patients that have larger care needs get more resources. Altogether the four interrelated pillars of quasi-market reforms are expected to create competitive behavior between care providers, which according to the theory will improve quality, patient experience, equality and efficiency (Allen, 2013). One of the foremost proponents of the quasi-market theory is Le Grand, whose main argument is that the combination of user choice and provider competition is superior to other public service systems in creating incentives to improve quality and efficiency (Le Grand, 2007:42*ff*). Furthermore Le Grand argues that user choice also is desirable in itself since citizens are given greater autonomy and stronger voice, which places the user's needs in the center (*Ibid.*).

However there are plenty of theoretical problematizations of quasi-markets as well. Allen (2013:5) highlights the issue on the supply-side with the risk of deficient competition in regions with small populations and concerning specialist care. Furthermore the freedom for care providers to establish anywhere and to avoid expensive specialist care services are types of cream-skimming that lead to inequality. Another issue, raised by Propper (1995), is the information asymmetry in the principal-agent relationship between the governing agencies and the care providers. Since health care is publicly funded the governing agency wants to monitor care providers in purpose to ensure that resources are correctly used. Propper claims that the high degree of information asymmetry in health care makes monitoring difficult to implement and therefore the incentives for care providers to improve efficiency and quality is limited (*Ibid.*). Allen (2013:5) reasons similarly and asserts that quasi-markets even create

incentives for care providers to skimp on unobserved aspects and thereby lower quality in health care in purpose to cut costs.

As Arrow (1963) emphasizes information asymmetry is also a critical problem in the relation between patients and care providers. The patient choice in quasi-market systems places a large responsibility on ordinary citizens to obtain, evaluate and compare information on health care quality for different providers. Even if quality-related information may be available it is an open question whether people really act as rational economic agents and search for this information and after rationally comparing all alternatives decides which care provider to choose.

The traditional *rational choice theory* on social and economic behavior assumes that individuals are expected-utility maximizers that act consistent, which imply that they are able to rank alternatives with transitive preference ordering (Green & Shapiro, 1996:13*ff*). Furthermore rational choice theorists typically assume that the relevant agent is the individual, not any collective or institutional entity, and that all individuals act in accordance with the same model assumptions (*Ibid.*). An area of disagreement within the rational choice school is about how much relevant information agents are able to acquire and act upon (Green & Shapiro, 1996:19). The traditional neoclassical model assumes perfect information and individuals that are able to obtain, understand and act on relevant information. These assumptions are apparently unrealistic which has made many rational choice theorists to revise the model to the assumption that individuals make the best of the imperfect information they got (*Ibid.*) Imperfect information is much more realistic since it takes into account that information collecting costs both time and money that could be consumed/invested in other activities that the individual conceive to yield more utility (*Ibid.*).

Some theorists also problematize the concept of rationality with the phenomenon of myopic behavior, which could be understood as rational if we assume that planning for the future is costly. In behavioral economics, sociology and psychology other alternative approaches towards rationality and human behavior can be found. For example Lupton (1998) criticizes the notion of patients as rational consumers in health care and instead promote the idea of complexity and irregularity in the relation between patients and care providers, in which emotions, desires and needs together construct these relations in various ways.

Muramatsu and Fonseca (2012) analyze the freedom of choice from the perspective of *bounded rationality*, and formulate the thesis that limits to rationality by cognitive shortcomings and difficulties of self-control in some cases could motivate light paternalism, but not in all cases. Another alternative theoretical approach to patient choice and rationality is provided by Fotaki (2006) whom applies psychoanalytical theory on human behavior associated with patient choice. Fotaki concludes that the patient-doctor relation is crucial in understanding patient choice, and that this relation to a large degree is formed by underlying psychological dynamics rather than rational reasoning (Fotaki, 2006).

4 Method and data

4.1 Synthetic Control Method

When conducting comparative case studies with few units of analysis the standard method is to use some sort of *difference-in-difference*-design, in which the logic is to compare the difference in the outcome variable over time for the treated unit with the difference over time for some untreated comparison unit. The idea is to choose a comparison unit that is most similar to the treated unit. But often it is hard to find comparison units that have been exposed to the same time-varying factors except the exogenous treatment or shock in question. When doing comparative case studies a more systematic and reliable approach called *synthetic control method* can be used. This method has quite recently been formulated in Abadie and Gardeazabal (2003) and further developed in Abadie et al. (2010) and Abadie et al. (2015). Later the method has also been used for example in Dietrichson and Ellegård (2015). The synthetic control method is a groundbreaking methodological innovation in the field of comparative case studies that enables more systematic and reliable inferences from small samples, without being forced to use more or less arbitrarily chosen control units.

The rationality behind the synthetic control method is to combine both qualitative and quantitative information from many comparison units into a synthetic control unit, which is most similar to the treated unit and thereby reproduces the counterfactual case (no treatment) more accurately than a single comparison unit would do (Abadie et al. 2015:496). Consequently the synthetic control method generates more reliability in comparative case studies since it avoids the complicated process of choosing a comparison unit. The data driven selection process used in the synthetic control method reduces the elements of discretion and instead transparently reveals on what basis the different comparison units are chosen, how they are weighted and which observable characteristics that are similar for the treated unit and the comparison units in the pretreatment period (Abadie et al. 2010:493*f*). The constructed

synthetic control unit is used to predict how the outcome variable (number of listed patients) would have evolved for Sjöbo HCC in the post-treatment period, had it not been affected by the information shock. All estimations performed with the synthetic control method in this study are done by use of the *Synth package* in Stata, developed by Abadie, Diamond and Hainmueller (2014).

4.2 Econometric model

The sample of health care centers used in this study consists of $I + 1$ units, where each unit is denoted as *i.* The "treated" unit, Sjöbo HCC, is represented by $i = 1$ and the remaining units $i = 2$ to $i = I+1$ represents the so-called *donor pool* of potential comparison units. It is from the donor pool that the synthetic control unit is generated. The synthetic control unit is defined as the weighted average of the units included in the donor pool (Abadie et al. 2015). Consequently a synthetic control unit can be described as a $(I \times 1)$ vector of weights, $W = (w_2, \ldots, w_{I+1})$, where $0 \leq w_i \geq 1$ for all units in the donor pool, in which all weights together sum up to 1; $w_2 + \ldots + w_{I+1} = 1$. The weights are intended to identify units from the donor pool that have similar characteristics as the treated unit in the pretreatment period. Therefore the synthetic control unit is constructed as the vector of weights that minimize the sum of differences in pretreatment characteristics between the treated unit and the synthetic control unit (Abadie et al. 2015; Abadie et al. 2010).

The relevant characteristics are defined by which predictor variables are included in the synthetic control estimation. Not only variables that are supposed to affect the outcome variable (Y_{it}) is used as predictor variables, but also a number of lags of the outcome variable itself is included as autoregressive predictor variables. The predictor variables are denoted as $m = 1, \ldots, k,$ and consequently the values of all predictor variables for every unit in the donor pool during the pretreatment period are represented by the $(k \times I)$ matrix X^{dp}. The corresponding variable values for the treated unit in the pretreatment period are represented by the $(k \times 1)$ vector X^{tu}. Accordingly the sum of differences, $X^{tu} - X^{dp}W$, for all predictor variables, *m,* will be minimized. For each predictor variable, *m*, there will be a weight, $v_{m,}$ for

the predictive power reflecting the relative strength in the correlation between the outcome variable and the specific predictor variable. Thus the following model equation is used to generate the optimal synthetic control unit (W*):

$$\text{Min} \sum_{m=1}^{k} v_m (X_m^{tu} - X_m^{dp} W)^2 \quad (1)$$

Then the generated vector of optimal weights W* = (w_2^*, …, w_{I+1}^*) is used in the estimation of the effect from the information shock. The synthetic control estimation is given by the difference in post-treatment outcomes between the treated unit and the synthetic control unit (*Ibid.*). The time periods are measured as months and are denoted as $t = 1, \ldots, T$, where T is the last time period and the information shock occurs in time period T_0. Thereby the pretreatment period is $t = 1, \ldots, T_0$ and the post-treatment period is denoted as T_1, so that $T_0 + T_1 = T$. The ($T_1 \times 1$) vector of post-treatment values on the outcome variable for the treated unit is denoted as Y^{tu} and the ($T_1 \times I$) matrix of post-treatment outcome values for the donor pool is denoted as Y^{dp}, so that $Y^{dp}W^*$ represents the weighted outcome for the synthetic control unit. For a specific post-treatment period $t > T_0$ the effect from the information shock can be estimated as:

$$Y_t^{tu} - \sum_{i=2}^{I+1} w_i^* Y_{it} \quad (2)$$

There is no easy way to assess if the estimated differences in outcome between the treated unit and the synthetic control unit implies a significant effect from the information shock. Since the sample is relatively small, containing 80 health care centers in the donor pool the conditions for statistical inference is not optimal. Nor is there any complete randomization in which health care center that gets the information shock. To assess the size of the eventual effect from the information shock the *root mean square prediction error* (RMSPE) is used. The RMSPE measures the average gap in the outcome variable between the treated unit and

its synthetic control unit (Abadie et al. 2015:502). In the pretreatment period the RMSPE shows how well the synthetic control unit matches the treated unit. A small pretreatment RMSPE indicates that the predictive power in the synthetic control unit is good. The post-treatment RMSPE shows the gap between the predicted trend for the outcome variable without the information shock and the actual trend. The pre- and post-treatment RMSPE are defined as:

$$RMSPE_{pre} = \left(\frac{1}{T_0} \sum_{t=1}^{T_0} \left(Y_t^{tu} - \sum_{i=2}^{I+1} w_i^* Y_{it} \right)^2 \right)^{\frac{1}{2}} \quad (3)$$

$$RMSPE_{post} = \left(\frac{1}{T_1} \sum_{t=T_0+1}^{T_1} \left(Y_t^{tu} - \sum_{i=2}^{I+1} w_i^* Y_{it} \right)^2 \right)^{\frac{1}{2}} \quad (4)$$

A large post-treatment RMSPE is not sufficient as a reliable indicator of an effect, but if it is large in relation to the pretreatment RMSPE this would indicate an effect (Abadie et al. 2015:505). Consequently the intuition is that if the treated unit and the synthetic control unit match well in the outcome variable before the exogenous shock but not afterwards, this indicates that the shock affected the outcome variable for the treated unit. To evaluate the reliability of the estimated effect, the ratio of post- and pretreatment RMSPE's should be compared to the corresponding RMSPE-ratios generated from the same estimation performed with non-treated units as placebo tests. The comparison with these placebo estimates will enable an assessment of the significance in the effect for the treated unit.

4.3 Placebo analysis

The method for inference in this study is based on an *in-space placebo analysis*. This means that the synthetic control estimation is performed on health care centers in the donor pool that were not exposed to any information shock, but are handled as if they were. Since they did not

experience an information shock, we expect small or no effects on the number of listed patients. Thus, if the placebo estimates yield equally large or larger effects on the outcome variable associated with the time period in which the information shock would have occurred, then it is unlikely that it was the information shock that caused the change in the outcome variable for the treated unit. It is important to note that the placebo analysis only yields inference by falsification and not verification, meaning that lack of falsification is not equal to verification of the correlation in question.

If the in-space placebo analysis is performed for all comparison units in the donor pool, a distribution of placebo effects can be used to evaluate the significance of the estimated effect for the treated unit (Abadie et al. 2015:500). The distribution of placebo effects, measured as the RMSPE-ratios, enables a quantitative comparison between placebo effects and the estimated effect for the treated unit. Like in statistical inference this quantitative comparison can be expressed in p-values equal to the fraction of placebo effects that are larger or equally large as the estimated effect for the treated unit (*Ibid.*). The p-value can be understood as the probability to obtain placebo effects that are at least as large as the estimated effect for the treated unit. Thus a low p-value indicates that it is unusual to find such large difference in the outcome variable between the pre- and post-treatment period, and thereby implies that the Glass Apple Award could have been the cause. A high p-value instead indicates that it is common to find differences of this size, and thus it is unlikely that the Glass Apple Award had a considerable effect on patient choice.

4.4 Data and variables

The data set consists of monthly panel data for all primary care centers in Scania County in Sweden. The data set is provided by the regional council administration of Scania (Region Skåne, 2015 b). For the time period from June 2011 to March 2014 there were 153 health care centers in Scania, and they are all included in the data set. The panel data set is balanced, which means that all included units are observed in each time period. As mentioned before Sjöbo HCC is chosen as the "treated" unit, where the treatment consists in winning the award

for best quality in the primary care sector of Scania. This award is supposed to function as a quality-related information shock to people living in the surroundings of Sjöbo. The hypothesis is that the number of people that choose to be listed at Sjöbo HCC increased after the positive information shock from the award in May 2012 (T_0).

In the construction of the donor pool health care centers must be dropped if there occurred other structural shocks to the outcome variable or if they are directly correlated with Sjöbo HCC in terms of the outcome variable. Therefore the health care centers Västra Fäladen and Centrum Landskrona were dropped because of a merger in the beginning of 2013. The health care centers Brahehälsan and Närlunda were also dropped since they got the Glass Apple Award in 2011 and 2013. Another dropped health care center is Degeberga, since the house property for the health care center was sold in 2012 and there were speculations of whether Degeberga HCC would shut down. Furthermore the other health care center in Sjöbo named Novakliniken was dropped from the donor pool because of assumed direct correlation with Sjöbo HCC. Some health care centers were dropped since they lack observations from the whole time period that is used in the synthetic control estimations (from June 2011 to March 2014).

It is also important to avoid interpolation biases generated by distorting information from units that are of essentially different character than Sjöbo HCC. One group of units that probably have quite different characteristics is private health care centers. These are likely to have a generally more positive trend of increasing number of listed patients since they entered the health care sector quite recently. In the estimations I use a dummy variable for private health care centers, and since there are many public health care centers the private providers will in practice be dropped if they get assigned zero weight (w_i) as predictors because they are too different from public health care centers.

The predictor variables are *CNI*, *ACG*, *Private* (dummy-variable for private health care centers) and three lags of the outcome variable; $Y_{t=1}$, $Y_{t=6}$ and $Y_{t=11}$. CNI stands for Care Need Index and measures the expected risk of developing bad health based on socioeconomic factors such as unemployment, having more than one child that is younger than five years, being born outside of EU, being a single parent with children that are younger than 17 years, living alone while being above 65 years old, having moved within the last year, and having a

low level of education (Region Skåne, 2015 b). These socioeconomic factors are for instance correlated with cardiovascular disease, cancer and mental illness (*Ibid.*). The CNI measures the aggregated mean for all listed patients in each health care center and it is defined relatively so that the total mean for all health care centers in Scania is equal to 1,0 over a specific period. The more of the socioeconomic conditions for CNI that are fulfilled, the higher value will there be and vice versa.

The variable *ACG* stands for Adjusted Clinical Group and measures the expected need for health care resources based on the health conditions of the listed patients at each health care center (Region Skåne, 2015 b). The ACG is constructed by data on diagnoses for all citizens during the previous 18 months. What values patients get on ACG is also determined by factors like the duration and severity of the health condition, the certainty in diagnosis, the cause of disease, and the requirement for specialist care (*Ibid.*). A high value on ACG indicates severe morbidity and a large expected need for health care. Similar to CNI the ACG variable is measured relatively to the total mean for all health care centers in Scania, so that the mean of the relative ACG-weights are 1,0.

The third variable used in the synthetic control estimations is the dummy variable for private health care centers. This is an important variable since it is likely that the number of listed patients directly or indirectly depends on whether the health care center is public or private. The most obvious way that ownership affects the patient flows is that the quasi-market reforms with patient choice and free entry for new private actors was introduced quite recently and therefore it is likely that the initial patient flow from public to private health care centers still has some effect in the time period looked at in this study. Thereby it can be expected that private health care centers generally have a more positive development in terms of number of patients listed. It is also motivated to include the dummy for private health care centers because it might be correlated with unobserved variables that could affect the output variable. For example it is plausible that those persons that once have changed to private health care providers are generally more sensitive to quality-related information shocks.

The last included predictor variables in the estimation are three lags of the dependent variable Y_t. The lags will be $Y_{t=1}$, $Y_{t=6}$ and $Y_{t=11}$, corresponding to the number of patients in June 2011, November 2011 and April 2012. The purpose of including lags of the outcome

variable in the pretreatment period is that these captures the effect from unobserved variables and therefore generates a better prediction on the outcome variable for the synthetic control unit in the post-treatment period. Consequently the synthetic control method has an important advantage compared to the difference-in-difference framework since it allows for unobserved variables to affect the outcome variable with time-varying effect (Abadie et al. 2010:494).

5 Results and analysis

5.1 General descriptive statistics

The quasi-market regulations were introduced in the end of 2009 in Scania. As expected we can observe from Table 1 that there is a clear trend of increasing mean number of listed patients in private health care centers, while there is a corresponding decrease for public providers. For Sjöbo HCC we can observe a decrease from year 2011 to 2012 and thereafter an increase, which implies a deviation from the negative trend for public health care centers.

Table 1. Descriptive statistics for all Health Care Centers in Scania County

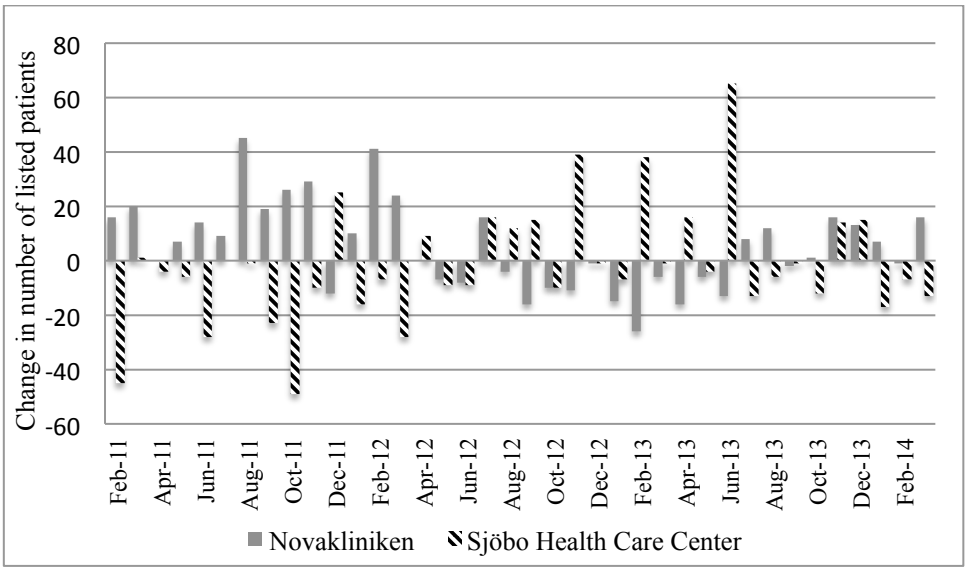
	Mean All	**Mean Private**	**Mean Public**	**Mean Sjöbo**	**Min. All**	**Max. All**
Listed patients:						
2014	8539,8 (3748,0)	7394,7 (4133,3)	9402,0 (3167,0)	13445,0	610	22062
2013	8425,1 (3840,4)	7097,5 (4216,4)	9434,1 (3176,2)	13432,5	232	22046
2012	8418,5 (3911,7)	6920,2 (4304,1)	9482,7 (3207,0)	13327,7	12	23422
2011	8583,5 (4123,1)	6812,0 (4756,5)	9642,6 (3261,8)	13412,3	93	28512
CNI	1,020 (0,299)	0,953 (0,280)	1,067 (0,302)	0,885	0,493	2,632
ACG	1,009 (0,116)	1,056 (0,136)	0,976 (0,086)	1,021	0,642	1,556

Note: The table shows variable values for Health Care Centers in Scania County between June 2011 and March 2014. Standard deviation of mean is shown in parentheses.

From Table 1 it can also be concluded that CNI is generally higher for public health care centers, which means that the socioeconomic conditions are worse for persons listed at public health care centers. If people in general are listed at health care centers nearby their homes, this suggests that the expected care need is larger in areas around public health care centers than around private. This pattern could be explained by the conclusions in a recent report from the Swedish national audit, Riksrevisionen, which asserts that private health care centers established significantly more in areas inhabited of persons with better socioeconomic conditions and lower need for health care (Riksrevisionen, 2014:10). Somewhat surprisingly the ACG is generally higher in private health care centers. But this does not necessarily imply that the need for health care is larger for private health care centers. In a study of the ACG and CNI as reimbursement determinants Borgquist et al. (2010) concludes that ACG was the best predictor of individual primary care costs, but that the variation in costs between health care centers was mostly explained by socioeconomic factors included in the CNI variable.

It is also shown in Table 1 that Sjöbo HCC has a lower CNI than the mean for both private and public health care centers. This supports the methodological idea that Sjöbo is a most likely case in the meaning that if we assume that people with better socioeconomic conditions (lower CNI) generally are better informed and also have the necessary resources to change provider, then the quality-related award to Sjöbo HCC should generate an effect on the number of listed patients if official information on quality matters at all. In addition to Sjöbo HCC there is one private health care provider in Sjöbo called Novakliniken, which reasonably can be assumed to be the main competitor for patients. In Figure 2 below we can observe how the number of listed patients increased for Novakliniken and decreased for Sjöbo HCC in 2011 and the first half of 2012. Thereafter Novakliniken experienced a downturn in the patient flow while Sjöbo HCC at the same time had an upturn. A graphic analysis is that it seems like the patient flows for the two health care centers are negatively correlated and that the trend actually shifted in favor of Sjöbo HCC around the time when they got awarded.

Figure 2. Patient flow at Sjöbo HCC and Novakliniken 2011-2014



Note: Novakliniken had 3860 listed patients in June 2011 and 4055 in March 2014, while Sjöbo HCC had 13496 listed patients in June 2011 and 13434 in March 2014.

It is impossible to know if the information shock from the award caused the trend shift in patient flows since the shock could have affected both Novakliniken and Sjöbo HCC. Therefore we need a control unit that could represent the counterfactual case of no information shock.

5.2 Constructing the synthetic control unit

By minimizing the difference in pretreatment characteristics between Sjöbo HCC and comparison units in the donor pool (see equation 1), the synthetic control unit is constructed as an optimal vector of weights (W*) where the weight for each comparison unit is presented in Table 2 below.

Table 2. Synthetic weights for Sjöbo HCC

Health Care Center (HCC)	Synthetic Control Weight	Health Care Center (HCC)	Synthetic Control Weight
HCC Anderslöv	0,001	HCC Nöbbelöv	0,001
HCC Arlöv	0,001	HCC Osby	0,001
HCC Bokskogen	0,001	HCC Oxie	0,001
HCC Borgmästaregården	0,001	HCC Perstorp	0,001
HCC Brösarp	0	HCC Planteringen	0,001
HCC Bunkeflo	0,001	HCC Påarp	0,001
HCC Centrumkliniken	0,001	HCC Ramlösa	0,001
HCC Dalby	0,002	HCC Rosengården	0,001
HCC Delfinen	0,001	HCC Rydebäck	0,001
HCC Drottninghög	0,001	HCC Råå	0,001
HCC Eden	0	HCC Sankt Lars	0,001
HCC Fagerängen	0,001	HCC Sjöcrona	0,002
HCC Fosietorp	0	HCC Skurup	0,001
HCC Fågelbacken	0,044	HCC Solbrinken	0,001
HCC Förslöv	0,001	HCC Sorgenfrimottagningen	0,001
HCC Granen	0	HCC Staffanstorp	0,424
HCC Gullviksborg	0,001	HCC Stattena	0,001
HCC Husensjö	0,001	HCC Svalöv	0,001
HCC Husie	0,002	HCC Södertull	0,001
HCC Hörby	0,002	HCC Södervärn	0,001
HCC Höör	0,153	HCC Söderåsen	0,001
HCC Kirseberg	0,001	HCC Södra Sandby	0,001
HCC Klippan	0,001	HCC Sösdala	0,001
HCC Knislinge	0,001	HCC Tollarp	0,001
HCC Kroksbäck	0,001	HCC Tomelilla	0,001
HCC Kärråkra	0,001	HCC Tåbelund	0,001
HCC Kävlinge	0,002	HCC Tågaborg	0,001
HCC Laröd	0,001	HCC Törnrosen	0,001
HCC Laxen	0,047	HCC Vellinge	0,002
HCC Limhamn	0,001	HCC Vilan	0,001
HCC Lindeborg	0,001	HCC Vinslöv	0,001
HCC Linero - Östra Torn	0,001	HCC Vittsjö	0,001
HCC Ljungbyhed	0,001	HCC Vä	0,001
HCC Lomma	0,001	HCC Vänhem	0
HCC Lundbergsgatan	0,001	HCC Ystad	0,255
HCC Lunden	0,001	HCC Åhus	0,002
HCC Löddeköpinge	0,002	HCC Åparken	0,001
HCC Måsen	0,001	HCC Åstorp	0,001
HCC Norra Fäladen	0,001	HCC Örkelljunga	0,001
HCC Näsby	0,001	HCC Östermalm	0,001

Note: Only public health care centers are included in this table since all private providers were assigned zero weight. The following health care centers are dropped since they do not have observations for the whole time period: Capio Citykliniken Bunkeflo-Hyllie, Capio Göingekliniken, Domus Medica, Feelgood HCC, Hälsomedicinskt Center Lomma, Läkarhuset Jägersro, Läkarmottagningen in Bjärnum, Multi-Clinic, Novakliniken Köpingebro, Rosengårdskliniken VC, Sveakliniken in Svedala VC, HCC Norrestad, Vårdhuset HCC Malmö City and Vårdkliniken in Ängelholm.

Table 2 shows how each health care center in the donor pool is assigned weights based on how similar they are to Sjöbo HCC in the pretreatment period and thereby how well they can reproduce a synthetic version of Sjöbo HCC that is used when estimating the effect from the information shock. Of all potential control units in the donor pool 80 of them are assigned weights. As described in the methodological chapter all the private health care centers are assigned zero weight and are therefore in practice dropped from the donor pool. The optimal vector of weights will constitute the constructed synthetic health care center that is used to simulate the counterfactual sequence of events, with absence of the award. We can see that the health care centers that are most similar (best predictors) to Sjöbo HCC are Staffanstorp HCC (w = 0,424) and Ystad HCC (w = 0,255). Together they stand for 67,9 percent of the predictive power in the donor pool. Since Staffanstorp HCC dominates the construction of the synthetic control unit with the largest weight, it is important to assure that Staffanstorp HCC was not affected by any exogenous shock. By searching for newspaper articles in Retriever media archive on Staffanstorp HCC from the middle of 2011 and onwards I cannot find any special incidence that might have affected patient flows.

In Table 3 below the pretreatment values on the predictor variables of Sjöbo HCC are compared to the weight-balanced predictor values for the constructed synthetic health care center and the average for all public health care centers in the donor pool. Staffanstorp Health Care Center is also included to enable an assessment of how much better the synthetic health care center is as a control unit, compared to the real health care center that is most similar to Sjöbo HCC. We can directly affirm that the synthetic control unit is very similar to Sjöbo HCC in all predictor variables. We can also conclude that the synthetic health care center is a considerably better control unit than what the group of all public providers or Staffanstorp Health Care Center would be. Thus the advantage of the synthetic control method to a traditional difference-in-difference method gets apparent when you see how much more similar the synthetic control unit is to the treated unit. For example the patients in Staffanstorp seem to have a bit “too good” socioeconomic conditions (CNI) and too low diagnoses-based expected need for health care (ACG), while the mean CNI for all other public providers would be too high in comparison with Sjöbo.

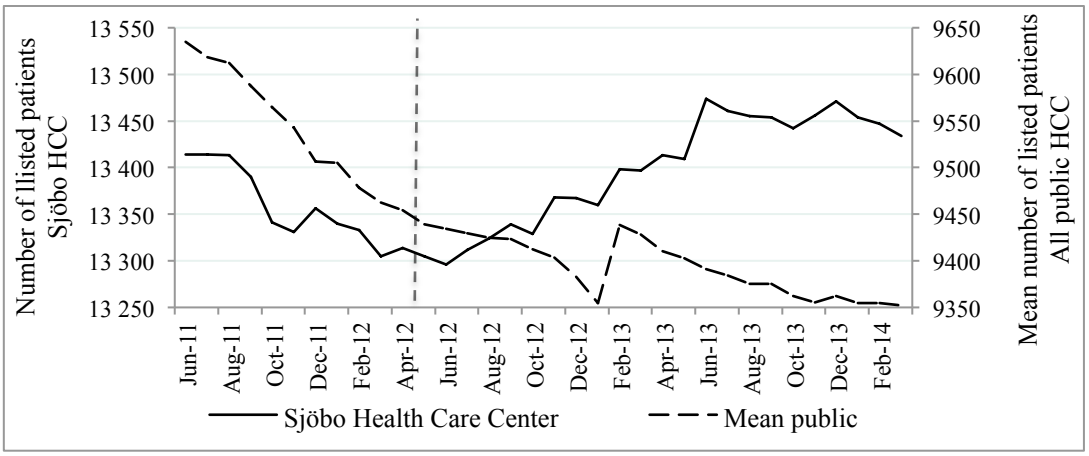
Table 3. Predictor means before information shock

Predictor variable	Sjöbo Health Care Center	Synthetic Sjöbo HCC	Public Health Care Centers	Staffanstorp Health Care Center
$Y_{t=1}$	13414	13407,4	9635,2	15701
$Y_{t=6}$	13331	13324,8	9542,9	15613
$Y_{t=11}$	13314	13307,8	9454,4	15569
CNI	0,9258	0,9302	1,1073	0,8017
ACG	1,0259	1,0279	0,9767	0,9394
Private	0	0	0	0

Note: Yt=1, Yt=6 and Yt=11 corresponds to the number of listed patients in June 2011, November 2011 and April 2012.

Even though the synthetic health care center is the best matching control unit, we can see from Figure 3 how Sjöbo HCC follows the trend of all the other public providers quite well in the period before the information shock. The parallel negative trends in patient flows last until around two months after the award was given to Sjöbo HCC, then the number of listed patients starts to increase for Sjöbo HCC while the average number of patients continues to decrease for the group of all other public providers.

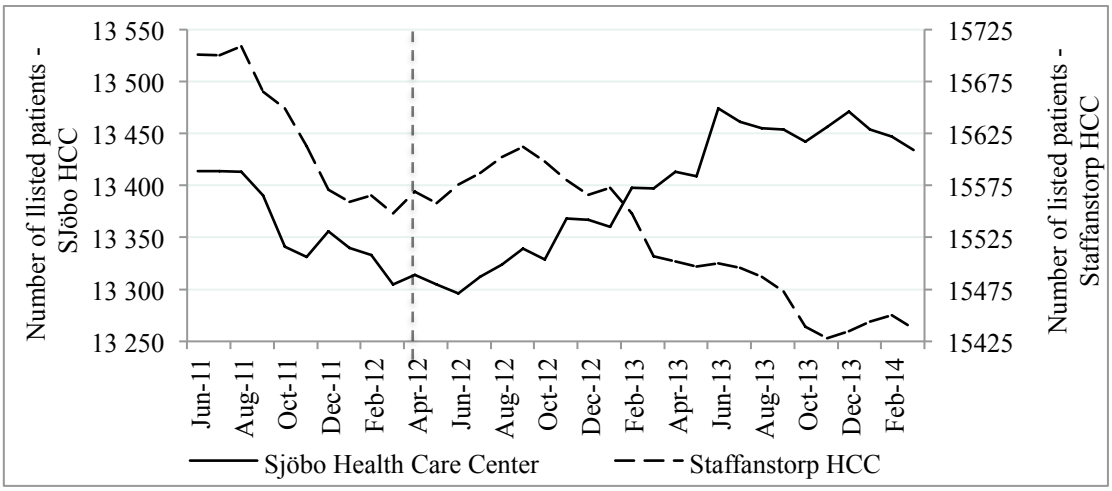
Figure 3. Trends in patient flows: Sjöbo HCC versus all other public providers



Note: The information shock from the award to Sjöbo HCC is illustrated with the small-dashed vertical line.

If Sjöbo HCC's trend in patient flows instead is compared with the trend for the most similar health care center, namely Staffanstorp HCC, we can see from Figure 4 that the trends are highly similar until October 2012, which is about four months after Sjöbo HCC received the Glass Apple Award.

Figure 4. Trends in patient flows: Sjöbo HCC versus Staffanstorp HCC



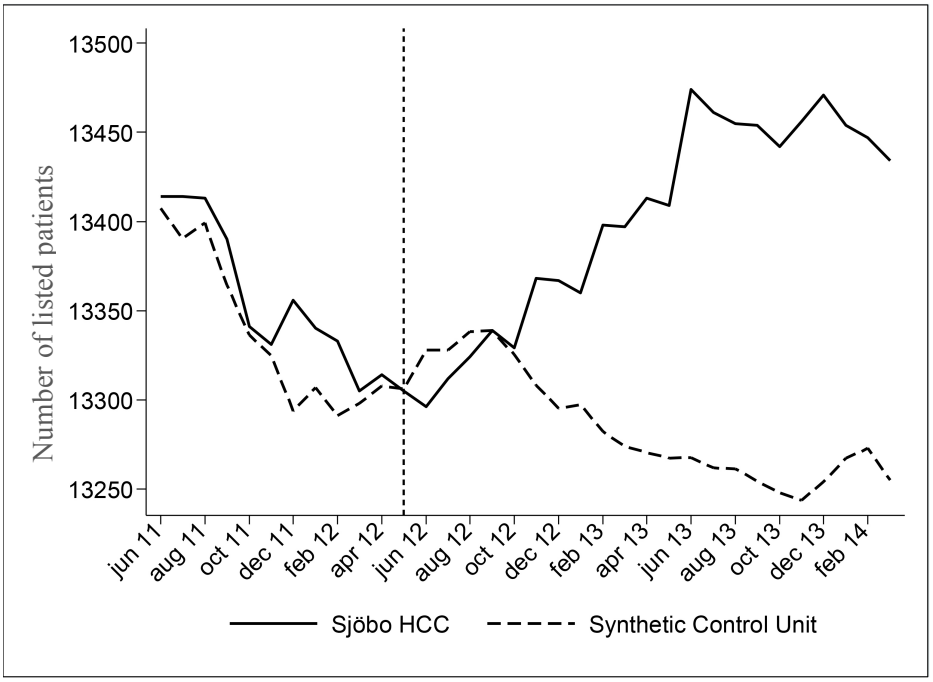
Note: The information shock from the award to Sjöbo HCC is illustrated with the small-dashed vertical line.

This shift in the trend for Sjöbo HCC relative to all public providers and to Staffanstorp HCC could indicate that the quality-related information shock had an effect with a lag of two to four months. In the next section this is examined by estimating the potential effect with the use of a synthetic control unit, representing a combination of information from all of the 80 health care centers that are given weight in the donor pool.

5.3 The effect of the quality-related information shock

The estimation of the effect from the information shock is calculated as the post-treatment difference in the number of listed patients between Sjöbo HCC and the synthetic control unit, as defined by equation 2. Running the estimation in Stata with help of the Synth package yields the following estimation output presented in Figure 5:

Figure 5. Synthetic Control Estimation: Gap in number of listed patients between Sjöbo HCC and Synthetic Control Unit



Note: The information shock from the award to Sjöbo HCC is illustrated with the small-dashed vertical line.

We can see that the synthetic control unit manages to reproduce the patient flow of Sjöbo HCC fairly good in the pretreatment period. However the patient flow for the synthetic control unit deviates quite considerably from November 2011 to March 2012. This could indicate that some important information related to this period is omitted in the predictor variables. Otherwise the difference in number of listed patients between Sjöbo HCC and the synthetic control unit is clearly greater in the post-treatment period, which indicates that there could be an effect from the award to Sjöbo HCC. If the information shock really generated the trend shift, then there seems to be a lag of four months from the information shock to the response from the citizens. This time lag is quite reasonable since it takes some time for the information to reach citizens, and in particular for citizens to act upon the new information.

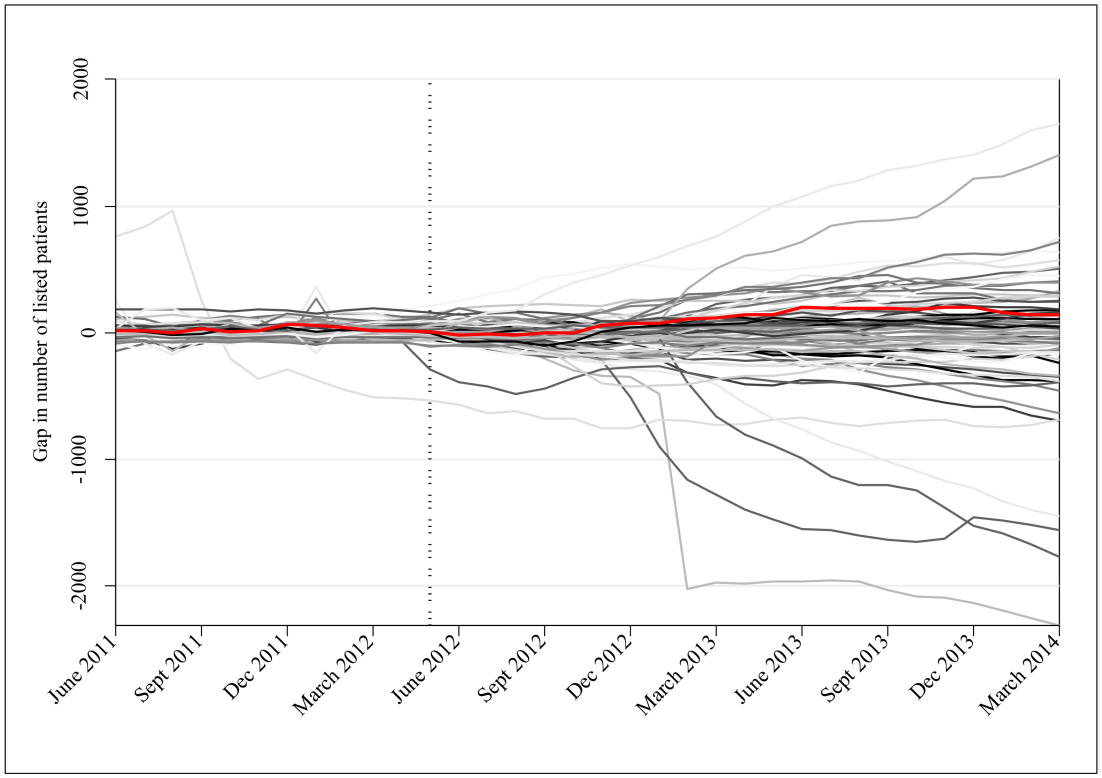
To measure the size of the potential effect, visualized as the gap between the outcome variable for Sjöbo HCC and the synthetic control unit, the root mean square prediction errors (RMSPE) are calculated with help of equation 3 and 4. The RMSPE for the pretreatment

period is calculated to 26,37 listed patients, while the corresponding value for the post-treatment period is 146,16 listed patients. This yields a RMSPE-ratio of: $\frac{146,16}{26,37} = 5,541704 \approx 5,54$. Consequently the gap in number of listed patients between Sjöbo HCC and its synthetic counterpart is 5,54 times larger after the information shock from the Glass Apple Award. Obviously this indicates that the award had an effect on the citizens' choice of provider. The size of the RMSPEs can be easier assessed in relation to the average total number of listed patients in the pre- and post-treatment periods. This *relative RMSPE* is 0,00197 for Sjöbo HCC over the pretreatment period and 0,01091 over the post-treatment period. This shows that the prediction error relative to the number of listed patients at Sjöbo HCC was 0,197 percent before the information shock, which confirms that the constructed synthetic control unit fit the patient flow of Sjöbo HCC quite precise. To evaluate if the increase in the prediction error to 1,09 percent in the post-treatment period is significant, the RMSPE-ratio must be compared to the placebo estimates.

5.4 Placebo analysis

The significance in the estimated effect can be evaluated by comparing it to placebo estimates. This is done with an *in-space placebo analysis*, in which the synthetic control estimation is conducted for all 80 public health care centers in the donor pool as if they were exposed to the information shock from the Glass Apple Award in May 2012. Sjöbo HCC is not included in the donor pool for the placebo estimations, since we want to remove all eventual effects from the Glass Apple Award. If the estimated placebo effects are of same size or larger than the effect estimated for Sjöbo HCC, then the reliability that the effect was generated by the information shock would be undermined. The aggregated results from all the placebo estimations are presented in Figure 6 that shows the gaps in number of listed patients between the real and the synthetic health care centers. Note that also the estimation results for Sjöbo HCC is included in the figure and can be distinguished by the red color.

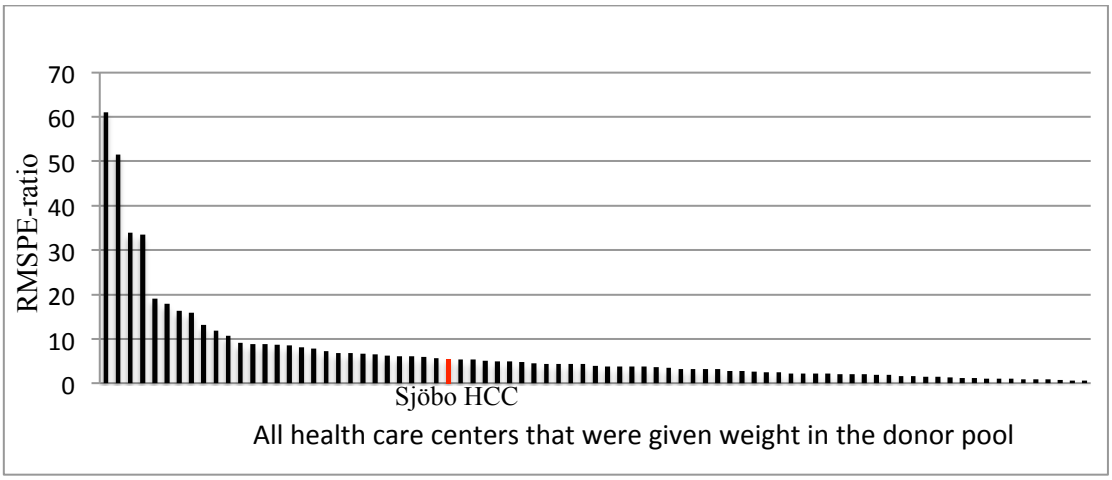
Figure 6. Placebo gaps between real and synthetic health care centers



Note: The figure shows the gap in the outcome variable from 80 placebo estimations and for Sjöbo HCC (the red colored data series). The dotted vertical line visualizes the information shock.

As we can understand from Figure 6 there are many placebo estimations that generate effects that are larger than for Sjöbo HCC. Consequently this implies that the estimated effect for Sjöbo HCC cannot be verified to have been caused by the information shock from the Glass Apple Award. Instead the estimated effect seems to be a result of poor predictive power in the model. The (lack of) reliability in the estimated effect for Sjöbo HCC can be more precisely evaluated by comparing the RMSPE-ratio for Sjöbo HCC with the placebo counterparts. Figure 7 presents the distribution of RMSPE-ratios for each placebo estimation.

Figure 7. Distribution of RMSPE-ratios from the placebo estimations



Note: The RMSPE-ratio is measured as the post-treatment RMSPE divided by the pretreatment RMSPE. There are 80 observations of RMSPE-ratios from the placebo estimations plus the RMSPE-ratio for Sjöbo HCC.

From Figure 7 we can observe that there are 27 health care centers that have larger RMSPE-ratios than Sjöbo HCC and 53 that have smaller RMSPE-ratios. The distribution of RMSPE-ratios enables a quantitative evaluation of the significance in the estimated effect of the information shock for Sjöbo HCC in terms of a p-value. The p-value reflects the fraction of RMSPE-ratios that are at least as large as the estimated effect for Sjöbo HCC. Consequently the p-value is; $\frac{27}{80} = 0{,}3375$ which can be interpreted as a 33,75 percent probability to obtain a placebo effect that is at least as large as the estimated effect for Sjöbo HCC. The traditional significance level corresponds to a p-value of 5 percent, which means that we cannot observe a significant effect from the information shock associated with the Glass Apple Award.

The question then is whether this indicates that there was no effect from the award or if the model specification is inadequate in some way. The overall robustness in the results is examined in the next section. But from the placebo analysis we can see that the distribution of all relative pretreatment RMSPE has an average of 0,00553, a maximum of 0,04248 and a minimum of 0,00113. This means that the deviation in number of listed patients between actual and synthetic health care centers on average was 0,553 percent of the mean number of listed patients at each health care center before the information shock. This is a very small average deviation and the original estimation for Sjöbo HCC gave an even smaller relative

pre-RMSPE of 0,197 percent. Therefore we can conclude that the predictive power in the synthetic control method used with this model specification is overall good and thus the absence of a significant effect indicates that there was no effect from the Glass Apple Award.

5.5 Robustness checks

The robustness check aims at controlling how sensitive the results are to changes in the model specification. This is done by performing the synthetic control estimation with only the few health care centers in the donor pool that were assigned the largest weights, then the model is changed stepwise by reducing the number comparison units. The three health care centers that were assigned the largest weights were Staffanstorp (0,424), Ystad (0,255) and Höör (0,153). Therefore these are selected to form the donor pool of comparison units in the first alternative estimation. Then the model is reduced to the two units that are assigned the largest weights.

Table 4. Synthetic weights in models with less comparison units

Synthetic Control Model	Health care centers and optimal weights			
Original model	Staffanstorp 0,424	Ystad 0,255	Höör 0,153	All others 0,168
Three comparison units	Staffanstorp 0,326	Ystad 0,356	Höör 0,318	
Two comparison units	Staffanstorp 0,544	Ystad 0,456		
One comparison unit	Staffanstorp 1			

Note: In the model with only one comparison unit (Staffanstorp HCC) it is not possible to construct a synthetic control unit. In the other models the weights for each comparison unit is generated from the optimal combination that minimizes the pretreatment outcome gap relative to Sjöbo HCC.

By omitting all but the three health care centers with largest synthetic weights from the original model we lose some goodness of fit but at the same time get the opportunity to assess how much of the estimated effect from the information shock that is driven by any specific comparison unit. We can see that when the information from the excluded comparison units is

omitted the synthetic control unit is constructed by much larger weights on Höör HCC and Ystad HCC but less weight on Staffanstorp HCC. In the three-unit model Ystad HCC is in fact the unit with largest synthetic weight. This indicates that most of the information from the 72 omitted health care centers are replaced with more weight on the characteristics of Ystad HCC and Höör HCC. When Höör HCC is omitted as the unit with least weight in the model with three comparison units, Staffanstorp HCC again gets weighted as the unit that is most similar to Sjöbo HCC. The model with only Staffanstorp HCC as comparison unit is equivalent to a simple difference-in-difference with only one treated and one control unit.

Another alternative model specification is constructed with the same comparison units as in the original synthetic control estimation, but with replacing the predictor variable $Y_{t=8}$ with $Y_{t=6}$. This means that the synthetic control estimation with this specification is based on the lagged outcome variable for January 2012 instead of November 2011. The substitution of that particular predictor variable is motivated by the fact that the estimation from the original model seems to fail in matching the synthetic patient flow with the actual patient flow from November 2011 to March 2012 (see Figure 4). Therefore the lagged outcome variable for January 2012 is supposed to better catch up information from comparison units in the donor pool that share more of the same trend as Sjöbo HCC in this specific period. The predictor means for the synthetic control units, constructed from the corresponding model specifications, are presented in Table 5 below.

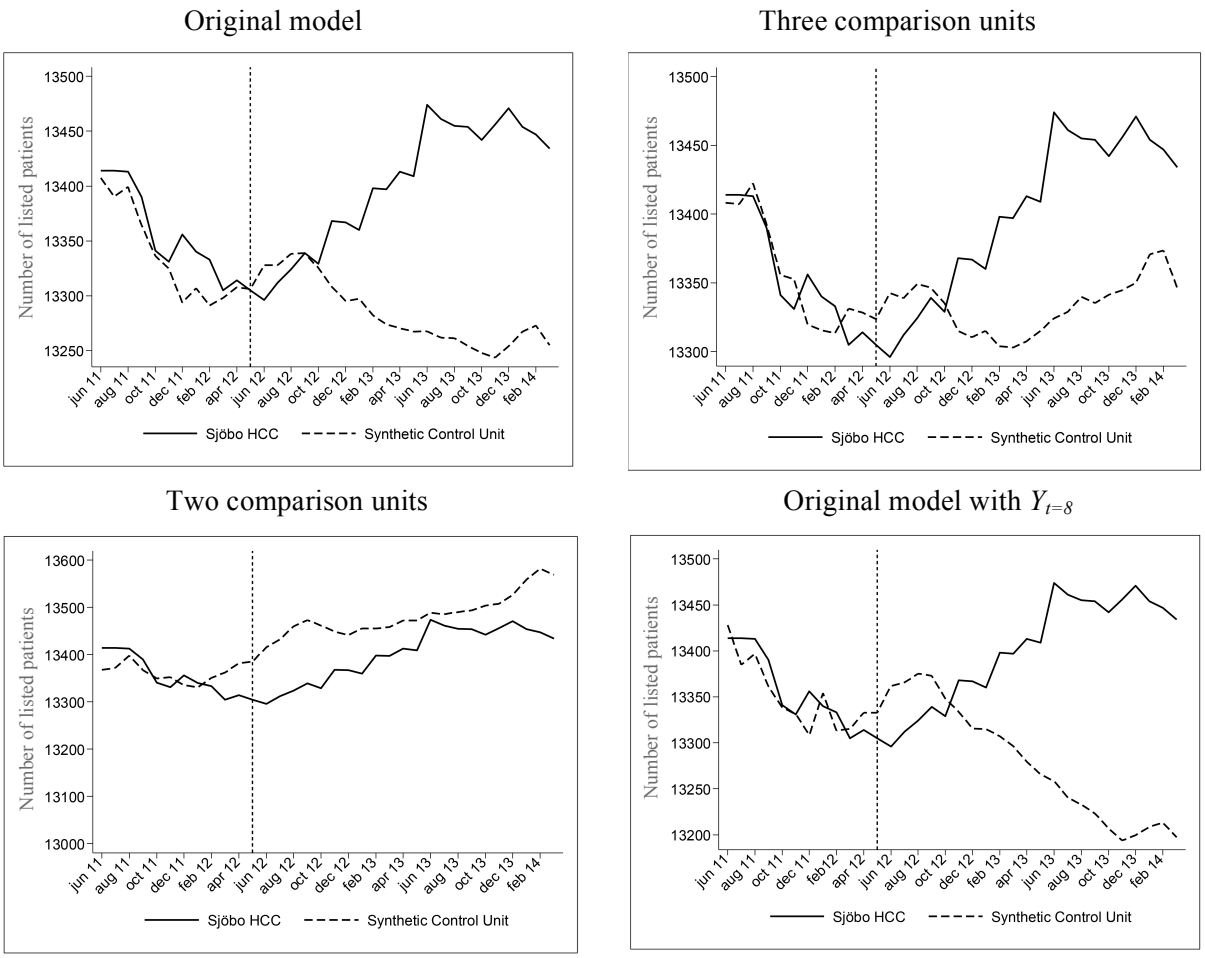
Table 5. Predictor means before information shock for synthetic control units constructed by various model designs

Predictor variable	Sjöbo HCC	Original model	Synthetic Sjöbo HCC Number of comparison units			Original model with $Y_{t=8}$	All Public HCCs
			3	2	1		
$Y_{t=1}$	13414	13407,4	13408,1	13367,7	15701	13428,0	9635,2
$Y_{t=6}$	13331	13324,8	13352,8	13352,2	15613	-	9542,9
$Y_{t=8}$	13340	-	-	-	-	13354,0	9504,9
$Y_{t=11}$	13314	13307,8	13328,3	13382,0	15569	13332,8	9454,4
CNI	0,9258	0,9302	0,9080	0,9136	0,8017	0,9268	1,1073
ACG	1,0259	1,0279	1,0538	1,0617	0,9394	1,0269	0,9767
Private	0	0	0	0	0	0	0

Note: Yt=1, Yt=6, Yt=8 and Yt=11 corresponds to the number of listed patients in June 2011, November 2011, January 2012 and April 2012. The predictor means show the pretreatment variable values for the synthetic control unit constructed for the corresponding model of comparison units.

We can see from Table 5 that both the synthetic control unit based on three and two comparison units generates predictor means that are very close to the values for the original model and the actual values for Sjöbo HCC. We can also conclude that the original model with a lagged outcome variable for January 2012 ($Y_{t=8}$) yields predictor means very close to the actual values. For example the original model with $Y_{t=8}$ gives predictor means on CNI and ACG that are even closer to the actual values than with the original model. For all alternative model specifications except the one-unit model the eventual sacrifice in goodness of fit seems to be modest. Figure 7 shows the resulting gaps between actual and synthetic patient flows from the estimations based on the different models.

Figure 8. Gaps in number of listed patients between Sjöbo HCC and the Synthetic Control Units constructed from different model specifications



Note: The gap in number of listed patients between Sjöbo HCC and Staffanstorp HCC, corresponding to the one unit model, can be seen in Figure 3.

The estimation based on the synthetic control unit composed of three health care centers seems to fit the actual patient flow in the pretreatment period at least as good as the synthetic control unit created from the original model, but with a generally more positive trend in pretreatment patient flows. In Table 6 below we can see that the pre-RMSPE in fact is smaller in the three-unit model estimation than with the original model. This indicates that the original model with weights for 75 comparison units in the donor pool contains some redundant information. Then why do we not get a better fit with more comparison units? This could be explained by the situation when there are some of the comparison units included that on the

whole are very different from Sjöbo HCC but in some specific variable are similar. Then if weight is being given to these comparison units, the values on the other variables will act as distorting information and lead to interpolation biases.

Table 6. Estimated effects with synthetic control units created by various model designs

	Original model	Synthetic Sjöbo HCC Number of comparison units			Original model with $Y_{t=8}$
		3	2	1	
Pre-RMSPE	26,37	19.19	41,17	2262,78	22,77
Post-RMSPE	146,16	88.86	90,36	2115,66	170,58
RMSPE-ratio	5,54 (0,3375)	4,63 (0,425)	2,19 (0,725)	0,93 (0,9375)	7,49 (0,2375)

Note: The numbers in parenthesis show the corresponding p-values for the RMSPE-ratios, and thus express the significance of the measured effects in relation to the distribution of placebo effects.

From Figure 7 and Table 6 we can observe that the gap in the post-treatment period is substantially smaller for the estimation with the three-unit model, but the RMSPE-ratio equals merely to 4,63, which is just a bit smaller than the estimated effect with the original model. When the model is reduced to only two comparison units the pre-RMSPE is drastically worsen and the RMSPE-ratio is also lower. With the one-unit model there does not seem to be any considerable difference between the RMSPE before and after the information shock. Non of the estimations based on the models with a reduced number of comparison units yields any significant effect and the significance gets lower for all the reduced models (see p-values in Table 6). For the estimation with a lagged outcome variable for Januray 2012 as predictor variable, the pre-RMSPE is lowered to only 22,77 and we can see from Figure 7 that this model specification generates a much better fit between synthetic and actual patient flows in the period from November 2011 to March 2012. This model specification yields the largest estimated effect with a RMSPE-ratio of 7,49, but the p-value at 0,2375 is nevertheless too high. Consequently the non-significant effect from the Glass Apple Award is robust for all different model specifications controlled for. Furthermore the robustness checks shows that it

would have been possible to be much more restrictive in which health care centers to include in the donor pool. It is also clear from the robustness checks that there are great advantages in using a synthetic combination of at least three health care centers rather than a combination of two units or only a single-unit comparison.

6 Discussion

6.1 Readings of the results

From the placebo analysis and the robustness checks there are quite reliable indications that there was no effect from the Glass Apple Award on the number of listed patients at Sjöbo HCC. Thereby it seems rather likely that improved availability of quality information have limited effect on citizens' choice of care provider. To untangle what these results imply, three aspects must be problematized. The first aspect is whether these results hold in general, when the quality information concerns other care providers than Sjöbo HCC. The choice of Sjöbo HCC as the "treated unit" was motivated by support from previous research (Dixon & Le Grand, 2006; Fotaki et al., 2008) that well-educated citizens with good socioeconomic conditions generally are better informed and utilize patient choice to a higher degree. Compared to the average of all public health care centers the patients at Sjöbo HCC have quite good socioeconomic conditions (CNI), and therefore this study can be understood as a most-likely study in which there are good potential for generalizability of the results.

Another feature that supports Sjöbo HCC as a most likely case is that the competition from other care providers is quite low, more precisely there is just one other health care center in Sjöbo, the private *Novakliniken*. A low degree of competition should make the information shock more pure from disrupting information from other care providers and thereby easier for citizens to act upon. The research by Botti and Iyengar (2006:26) also supports this thesis that more alternatives make people less willing to choose. Consequently the basis for generalizations is quite good. At least it is likely that health care centers in more socioeconomically deprived areas with more competition neither would be affected of a quality-related information shock equivalent to the Glass Apple Award.

The second aspect concerns the question of to what degree the information from the Glass Apple Award was exogenous. The award function as a natural experiment in which the

exogeneity would not hold if the criteria for being awarded were based on the historical patient flows. This would mean that the awarding process was correlated with the outcome variable and hence the estimates would be biased due to endogeneity. In assessing to what degree the Glass Apple Award contains exogenous information we must look at the selection criteria for the award, which are; creativity, quality (clinical), accessibility, continuity, safety and health promoting efforts. All these criteria can be perceived as quality indicators, both in a clinical sense and from a patient-experience perspective.

The question is whether people in general knew about the good performance by Sjöbo HCC in terms of quality before the award. The more noticeable quality aspects, like accessibility and continuity, might have been noticed before the award and could have generated positive effects on the patient flows. However the more "hidden" quality aspects like clinical quality, creativity, safety and different health promoting efforts are reasonable to assume being less well known by the public. Consequently the noticeable quality aspects could lead to some endogeneity bias, but a great deal of the information from the Glass Apple Award can be assumed to be previously unknown and thereby exogenous. It can also be argued that most people who got the information about the award to Sjöbo HCC probably did not scrutinize what the award was based on that carefully, but instead just got a positive signal about the health care center. This signaling value is more indistinct and should reasonably be interpreted as exogenous information.

The third and most comprehensive aspect of the results that must be problematized concerns the issue of why people seems to be unaffected by the new quality information that got available with the Glass Apple Award. From previous research we know that it is a rather small share of the population that actually change care provider. The Swedish Agency for Health and Care Services concludes in their survey study that only 24 percent of the respondents changed provider and of these 19 percent changed provider because they were dissatisfied with their previous provider and 12 percent because another health care center appeared to be better (Myndigheten för Vårdanalys, 2013). Accordingly this means that about 4,6 percent of the respondents changed care provider because of dissatisfaction with the previous provider and about 2,9 percent changed because another provider seemed better. Consequently this means that with normal conditions for information, i.e. with no information

shock, it is only 7,4 percent of citizens that change care provider due to perceived quality differences between their care provider and other available providers. Though we can assume that the information shock from the Glass Apple Award should generate a greater willingness to change provider than under ordinary information conditions. As discussed before there are some quite strong indications that the information from the award actually did reach out to people around Sjöbo. If we suppose that was the case, then the relevant question from the results is why people do not act in accordance with the information.

In the analysis of why people seems to not act in line with information, it is important to distinguish between the expected effect from the information shock on *outflow* and on *inflow* of patients. Since there only is one more health care center in Sjöbo, namely Novakliniken, one could assume that the potential positive inflow-effect of patients to Sjöbo HCC would mainly come from Novakliniken. Then one could argue that it is rather unlikely that those persons who recently choose to leave Sjöbo HCC and get listed at Novakliniken, that opened in May 2009, would change back again. Even if they got the information about the Glass Apple Award they might suspect that Sjöbo HCC has not improved radically since they left or that Novakliniken is not that much worse. In line with this it could be argued that it would be better to choose a “treated" health care center that has a main competitor that also is public, in purpose to avoid potential effects from a previous large outflow of patients to a new private provider. But natural experiments in terms of information shocks that affect a desirable health care center are quite rarely found.

However there were also some citizens in Sjöbo that were listed at health care centers outside of Sjöbo and potentially were more willing to changed care provider to Sjöbo HCC. At the time when Sjöbo HCC received the award Sjöbo had 18290 inhabitants, and Sjöbo HCC had 13305 listed patients while Novakliniken had 4101 listed patients (Sjöbo Municipality, 2015). If we assume that all listed patients at the two health care centers were living in Sjöbo then only 884 citizens were listed at health care centers outside of Sjöbo. Together this could explain a small inflow-effect from the information shock. The expected small inflow-effect suggests that the outflow-effect should dominate. This effect is generated by the reduction in the number of listed patients leaving Sjöbo HCC when they get assured from the award that their health care center performs well. As we have seen there is a strong

trend of outflow in patients from public to private providers, therefore a break in this trend could yield substantial effects. Another thing indicating that the outflow-effect should dominate is that it is plausible to assume that the patients listed at Sjöbo HCC to a higher degree than others actually got the information about the award due to information dispersion from person to person.

The fact that we cannot see any effect on citizens' choice of care provider from the information shock suggests that the conception of individuals as "rational consumers" must be problematized. This raises some doubt about the accuracy in some of the assumptions used by rational choice theorists. At first we can note that the neoclassical rational choice-assumption that individuals are fully able to acquire, understand and act upon relevant information seems incompatible with the acquired results from this study. If we consider what could have caused the behavior of not changing care provider to Sjöbo HCC one potential explanation could be difficulties in assessing level differences in quality comparisons. The Glass Apple Award might just have signaled that Sjöbo HCC has better quality than most care providers, but not how much better. Maybe this uncertainty in the relative level differences in quality makes people think that the differences perhaps are not that big and that their current care provider has sufficiently good quality for not changing. This uncertainty more specifically could have reduced the inflow effect of patients to Sjöbo HCC from Novakliniken. Another potential explanation for not changing care provider could be that citizens do not perceive the Glass Apple Award as a reliable indicator of quality. Maybe there is a lack of trust in the regional council's competence and ability to evaluate quality in the primary care.

In the survey study by the Swedish Agency for Health and Care Services Analysis (Myndigheten för Vårdanalys, 2013:16) they conclude that there are two main causes for not changing care provider. The first cause, stated by one third of the respondent is lack of relevant information. The second main cause, also stated by one third of the respondents, was that they were tired of all choices in today's society and that it is demanding to start over with a new care provider (*Ibid.*). In line with these attitudes a fifth of the respondents clarifies that it takes too much time to change care provider (*Ibid.*). Consequently we have two main potential causes of not changing care provider; the first is *lack of relevant information* and the second is *transaction costs and being tired of all choices*. In our case the information from the

Glass Apple Award is likely to have reached out to the public, this together with a low degree of competition from other care providers imply that the access to relevant and fairly easy-compared information was pretty good. Therefore we can exclude that lack of relevant information was the main cause for not changing care provider to Sjöbo HCC.

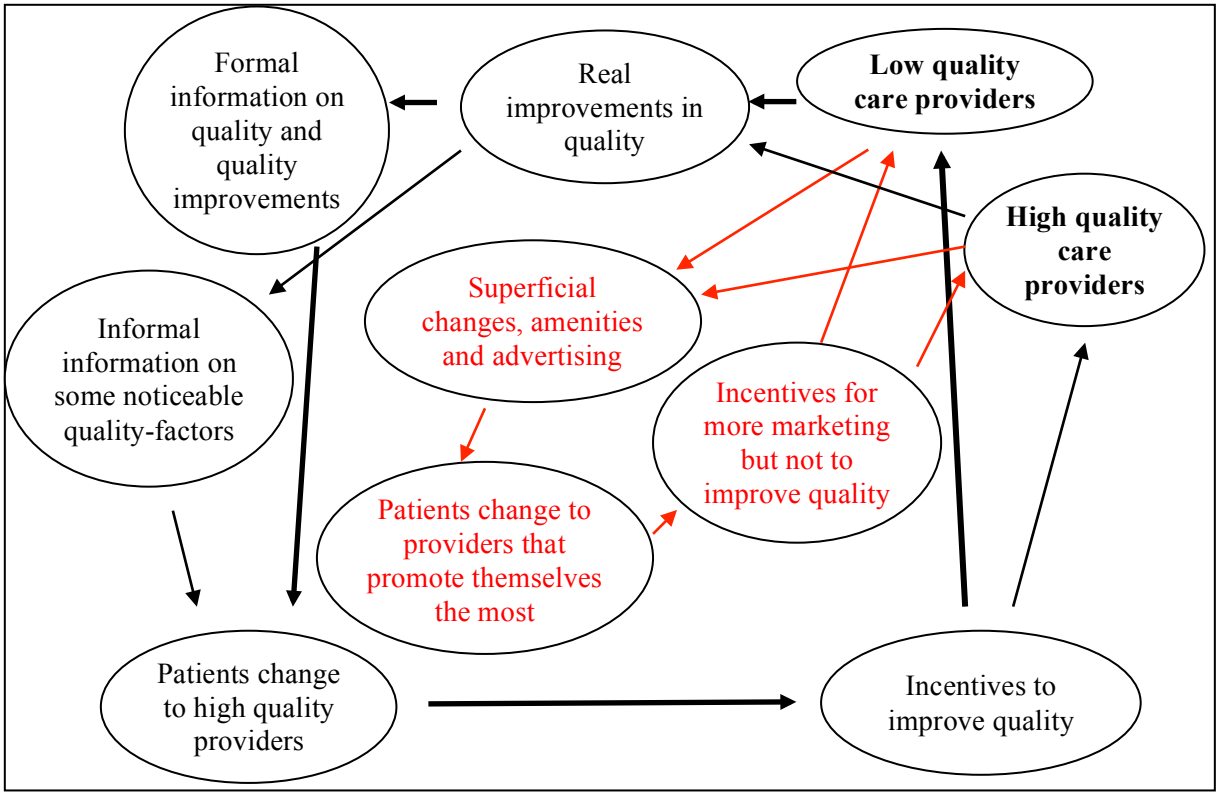
That leaves us with the other potential main cause, namely that transaction costs in time and effort of changing care provider are perceived as too high, and that people in general are tired of all choices. If we assume that the preferences for patient choice are similar for persons around Sjöbo as for respondents in the survey study by the Agency for Health and Care Services Analysis, it is likely that transaction costs and the feeling of being tired of all choices were the most important causes behind not changing care provider to Sjöbo HCC after the information shock. These causes are rational in the sense that they signify opportunity costs of changing provider in terms of time and inconvenience. If the expected utility increase from changing provider is uncertain and probably quite small it is rational for many individuals to not change. The unwillingness to utilize one's patient choice because of being tired of choosing supports Botti and Iyengar's (2006) thesis that too many choices and alternatives make people less willing to choose and increase the risk of feeling unsatisfied with one's choice.

But there could also be other explanations for not utilizing one's patient choice that go beyond rational reasoning about transaction costs and disutility from choosing. For example it could be that more concrete factors like the patient's already established relation to the doctor at the current health care center is much more important than abstract information about quality. This view is supported by both Lupton (1998) and Fotaki (2006) who argue that factors like emotions, desires, needs and psychological dynamics in the patient-doctor relation are much more important in analyzing patient choice than typically rational factors. The study by Robertson et al. (2008) also concludes that the most important aspect for patients in primary care is the quality in the relationship to their doctor. Since these patient-doctor relations probably are unaffected by quality information, this could be one important explanation to why the Glass Apple Award had no affect on citizen's choice of health care provider.

6.2 Implications from the results on quality

Irrespective of why people do not act in accordance with the available quality-related information from the Glass Apple Award we can conclude that the absence of an effect suggests that the information-mechanism between performance in terms of quality and how people use their patient choice is not working correctly. This has important implications on how successful the quasi-market for primary care is in improving quality. The central idea in the quasi-market theory applied on health care is that the combination of patient choice and competition between care providers will generate incentives for providers to improve quality and efficiency (Le Grand, 2007:42*ff*). In Figure 9 below a theoretical model is sketched of the assumed causal mechanisms between care provider's quality-performance, information, patient choice and incentives.

Figure 9. The information-mechanism behind incentives to improve quality



In Figure 9 the assumed chain of causation is linked together by arrows that show the supposed direction of causation. Bold arrows represent the expected chain of causation from formal information, such as the Glass Apple Award, via patient choice to incentives for low-quality providers to improve. As illustrated it can be expected that the incentives for care providers to improve quality would be weak if the information-mechanism does not work.

The risk is that when the formal information on quality from the county councils does not reach citizens or if citizens just don't act in accordance with the information, then care providers might place their resources on other things than quality-improving measures to attract patients. Such measures are likely to be of a type that is highly noticeable and appealing for potential patients, like advertising and different amenities as attentive staff, decorative surroundings and good food. This generates a parallel chain of causation that is represented by red color in Figure 9. From previous research we have seen that amenities in health care is highly effective in attracting patients (Goldman & Romley, 2008). These amenities could of course be pleasant for patients, but in a strict sense they cannot be interpreted as factors of health care quality. These marketing measures raise questions of whether common resources really couldn't be used more efficient. Do we for example want public spending on advertising when those resources could be used to improve health care quality?

There is also reason to believe that when the formal information mechanism does not work adequately care providers would still put resources on quality-factors that are easy for patients to notice and assess, since the information on these quality-factors can be spread through informal information channels and thereby attract more patients. Such quality-factors could be high accessibility and short waiting times. These more noticeable quality-factors are also confirmed to be in focus when citizens seek information about care providers (Myndigheten för Vårdanalys, 2013). However it can be expected that a badly functioning formal information mechanism would have difficulties in generating incentives to improve less noticeable quality-factors like clinical quality, safety and long-term health promoting efforts.

6.3 Future research

An alternative way of setting up a study about the role of quality information for patient choice would be to examine the effects from a negative information shock instead of a positive. The reason for this is that information about low quality for a specific care provider might generate larger effects on patient flows. This is indicated by the Swedish Agency for Health and Care Services Analysis, that has shown that 19 percent of those who change care provider change because of dissatisfaction with the provider, while only 12 percent of them changed because of attraction to care providers that are perceived as better (Myndigheten för Vårdanalys, 2013:16). Thereby people seem more willing to change provider if they feel exposed to bad health care than when health care just could be better with another care provider. It is also reasonable that negative information shocks, like health care scandals, have more news value in media and larger dispersion in public.

For future research on patient choice in quasi-market systems there is also a need for deeper and more qualitative analyses of the mechanisms behind patient choice. We have to problematize the concept of rational agents and have the starting point that the health care sector functions radically different from competitive markets due to uncertainty, risk and information asymmetry. More empirical studies are needed about how people really handle information and what different sources of information that affect peoples behavior. Furthermore it would also be relevant to examine the effects from an information shock on patient choice in areas with more care providers and thereby larger competition. It is not obvious if citizens in areas with more alternatives are more willing to change provider or not. The degree of competition could also affect how much care providers try to attract patients, which in turn could affect the mobility of patients.

The methodological prospects for future research with the synthetic control method are positive. There are great opportunities for what can be achieved in social, political and economic science with further use and development of the synthetic control method. For example the method is highly appropriate in research based on cross-country comparisons. The combination of quantitative and qualitative procedures for inference enables both

qualitative analyzes of the relation between specific comparison units and the treated unit, and more reliable estimates than in ordinary comparative case studies.

7 Conclusions

Health care is one of the most important welfare services for people, especially in the weakest and most vulnerable phases of life. Therefore it is of great importance that health care systems manage to fulfill the needs and requirements for efficient and equal health care with high quality. A condition for creating quality-improving incentives in quasi-market systems is that citizens act upon quality information by changing to better care providers. The information about the awarding of Sjöbo HCC had quite extensive dispersion through news media, which suggests that many people actually knew about it but anyway did not act in line with the information.

The synthetic control estimation yields an insignificant effect associated with the information shock from the Glass Apple Award. The effect is assessed to be insignificant since the placebo analysis yields a large probability to obtain a placebo effect that is at least as large as the estimated effect for Sjöbo HCC. Furthermore the predictive power in the model specification is considered as good, which indicates that the insignificance in the effect in fact means that there was no effect from the Glass Apple Award.

Altogether it seems like improved availability of information on quality have limited effect on citizens' choice of care provider. This defect in the information mechanism creates a risk of reducing incentives for care providers to improve quality. However there is a need for further research on patient choice and the connection between quality information and incentives for care providers. The question on what specific mechanisms that determines this connection is still rather unresolved. In assessing the previous market-oriented reforms and to enable improvements in health care, we need a better understanding of how citizens and care providers act in quasi-markets for health care.

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