SCHOOL OF ECONOMICS AND MANAGEMENT

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The Impact of Patient Fees on Demand for Direct-to-Consumer Telemedicine

A Difference-in-Differences Approach

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Abstract

This paper analyzes if patients' demand for Direct-to-Consumer Telemedicine (DCT) providers is affected by a change in patient fees. The paper utilizes a natural experiment when the patient fee increased for patients in Region Stockholm using one DCT provider but remained unchanged for other DCT providers. By using DCT visits per month for all other regions as control, the effect on the demand for other DCT providers is estimated using a Difference-in-Difference model. The result indicates that in the longer run, there is no significant effect on the demand facing other DCT providers that did not experience an increase in the patient fee. Further, the result suggests that the DCT business could have winner-takes-it-all tendencies, but more research is needed to establish this.

Keywords: Difference-in-Difference, Patient Fee, DCT, Cross-price Elasticity of Demand, Digital Economics, Brand Loyalty.

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1. Introduction

Direct-to-Consumer Telemedicine (DCT) is rapidly growing in Sweden (Ekman et al. 2019). The Swedish Agency for Health and Care Services Analysis (2022) define DCT as a private healthcare provider that offers consultations directly to patients, such as voice, video, or text-based communication, excluding interactions where the patient meets the healthcare provider in person. This is an important field of economic research as this new type of digital healthcare service has the potential to meet an increased need for care without costs increasing correspondingly (SALAR, 2023a). Characteristics of this type of digital technology are that matching the provider with the supplier is often instant, and that the geographic distance does not matter (Goldfarb & Tucker, 2019).

Previous studies have shown that DCT is a cost-efficient alternative to traditional primary care. However, eventual cost-savings introduced by DCT may vanish by the excess demand it creates (Ashwood et al. 2017; Ekman, 2018). Further, research has shown that young adults' demand for DCT consultation is very price-sensitive (Ellegård, Kjellsson & Mattisson, 2022). At the same time, studies show that the price sensitivity for traditional healthcare in Sweden among the adult population is low, indicating that the number of care visits does not change much when the patient fee increases (Jakobsson & Svensson, 2016). However, how the adult population reacts to an increased patient fee for DCT service is a blind spot in the research and there is little knowledge of the cross-price elasticity of the demand of DCT services. Compared to youths, an adult population have a higher possibility of having a larger disposable income due to a higher likelihood of being established in the labor market. They might therefore react differently to changes in the patient fee. Compared to traditional healthcare, other factors such as brand loyalty and platform dis/advantage might influence the adult population's demand of DCT providers when the patient fee is increased.

I aim to contribute to this field of research by studying how the adult population chose between DCT providers when there is a change in patient fees. The Swedish DCT market is highly concentrated with one big DCT provider, Kry, which in 2020 had a 40 % market share, twice as much as their closest competitor (SALAR, 2021). In 2020, Kry moved from being a pure online healthcare provider to open healthcare facilities in Stockholm. As a result, the patient fee for inhabitants in Region Stockholm increased when using Kry, while the patient fee for the other DCT providers operating from Sörmland remained the same (Dagens medicin, 2020;

SALAR, 2020). The research question is therefore how patients in Region Stockholm will react to this in terms of changes in demand. By using a Difference-in-Difference (DiD) method, I seek to explore the effect on the demand facing the other DCT providers operating from Region Sörmland. Patients from Region Stockholm will form the treatment group while patients from all other regions will constitute the control group. They will be compared in their demand for other DCT providers' services before and after Kry's establishment in Stockholm.

The focus of this essay is private DCT providers that offer healthcare on a national level and outside the regular healthcare system. I will also narrow my field of study by focusing on the use of DCT in general primary care and not include DCT providers operating in specific areas, such as mental illness or high blood pressure care. Primary care is defined according to Swedish legislation, referring to healthcare that does not require treatment at a hospital or interventions by doctors specializing in non-general medicine (National Board of Health and Welfare, 2020). By traditional healthcare, I refer to primary healthcare where the patient meets the healthcare provider in person.

The results shows that there is no significant effect on the demand for other DCT providers in the longer run. This is an important contribution to this field of research as this indicates that patients do not regard different DCT providers as substitutes for each other. Further, the result suggests that the DCT business could have winner-takes-it-all tendencies, but more research is needed to establish this.

This report will be disposed as follows. Chapter two gives a background to the healthcare system and DCT in a Swedish context. Thereafter follows a literature review in chapter three, addressing previous research and economic theory on the area. The next chapter specifies the research question, and describes the data and empirical strategy used in the paper. The main result and robustness checks are presented in chapter five. Lastly, there is a concluding discussion in chapter six.

2. Background

This chapter aims to give an understanding of DCT and its role in the Swedish healthcare system. Therefore, the first section broadly explains the Swedish healthcare system. It is followed by a review of DCT and patient fees in a Swedish setting.

2.1. The Healthcare System in a Swedish Context

Sweden's healthcare system is managed at state, regional and municipality levels (SALAR, 2022a). However, primary care is mainly operated at regional level, even though the state is responsible for making laws and pointing out the direction of the healthcare system (SALAR, 2022). The regions finance healthcare primarily through taxes and government grants (SALAR, 2022). To a lesser extent, the healthcare system is also funded by patient fees (SALAR, 2022). Healthcare is the regions' most significant area of responsibility, accounting for about 90 per cent of the regions' total expenditures (Government Offices, 2020). There are twenty-one regions in Sweden, and their self-government is protected by the constitution (Government Offices, 2020). The regions work closely with SALAR, which is a member-and-employer organisation for all regions and municipalities in Sweden (SALAR, 2018). Among other areas of responsibility, SALAR issues policy recommendations on topics such as patient fees and out-of-region fees (SALAR, 2018). Out-of-region fee is the reimbursement between regions for visits made by patients outside their home region (SALAR, 2022b).

In 2015, new healthcare legislation was enforced in Sweden, the Patient Act (2014:821). From there on, patients could choose which healthcare facility to turn to in need of outpatient primary care (Patient Act, 2014). This meant that patients could seek healthcare in a different region than the one they live and pay taxes in. However, if a patient chooses an out-of-region healthcare provider, the patient would not be compensated for the travel expenses back and forth to the facility (1177, 2022). Also, if the patient chooses an out-region healthcare provider, the patient's home region must pay an out-of-region fee, which is set by the out-of-region fee agreement from SALAR, to the region where the healthcare provider is located (SALAR, 2022b).

2.2. DCT in Sweden

A result of the implementation of the Patient Act in 2015 was that DCT providers could claim reimbursement from the public healthcare system (Dahlgren et al. 2021). DCT was then introduced on a bigger scale in Sweden by 2016 (Läkartidningen, 2017). Since then, DCT has grown rapidly with many more DCT providers for patients to choose among (SALAR, 2021). Initially, most DCT providers chose to locate in Region Jönköping (SALAR, 2021). But, as of 2018 many of the DCT providers relocated to Region Sörmland due to the region´s policy of no patient fee and the fact that the patient pays the patient fee set by the region in which the DCT provider is established in (SVT, 2019; SALAR, 21).

In 2020, there were mainly 12 DCT providers located in Region Sörmland (SALAR, 2021). By 2020, Kry was the biggest DCT provider with about 40 % in market shares, followed by Doktor.se and Min Doktor with 17 % respectively 15 % in market shares (SALAR, 2021). In 2020, DCT was mainly consumed by inhabitants in the metropolitan regions, and Stockholm stood out as the region with the biggest percentage of DCT patients (SALAR; 2021). A study published in 2019 also points out that DCT is more used by inhabitants in cities than those in rural areas in Sweden (Ekman et al. 2019). Further, a paper examining the usage of DCT year 2018 in Stockholm, Sweden found that factors such as being a woman, of younger age, born in Sweden, and having a higher education increased the likelihood of using DCT services (Dahlgren et al. 2021). SALAR (2021) also concludes that women consume more DCT than men and that DCT is mostly used by patients in the age span 18-40 years old.

DCT has facilitated for patients to seek primary care in other regions since it removes the obstacle of distance. Due to this, regions have seen the amount they have to spend on out-of-region fees increase as DCT becomes wider used (SALAR, 2022b). Until 2017, the out-of-region fee that Region Jönköping invoiced per DCT visit to a doctor was 2 195 SEK, which was the same as an out-of-region fee for a doctor visit in traditional primary healthcare (SALAR, 2017). Since then, a special out-of-region fee applicable only for DCT has been introduced, and the fee per DCT visit has since been lowered (SALAR, 2017). In 2020, the out-of-region fee was 500 SEK (SALAR, 2022b). The out-of-region fee has been and still is a hot topic of discussion. From more regions, voices are raised to end the reimbursement system with the out-of-region fee to DCT providers (Läkartidningen, 2021). This is believed to force DCT providers to either establish their own healthcare facility or enter partnerships with already existing healthcare facilities in more regions (Läkartidningen, 2021). A few DCT providers have already chosen this path in some regions. One example is Kry, which in September 2020 opened its first healthcare center in Stockholm (Dagens medicin, 2020).

2.3. Patient Fees

Given the sovereignty of the Swedish regions, each of the twenty-one regions has the right to set the patient fee in primary care as they see fit. If the DCT provider is established in the same region as the patient, the patient pays the patient fee set by the home region. However, if the DCT provider is not established in the same region as the patient, the patient fee is set by the

region in which the DCT provider operates from (SALAR, 2020). As a consequence of being part of the public finance healthcare system, the DCT providers do not set their own patient fees.

Common for all regions is that no patient fee is charged for patients older than 85 years (SALAR, 2020). Similarly, no patient fee is charged for children and youths, however, the regions apply different rules for when the free-of-charge ceases (SALAR, 2020). But, at the age of 20 years, all regions except Region Örebro[1] apply the same patient fee for youths as for adults (SALAR, 2020).

In the beginning of 2018, Region Sörmland was the only region that did not charge any patient fee for the adult population in primary care, including DCT visits (SALAR, 2018). The patient fee for a DCT appointment with a doctor was later raised to 100 SEK in 2020 in Region Sörmland (SALAR, 2020). When Kry opened its first healthcare center in Stockholm 2020, inhabitants in Region Stockholm had to pay the patient fee set by Region Stockholm, which meant that the patient fee rose from 0 SEK to 100 SEK for a DCT visit with a nurse, and from 100 SEK to 200 SEK for a DCT visit with a doctor (Dagens Medicin, 2020; SALAR, 2020). Figure 1 illustrates how the patient- and the out-of-region fee is determined by which region the patient seeks healthcare in.

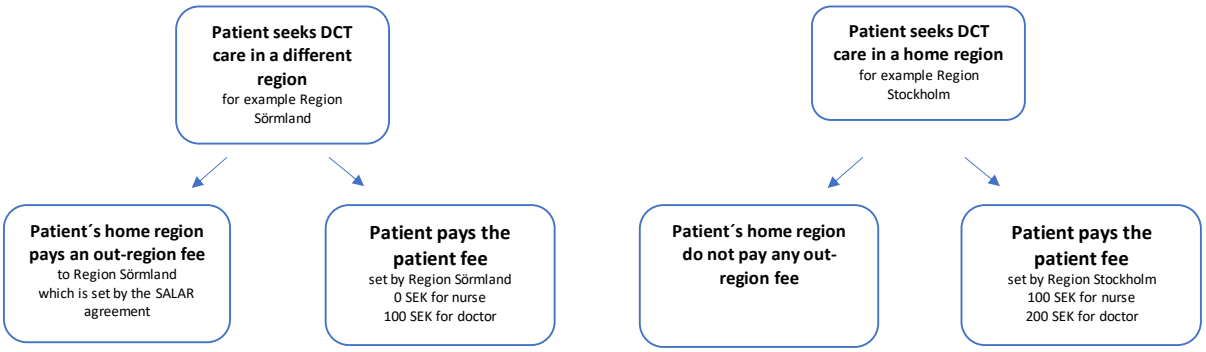

Figure 1: Scheme over the patient- and out-of-regions fees when the patient seeks DCT care within versus outside the home region in year 2020 (adapted from SALAR, 2018; SALAR, 2020).

3. Literature Review

This chapter starts with a review of previous research on DCT and its effect on the healthcare system. It is followed by economic theory on cross-price elasticity of demand. Thereafter is

[1] Region Örebro do not charge any patient fee until the patient turns 25 years (SALAR, 2020).

the concept digital economics explained and how DCT fit into that. Lastly, research on brand loyalty in terms of traditional healthcare and digital economics is reviewed.

3.1. The Effect of DCT on the Healthcare System

In a study by Ashwood et al. (2017), the use of DCT in its early years, 2011-2013, was examined in an American setting. By combing a matching method with a DiD model, they found that the increased convenience of DCT gave rise to new utilisation, and that the substitution to DCT from traditional primary care gave rise to cost savings. However, this cost-saving was outweighed by the new demand created by DCT. In a recent study, Yu et al. (2023) found that for uncomplicated, and nonemergent conditions, DCT is a fully good substitution for a traditional in-person visit. This conclusion was made by using a DiD method examining changes in healthcare use and quality of care in relation to the expansion of DCT coverage in an American context. In 2018, Ekman made a cost analysis in a Swedish context. He found that DCT is a less costly alternative compared to traditional in-office primary care, both for the healthcare provider and the patient. There is a potential to generate substantial cost-savings, depending on the rate of digital substitution (Ekman, 2018).

In a paper about young adults' usage of DCT, researchers found that the demand for DCT dropped significantly once the patient turned 20 years old and no longer had access to free DCT healthcare, indicating that the demand for DCT is very sensitive to price for this group of individuals. They also concluded that DCT gave rise to additional consultations due to the low barriers of access to DCT healthcare (Ellegård, Kjellsson & Mattisson, 2022). Further, the Swedish Competition Authority stated in a report from 2022 that the greater accessibility to DCT has created a demand, without the demand for other health services appearing to have decreased to any great extent. Similarly, Ellegård and Kjellsson (2019) found that in Region Skåne, DCT did not seem to reduce the demand for traditional primary health care in the region.

The Swedish Agency for Health and Care Services Analysis tried to estimate the size of the new consumption created by DCT in a report published in 2022. Given that a DCT patient would consume healthcare the same way as a patient of traditional care would if DCT did not exist, one of four DCT visits could be seen as new consumption. However, if the assumption is that the DCT patient would have the same healthcare consumption pattern as the population at large if DCT did not exist, all DCT visits could be considered to be new demand (Swedish Agency

for Health and Care Services Analysis, 2022). The report concludes that the truth lies somewhere in between, and that a reasonable interpretation is that DCT to some extent replace traditional primary care visits, but that it also leads to new consumption.

3.2. Cross-price Elasticity of Demand

Previous research on the DCT market in the healthcare system has shown that patients' demand is not completely inelastic with respect to price for this kind of healthcare services. However, the nature of the cross-price elasticity of the demand on different DCT providers is unknown. The cross-price elasticity of demand measures the responsiveness of the demand for one product in relation to changes in the price of another product (Pindyck & Rubinfeld, 2017). Thus, the interest of this paper lies within the cross-price elasticity of the demand for other DCT providers healthcare services with respect to the increase of the patient fee of Kry's DCT service for patients in Region Stockholm. If the cross-price elasticity is positive, meaning that an increase in the patient fee for Kry's DCT service increases the demand for other DCT providers service, they are said to be substitutes (Pindyck & Rubinfeld, 2017). On the contrary, Kry and the other DCT providers can be said offering services that are complements if an increase in the patient fee for Kry's DCT service decreases the demand of other DCT providers services. In that case, the cross-price elasticity of demand is negative (Pindyck & Rubinfeld 2017). The shape of patients' indifference curves determines whether DCT services are considered substitutes or complements. According to economic theory, goods that are said to be homogeneous are often considered to be substitutes for each other, meaning that the cross-price elasticity tends to be positive (Pindyck & Rubinfeld, 2017).

For services such as DCT healthcare, one could argue that the service they provide can be seen as substitutes to each other. Patients that seek DCT healthcare generally do so for symptoms that do not require a physical examination by a healthcare professional (SALAR, 2021). Since DCT also operates outside the regular healthcare system it is likely to believe that for easier symptoms and routine check-ups patients regard the services provided by different DCT as homogeneous. Also, previous research has shown that patients to some extent consider DCT visits as substitutes for traditional primary care visits. Therefore, a potential hypothesis is that the cross-price elasticity for other DCT providers, when patients using Kry faced an increased patient fee, is positive. However, there are other possible factors that can affect the demand

for the other DCT providers services when the patient fee rose for Kry's patients in Region Stockholm. Some potential factors are addressed in the following sections.

3.3. Digital Economics and the DCT Business

According to Goldfard and Tucker (2019), the digital economy is about how economic models change as digital technology enables certain costs to fall drastically. They identify search and transportation cost as two types of costs, among others, that are affected by the digital transformation. Goldfarb and Tucker (2019) state that both the cost of transporting the digital good as well as the cost of nearby and distant communication is as good as zero. Further, they state that lower search cost changes the condition for matching in different settings and will likely increase the quality of the matching and at the same time enable unused capacity to be used more efficiently. Altogether, Goldfarb and Tucker (2019) conclude that low search cost has led to an increase in the prevalence of platform-based businesses. For these types of businesses, network effects are a phenomenon. This means that the value of consuming a good or service increases as the number of consumers increases (Nyberg et al. 2021). For platform businesses, an important aspect is that the value on the consumer side of the market increases with the number of suppliers or producers on the other side of the market, also known as indirect network effects (Nyberg et al. 2021). According to research, business with network effects tend to have winner-take-it-all trends as success tends to bread success, resulting in the dominance of a single company, blocking out competitors (Schilling, 2002; Nyberg et al. 2021).

The DCT business takes advantage of these typically cost-saving opportunities arising from digital technology. As a result of low search costs, DCT platforms have facilitated the matching process between healthcare professionals and patients by making it possible for patients in an easy manner to get in contact with available professionals. Further, DCT platforms enable patients to get in contact with professionals no matter the distance, in an otherwise every location-bound sector, driving the transportation cost for both parties to zero. As previous research indicates (Schilling, 2002), the DCT market in Sweden also indicates that there could be winner-take-all tendencies as the market is clearly dominated by one player, Kry.

3.4. Brand Loyalty

Patients who exhibit brand loyalty are more likely to return to the same healthcare provider and less likely to engage in a "shopping" behavior (Zhou et al. 2017, p. 443). In a systematic review, Zhou et al. (2017) examined the determinants of patient loyalty to traditional healthcare providers. They conclude that there are mainly eight determinants of patient loyalty for traditional healthcare providers, such as satisfaction, service quality, and trust but, that the direct impact of these on loyalty is conflicting. They also highlight that further research on switching barriers on patient loyalty is desirable. How the DCT business is affected by brand loyalty is there little knowledge of.

There are studies that investigate how offline stores affect online stores. Brynjolfsson, Hu, and Rahman examined in a paper from 2009 brand loyalty between online and offline stories. They found that online sales are lower in areas with many offline stores. Conversely, Choi and Bell (2011) found that online sales of niche brands are higher in areas where they are unlikely to be available offline. Even though these studies do not examine brand loyalty between DCT providers, they do give an insight of how brand loyalty for digital economics can be affected by offering the same service or good but in a traditional setting, such as an offline store.

4. Methodology

This chapter gives an overview of the research design, starting with specifying the research question. It is followed by a description of the data and sample used. The next section contains descriptive statistics where the two groups are compared to generate an understanding of the main characteristics of the groups. The DiD model is thereafter explained, as well as the regression equation used. Lastly, the key identification assumption needed for the DiD model to generate a valid estimate is described.

4.1. Research Question

The core of my research is to examine how patients in Region Stockholm choose between DCT providers. I will do so by using a natural experiment when the patient fee rose for Kry´s patients residing in Region Stockholm. At the same time, the patient fee for other DCT providers established in Region Sörmland remained unchanged, as well as the patient fee for patients in other regions using both Kry and other DCT providers in Sörmland. Figure 2 illustrates the research question and the possible effects on the demand for other DCT providers.

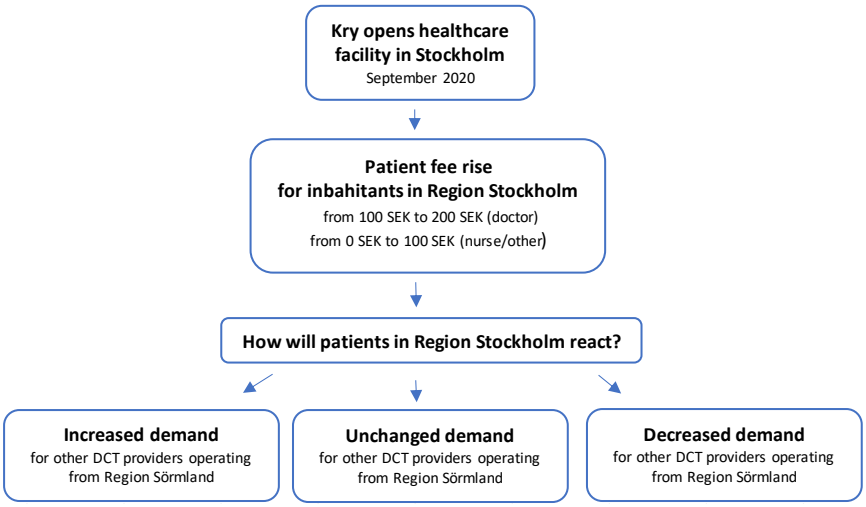

Figure 2: The research question and possible outcomes

If the demand for other DCT providers in Region Sörmland increases, this might suggest that adult patients are, as with youths, price-aware and price sensitive and that factors such as brand loyalty matters less than the price for DCT care. That would indicate a positive cross-elasticity of demand and that patients consider the service of different DCT providers as substitutes. Another possibility is that there is no effect on the demand for the other DCT providers, suggesting that the DCT patient, just like a patient for traditional healthcare, is not very price sensitive and that there are other factors apart from the price that are more important for the patient. A third option is that the demand for other DCT providers decreases when Kry offers both 'online' and 'offline' healthcare, similar to research about brand loyalty between online and offline stores. It is possible to believe that patients may favorize a DCT provider that extends their offer by providing traditional healthcare visits when needed, in extension to the DCT visit.

4.2. Data and Sample

This study will use data compiled from Region Sörmland. From year the 2019 to 2021, there has been a total of 12 DCT providers operating from Sörmland, however, not all of them were active during the whole sample period. Some of the DCT providers are specialized in what type of care they provide and will hence be excluded. As the aim of this study is to explore how the demand facing the other DCT providers operating from Region Sörmland was affected when Kry established in Region Stockholm, Kry is not a part of the sample. Two other DCT providers, Doktor.se and Capio Go, are operating from several other regions and are therefore also

excluded from the sample[2]. Thus, the analysis is based on data on consultations with Doktor24, Min Doktor and Vårdhjälpen. Therefore, other DCT providers are defined as these three DCT providers.

The data consists of monthly visits to the DCT provider, from July 2019 to December 2021. This includes visits to doctors, nurses, psychologists, and physiotherapists. However, the majority of visits are to doctors and nurses. Even though the patient fee differs between doctors and nurses, inhabitants of Region Stockholm faced the same level of increase in patient fee no matter which type of professional they had contact with, and therefore the different types of DCT appointments are reported together. As youths younger than 20 years old are typically exempted from paying the patient fee, patients that in 2019 were 20 years old or younger are excluded from the data. Patients over the age of 85 years are also exempted from patient fee, but as they constitute a vanishingly small part of the total DCT users (SALAR, 2021), they are not excluded due to limitations in the sorting of the data. As there are twenty-one regions in Sweden, and given that Region Stockholm constitutes the treatment group, there are twenty regions left that will constitute the control group.

4.3. Descriptive Statistics

The data sample consists of 630 observations and there are no missing values in any period. Table 1 shows the mean and median for monthly visits for the other DCT providers per 1 000 inhabitants for the treatment and control group. It is calculated using the 2020 population statistics from Statistics Sweden (2023). Both the mean and the median differ between the groups. This is however consistent with previous research stating that Region Stockholm has the largest proportion of DCT patients (SALAR, 2021).

Table 1: Mean and median in monthly visits per 1 000 inhabitants

Region	Observations	Mean monthly visits per 1 000 inhabitants	Median monthly visits per 1 000 inhabitants
Treated (region Stockholm)	30	5.6	5.9
Control (all other regions)	600	3.1	1.8

Table 2 gives a comparison of the mean visit for other DCT providers operating in Region Sörmland between the treated and control region before and after Kry's establishment in

[2] See appendix 1 for a full list of DCT providers operating in Region Sörmland between June 2019 and December 2021.

Stockholm. Both groups had an increase in the demand for other DCT providers, however, the increase was slightly larger in Region Stockholm.

Table 2: Comparison in monthly visits

Measurement	Treated region	Control regions
Mean visits pre-treatment	11 063	1 031
Mean visits post-treatment	15 358	1 410
Difference in number of visits	4 295	379
Difference in percent	38.8%	36.7%

4.4. Difference-in-Difference Model

To evaluate the effect on the demand for other DCT providers when Kry established healthcare facilities in Region Stockholm, a DiD model will be used. DiD is one of the oldest and most common methods to use for a quasi-experimental study design (Goodman-Bacon, 2021). In this paper I will use a canonical DiD, meaning that I have two groups; a treatment and a control group, and two time periods; a 'pre' and a 'post' treatment period (Goodman-Bacon, 2021). A DiD consists of two differences, the difference between the change in outcomes before and after treatment, and the difference in treatment and control group (Angrist & Pischke, 2009). By combining these two differences, I get the DiD estimate. This is also known as the average treatment effect on treated (ATET) as it only provides an estimate of the effect of the treatment on the treated group (Angrist & Pischke, 2009). Table 3 specifies the groups and periods for the DiD model used in this paper.

Table 3: Groups and periods in the DiD model

Treatment group	Control group	Pre-treatment period	Post-treatment period
Region Stockholm	All other regions	July 2019 - August 2020	September 2020 - December 2021

To obtain the DiD estimate, the following regression model will be used:

$$y_{rt} = \alpha + \beta_2 Treated \times Post + \delta_t + \mu_r + \varepsilon_{rt}, \qquad (1)$$

Where y_{rt} is the natural logarithm of monthly DCT visits from region *r* in month *t* for other DCT providers in Region Sörmland. $Treated$ is a dummy for the treated region, which is Region Stockholm. $Post$ is a dummy for the post-treatment period, that is when Kry established healthcare facilities in Stockholm. $Treated \times Post$ combines the dummy for being treated with the dummy of being in the post-treatment period. Given this, β_2 is the coefficient of

interest as it estimates the impact of Kry's establishment in Stockholm on the demand faced other DCT providers from patients residing in Region Stockholm. Since the outcome variable is logged, β_2 measures the effect in percent. δ_t is a vector for time fixed effect, and therefore deals with issues such as an eventual excess demand driven by Corona in March to May 2020. μ_r is a vector that accounts for region fixed effect and ε_{rt} is the error term.

Serial correlation is a violation against the assumption that the error terms are independent and identically distributed across all observations (Angrist & Pischke, 2009). Unfortunately, serial correlation tends to be an issue when using a method such as DiD, where we have both a time dimension and clustering (Angrist & Pischke, 2009). As a result, it is common that DiD estimation will understate the standard errors for the estimated treatment effect (Bertrand, Duflo & Mullainathan, 2004). To address this issue, I will use clustered standard errors. When doing so, I assume that the error terms are correlated within clusters but uncorrelated between clusters (Bertrand, Duflo & Mullainathan, 2004). Angrist and Pischke (2009) argue that this works well if the number of clusters is not less than 42, using fewer clusters than so might cause downward biased standard errors. That may lead to an overestimation in the statistical significance of the result. As the main result later will show, the estimated causal effect of the treatment is non-significant. Therefore, it is not a concern that using less than 42 clusters, as suggested by Angrist and Pischke (2009), will result in an overestimated significant interpretation of the treatment effect.

4.5. Parallel Trend Assumption

For the DiD model to produce a valid estimate of the causal effect, a key identifying assumption is that the demand trend of other DCT providers would be the same in both the treatment and control group in absence the of Kry's establishment in Stockholm (Angrist & Pischke, 2009). This is also known as the parallel trend assumption. However, Angrist and Pischke (2009) highlight that if there is a common trend in logs, there will not be one in levels and the other way around. This is because the transformation of the outcome variable changes the interpretation of the trends. Since I will use the natural logarithm of the outcome variable, I will therefore examine if there is a common trend in the percentage change over time.

To study the parallel trend assumption, I will do a visual inspection by plotting the means of the outcome over time for both groups and visualizing the results of the linear-trends model, see graph 1. Secondly, I will conduct a parallel-trend test to test if the null hypothesis that the

linear trends are parallel. Another assumption is that we assume that the treatment had no causal effect before its implementation (Roth et al. 2022). To test that neither the control nor treatment group change their behavior in anticipation of treatment, I will perform a Granger causality test (STATA, 2023). Altogether, these diagnostics will help me to evaluate the parallel trend assumption.

5. Results

This chapter presents the main results from the regression equation (1) and the evaluation of the parallel trend assumption. This is followed by a robustness check to assess the robustness and validity of the results. For this, three alternative specifications are used.

5.1. Main Results

The result from the DiD model specified in equation (1) is shown in table 4. The coefficient for the interaction between the treated region and the post-treatment period ($Treated \times Post$), is (when multiplied by 100) the change in percent in the demand for other DCT providers. However, this change is not significant. Therefore, there is not enough evidence to suggest that Kry's establishment in Stockholm had any significant effect on the demand for other DCT providers from patients in Region Stockholm.

Table 4: Results from the DiD regression

Variables	Coefficient
Treated x Post	0.0103 (0.0128)
Constant	6.417*** (0.186)
Observations	630
R-squared	0.350
Region FE	Yes
Time FE	Yes

Robust standard errors (adjusted for 21 clusters) in parentheses

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

5.2. Evaluation of the Parallel Trend Assumption

Graph 1 contains two plots, the first one plots the mean of the outcome over time for both the treatment and control group. In the second plot, the predicted value of the outcome is plotted against time, assuming a linear relationship. However, note that the groups follow each other tightly and therefore may be perceived as one. The vertical line in both plots indicates the month when Kry established healthcare facilities in Stockholm. The results from these plots

suggest that prior to Kry's establishment in Region Stockholm, the treatment and control group's demand for other DCT providers followed a parallel path.

Graph 1: Graphical diagnostic for parallel trends

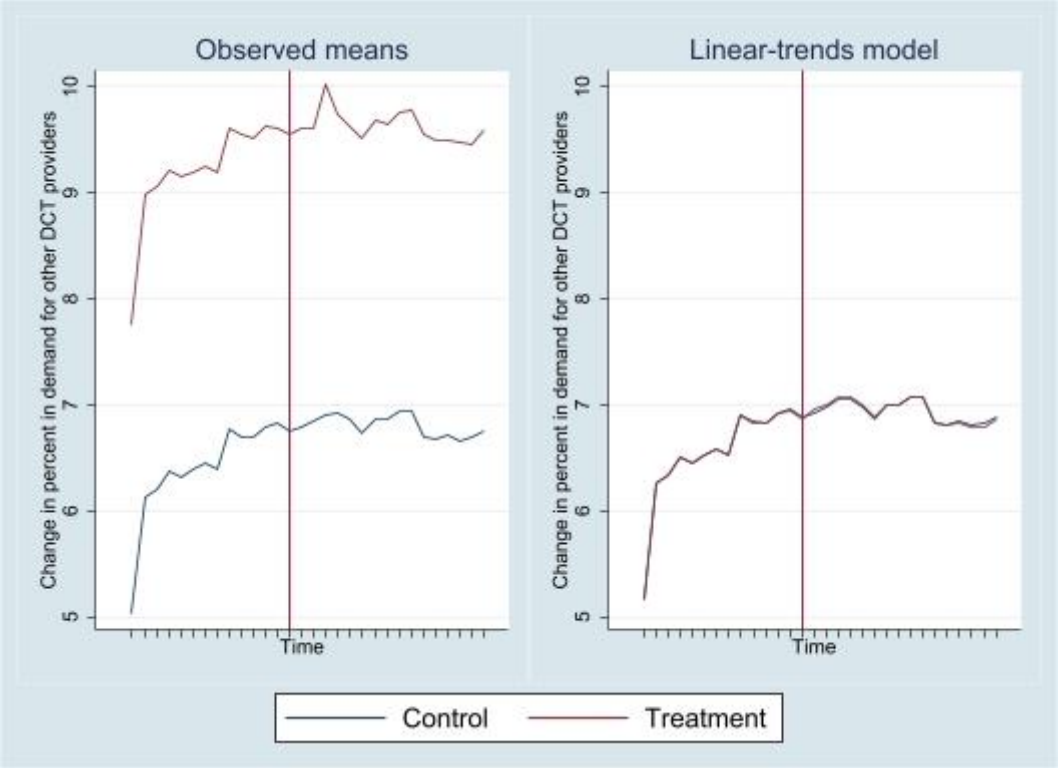

Table 5 shows the result from two tests conducted to assist the evaluation of the common trend assumption. The first one test whether the linear trends in the outcome variable are parallel between control and treatment groups during the pretreatment period. The second one test whether treatment effects can be observed in anticipation of the treatment. The result shows that for the parallel trend test, the null hypothesis cannot be rejected. This suggests that there was no significant difference in the trend regarding the demand for other DCT providers between the groups prior to Kry's establishment in Stockholm. For the Granger causality test, the null hypothesis is rejected. This indicates that Kry's establishment in Stockholm had an effect on the demand for other DCT providers before Kry actually opened healthcare facilities in Stockholm. The Granger causality test does not give any further information on whether the demand increased or decrease in anticipation of treatment.

Table 5: Test for evaluating the parallel trend assumption

Test	Null hypothesis (H0)	F-statistic	Prob>F
Parallel-trends test (pretreatment period)	Linear trends are parallel	F(1, 20) = 0.27	0.6066
Granger causality test	No effect in anticipation of treatment	F(13, 20) = 24.20	0.0000

Both the visualization of the observed mean prior to Kry's establishment in Stockholm, the linear-tend model and the parallel trend test support that the parallel trend assumption holds. However, the Granger causality test suggests that there might have been a change in behavior before Kry's establishment in Stockholm. However, this is unlikely for several reasons. One is that a patient cannot schedule when to have a health problem. One could argue that for some health issues, the patient has some flexibility to choose when to seek healthcare and could eventually do so earlier than they otherwise would. Further, the patient must have been well informed in advance that the patient fee for inhabitants in Region Stockholm was going to rise due to Kry's establishment in Stockholm. For most patients, this is not likely. Therefore, the assessment is that the result from the Granger causality test does not reflect a causal relationship between the treatment and the monthly visits before Kry's establishment in Region Stockholm. Hence, the conclusion is that the parallel trend assumption holds.

5.3. Robustness Check

Robustness checks are conducted to evaluate the robustness of the results. This is done by using alternative specifications. The first specification excludes the months before and after[3] the increase in the patient fee for patients from Region Stockholm using Kry. This is done because the Granger causality test indicated an effect of anticipation of treatment. Even though it was argued to be unlikely, this provides a more formal way of examining if the main result was affected by patients changing their behavior in anticipation of the increased patient fee for Kry´s patients from Stockholm. For the second specification, the post-treatment period sample is shortened to only include observation until December 2020. This is since the plotted observed means for region Stockholm (graph 1) shows that there is a spike in the demand closely after Kry was established in Stockholm. By doing so, I wish to control for an initial effect that is not captured when the whole time span is used. Lastly, the eight smallest regions

[3] August 2020 and September 2020 are excluded from the sample.

compared to number of DCT visits per 1 000 inhabitants are excluded from the sample[4]. They are excluded since region Stockholm has more than the double number of DCT visits per 1 000 inhabitants (SALAR, 2021). By the exclusion, I attempt to make the regions more similar in terms of DCT usage. The result for the different alternative specifications is shown below in table 6.

Table 6: Result from the DiD regression with alternative specifications

VARIABLES	Coef. (the month before and after excluded)	Coef. (months after December 2020 excluded	Coef. (smallest eight regions in usage excluded)
Treated x Post	0.00928 (0.0131)	0.0685*** (0.0150)	-0.00723 (0.0174)
Constant	6.391*** (0.186)	6.417***(0.187)	6.733*** (0.270)
Observations	588	378	390
R-squared	0.353	0.332	0.362
Region FE	Yes	Yes	Yes
Time FE	Yes	Yes	Yes

Robust standard errors (adjusted for 21 respectively 13 clusters) in parentheses

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

The result shows that there is no significant effect when excluding the months before and after treatment, which is consistent with the main result and the reasoning regarding the unlikeliness of anticipation of the treatment. However, there is a significant effect when observations after December 2020 are excluded. The result suggests that other DCT providers had a 6.85 % increase in demand from patients in Region Stockholm after Kry's establishment in Stockholm. Since this deviates from the main result, it indicates that there initially might have been a positive effect, but that this effect faded out in the longer run. There is no evidence of a significant effect when the eight smallest regions in terms of DCT visits per 1 000 are excluded. Overall, the results from the robustness check indicate that the main finding is somewhat sensitive to the exclusions of certain time periods but not for exclusion of regions in the control group.

6. Concluding Discussion

The results from the robustness check suggest that there is an initial positive effect on the demand for other DCT providers from patients residing in Region Stockholm. However, this effect quickly fades away and we are left with no significant effect on the demand for other

[4] These are Region Norrbotten, Region Västerbotten, Region Härjedalen, Region Kalmar, Region Västernorrland, Region Kronoberg, Region Blekinge and Region Dalarna (SALAR, 2021).

DCT providers in the longer run. This does not correspond to the hypothesis that Kry and other DCT providers could be considered as substitutes for each other, as we would expect a longer-lasting positive effect indicating a positive cross-price elasticity of demand in that case. This raises the question if regions can affect and control the demand for DCT by having different patient fees among the regions if the patient does not react to differences in patient fees between regions. However, this study is limited in such a manner as it does not examine if a change in the patient fee within the region will affect the demand for DCT services.

As Kry is the dominating DCT provider, the result is consistent with the theory of the winner-take-it-all tendency as other DCT providers do not see an increase in the demand when the patient fee for Kry's services rises in Stockholm. However, one could argue that unlike social network platforms, patients do not communicate with other patients on the DCT platforms and therefore question if there is any obvious network advantage for patients when a DCT providers grows bigger in the number of patients. But, on the other side, indirect network effects such as a bigger DCT provider can offer more doctors and nurses, should not be ruled out.

Another possible explanation for the unchanged demand is that Kry is making their offer to patients more attractive by being able to offer both DCT and traditional primary care. It is also possible that brand loyalty is strong and that combined with the patients being non price sensitive, as is the case for traditional primary care, patients might not change DCT provider due to an increase in the patient fee. However, the effect that the increased patient fee had on the demand for Kry from patients residing in Region Stockholm, is not examined in this thesis. This would be an interesting future research topic as it can give insights of how patient demand and preferences change when digital healthcare is combined with traditional primary care. Especially considering that more and more regions chose to develop their own digital healthcare solutions as a complement to the traditional primary care offered by the regions (Läkartidningen, 2022).

The result of this paper can also be applicable to other areas, such as the level of patient fee applied by the regions. The main findings of this paper indicate that an increase in patient fee for one DCT provider is not an effective tool to affect the demand for other DCT providers. However, there are currently seven different patient fees, in the range from 100 SEK to 330 SEK, applied by the different regions for a DCT visit to a doctor (SALAR, 2023b). Therefore, this

result could also be beneficial to address the different patient fees in regions in terms of that healthcare shall be offered to all inhabitants on equal terms. Further, the Swedish Competition Authority has raised concerns about the different systems of reimbursement for out-of-region DCT and with-in-region traditional primary care (Nordqvist et al. 2022). They state that it causes competition problems as they can be seen operating in the same market, targeting the same patients but with a different compensation scheme. Similar can be said about the different patient fees for DCT providers. No matter which region the DCT providers is established in, they compete for the same patients, but the patients face different patient fees depending on which region the DCT provider operates from. An equal patient fee across regions would not create competition incentives for DCT providers to establish in certain regions. An equal patient fee could also be more transparent for the patient in terms of healthcare equality.

One limitation with this study is that the use of aggregated data has made it difficult to control for individual characteristics such as age, gender, level of education and place of residence (metropolitan or rural). From previous research, it is known that these are factors that affect the individual's demand for DCT. Further, no covariates, such as population size, for the aggregated data have been included in the analysis. Even though using a DiD approach control for omitted variable bias, the DiD-regression could have provided a more accurate estimate if these control variables had been included.

To summarize, the results indicate that there is no significant effect on the demand for other DCT providers when the patient fee for Kry's patients in Stockholm rose. This suggests that patients do not regard the different DCT provider's services as substitutes for each other. Instead, other factors that are due to the nature of DCT being a platform-driven digital business could be the potential reason the result does not suggest a positive cross-price elasticity of demand. However, to establish that, further research, such as studies of how Kry´s and the individual DCT provider's demand was affected by the change in patient fee, is needed.

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Appendix

Appendix 1: List of DCT providers in Region Sörmland (adapted from Region Sörmland and each DCT providers webpage)

DCT provider in Region Sörmland	Been active the whole period (July 2019 to December 2021)	Included in the data sample/ reason for exclusion
Kry	Yes	No, not part of the "other DCT providers", which are defined as all DCT providers operation in Region Sörmland except for Kry
Capio Go	No	No, have healthcare facilities in many other regions
Doktor.se	Yes	No, have healthcare facilities in many other regions
Min Doktor	Yes	Yes
Vårdhjälpen	No	Yes
Blodtrycksdoktorn	No	No, operates only in a special area of primary healthcare
Din Psykolog	No	No, operates only in a special area of primary healthcare
Joint Academy	No	No, operates only in a special area of primary healthcare
Mendly	No	No, operates only in a special area of primary healthcare
Multirehab	No	No, operates only in a special area of primary healthcare
Pratamera	No	No, operates only in a special area of primary healthcare
Doktor24	Yes	Yes