The Effects of the Domestic Help Services Tax Credit on Demand for Services

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Abstract

The Finnish government proposed the domestic help services (DHS) tax credit at the first time in 1997. The government had many reasons for introducing the tax credit. One of the motivations was to increase demand of services in tax credited industries. The Finnish domestic help services tax credit system has been changed many times between 2001 and 2014. In this thesis I concentrate on the reforms in 2009 and 2012. I examine the effects of these reforms on demand for and consumer prices of services.

Theory of tax incidence predicts that a reduction of the domestic help services tax credit should decrease consumer prices and therefore also change demand for services. I apply a regression differences-in-differences (DD) method to investigate the theory prediction on demand for services. I use Finnish firms as a treatment group and Swedish firms as a control group. I utilize firms' value added tax (VAT) exclusive turnover to estimate the quantities of purchased services. The key assumption of the DD approach is that the treatment group and the control group have similar turnover trends in the absence of the treatment. This assumption is fulfilled in my analysis. The results on turnover vary between years. The results of the DHS tax credit reform in 2012 indicate that firms' turnover reduced from 1.09 % to 2.32 % depending on firms' location and industry. The results then support the theory predictions. On the other hand, the results of the reform in 2009 are not statistically significant.

To analyze the price responses, I exploit the fixed effects (FE) method which answers the question: Do the consumer prices of services change due to the reform or do they change anyway despite the reform? The estimation results of price responses show that the DHS tax credit reduction in 2012 increased consumer prices of cleaning services by 2.1 % just after the reform in the beginning of 2012 and by 5.3 % about year after the reform. Thus the results do not respond to theory predictions of tax incidence.

I have comprehensive data from Finnish and Swedish Tax Administration. Data contains all firms liable for VAT at the monthly level and income declaration data of firms and the DHS tax credit applications data at the yearly level. Data covers years from 2006 to 2013. I also use the survey data of consumer prices of cleaning services in the analysis of price responses.

This study contributes previous literature of the DHS tax credit by conducting the first econometric analysis of the Finnish tax credit system which uses the DD approach and both Finnish and Swedish data. However, I cannot provide any policy recommendations because the quality of my empirical results is not sufficient.

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Tiivistelmä

Suomen hallitus esitti kotitalousvähennystä ensimmäisen kerran vuonna 1997. Hallitus perusteli kotitalousvähennyksen käyttöönottoa useilla syillä. Yhtenä syynä oli lisätä palveluiden kysyntää kotitalousvähennykseen oikeuttavilla toimialoilla. Kotitalousvähennysjärjestelmää on muutettu useaan kertaan vuosien 2001 ja 2014 aikana. Tutkielmassani keskityn vuoden 2009 ja 2012 muutoksiin. Tutkin näiden muutoksien vaikutuksia kuluttajahintoihin ja palveluiden kysyntään.

Verokohtaannon teoria ennustaa, että kotitalousvähennyksen pienentämisen pitäisi laskea kuluttajahintoja ja siten myös muuttaa palveluiden kysyntää. Hyödynnän ero eroissa (DD) menetelmää tutkiakseni pitääkö teorian ennustukset palveluiden kysynnästä paikkansa. Käytän suomalaisia yrityksiä koeryhmänä ja ruotsalaisia yrityksiä verrokkiryhmänä. Estimoin ostettujen palveluiden määrää käyttämällä yritysten verotonta liikevaihtoa tulosmuuttujana. Ero eroissa menetelmän tärkein oletus on, että ilman muutosta koe- ja kontrolliryhmien liikevaihdot noudattavat yhtenäistä trendiä. Oletus täyttyy tutkimuksessani. Tulokset verottoman liikevaihdon analyysista eivät ole yksiselitteiset. Tulokset osoittavat, että vuoden 2012 kotitalousvähennyksen muutos laski yritysten verotonta liikevaihtoa 1.09–2.32 % riippuen yrityksen sijainnista ja toimialasta. Siten tulokset tukevat teoriaa. Toisaalta vuoden 2009 kotitalousvähennyksen muutoksen tutkimustulokset eivät ole tilastollisesti merkitseviä.

Hyödynnän kiinteiden vaikutusten (FE) menetelmää analysoidakseni kotitalousvähennyksen vaikutuksia palveluiden kuluttajahintoihin. Menetelmän avulla pystyn vastaamaan kysymykseen: Onko muutos kotitalousvähennyksessä vaikuttanut palveluiden kuluttajahintoihin vai olisivatko kuluttajahinnat muuttuneet joka tapauksessa? Tutkimukseni tulokset osoittavat, että kotitalousvähennyksen pienentäminen vuonna 2012 nosti siivouspalveluiden kuluttajahintoja 2.1 % heti muutoksen jälkeen alkuvuonna 2012 ja 5.3 % noin vuosi muutoksen jälkeen. Siten tutkimukseni tulokset eivät vastaa verokohtaannon teorian ennustuksia.

Tutkimuksessani käytän kattavaa Suomen ja Ruotsin veroviranomaisilta saatua aineistoa. Aineisto sisältää kaikki yritysten arvonlisäverotustiedot kuukausitasolla ja yritysten ja kotitalousvähennyshakemusten veroilmoitustiedot vuositasolla. Aineisto kattaa vuodet 2006–2013. Hyödynnän myös siivouspalveluiden kuluttajahinnoista koottua kyselyaineistoa tutkiessani hintavaikutuksia.

Tutkimukseni kontribuoi aiempaa kotitalousvähennyskirjallisuutta toteuttamalla ensimmäisen ekonometrisen analyysin Suomen kotitalousvähennysjärjestelmästä käyttäen DD menetelmää ja sekä Suomen että Ruotsin aineistoa. En voi kuitenkaan antaa mitään politiikkasuosituksia tutkimukseni perusteella, koska empiiristen tulosten laatu ei ole riittävä.

Contents

1 Introduction

Could governments affect the demand for services by using tax instruments? Do consumer prices change because of a tax instrument? These kinds of questions lie at the center of public economics. One purpose of public economics is to analyze government policy. Government policies can cause distortions in society and affect negatively or positively citizens' lives. Therefore studies of government policies can provide important information about how the policies affect people's lives.

Policy reforms offer researchers a possibility to explore the effects of government policy. In recent years there has been an increasing interest to study the effects of policy reforms as natural experiments. Quasi-experimental methods have been used, for instance, in studies of value added tax (VAT) reforms (e.g. Kosonen, 2015) and employment subsidies or minimum wage reforms (e.g. Betcherman *et al.*, 2010; Card & Krueger, 1994). In this thesis I aim to provide an empirical analysis of the effects of the Finnish tax credit reform on the demand for and consumer prices of services.

The Finnish government put in place a tax instrument, the domestic help services (DHS) tax credit[1], for the first time in 1997. Many reasons motivated the introduction of the domestic help services tax credit (HE 85/1997, HE 140/2000). The government wanted to increase the demand for domestic help services and improve households' opportunities to employ workers at home. Other motivations of the DHS tax credit were to reduce the shadow economy, influence labor supply and demand, encourage small entrepreneurs in tax credited industries and support house renovations. This thesis focuses on the government's motivation to increase the demand for domestic help services. In particular, this thesis attempts to answer to following questions: Does the domestic help services tax credit affect consumer prices of services and increase or decrease the demand for services?

Finland is not the only country which has implemented the domestic help services tax credit. The DHS tax credit is or has been in use also in Austria, Belgium, Denmark, France, Germany, Italy and Sweden (SOU 2008:57). France was the first country to introduce one form of the domestic help services tax credit in 1991 (Flipo *et al.*, 2007). After that, in the 1990s, the domestic help services tax credit was in use at least in Denmark, Finland and Sweden. In the 2000s, the domestic help services tax credit was introduced also in other countries and, for instance, in Sweden the government included more services to the system. Moreover, the Finnish government has changed

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[1]The Finnish term is kotitalousvähennys and the Swedish term is husavdrag

the domestic help services tax credit system several times in the period 2001-2014.

In this study I concentrate on the Finnish and Swedish DHS tax credit systems since both countries' systems are organized similarly. In Finland and Sweden, the domestic help services tax credit is a form of tax credit, which is provided to the consumers in their personal taxation. Consumers can apply the DHS tax credit for labor costs of services, such as renovation, cleaning and childcare. The domestic help services tax credited work has to be done at applicant's apartment and the DHS tax credit is not provided if the work is done by the applicants themselves.

In this thesis I utilize the changes in the Finnish DHS tax credit system to analyze the effects of the DHS tax credit on the demand for and consumer prices of services. I am especially interested in the changes made in the Finnish DHS tax credit system in 2009 and 2012. In 2009, the total maximum amount of the DHS tax credit was increased from 1150-2300 euros to 3000 euros. In 2012, it was decreased from 3000 euros to 2000 euros and the percentage amount of the DHS tax credit was decreased from 60 % to 45 % of labor costs.

The changes in the Finnish DHS tax credit system can be interpreted as shocks to firms. Therefore I apply a regression differences-in-differences (DD) method. I use Finnish firms as a treatment group and Swedish firms as a control group. Thus I compare the Finnish firms' value added tax exclusive turnover against to the Swedish firms' turnover in DHS tax credited industries.

The main identifying assumption of the DD method is that the treatment group and the control group have similar turnover trends without a treatment. Finland and Sweden have similar economic and cultural characteristics, such as labor laws and working conditions. Therefore firms face the similar business environments in both countries. Hence it is reasonable to assume that turnover trends are similar in the absence of the treatment. The graphical analysis of turnover trends illustrates that trends are similar before the DHS tax credit reforms and the main identifying assumption of the DD approach is fulfilled.

I use wide firm-level data from both Finnish and Swedish Tax Administrations to estimate the effects of the DHS tax credit reform on the demand for services. Both Finnish and Swedish data contains all firms liable for VAT at the monthly level and income declaration data of firms and the DHS tax credit applications data at the yearly level. Data sets cover years from 2006 to 2013. The monthly level data includes the firm's VAT payments of sales from which I calculate firms' VAT exclusive turnover. I exploit Finnish and Swedish firms' VAT exclusive turnover and estimated price responses

to analyze the effects of the DHS tax credit reform on the quantities of purchased services.

Despite the comprehensive data of firms, I do not have available consumer price data of cleaning services from Sweden, because Tax Administration data does not contains any information about the consumer prices. I have consumer price survey data only from Finnish cleaning firms before and after the reform in 2012. Therefore I cannot apply a regression DD approach for analyzing the price responses. Instead I investigate price responses of the DHS tax credit reform using the fixed effects (FE) method. The fixed effects estimation provides an answer to the question: Do the consumer prices of services change due to the reform or do they change anyway in spite of the reform?

The theory of tax incidence implies that the reduction of domestic help services tax credit should reduce consumer prices. My empirical results of price responses show that the DHS tax credit reduction in 2012 increased consumer prices of cleaning services by 2.1 % just after the reform in the beginning of 2012 and by 5.3 % a year after the reform. Thus the results are not in accordance with the theory predictions of tax incidence.

I analyze the impact of the DHS tax credit reforms in 2009 and 2012 on VAT exclusive turnover in three different approaches. First, I estimate the effects on turnover in all DHS tax credited industries together. Second, I investigate the main DHS tax credited industries, construction and cleaning industries, separately. Third, I divide firms in two groups depending on firms' location, i.e. first group contains firms which are located in the capital and second group those who are not.

The empirical results of turnover are not similar in the reforms. I show that the DHS tax credit reform in 2012 has reduced on turnover from 1.09 % to 2.32 % depending on firms location and industry. However, the results on cleaning firms' turnover are not statistically significant which indicates that the DHS tax credit reform has no impact on cleaning firms' turnover. Nevertheless, the results of the reform in 2012 are in line with the theory which implies that a reduction of the DHS tax credit should decrease the demand for services. Since consumer prices of cleaning services increase after the reform and VAT exclusive turnover decrease or does not change, quantities sold have to decline after the reform which indicate that the demand for services is decreased. The results of the reform in 2009 are not statistically significant and turnover trends are more messy in the time period than in 2011-2012 which complicated the interpretation. Moreover, I do not have the results of price responses of the reform in this period. Therefore I cannot reach any conclusions of the impact of the DHS tax credit reform in 2009.

My results contribute to the scarce literature on the tax credit reforms. To the best of my knowledge, there are hardly any studies of the effects of the domestic help tax credit system, which have done analyses with econometric methods and using Finnish data. Moreover, the differences-in-differences approach has not been utilized in the previous literature of the DHS tax credit. The previous studies of the Finnish DHS tax credit system have mainly focused on descriptive analyses about who uses the domestic help services tax credit and how much (e.g. Häkkinen Skans 2011; Lith 2011). The only econometric research about the effects of the domestic help services tax credit on the demand have done by Flipo *et al.* (2007). They studied the French DHS tax credit system with econometric simulation models. Their simulation results indicate that if the tax credit were to increase by 10 %, the 13.5 % of households who do not consume domestic services would use them after the increase.

The rest of the thesis is organized as follows. Section 2 presents previous literature and theory predictions of the changes in the DHS tax credit. Section 3 presents the institutional background in Finland and Sweden. Section 4 describes data and macroeconomic background and presents empirical strategy of this study. Section 5 presents the results of price responses and demand analyses and the discussion of the results. Finally, Section 6 concludes the thesis.

2 Literature Review

2.1 Theory

In this section, I present the theory of tax incidence and its predictions to the DHS tax credit. Furthermore, I show how the DHS tax credit can theoretically impact on the consumer prices and the demand for services. In my analysis I follow the theory of tax incidence by Kotlikoff & Summers (1987).

The theory of tax incidence implies that the DHS tax credit affects consumer prices, because it directly decreases prices, which consumers pay for services. I analyze demand and price effects as a shift in the demand curve, because consumers apply the DHS tax credit in their personal income taxation. I assume that the supply curve is unchanged. Uusitalo (2005) showed that the DHS tax credit only shifts the demand curve and not the supply curve. In the end of this section, I discuss the possibility of change in the supply curve as well.

Figure 1 visualizes the effects of the DHS tax credit to the demand curve. Before introducing the DHS tax credit, equilibrium is at point E_0, with quantity q_0 and price p_0. The consumer price with value added tax is $p_0 = \phi(1 + t)$, where a producer price is ϕ and VAT is t. The demand curve shifts up exactly by τ, which is the DHS tax credit. The consumer price p_0 increases to p_1 and new equilibrium is now on the point E_1. After the DHS tax credit consumers pay a price $p_1 - \tau$ and quantity increases to q_1. The vertical distance between the old and new demand curve is the amount of the DHS tax credit τ. Thus demand effects depend on the amount of the DHS tax credit and the elasticities of demand and supply.
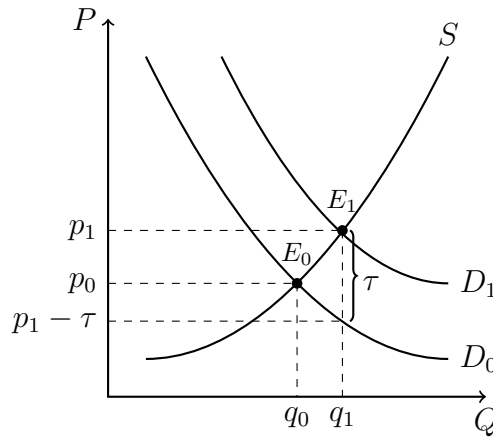

Figure 1: The tax incidence of the DHS tax credit

The theory of tax incidence implies that the changes in the DHS tax credit should shift consumer prices. I use the partial equilibrium analysis of tax incidence to determine price effects of the change in the DHS tax credit. In order to use the partial equilibrium analysis, I have to assume that the market is relatively small versus entire economy. This assumption is reasonable because the DHS tax credit can apply only for certain industries' services and not for all services in every industries.

The economy without taxation is in equilibrium, when demand and supply equals,

$$D(p_0) \equiv S(p_0), \tag{1}$$

where p_0 is the equilibrium price without the tax credit τ. By introducing the tax credit

τ, the equilibrium changed to

$$D(p_1 - \tau) \equiv S(p_1), \tag{2}$$

where p_1 is the price with VAT. Figure 1 shows the impact of the DHS tax credit to equilibrium. The consumer pays the price $p_1 - \tau$ and the producer sells at the price p_1 after introducing the tax credit τ.

I exploit equilibrium condition (2) to study tax or price incidence of the DHS tax credit. I begin with analyzing how the change in the DHS tax credit τ affects the consumer prices p_1. By differentiating the equilibrium condition (2) with respect to τ:

$$\frac{dp_1}{d\tau} D(p_1 - \tau) = \frac{dp_1}{d\tau} S(p_1) \implies D'(p_1 - \tau)(\frac{dp_1}{d\tau} - 1) = \frac{dp_1}{d\tau} S'(p_1). \tag{3}$$

I assume that the DHS tax credit τ is zero,

$$D'(p_1 - \tau)(\rho - 1) = \rho S'(p_1) \implies \rho D' - D' = \rho S'$$

$$\implies D' = (D' - S')\rho \implies \rho = \frac{D'}{D' - S'}, \tag{4}$$

where $D' = \frac{dD(p_1 - \tau)}{dp_1}$, $S' = \frac{dS(p_1)}{dp_1}$ and $\rho \equiv dp_1/d\tau$, which is defined as a pass-through rate (Weyl & Fabinger, 2013).

Weyl & Fabinger (2013) introduced the pass-through ρ as an economic tool, which is determined by the elasticities of demand and supply. Therefore I also derive the pass-through using the elasticity of demand $\epsilon = \frac{dD(p_1 - \tau)}{dp_1} \frac{p_1 - \tau}{D}$ and the elasticity of supply $\eta = \frac{dS(p_1)}{dp_1} \frac{p_1}{S}$.

Assuming that the DHS tax credit is zero, the elasticity of demand is $\epsilon = D' \frac{p_1}{D}$ and the elasticity of supply is $\eta = S' \frac{p_1}{S}$. Because demand and supply are in the equilibrium condition (2) and equation (4) is multiplied by p_1/D, the pass-through ρ is

$$\rho = \frac{\epsilon}{\epsilon - \eta}. \tag{5}$$

The equation (5) is the standard representation of tax incidence (Marion & Muehlegger, 2011; Weyl & Fabinger, 2013). Weyl & Fabinger (2013) define the pass-through as a sum which pass to consumer when tax or cost is applied.

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Therefore price incidence of the DHS tax credit depends on the elasticities of demand and supply, when the markets are perfectly competitive (Kotlikoff & Summers, 1987; Salanié, 2003). Whereas under a general model of symmetric imperfect competition, the pass-through differentiates from the perfect competition pass-through by a conduct parameter, $\theta = [(p - mc)/p]\epsilon$. In the conduct parameter, p is the consumer price, mc represents the producer's marginal cost and ϵ is the elasticity of demand. The conduct parameter varies between zero and one, depending on the degree of the competition. Naturally, under the perfect competition it equals to zero and under the monopoly it equals to one (Weyl & Fabinger, 2013). Hence the elasticities of demand and supply affect the pass-through also under the imperfect competition.

The elasticity of demand affects more the pass-through if firms have some market power because the conduct parameter is larger than zero. Consumers can apply the domestic help services tax credit, for instance, to cleaning and renovation services. The markets of cleaning and renovation industries can differ from each other. I assume that cleaning firms have little market power since, in average, cleaning firms are quite small and there is a large number of cleaning firms in Finland. Therefore the market is almost perfectly competed and the DHS tax credit should have the impact close to what theory implies. Instead, in the construction and engineering industries, e.g. renovation sector, theory implications are not necessarily valid since firms can differentiate more easily and some firms may have more market power than other. The change in the DHS tax credit then does not possible have impact on the demand as the theory implies.

The elasticities of demand and supply also affect on quantities purchased. Theory of price elasticity implies that if demand is almost inelastic, the price change does not have large impact on quantities purchased and vice versa if demand is very elastic. In Figure 1 I visualize the effect of the DHS tax credit on prices with almost equally elastic demand and supply. The pass-through to consumer prices is then about half of the full pass-through. The pass-through to consumer prices is near to full if demand is almost inelastic and supply is very elastic ($\epsilon \ll \eta$). Conversely, the pass-through is close to zero if demand is very elastic and supply is close to inelastic ($\epsilon \gg \eta$).

Consequently, the theory of tax incidence implies that if consumer prices change, quantities purchased can also change. Therefore without the change in consumer prices there cannot be any change in demand. According to theory, the reduction of the DHS tax credit should decrease consumer prices. Figure 2 shows the effects of the reduction of the DHS tax credit. Before the reduction the price is p_1. Then the government reduces the DHS tax credit from τ_1 to τ_2. The demand shifts down due to the smaller
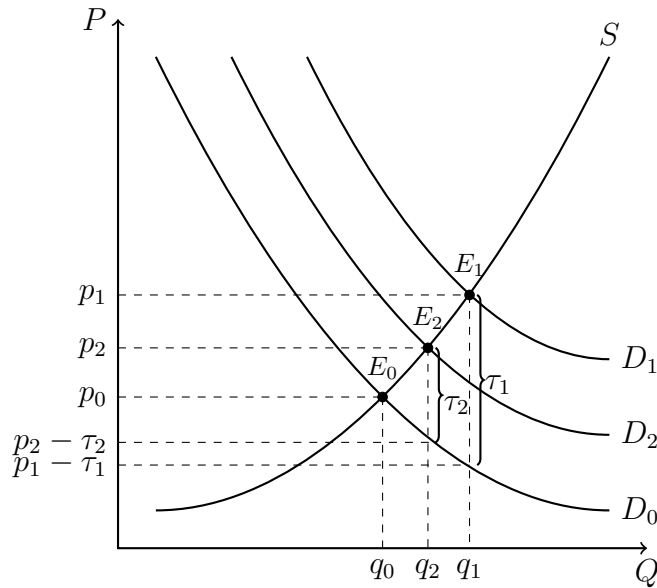
Figure 2: The change in the DHS tax credit

tax credit and consumers pay a price $p_2 - \tau_2$, which is larger than the price $p_1 - \tau_1$ before the reduction. Also the consumer price decreased to p_2. The quantity sold drops from q_1 to q_2. Thus if the consumer price do not change due to reduction of the DHS tax credit, demand cannot change either.

In the beginning of this section, I assume that supply does not change due to the tax credit. The assumption is based on the information that in Finland consumers apply the DHS tax credit in their personal income taxation. Instead, in Sweden buyers of services get the DHS tax credit directly, when they purchase services. The details of the both countries' DHS tax credit systems are presented in Section 3. Because of the institutional differences, Swedish firms can possibly easier adjust prices due to the DHS tax credit, since a buyer only pays half of the price of services to the firm. In Sweden supply of services can also change, not only the demand.

Moreover, the institutional differences between Finland and Sweden can also affect the demand curve. The consumer's preferences for purchasing services determine the demand curve. Finnish consumers can have different preferences than Swedish consumers. The Swedish tax credit system enables Swedish consumers allocate more consumption for today since they do not have to pay a full price of services. While in Finland the claim of the DHS tax credit is done even a year and half later than the services is purchased. Finnish consumers pay the full price of services and hence they

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have a smaller budget for consumption. Therefore the consumer's budget constraint is different in Finland and Sweden and the preferences for consumption differ from each other.

In consequence of the institutional differences, tax incidence of the DHS tax credit could be different in Sweden and Finland. The difference in tax incidence between countries is not a problem because the Swedish system has been unchanged in the period I am focusing on.

The DHS tax credit can also cause spillover effects to other industries. The DHS tax credit reduces prices of the tax credited services. Therefore consumers have more budget to spend in other services. Also the possible spillover effect can be larger in Sweden than in Finland, because Swedish consumers get the tax credit directly. Conversely, the DHS tax credit can have negative impact on the demand for the substitutes of the DHS tax credited services, for instance food delivery and complementary building and building an addition. Thus the demand for tax credited services can increase at the expense of other non-tax credited services. All these possible spillover effects are depending on the consumers' behavior. Moreover, the interest rate and inflation can also affect the size of spillover effects, because in Finland consumers receive the sum of the DHS tax credit next year from purchased at the earliest.

Other possible external effects of the DHS tax credit are based on firms' behavior. The firms can increase supply of services in the DHS tax credited industries or these industries can attract more new firms to enter the business. These new firms are then absent from other industries. Moreover, in the DHS tax credited industries firms can have incentives to shift material costs to labor costs, in which case the demand effects can be distorted. As a consequence, the general effects of the DHS tax credit on demand can differ from the demand effects of the specific industry. Furthermore, the DHS tax credit can also increase lobbing activity of substitutes services industries (Häkkinen Skans, 2011). Hence it can raise the political pressure to accept these services in the DHS tax credit.

2.2 Previous Evidence

The previous empirical literature of the tax credits for consumers is thin. Especially, as the DHS tax credit is not a widely used form of tax credit, there are only few previous studies of the effects of the DHS tax credit. The only econometric studies of the DHS tax credit have been done by Flipo *et al.* (2007), Halldén & Stenberg (2013) and Öberg (2005). Other previous studies have mainly concentrated on descriptive analyses of the DHS tax credit applicants (e.g. Häkkinen Skans 2011; Lith 2011; Riksskatteverket 2011).

Häkkinen Skans (2011) and Lith (2011) describe the DHS tax credit systems in Finland and Sweden. Häkkinen Skans (2011) discusses possible theory implications of the DHS tax credit on demand and employment. She also focuses on describing applicants of the DHS tax credit and from which services they apply the DHS tax credit. Lith (2011) instead focuses on describing the production of domestic help services and services providers' economic situations. Furthermore he discusses the impacts of DHS tax credit to the shadow economy.

Grönberg & Rauhanen (2015) also discuss the Finnish and Swedish domestic help services tax credit systems. The purpose of their study was to examine how much the DHS tax credit is not applied or is not payed to pensioners, because of pensioners' tax payments are not large enough to cover the total amount of the DHS tax credit.

While Tuovinen (2007) only describes the Finnish DHS tax credit system and discusses theoretically employment effects of the DHS tax credit. In addition she reviews the previous literature about the employment effects of the DHS tax credit.

In previous literature there are hardly any econometric studies with comprehensive data about the effects of the DHS tax credit on demand and employment. Häkkinen Skans (2011) remarked in her paper that without detailed data about service providers and applicants of the DHS tax credit, the estimation of the effects of the DHS tax credit cannot be done. Niilola *et al.* (2005) study the effects of the DHS tax credit on demand and employment in Finland using data which contains surveys of households and domestic help services firms. They argued that the DHS tax credit has had an impact on the demand for services and employment. Niilola *et al.* (2005) calculate the employment effects dividing the sales of services (in euros) by the effectiveness of work (in euros/person-year). As a result, they got the person-year quantity of employments.

However, Uusitalo (2005) claimed that the method used by Niilola *et al.* (2005) is not valid, because it does not take into account the price effects of the DHS tax credit or control for the underlying development of employment and demand for services in industries of domestic help services. Uusitalo (2005) argued that a reliable study cannot be conducted without relevant data or comprehensive empirical analysis. He suggested that the DHS tax credit should be studied with a natural experimental method, which includes a treatment and control group.

The previous literature of the Swedish DHS tax credit system is also mainly focused on descriptive analyses. The reports by Riksskatteverket (2011) and SOU (2008:57) describe the Swedish DHS tax credit system. SOU (2008:57) also present the overview of the other countries' domestic help services tax credit systems. While in the report of Riksskatteverket (2011), the main purpose is to analyze how the Swedish DHS tax credit system has affected the shadow economy.

The Swedish domestic help services tax credit system have been studied also empirically. Öberg (2005) analyzes the effects of the hypothetical DHS tax credit to the formal and informal employment. She estimates, using a general equilibrium simulation, that formal long-term employment increased by 0.07-0.45 percent of the labor force. Also Halldén & Stenberg (2013) study the domestic help services tax credit empirically, but they have a different perspective than other researchers. They examine the Swedish DHS tax credit system and its impact on female earnings with difference-in-differences propensity score matching. The main idea in their study was to analyze female labor supply and how the DHS tax credit shifts the household time constraint. However, there are no studies of the effects of the Swedish DHS tax credit system on the demand for and consumer prices of services.

The only econometric research about the demand effects of the DHS tax credit have been done by Flipo *et al.* (2007). They studied the French DHS tax credit system with econometric simulation models. They estimate the impact of the French tax reduction for domestic work on the demand for services and employment. Their simulation results show that if the tax reduction increases by 10 %, the 13.5 % of households would consume domestic services after the increase even if they do not consume such services before. Thus the results show that the demand for domestic help services is considerable elastic in France. However, Flipo *et al.* (2007) argued that with their simulation models and data, results show no employment effects at the aggregate level. Instead, their study shows that the increase of the tax reduction would reduce the use of undeclared work and hence increase employment. Nevertheless, the study of Flipo *et al.* (2007) shows

only the simulation results of the increase of the domestic help services tax credit and not any comparative analysis of the demand and employment effects.

3   Institutional Background

In this section, I present the institutional background of the domestic help services tax credit in Finland and Sweden respectively. Especially I focus on changes in the DHS tax credit systems in both countries and differences in these changes. In general, the DHS tax credit systems have organized almost similarly in both countries. The most significant difference between Finland and Sweden DHS tax credit systems is that in Sweden consumers get the tax credit directly, when they buy the tax credited services whereas in Finland consumers have to apply the tax credit in their personal income taxation. Fortunately, the difference in the applying mechanism has not changed among the period I focus on.

3.1   Finland

The Finnish government proposed the DHS tax credit for the first time in 1997 (HE 85/1997). In 1997-2000 the DHS tax credit was experimented with two different variants. The first variant was a subsidy for firms, that offered domestic help services, and the second was a tax credit for households, which purchased services. The subsidy for firms was in use in Western and Eastern Finland and the tax credit was applied in the Province of Oulu, Lapland and Southern Finland.

The Finnish government had many motivations for introducing the DHS tax credit (HE 85/1997, HE 140/2000). The first was that the DHS tax credit could improve households' opportunities to employ workers at home. The second was that the DHS tax credit could increase the demand for domestic help services. Thus the government wanted to influence labor demand and supply in the DHS tax credited industries. The third was that if services are bought more from firms, it could reduce the shadow economy, because people would not do work by themselves or use undeclared work. The fourth was that the government wanted to encourage small entrepreneurs and health care at home. The fifth was that the government wanted to support house renovations.

The subsidy for firms was used more to buy domestic help services and the tax credit more to buy house renovation services (Häkkinen Skans, 2011; Lith, 2011). Households using the tax credit had better earnings on average than households using services of

subsidized firms (Häkkinen Skans, 2011; Lith, 2011). In 2001 the government terminated the subsidy system and continued with the tax credit system. At the same time the tax credit system was extended to the whole country. The main reason for terminating the subsidy system was that it was administratively too burdensome (HE 140/2000). The decision of termination was made without any evaluation of differences and effectiveness of these systems. After 2001 the tax credit system has changed many times. I present the changes in the system in a more detailed manner later in this section.

Table 1: Examples of the DHS tax credited services in Finland

Domestic help:		
Cleaning apartment	Gardening	Furniture assembly
Cooking	Ironing and laundering	Childcare and senior care
House renovations:		
Painting	Kitchen and bathroom renovation	Patio construction
Plumbing and electricity works	Installation of IT devices	Installation of solar panels

DHS tax credited services are determined by the government. The DHS tax credit can be applied for domestic help and health care services, which are done at home, and house renovation services (HE 85/1997). In Table 1[2] I present some examples of tax credited services. However, all domestic help services are not included in the DHS tax credit. There are some restrictions from which kind of work the DHS tax credit can be applied for. For instance, the DHS tax credit would not be granted for health care services which have a zero percent tax rate. The tax credited services also have to be bought from a natural person or a company and they have to carry out at a taxpayer's apartment[3] or an apartment where a taxpayer's close relative live (HE 146/2004). Applicants of the DHS tax credit cannot get the credit if they do the work by themselves or with the help of a person who lives in the same apartment with the applicant (HE 144/2006). Also the government's house renovation subsidies, vouchers for health care services and some other subsidies for childcare or caring for close relatives restrain the DHS tax credit (HE 144/2006, HE 133/2012).

The rules of the DHS tax credit have changed several times between 1997 and 2014. These changes offer possibilities to analyze the effects of the DHS tax credit on various outcomes. The government has changed the amount or other terms of the DHS tax

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[2]The Finnish Tax Administration lists services in a more detailed manner in their website https://www.vero.fi/fi-FI/Henkiloasiakkaat/Kotitalousvahennys/Taulukko_kysytyimmista_kotitalous vahenny(9231)

[3]Both rental or owner-occupied flat is accepted

Table 2: The changes in the DHS tax credit in Finland

Year	1997-2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Percentage amount of the tax credit (%)	40	40	40	60	60	60	60	60	60	60	60	60	45	45	45
The tax credit for hiring employee	SSC[1]	SSC[1]	SSC[1]	SSC[1] and 10 % of a salary	SSC[1] and 10 % of a salary	SSC[1] and 30 % of a salary	SSC[1] and 30 % of a salary	SSC[1] and 30 % of a salary	SSC[1] and 30 % of a salary	SSC[1] and 30 % of a salary	SSC[1] and 30 % of a salary	SSC[1] and 30 % of a salary	SSC[1] and 15 % of a salary	SSC[1] and 15 % of a salary	SSC[1] and 15 % of a salary
The own liability (€)	0	85	100	100	100	100	100	100	100	100	100	100	100	100	100
Total max. amount of the tax credit (€)	845	845	900	1150	1150	1150	2300 and only 1150 for a renovation	2300 and only 1150 for a renovation	2300 and only 1150 for a renovation	3000	3000	3000	2000	2000	2400
Other changes in the tax credit		Household tax credit to a personal tax credit			Exclude a work paid by a voucher	Include a work in a parents' house	The tax credit primarily from income taxation	Other credits do not exclude the tax credit		An extended coverage of the tax credit				Includes a work of foreign firms and a work in EU countries, some credits exclude the DHS tax credit	
The government bill	HE 85/1997 and 72/1999	HE 140/2000	HE 140/2000	HE 256/2000	HE 49/2003	HE 146/2004	HE 68/2005 and 117/2005	HE 144/2006		HE 112/2008			HE 50/2011	HE 87/2012 and 133/2012	HE 105/2013
The date of entry into force	1 Oct	1 Jan	1 Jan	1 Jan	1 Jan	1 Jan	1 Jan	1 Jan		1 Jan			1 Jan	1 Jan	1 Jan

[1]SSC=employer's social security contributions

credit almost every year. Changes and details of the DHS tax credit are presented in Table 2. Table 2 shows that the percentage amount and total maximum amount of the DHS tax credit have changed many times between 2001 and 2014. Currently the effective maximum total amount of the DHS tax credit is 2400 euros or 45 % of labor compensations. The own liability of a buyer is 100 euros. The DHS tax credit cannot be handed from material costs or installations of domestic appliances. Therefore only labor costs and hiring an employee at home are tax credited. If a household hires an employee, the amount of the DHS tax credit is 15 % of a salary and all employer's social security contributions (SSC) can be deducted in personal income taxation. Nowadays the DHS tax credit can also be applied from a work of foreign firms and a work which is done in other EU countries. (HE 87/2012, HE 105/2013)

In this study I focus on changes where the total maximum or percentage amount of the DHS tax credit have increased or decreased. Table 2 shows that these kinds of changes were in 2002, 2005, 2006, 2009, 2012 and 2014. I analyze the changes in 2009 and 2012, because I have data available only from 2006 to 2013. The change in 2012 is especially interesting since both the total maximum and percentage amount decreased. The total maximum amount changed from 3000 euros to 2000 euros and the percentage amount decreased from 60 % to 45 %. Also the percentage amount of the DHS tax credit for hiring employee decreased from 30 % to 15 %. In 2009 only the total maximum amount of the DHS tax credit increased from 2300 euros to 3000 euros in household help services and from 1150 euros to 3000 euros in renovation services. There were no changes in the percentage amount at that time.

3.2 Sweden

The Swedish government proposed the domestic help services tax credit at the first time in 1993 (Prop. 1992/93:150). The motivation of the DHS tax credit was to balance the business cycle and also boost the building industry until 2005. The DHS tax credit was called the ROT deduction[4] and the buyer could apply it for labor costs of renovation[5]. The DHS tax credit was 30 % of labor costs and the total maximum amount varied between 5 000-35 000 SEK. The variation depended on the type of renovated house. Housing types included an own apartment, a rental apartment or even a holiday home.

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[4]ROT = "Reparation och underhåll, Ombyggnad, Tillbyggnad" (Renovation and building extension)

[5]The Tax Administration lists services in a more detailed manner in their webside https://www.skatteverket.se/privat/fastigheterbostad/rotrutarbete/exempelparotarbete.106. 7afdf8a313d3421e9a9256b.html

The own liability of the DHS tax credit was 2000 SEK. In 1995, 2000-2003 and 2006 there were no domestic help services tax credit in use.

The Swedish government motivated the introduction of the DHS tax credit in several ways (Prop. 1992/93:150, Prop. 2006/07:94). In 1993, the main reason was to temporarily balance the economy and boost the building sector in recession. The government wanted to reduce unemployment and also the shadow economy in the building sector. Therefore the ROT deduction was in use in several years between 1993 and 2005. The government proposed the RUT deduction[6] for household work in 2007. The aim of the RUT deduction was to increase freedom of choice in labor markets. The government wanted to develop more short-time employment and provide people more options to arrange their family life and work. One of the goals was to improve sexual equality, because the DHS tax credit relieves time from household work and women still spend more time on doing them. The government also wanted to reduce the shadow economy with RUT, because people often do household work by themselves and this work does not show in gross domestic product (GDP) and other national accounting based indices.

In the first of July 2007 the government made the DHS tax credit permanent (Prop. 2006/07:94). Since 2007 the percentage amount of the DHS tax credit has been 50 % of labor costs and the total maximum amount 50 000 SEK. The own liability of a buyer is 1000 SEK. Until November 2008 the DHS tax credit was only the RUT deduction. The RUT deduction can be applied for domestic help services, for instance cleaning, childcare and gardening[7]. In December 2008 the ROT deduction was also included to the DHS tax credit system (Prop. 2008/09:178). In July 2009 the government changed the DHS tax credit application system to a direct invoicing system[8] and hiring an employee at an apartment became tax credited. There has not been any changes in the total maximum and percentage amount of the DHS tax credit after 2007. Only changes after 2009 have been that the paid homework assistance became tax credited in 2013 and that the direct invoicing system was improved in 2015 (Prop. 2012/13:14, Prop. 2014/15:10). Therefore from July 2007 the DHS tax credit system has been almost unchangeable. Table 3 presents all changes and the system in a more detailed manner.

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[6]RUT = "Rengöring, Underhåll, Tvätt" (Cleaning, nursing/caring, washing)

[7]The Tax Administration lists services in a more detailed manner in their website https://www.skatteverket.se/privat/fastigheterbostad/rotrutarbete/exempelparutarbete.4. 2ef18e6a125660db8b080001424.html

[8]Fakturamodellsystemet. The direct incvoicing system, where the taxpayer get the tax discount direct from the company from which she buy services.

Table 3: The changes in the DHS tax credit in Sweden

Year	1993-1994	1995	1996-1997	1998-1999	2000-2003	2004-2005	2006	2007	2008	2008	2009	2010-2012	2013	2014	2015
Percentage amount of the tax credit (%)	30	0	30	30	0	30	0	50	50	50	50	50	50	50	50
The tax credit for hiring employee	0	0	0	0	0	0	0	0	0	0	10.21-31.42 % if a salary is over 10 000 SEK per year	10.21-31.42 % if a salary is over 10 000 SEK per year	10.21-31.42 % if a salary is over 10 000 SEK per year	10.21-31.42 % if a salary is over 10 000 SEK per year	10.21-31.42 % if a salary is over 10 000 SEK per year
The own liability (SEK)	2000	0	2000	2000	0	2000	0	1000	1000	1000	1000	1000	1000	1000	1000
Total max. amount of the tax credit (SEK)	10 500 - 35 000	0	5 000 - 20 000	7 000 - 27 000	0	5 000 - 20 000	0	50 000	50 000	50 000	50 000	50 000	50 000	50 000	50 000
Other changes in the tax credit	The ROT as an instrument for balancing business cycle	No tax credit system	The ROT as an instrument for balancing business cycle		No tax credit system	The ROT as an instrument for balancing business cycle	No tax credit system	The RUT deduction	The tax credit also from company benefits	Includes the ROT deduction	A direct invoicing system and the tax credit from hiring an employee		Includes the paid homework assistance		Improvement to the direct invoicing system
The government bill	Prop. 1992/93:150		Prop. 1995/96:229	Prop. 1997/98:119		Prop. 2003/04:163		Prop. 2006/07:94	Prop. 2007/08:13	Prop. 2008/09:178	Prop. 2008/09:77 and 2008/09:178		Prop. 2012/13:14		Prop. 2014/15:10
The date of entry into force	1 Jan		1 Jul	19 Mar		1 Nov		1 Jul	1 Jan	8 Dec	1 Jul		1 Jan		1 Jan

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4   Data and Empirical Strategy

In this section, I describe the data and empirical strategy. First, I provide macroeconomic background of Finland and Sweden. I visualize macroeconomic indicators and their development in both countries. Second, I present data sets which I use in my empirical analyses. I exploit mainly Tax Administration data from Finland and Sweden but I also have the survey data from Finnish cleaning firms. And last, I present the empirical strategy of this study.

4.1   Macroeconomic Background

In this section, I present macroeconomic indicators from Finland and Sweden. I compare Finnish and Swedish firms in analyses and therefore also the countries' macroeconomic conditions are of interest. If the trends of macroeconomic indicators are very different in Finland and Sweden, it is not reasonable to compare countries with each other. Both Finland and Sweden are Nordic welfare states and societies are orderly in the same foundation. Both countries have similar labor laws, working conditions, annual vacations and cultural background. Therefore firms experience similar business environments in both countries. Figure 3 shows that general economic and consumer price trends are similar in both countries between 2005 and 2013, the period I am focusing on (OECD, 2015a,b,d). I study consumer price trends in more detailed manner in Section 5.1.

In econometric analyses my main variables of interest are firms' VAT exclusive turnover and consumer prices. For that reason I am especially interested in the general growth rate of the economy, the employment rate and consumer price index (CPI). Figure 3a shows that the quarterly GDP growth has been similar in Finland and Sweden in the period I am focusing on. The economic crisis in 2008-2009 affected the quarterly GDP growth more in Finland, but after the crisis growth trends have varied in similar manner in both countries.

Figure 3b visualizes the employment rate trends in Finland and Sweden in 2005-2015. The employment rate has similar trend in both countries, but in general Sweden has a higher employment rate. Historically the employment rate in Sweden has been always larger than in Finland and other developed countries, which explains the difference between rates. However, the employment rate has increased after 2013 in Sweden and in contrast it has decreased in Finland, but that is not a problem because I am focusing on the changes in the DHS tax credit in 2009 and 2012.

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The quarterly GDP growth rate

The employment rate
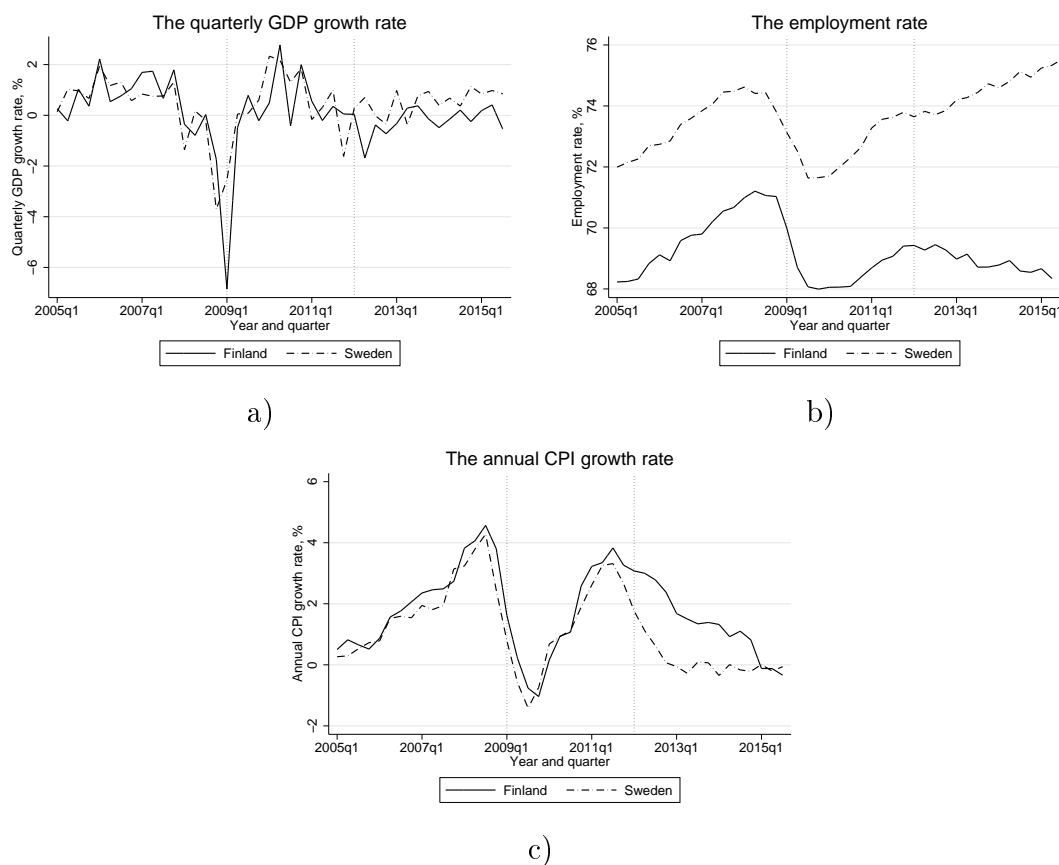
a)

b)

The annual CPI growth rate

c)

Figure 3: a) The quarterly GDP, b) employment rate and c) the consumer price index growth rate in Finland and Sweden from 2005 to 2015. Vertical lines indicate the reforms in Finland.

Figure 3c shows that annual consumer price index growth rates have been very similar from 2005 to 2011 in Finland and Sweden. The CPI growth rate is a common indicator for identifying inflation and deflation periods. Before the economic crisis in 2008-2009 inflation increases every year in both countries. As Figure 3c shows that the economic crisis affect the CPI growth rate in both countries and inflation slowed down. Until 2012, there are no differences in CPI annual growth rates between Finland and Sweden, but after that inflation has slowed down more rapidly in Finland than in Sweden. In general Finland has recovered from the 2009 economic crisis slower than Sweden as Figure 3a shows that the GDP growth rate has been negative more often in Finland than in Sweden. Under the continuing economic downward inflation has fallen close to zero in Finland in 2013. In Sweden inflation fell close to zero in 2015, most likely because energy prices have decreased worldwide and interest rates on housing costs have

been low which has increased households' savings and investments in housing at the expense of the other consumption (OECD, 2015c). Overall, the quarterly GDP, annual CPI growth rate and the employment rate trends have been similar in the period I am focusing on. Therefore it is reasonable to compare Finland and Sweden with each other.
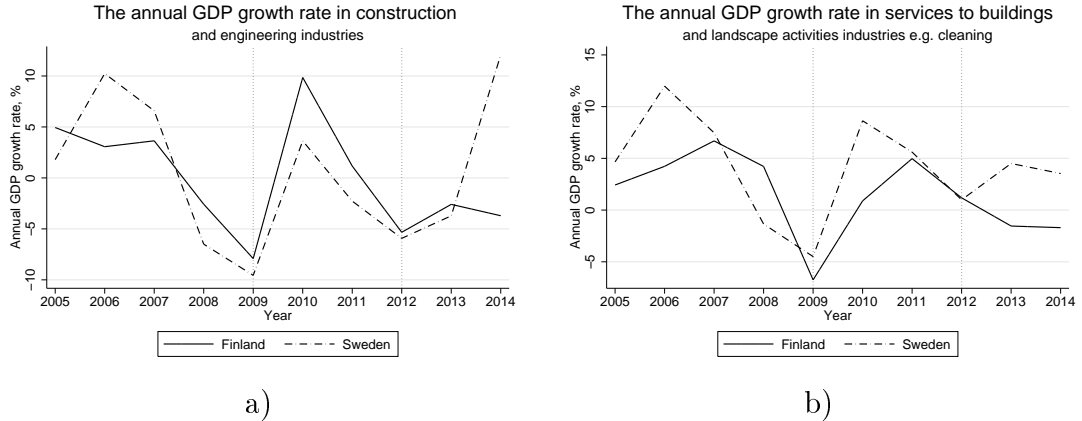

Figure 4: The annual GDP growth rates in two industries a) construction and engineering and b) services to buildings and landscape activities industries e.g. cleaning in Finland and Sweden from 2005 to 2014. Vertical lines indicate the reforms in Finland.

In addition to presenting macroeconomic indicators from Finland and Sweden, I show the annual GDP growth rates in two main industries of my research. In Figure 4a I present the GDP growth rates in construction and engineering industries in both countries from 2005 to 2014 (OECD, 2016). Figure 4a shows that the construction and engineering industries' growth rates have varied a lot, but in general growth rate trends have been similar in both countries. Especially, in the period from 2007 to 2013 trends match to each other well. The 2009 economic crisis impacted on construction and engineering industries equally in both countries. After 2013 Swedish households have increased investments in housing which explains the difference in growth rates between countries (OECD, 2015c).

In Figure 4b I present the GDP growth rates in services to buildings and landscape activities industries, for instance cleaning industry, in both countries from 2005 to 2014. Figure 4b shows that growth rate trends have similar characteristics although there are more variation between countries than in construction and engineering industries. However, the 2009 economic crisis has impacted on services to buildings and landscape activities industries less than construction and engineering industries.

Overall, macroeconomic trends have been substantially similar in Finland and Sweden from 2006 to 2013, in the period I am focusing on. In this perspective, it is justified

to use Swedish firms as a control group for Finnish firms.

4.2   Data Description

In this study, I exploit data from both Finnish and Swedish Tax Administrations. The Finnish data contains all firms liable for VAT at the monthly level, income declaration data of firms at the yearly level and all DHS tax credit applications at the yearly level. The Swedish data includes every firm liable for VAT at the monthly level in those industries which are relevant in my analysis. These industries are construction and engineering (ISIC codes[9] 41-43, 71), retail trade (47), services to buildings and landscape activities including cleaning (81), public administration and defence and compulsory social security (84), human health and social work activities (87-88) and other services activities (95-96). The Swedish data also contains income declaration data of firms and the DHS tax credit applications at the yearly level. Both Finnish and Swedish data cover years from 2006 to 2013.

For the price analysis, I use consumer price index data of Statistics Finland and survey data which has been collected from Finnish cleaning firms at three different points of time: end of 2011 (t=1), beginning of 2012 (t=2) and end of 2012 or beginning of 2013 (t=3). The details of the survey data are in Appendix A. Table 4 shows the descriptive statistics for cleaning services prices. Price1 represents hourly price of cleaning services from Monday to Wednesday, price2 hourly prices in Thursday and Friday, price3 hourly prices in Saturday or smaller special cleaning services as washing windows and price4 hourly prices in Sunday or larger and more timely special cleaning as renovation cleaning. Table 4 present prices 1 to 4 in every time point (t=1,2,3) and all prices 1-4 together in three time points. I use all prices 1 to 4 in the analysis of the price effects. Table 4 shows that means are almost same in all prices.

The Finnish Tax Administration data contains monthly level information about the firm's VAT payments of sales and yearly level control variables, e.g. information about municipal and industry classification codes. I mainly focus on construction and engineering (41-43, 71) and services to buildings and landscape activities including cleaning industries (81) in my analysis. In the first column of Table 5, I present the descriptive statistics of Finnish firms' VAT exclusive turnover, labor costs and municipality in

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[9]The group codes are classified by the two-digit industrial classification, ISIC (=International Standard Industrial Classification of All Economic Activities, Rev.4, more information on the webside http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=27)

Table 4: Descriptive statistics of cleaning services prices per hour (in euros)

Price	Variable	t=1	t=2	t=3	t=1-3
1=Monday to Wednesday	Mean	32.66	32.83	34.41	33.24
	N	170	158	139	467
2=Thursday to Friday	Mean	35.84	36.45	37.84	36.65
	N	122	114	102	338
3=Saturday	Mean	35.54	36.38	38.01	36.57
	N	98	91	82	271
4=Sunday	Mean	37.02	37.81	38.74	37.81
	N	87	82	75	244
Total (price1-price4)	Mean	34.86	35.40	36.85	35.64
	N	477	445	398	1320

those industries in 2007, 2010 and 2013. VAT exclusive turnover of firm is calculated from firm's VAT payments by dividing VAT sum by the applicable VAT rate and then sum all different sums of VAT rates together. All the monetary variables are in euros. I eliminated the firms for which VAT exclusive turnover was over 1 300 000 euros. These firms were the largest 0.5 % share of distribution of VAT exclusive turnover. The elimination decreases standard deviations of firms and reduces outliers from data.

Table 5 shows that Finnish construction firms have larger mean of VAT exclusive turnover and labor costs than cleaning firms in every year. However, standard deviations are large, which indicates that distributions of turnover and labor costs are skewed. Table 5 also shows that turnover of construction and cleaning firms are smaller in 2013 than in 2007 and 2010. About 30 % of all cleaning firms are located in the capital. While only around 15 % of all construction firms are located in the capital. The capital includes Helsinki, Espoo and Vantaa in Finland. The number of observations in the construction industry has increased a lot from 595199 in 2007 to 890386 in 2013. Whereas the number of observations in the cleaning industry was largest in 2007 and in 2010 and 2013 it has been near to same.

For the DHS tax credit applications data, I collected information about the sum of invoices, the number of applications per firm and type of work from Finnish Tax Administration data, which contains the DHS tax credit applications from individual taxpayers. All variables are at the yearly level. I pooled all years from 2006 to 2013 together and identified data to firm-level. Table 6 presents the descriptive statistics of the DHS tax credit applications. Table 6 shows from which type of work the DHS tax credit have been applied in years 2006-2013. The DHS tax credit have been applied

Table 5: Descriptive statistics of firms in Finland and Sweden

		Finland		Sweden	
		Mean	St. Dev.	Mean	St. Dev.
2007					
Construction	VAT exclusive turnover	25312.18	78461.90	43153.12	115777
(Fin N=595199, Swe N=542346)	labor costs	80338.73	318994.20	201934.10	2885984
	capital	0.14	0.35	0.26	0.44
Cleaning	VAT exclusive turnover	13519.54	58897.93	24220.14	79862.34
(Fin N=711022, Swe N=197903)	labor costs	71578.39	423829	138088	4991434
	capital	0.31	0.46	0.29	0.45
2010					
Construction	VAT exclusive turnover	24665.55	79251.65	34683.38	108598.20
(Fin N=866109, Swe N=733154)	labor costs	86923.18	387489.20	192624	2855896
	capital	0.17	0.37	0.26	0.44
Cleaning	VAT exclusive turnover	12203.42	52456.92	20340.27	71804.22
(Fin N=629473, Swe N=297635)	labor costs	64016.69	426079.30	117350.90	3962648
	capital	0.29	0.45	0.30	0.46
2013					
Construction	VAT exclusive turnover	19843.60	73663.29	23584.46	87584.75
(Fin N=890386, Swe N=1262332)	labor costs	97553.70	428722.40	49792.62	679595.80
	capital	0.15	0.36	0.26	0.44
Cleaning	VAT exclusive turnover	11716.36	52210.52	12634.35	58025.32
(Fin N=633506, Swe N=640460)	labor costs	66267.50	425062.10	20602.46	846719.30
	capital	0.26	0.44	0.28	0.45

most for house renovation services, on an average 72.9 % of invoices and 62.8 % of employee's wage applications. The second most applications where made from domestic work, about 25 % and the rest of applications were from health care services and other undefined types of services. It has been more common to employ a worker at home by self in health care services comparing to other services, where the amount of hiring employee is almost same than buying a work from firms.

Table 6: Descriptive statistics of tax credit in 2006-2013 in Finland

Type of work	Variable	% of total N	N	Mean
House renovation	invoice	72.9	3220297	3341.084
	wage	62.8	81494	2743.429
Domestic work	invoice	25.0	1103485	1212.476
	wage	24.0	31194	4212.366
Health care services	invoice	1.5	64780	3350.935
	wage	12.6	16376	2043.997
Other types	invoice	0.6	29527	2962.067
	wage	0.6	714	4493.21
Total	invoice	100.0	4418089	2807.043
	wage	100.0	129778	3017.878

The DHS tax credit applications data shows that between 2006 and 2013 there has been changes in applications of the DHS tax credit. The data shows that the total number of the DHS tax credit applications has been increased a lot after 2009. In 2009 the total maximum amount of the DHS tax credit increased from 1150-2300 euros to 3000 euros. For example in 2007 the total number of the DHS tax credit applications was 367 542 and by contrast in 2011 it was 734 901. In 2012 the total maximum amount of the DHS tax credit decreased to 2000 euros and applications drop to 657 479. Figure 5 presents the over time development of the quantity of applied DHS tax credits in hundred thousands euros and the number of DHS tax credit applications in different types of work. Clearly, the number of DHS tax credit applications and their quantity in euros has been the largest in house renovation in every year. Overall the quantity and the number has grown between 2006 and 2013 in every types of work.

a) Finland   b) Finland

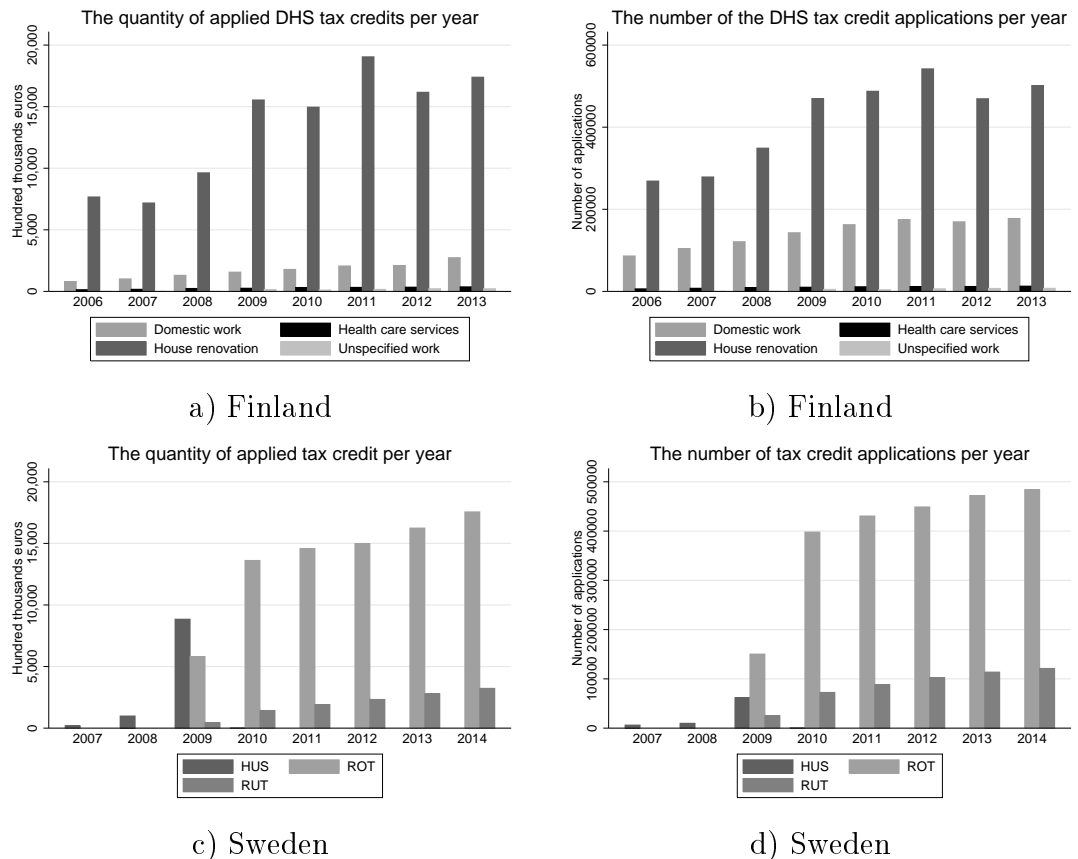c) Sweden   d) Sweden

Figure 5: The development of the DHS tax credit applications over time in Finland and Sweden. Figures a) and c) present the quantity of applied DHS tax credits in hundred thousands euros and b) and d) the number of the DHS tax credit applications.

From the DHS tax credit application data I also collected information about individual taxpayers, which have applied the DHS tax credit. Table 7 presents descriptive statistics of the Finnish DHS tax credit applicants in 2013. The total number of observations is 389 859. Table 7 shows that applicants' yearly average wage is larger than the Finnish yearly average wage in 2013[10]. Also applicants' yearly average pension is larger than the Finnish yearly average pension in 2013[11]. Around half of the applicants have capital incomes and 69 % of applicants have dividends and interest income. Over half of the applicants have debt and the average amount of debt was 79333.45 euros. Applicant's average age is 57 years and there are near to same amount of male and female applicants. 22 % of applicants live in the capital. Overall the DHS tax credit was applied more for buying services from firms than hiring an employee at home.

Table 7: Descriptive statistics of applicants in 2013 in Finland and Sweden

	N	Mean	St. Dev.
Finland			
Wage sum	248333	47063.58	48621.48
Pension	169221	25500.91	19896.58
Capital income	193131	12788.86	409782.30
Dividends and interest income	269317	5732.36	81795.62
Debts	218334	79333.45	204103.90
Age	389859	57.03	16.13
Male	389859	0.51	0.50
Metropolitan	389859	0.22	0.41
Quantity of the applied DHS tax credit	382928	5415.67	90639.27
Quantity of the applied DHS tax credit for hiring employee	12869	4015.15	8954.00
Sweden			
Wage sum	1199700	39302.40	27862.22
Pension	686012	20458.17	13687.47
Dividends and interest income	1024815	1248.26	16945.91
Quantity of the applied DHS tax credit	789793	1202.03	1504.49

The Swedish Tax Administration data contains two different data sets. The first data set contains monthly level information about the firm's VAT payments of sales and yearly level control variables, e.g. information about municipal and industry classification codes. However, the Swedish VAT payments data contains fewer control variables than the Finnish Tax Administration data. In the second column of Table 5, I present

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[10]I calculated the yearly average wage from the monthly average wage. In 2013 it was 3284 euros times 12,5 months = 41050 euros (OSF, 2013).

[11]I calculated the yearly average pension from the monthly average pension. In 2013 it was 1500 euros times 12 months = 18000 euros (OSF, 2014).

the descriptive statistics of Swedish firms' VAT exclusive turnover, labor costs and municipality in construction and cleaning industries in 2007, 2010 and 2013. I calculate VAT exclusive turnover of firm from the firm's VAT payments in a similar manner than from Finnish Tax Administration data. All the monetary variables are converted to euros from the Swedish currency, krona, using the exchange rate at 13 August 2015, which was $1/9.4520$ SEK/EUR. I also eliminated the firms for which VAT exclusive turnover was over 1 500 000 euros. These firms were the largest 0.5 % share of distribution of VAT exclusive turnover.

Table 5 shows that firms have larger turnover in average in construction than in cleaning industries in every year. Swedish firms' turnover has decreased over time in both industries. Standard deviations are large in both industries in Sweden, which indicates that the distributions of firms' turnover and labor costs are skewed. Table 5 shows that in Sweden, firms are more intensively located in the capital than in Finland. In Sweden about 30 % of all cleaning firms and 26 % of construction firms are located in Stockholm, which I define as an only city in the capital in Sweden. Moreover, the number of observations has increased substantially in both industries.

The second Swedish data set contains information about the DHS tax credit applications. The data is from Swedish Tax Administration and includes years 2007-2014. The DHS tax credit data is at the firm-level, because Swedish firms can directly apply the DHS tax credit for costumers using the direct invoicing system. The DHS tax credit data contains the total sales (both labor and material costs) of firms and approved sum of the DHS tax credit per firm at the yearly level. Table 8 presents descriptive statistics of the DHS tax credit in Sweden. All values are in euros. The HUS deduction was used in 2007-2010 and the average quantity of approved sum was 1363.27. The applications made only 77740. Both RUT and ROT deduction was used in 2009-2014 and those years the number of applications were increase near to 3 000 000 as total.

Table 8: Descriptive statistics of the DHS tax credit in Sweden

Type of deduction	Variable	N	Mean	St. Dev.
HUS deduction 2007-2010	approved sum	77740	1363.27	4119.77
	total labor cost	77740	2483.12	287159.97
RUT deduction 2009-2014	approved sum	523 408	245.22	1763.72
	total sales	53 629.18	8994.23	229581041
ROT deduction 2009-2014	approved sum	252156.90	367.45	832.66
	total sales	251776.77	2406.46	801562.74

Figure 5 visualizes the development of DHS tax credit applications. The quantity and number of ROT deduction applications are substantially larger than RUT or HUS deduction applications. The number of applications of RUT and ROT deduction has increased every year. In 2009 the number of applications was under 200 000 and in 2014 the number was already over 500 000. There has not been any large changes in the Swedish DHS tax credit system during these years and also the total maximum amount of the DHS tax credit has been the same, 50 000 SEK per applicant, which is 5289.89 euros using the exchange rate at 13 August 2015.

The Swedish data does not contain as much information about the DHS tax credit applicants as the Finnish data. There are only few same variables in data. Table 7 presents descriptive statistics of Swedish applicants in 2013. I convert all monetary variables to euros using the same exchange rate than earlier. The total number of observation in this data is 1 708 540. Table 7 shows that applicants' average yearly wage is slightly smaller than the Swedish average yearly wage in 2013[12]. The DHS tax credit applicants' yearly average pension is almost the same than Swedish yearly average pension in 2012-2014[13]. Large share of applicants have dividends and interest income. The average sum of applied tax credits was 1202.03 euros in 2013.

4.3 Empirical Strategy

The empirical strategy of my study is to use a natural experimental method to estimate the demand and price effects of the changes in the DHS tax credit. The changes in the Finnish DHS tax credit system in 2009 and 2012 can be interpreted as naturally occurring shocks to firms. By contrast there is no changes in the Swedish tax credit system in those years. In this section, I first describe a fixed effects method which I use to estimate the price effects. Second, I show how turnover can be used as an outcome variable for the estimation of demand. Third, I present a regression differences-in-differences method for analyzing the effect of the DHS tax credit reforms on the demand for services. The estimation methodologies, a fixed effects (FE) and regression differences-in-differences (DD) method, are provided in several microeconometrics textbooks (e.g. Angrist & Pischke, 2009; Cameron & Trivedi, 2005). In general

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[12]I calculated the average yearly wage from average monthly wage. In 2013 it was 30600 SEK times 12,5 months = 382500 SEK which is 40467.63 in euros (SCB, 2015a).

[13]I calculated the average yearly pension from average monthly pension. In 2012-2014 it was around 16248-16269 SEK times 12 months = 194 976-195 228 SEK, which is 20628.02-20654.68 in euros (Pensionsmyndigheten, 2015, 2016).

I follow the textbook "Mostly Harmless Econometrics: An Empiricist's Companion" by Angrist & Pischke (2009).

In the analysis of price effects I exploit the fixed effects method. An ideal situation would be that I could use the differences-in-differences approach. However, I have only available data which contains information about consumer prices of cleaning services in Finland. Therefore I do not have an appropriate control group which to use in the analysis. Instead, I apply a fixed effects model to estimate the effects of the DHS tax credit reform on consumer prices of services. The fixed effects estimation allows to separate the effects of the reform from other unobserved underlying causes of price changes.

The key idea behind the fixed effects model is that the observed outcome variable Y_{it} is either Y_{0it} or Y_{1it}, depending on the reform. I assume that

$$E[Y_{0it}|A_i, t, D_{it}] = E[Y_{0it}|A_i, t],$$

where A_i is the unobserved individual fixed effects, D_{it} represents the reform and t is time. Thus the outcome variable Y_{0it} is same with or without the reform.

The main assumption of the fixed effects model is that the unobserved individual fixed effects A_i are not depended on time,

$$E[Y_{0it}|A_i, t] = \alpha + \lambda_t + A_i'\eta, \tag{6}$$

where λ_t is the time spesific fixed effects and α is a constant. The effect of the reform ϕ is assumed to be constant and additive:

$$E[Y_{1it}|A_i, t] = E[Y_{0it}|A_i, t] + \phi. \tag{7}$$

The equations (6) and (7) together imply that

$$E[Y_{it}|A_i, t, D_{it}] = \alpha + \lambda_t + \phi D_{it} + A_i'\eta. \tag{8}$$

Thus from the equation (8) I get the fixed effects model:

$$Y_{it} = \alpha_i + \lambda_t + \phi D_{it} + \varepsilon_i, \tag{9}$$

where the error term is $\varepsilon_{it} \equiv Y_{0it} - E[Y_{0it} \mid A_i, t]$ and $\alpha_i \equiv \alpha + A_i'\eta$ is the estimated individual specific fixed effect, where α is a constant and $A_i'\eta$ is a vector of unobserved

individual fixed effects.

I exploit the equation (9) in the estimation of the effects of the DHS tax credit reform on consumer prices. I use the fixed effects model with binary treatment in the following equation:

$$Y_{it} = \alpha_i + \lambda_t + \phi_1(After)_{1i} + \phi_2(After)_{2i} + \varepsilon_{it}, \tag{10}$$

where the outcome variable Y_{it} represents the logarithmic consumer prices of individual firm's service i at time t, the constant λ_t is the estimated time specific fixed effect, $(After)_{1i}$ takes the value of one if individual i receives treatment in the first period after treatment ($t = 2$) and zero otherwise, and $(After)_{2i}$ takes the value of one if individual i receives treatment in the second period after treatment ($t = 3$) and zero otherwise. The coefficients of binary treatment variables, ϕ_1 and ϕ_2, identify the effect of the reform on the outcome variable Y_{it}. The constant $\alpha_i \equiv \alpha + A_i'\eta$ is the estimated individual-specific fixed effect, where α is a constant and $A_i'\eta$ is a vector of unobserved individual fixed effects and ε_{it} is the i.i.d. error term.

The treatment effects ϕ_1 or ϕ_2 are consistently estimated, when the individual fixed effects α_i are eliminated. I calculate the individual averages,

$$\overline{Y_i} = \alpha_i + \bar{\lambda} + \phi_1(\overline{After})_{1i} + \phi_2(\overline{After})_{2i} + \bar{\varepsilon}_i.$$

By subtracting averages to the equation (10), I get the equation:

$$Y_{it} - \overline{Y_i} = (\lambda_t - \bar{\lambda}) + \phi_1(After_{1i} - \overline{After}_{1i}) + \phi_2(After_{2i} - \overline{After}_{2i}) + (\varepsilon_{it} - \bar{\varepsilon}_i). \tag{11}$$

Thus deviations from means eliminates the individual fixed effects α_i.

I apply post code-level clusters to present appropriate standard errors in the estimation of the price effects (Cameron & Miller, 2015). Cluster-robust standard errors do not restrict heteroskedasticity and correlation within post code-level. Standard errors are larger with clustering than without it, but clustering does not affect the significance of the results.

Next, I show why I use turnover as an outcome variable in the demand analysis. The best case scenario for studying the effects of the domestic help services tax credit on demand, would be to have data which includes the information about consumer prices of services and the quantity of sold services by firm. In spite of the large and comprehensive

Tax Administration data from Finland and Sweden, I do not have information about consumer prices and quantity of sold services. In general very detailed data of consumer prices and quantities sold are seldom available. Therefore I have to use the second best option, where I calculate the value of turnover from total sales of the firm, as I show earlier in Section 4.2.

I can use turnover to analyze the effects of the DHS tax credit on demand. Turnover is consumer prices P multiplied by the quantity of sales Q:

$$Y = P * Q. \tag{12}$$

The demand effects, i.e. the amount of quantity change, only occur if consumer prices or turnover change. Because demand and supply are in the equilibrium condition (2), quantities purchased are same than quantities sold. Therefore quantities sold by firm can be used on the demand analysis. If there are no changes in turnover or prices after the DHS tax credit reforms, there cannot be any demand effects of the DHS tax credit. The theory of tax incidence imply that consumer prices should decrease if the amount of the DHS tax credit declines and vice versa if the DHS tax credit increases. Therefore if consumer prices change and the quantity remains same, turnover would change by the amount of the price change. If turnover changed more than the amount of the price change, the quantity have to change also. Then the demand effects occur.

Mathematically the change can be studied by taking the partial derivatives of turnover Y with respect to price P and quantity Q. The partial derivative with respect to price P is

$$\frac{dY}{dP} = \frac{dY}{dP}\frac{dP}{dP} + \frac{dY}{dQ}\frac{dQ}{dP} = Q + P\frac{dQ}{dP}. \tag{13}$$

The elasticity of demand ϵ is $\epsilon = \frac{dQ/Q}{dP/P} = \frac{P}{Q}\frac{dQ}{dP} \implies \epsilon\frac{Q}{P} = \frac{dQ}{dP} \implies \epsilon = \frac{dQ}{dP}\frac{P}{Q}$. I substitute ϵ to equation (13) and now I have the equation:

$$\frac{dY}{dP} = Q + P\epsilon\frac{Q}{P} = Q + \epsilon Q = Q(1 + \epsilon). \tag{14}$$

The equation (14) shows that the effect of the price change on turnover depends on the elasticity of demand. If the demand is elastic and the price increases, turnover decreases and if the demand is inelastic, turnover increases when the price increases. Therefore turnover is a relevant variable for analyzing the effects of the DHS tax credit on demand.

In the demand analyses I use the DD approach for identifying the effects of the reforms. The main assumption of the DD method is the parallel time trends of treatment and control group before the reform. The similar time trends in both groups before the reform enables the comparison of the groups in the absence of the reform. Thus the difference between the treatment and control group after the reform indicates the treatment effect. The study of similar time trends requires panel data, which contains observations from both treatment and control groups before the reform and also observations after the reform. I have relevant data from both Finnish and Swedish firms.

The reason why I choose Swedish firms as a control group is not necessarily clear. Particularly when I am interested in the reforms of the DHS tax credit system in Finland. The Finnish firms in tax credited industries are a natural choice as a treatment group. Whereas I cannot use Finnish firms as a control group. The DHS tax credit system is in use in the specific industries in Finland, i.e. the DHS tax credit can be applied for certain services from these industries' firms. It is not reasonable to compare the DHS tax credited firms to non-tax credited firms within industries, because the DHS tax credited services offer certain types of firms in the industry. The other firms in the same industry, whose services do not include in the DHS tax credit system, do not have same characteristics than those firms which offer the DHS tax credited services. For that reason I use the Swedish firms from the same industries as Finland, as a control group. In Sweden the tax credit system is similar than in Finland, yet in Sweden there has not been any changes in the percentage or total maximum amount of the DHS tax credit between 2007 and 2014, that is, the period I am focusing on. Consequently, the treatment only affects the treatment group and the control group are not affected.

On the other hand, are the Swedish firms a more appropriate control group to the Finnish firms than the Finnish non-tax credited firms? To compare two different countries' firms to each other, I have to acknowledge that there are no macroeconomic shocks or differences in the background. Time trends before and after the reform can be affected by these shocks or differences.

As I described in Section 4.1, the macroeconomic indicators have been developing similarly in Finland and Sweden in 2006-2013. Also the macroeconomic trends have been close to similar in the DHS tax credited industries in both countries. Even though macroeconomic indicators can change in the long run, it is not a problem in my analyses, because I focus on relatively short time periods, i.e. year before and after the reform. Moreover, macroeconomic shocks as themselves are not an issue. For instance, the

economic crisis in 2009 impacted similar way in both countries. For these reasons the Swedish firms can be used as a control group in my analyses.

Thus the idea behind the DD approach is to compare treatment group to control group and estimate the difference between these groups after the reform. Next I introduce mathematically a differences-in-differences model which I exploit in a regression differences-in-differences method.

The DD model is based on the assumption that the treatment does not affect the control group. Therefore if there is no observed treatment, I can assume that

$$E[Y_{0ict}|c,t] = \gamma_c + \lambda_t, \tag{15}$$

where Y_{0ict} is an outcome variable of firm i at time t in the control country c, the constant γ_c is a time-invariant country effect and the constant λ_t is a mutual time specific effect. The equation (15) denotes that if there is no treatment effect, the outcome variable is the sum of the time-invariant country effect and the mutual time specific effect.

In the presence of the treatment, the dummy D_{ct} represents the treatment in country c at time t. The dummy gets the value of one if the firm is in the treatment country at time after treatment. The estimate δ denotes the differences-in-differences $E[Y_{1ict} - Y_{0ict} \mid c,t]$, where variable Y_{1ict} is the outcome variable of firm i at time t in the treatment country and Y_{0ict} is the the outcome variable of firm i at time t in the control country. The DD model is

$$Y_{ict} = \gamma_c + \lambda_t + \delta D_{ct} + \varepsilon_{ict}, \tag{16}$$

where Y_{ict} is the outcome variable of firm i in the country c at time t and ε_{ict} is the independent and identically distributed error term, $E(\varepsilon_{ict} \mid c,t) = 0$.

The differences-in-differences can be written:

$$E[Y_{1ict} - Y_{0ict}|c,t] = \{E[Y_{ict}|c = Treatment, t = 1)] - E[Y_{ict}|c = Treatment, t = 0]\}$$
$$-\{E[Y_{ict}|c = Control, t = 1)] - E[Y_{ict}|c = Control, t = 0]\} = \delta.$$

Thus the differences-in-differences estimate is the causal effects of interest. The DD model provides the estimate of the treatment effects and in addition the constants provide also unobserved country- and time-specific fixed effects.

I apply the DD model as a regression differences-in-differences method to estimate the effects of the DHS tax credit reform on turnover. In the regression DD method I compare turnover between the treatment group and the control group over time. I use the regression DD method with firm fixed-effects in the following equation:

$$Y_{ict} = \alpha_i + \beta_1 1(Treat)_{ic} + \beta_2 1(After)_t + \beta_3 1(Treat_{ic} * After_t) + \beta_4 X_{ict} + \varepsilon_{ict}, \quad (17)$$

where the outcome variable Y_{ict} represents VAT exclusive logartihmic turnover of firm i at time t in the country c, the constant α_i is the estimated firm fixed effects, $1(Treat)_{ic}$ takes the value of one for the firm in the treatment country and zero otherwise, $1(After)_t$ takes the value of one after the reform and zero otherwise, and $1(Treat_{ic} * After_t)$ represents the interaction variable of these two variables. The variable $1(Treat_{ic} * After_t)$ is the same as the variable D_{ct} in the DD model and the coefficient of the interaction variable β_3 identifies the effect of the reform on the outcome variable Y_{ict}. X_{ict} is a vector of relevant firm-level controls and ε_{it} is the i.i.d. error term.

I use the firm fixed effects for controlling the individual differences over time within firm, because I have data which contains turnover of same firm over time both before and after the reform. The firm fixed effects then control the unobserved individual effects which are persistent over time. Thus the omitted variable bias gets smaller. As a result the estimate β_3 represents the average proportional change in outcome variable in consequence of the reform. The estimate of the interaction variable β_3 is the differences-in-differences estimate, as δ in the DD model:

$$\beta_3 = \{E[Y_{ict}|Treat_c = FIN, t = 1)] - E[Y_{ict}|Treat_c = FIN, t = 0]\}$$
$$-\{E[Y_{ict}|Treat_c = SWE, t = 1)] - E[Y_{ict}|Treat_c = SWE, t = 0]\}.$$

As I presented earlier, the DD approach has its limitations, which have to be considered carefully. For using the regression DD method, fundamental assumptions are parallel time trends and that the reform only affects the treatment group. Furthermore, I have to consider a possible serial correlation problem when I present the standard errors of the estimates. Bertrand *et al.* (2004) and Cameron & Miller (2015) present alternative estimation methods for solving the serial correlation problem. I calculate cluster-robust standard errors for each estimation. I clustered firms by 5-digit industrial

classification codes in Finland and Sweden. Therefore cluster-robust standard errors allow correlation and heteroskedasticity within industry per country. Cluster-robust standard errors are larger than OLS standard errors but the significance of the results is not be affected.

5 Results

5.1 Price Responses

I begin my analysis of the effects of the changes in the DHS tax credit by estimating the price responses. Theoretically, the DHS tax credit should affect the consumer prices of services. In Section 2.1, I present the pass-through method for analyzing the price effects. Although the pass-through is commonly used method to measure tax incidence, I cannot directly use it to measure tax incidence of the DHS tax credit. In the empirical literature, the pass-through has been mostly used to measure, for instance, the effects of the VAT changes (eg. Harju & Kosonen, 2013; Kosonen, 2015; Marion & Muehlegger, 2011; Weyl & Fabinger, 2013). However, the DHS tax credit cannot directly identify as a VAT change. Therefore I have to remodel the pass-through method for my analysis.

I study the price effects of the DHS tax credit only in Finland, because I do not have suitable data which contains the consumer prices of cleaning services from Sweden. Another reason to study the price responses only in Finland is that the DHS tax credit is provided in different ways in Finland and Sweden. In Finland, consumers apply the DHS tax credit in their personal income taxation; in Sweden, consumers get the DHS tax credit directly, when they purchase services. Therefore the price incidence of the DHS tax credit can be different in Finland and Sweden.

I focus on the change in the domestic help services tax credit in 2012. The amount of the DHS tax credit was reduced from 60 % to 45 % on the first of January 2012. I study the price effect of this change using the consumer prices of cleaning services. I use the proportional change in consumer prices to estimate price effects of the reduced DHS tax credit. I have to make some restrictive assumptions in order to calculate the price effects. I assume that the producer price of services ϕ, quantities sold and the price that consumer pays h before and after the change are fixed. Also there are no change in VAT t. The consumer price p is $p = \phi(1 + t)$. The real price which a consumer pays after the DHS tax credit is the consumer price minus the DHS tax credit τ. It is given by $h = p - \tau$, from which I get the consumer price $p = h + \tau$.

I study the price effects of the change in the DHS tax credit, therefore I calculate consumer prices before and after the change in the DHS tax credit. The DHS tax credit before the change is $\tau_b = p_b 0.6 - 100$ and after the change $\tau_a = p_a 0.45 - 100$, where 100 is the own liability of the DHS tax credit. Now I have the tax inclusive consumer prices before and after the change. Hence I can calculate the consumer price before the change

$$h_b = p_b - \tau_b \implies h_b = p_b - p_b 0.6 - 100 \implies h_b = (1 - 0.6)p_b - 100$$
$$\implies h_b = 0.4p_b - 100 \implies 0.4p_b = h_b + 100 \implies p_b = \frac{h_b + 100}{0.4},$$

and after the change

$$h_a = p_a - \tau_a \implies h_a = p_a - p_a 0.45 - 100 \implies h_a = (1 - 0.45)p_a - 100$$
$$\implies h_a = 0.55p_a - 100 \implies 0.55p_a = h_a + 100 \implies p_a = \frac{h_a + 100}{0.55}.$$

.

The proportional change is given by

$$\Delta p = \frac{p_a - p_b}{p_b} * 100 = x\%, \tag{18}$$

which is the upper bound for price effect if the producer price ϕ and VAT t are fixed and the price a consumer pays is $h = h_b = h_a$. Because the DHS tax credit can be applied only to labor costs, material prices are not affected by changes in the DHS tax credit. As a result, I can calculate the proportional change:

$$\Delta p = \frac{\frac{h_a + 100}{0.55} - \frac{h_b + 100}{0.4}}{\frac{h_b + 100}{0.4}} * 100 \implies \Delta p = \frac{\frac{h + 100}{0.55} - \frac{h + 100}{0.4}}{\frac{h + 100}{0.4}} * 100$$
$$\implies \Delta p = \frac{\frac{1}{0.55} - \frac{1}{0.4}}{\frac{1}{0.4}} * 100 = -27.27\%.$$

The change in the DHS tax credit can theoretically reduce consumer prices 27.27 %.

Before the empirical estimation, I study the price effects with figures. Figure 6 visualizes consumer price index trends of cleaning services between 2011 and 2013 (OSF, 2015; SCB, 2015b). It shows that consumer price index of cleaning services has increased over time in Finland. In Sweden there are some small changes in both directions but

main trend have been slightly increasing. The Swedish consumer price index data is at the monthly level and Finnish data is at the quarterly level. I calculate the quarterly consumer price index also from Swedish data and use that in the analysis. In Swedish data there was a large drop in CPI in August 2011. It smooths when a three months average is taken.

In addition, I calculate the percent change of cleaning services prices from the consumer price index which I present in Figure 6. I calculate the percent change by using the equation

$$\Delta CPI = \frac{CPI_{time} - CPI_{basetime}}{CPI_{basetime}} * 100 = x\%.$$

Thus I can better analyze and compare the changes in consumer prices between countries. Figure 7 shows that consumer prices changed more in Finland just after the implementation of the DHS tax credit reform in 2012. Before 2012 the consumer price index was at the same level in both countries. However, Figure 7 shows only the general trends of consumer price index in cleaning services. I cannot reach any significant conclusions about the price effects with these figures. Nevertheless, they provide some information about the cleaning services consumer prices in both countries.
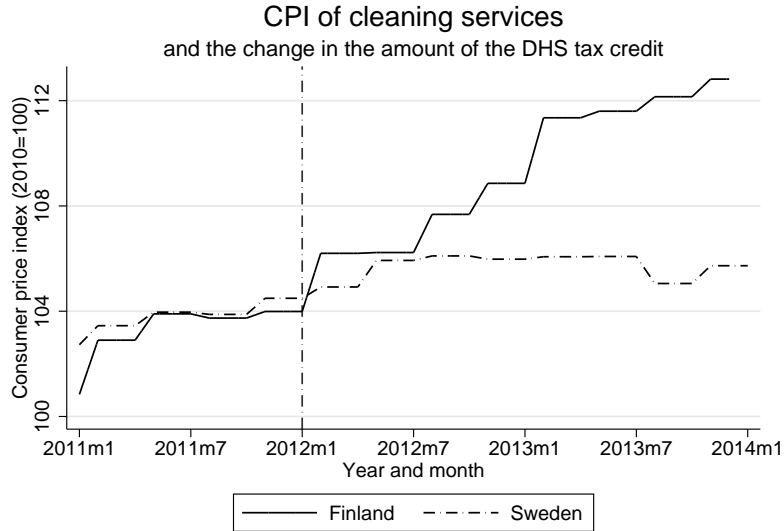

Figure 6: Consumer price index for cleaning services in Finland and Sweden in 2011-2013. Vertical line indicates the time of the reform.
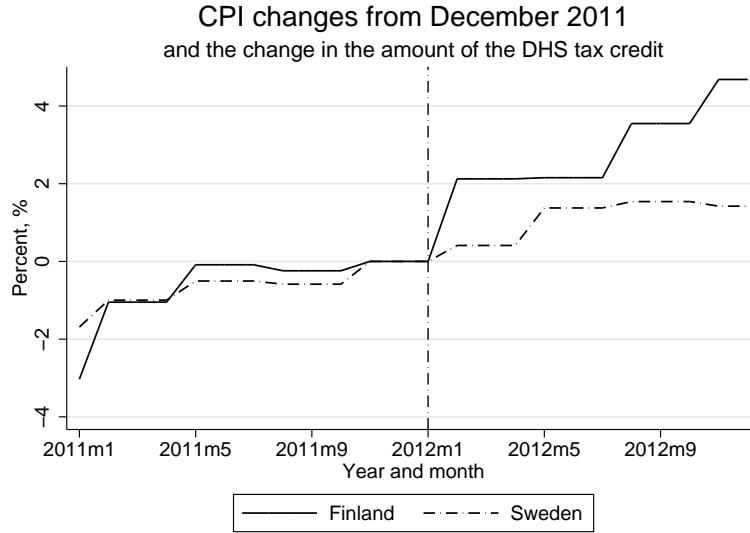
Figure 7: Percent change of cleaning services consumer prices in 2011-2013. Base time is December 2011, the month before change. Vertical line indicates time of the reform.

In the empirical estimation, I use firm-level survey data of cleaning services consumer prices to evaluate price effects in Finland. I do not have suitable data of Swedish cleaning firms. Another reason why I do not use Swedish data is that the DHS tax credit is provided in different ways in Finland and Sweden. The Finnish survey data contains cleaning services prices per hour in different days of the week, as I described in Section 4.2. Table 9 shows that a OLS regression in column (1) does not provide good estimates of consumer prices. To eliminate the omitted variable bias, I use a fixed effects method to estimate the percentage change in consumer prices. The results of fixed effects estimates are presented in Table 9 in columns (2) and (3). The fixed effects estimators are statistically significant and the coefficient of determination is larger than in the OLS regression ($R^2 = 0.328$). The estimated impact on consumer prices, because of the DHS tax credit reduction, is a 2.1 % increase at time $t = 2$ and 5.3 % increase at time $t = 3$ in prices.

The theory of tax incidence implies that the DHS tax credit reduction should reduce consumer prices 27.27 %, if the producer price ϕ, quantities sold and the price h, which the consumer pays after the DHS tax credit, is fixed to same as it was before the reform. The analysis shows that consumer prices do not decrease as the theory implies. Instead, the estimation results present that consumer prices increase after the domestic help services tax credit reform.

Table 9: OLS and fixed effects estimates of log consumer prices

	OLS (Std. Err.) (1)	FE (Std. Err.) (2)	FE clustered (Rob. Std. Err.) (3)
$After_1$	0.016	0.021***	0.021***
	(0.016)	(0.003)	(0.004)
$After_2$	0.068***	0.053***	0.053***
	(0.017)	(0.003)	(0.008)
Intercept	3.523***	3.525***	3.525***
	(0.011)	(0.002)	(0.004)
N	1320	1320	1320
R^2	0.013	0.328	0.328
Standard errors in parentheses			
***$p < 0.01$,**$p < 0.05$, *$p < 0.1$			

There can be several reasons why the estimation results differ from the theory implications. First, there can be problems with data. The number of observations can be too small in the cleaning services price data. More comprehensive data can improve the analysis. Second, the estimation method can be unsuitable for analyzing the effects of the DHS tax credit reform. For instance, a differences-in-differences method and a control group can be more appropriate model to estimate the reform. Third, it is possible, that firms and consumers do not respond the DHS tax credit reduction. Fourth, the assumptions that the producer price ϕ, quantities sold and the price which consumer pays h are fixed is not necessary be fulfilled. The reduction of consumer price is smaller than the theory implies if the producer price could change. The price h and quantities sold have to change also if the producer price change. Fifth, the theory implications can be different than my calculation of the proportional change if the elasticities of demand and supply are very elastic or inelastic. For instance, if the supply is very elastic, the reduction of the DHS tax credit does not change consumer prices as much as the theory implies. Also my calculation does not take into account the elasticities as the pass-through does. And last, cleaning services markets can be distorted and in some reasons markets are not necessary perfectly competed.

The imperfect competition in the cleaning services markets can change the theory implications of the DHS tax credit reduction. Consumer prices can change less after the reform if markets are characterized by imperfect competition. In Section 2.1 I show

how the pass-through differs if markets are perfectly or imperfectly competitive. I do not use the pass-through in this section, instead I calculate the proportional change in consumer prices. The calculation of the proportional change does not take into account imperfect competition. Therefore if cleaning services markets are imperfectly competed, the theory implications can be different than my calculations. However, the imperfect competition should not shift the theory implications so much that the DHS tax credit reduction would increase consumer prices. Consequently, cleaning services markets conditions do not entirely explain the difference between the estimation results and the theory implications.

5.2   Demand

I study the effects of the DHS tax credit reform on demand using three different approaches. First, I analyze the effects of the DHS tax credit reform in all tax credited industries. Second, I concentrate on the construction and cleaning industries, because those industries cover around 98 % of the DHS tax credit applications in 2006-2013 (see Table 6). Also the DHS tax credit reforms can affect differently in construction firms than in cleaning firms. Third, I divide firms into two different groups depending on the location of the firm, i.e. is the firm located in the capital or not, since the markets can be more competitive in the capital than in other areas. In these analyses, I focus on the domestic help services tax credit reforms in 2009 and 2012.

At the beginning, I analyze the effects on demand by presenting the development of the outcome variable over time, VAT exclusive turnover. Figure 8 shows trends of average monthly turnover in construction and cleaning firms between 2006 and 2013 in Finland and Sweden. Figure 8 visualizes that there are similar variation in each year over time in cleaning industry. However, there is more variation between years in construction industry, especially in Finland. Consistently, turnover is its lowest level in cleaning industry in each year July and in construction industry in January. In my analysis, I have to take into consideration the variation between months because the variation complicates the interpretation of the estimation results.

To smooth out monthly variation and to observe the changes in the outcome variable, I estimate the predicted values of the log of turnover. Turnover indicates the proportional change, therefore the deviations from zero demonstrate percentage changes. I use the prediction with individual fixed effects $E[y_{js}|x_{js}, \alpha_i]$, where $j = 1, \ldots, N$ and s is time. A regressor x_{js} equals one if $j = i$ and zero otherwise. The predictor is then
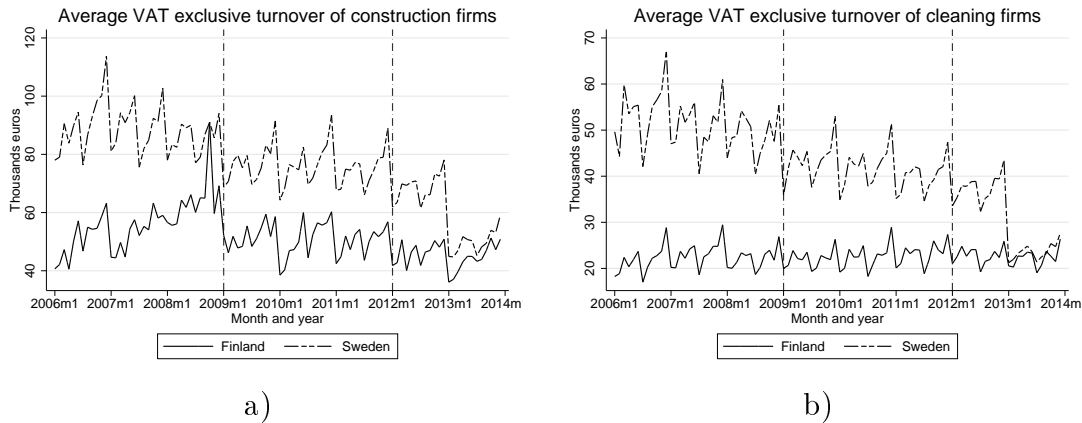
a)   b)

Figure 8: Average VAT exclusive turnover over time of a) construction firms and b) cleaning firms in Finland and Sweden. Vertical lines indicate the reforms of the DHS tax credit in Finland.

$\widehat{y}_{i,t+s} = x'_{it}\widehat{\beta_W} + \widehat{\alpha}_{i,FE}$ and the error term is $u_i + e_{it}$ which includes the fixed-error and the overall error components. Often the predicted values is referred to as the fitted values because they are the estimate of the mean. Moreover, in the regression of the predicted values, I use a few control variables such as an indicator of month, a tax reporting period, firm's legal form and industry classifications. I use several time periods to estimate the predicted values since the predictor is only consistent in the long panel data. (Cameron & Trivedi 2005, 738.)

I restrict the data in following ways. I only investigate firms with positive turnover in every month. Therefore I do not examine firms' entries and exits. This restriction eliminates total 9291 firms in years 2008-2009 and 2011-2012. I also restricted data to cover only firms which do not have over 100 % changes in turnover from year to year, i.e. the difference $y_m - y_{m-12}$, where m is month, is less than 100 %. This restriction eliminates 141991 of 406511 firms in 2008-2009 and 167837 of 459729 firms in 2011-2012. The eliminated firms are, for instance, smaller firms which have large yearly variation of turnover, even though these changes are relatively small in euros. Furthermore the estimation period in the DD estimation was limited to cover one year before and after the reforms. Thus the estimation only produce the short-run effects of the DHS tax credit reforms on demand. A longer time period could cause problems, because the reforms have been implemented close to each other.

First, I estimate the effects of the DHS tax credit reforms on turnover in all tax credited industries. Figure 9 illustrates estimated turnover trends over time. The horizontal axis is quarters from the reform, where zero is the time of the reform. Figure

9 shows that before the reforms, in 2008 and 2011, turnover trends have been similar, hence the main assumption of the DD approach, parallel time trends before the reform, is fulfilled. However, turnover trends are more volatile in 2008-2009 than in 2011-2012.

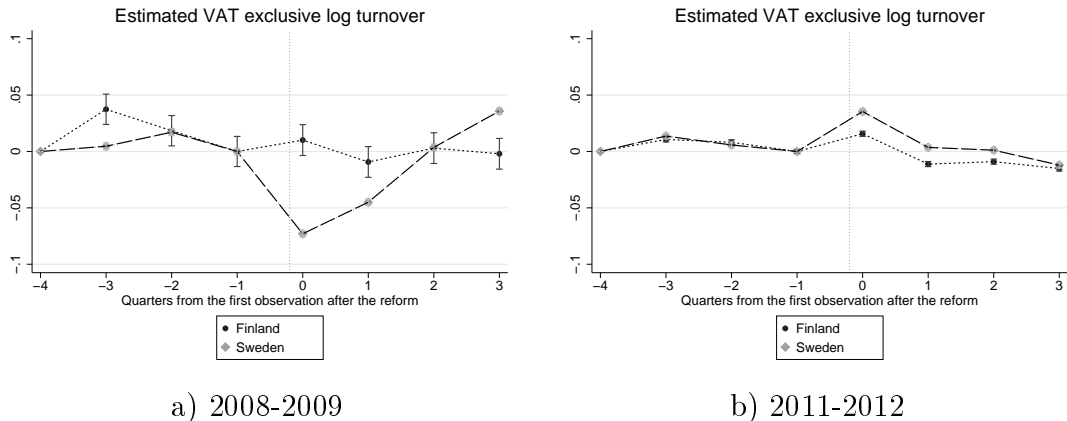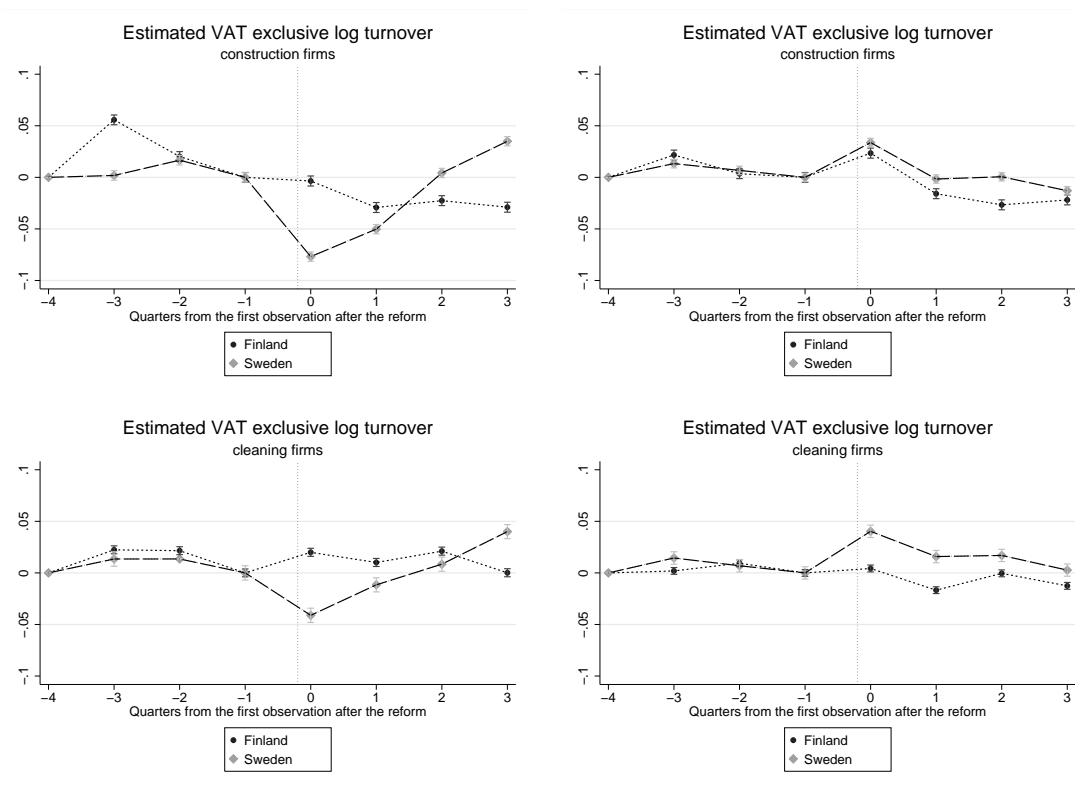a) 2008-2009   b) 2011-2012

Figure 9: Estimated VAT exclusive turnover of all Finnish and Swedish firms in DHS tax credited industries. Vertical lines indicate the DHS tax credit reforms in Finland. Note: Confidence intervals are so small that they can barely see in the figures.

Figure 9a presents that immediately after the reform in 2009 the turnover trends separate to each other. However, the effect is only short-time and the lines are united two quarters after the reform. Furthermore turnover is larger in three quarters after the reform in Sweden. Also there is no clear increase in turnover after the reform in Finland. Therefore the impact of the reform is not explicit even though turnover reduce more in Sweden just after the reform. The reduction of turnover is considerable large in Sweden just after the reform in 2009. I try to find the reason for the reduction from data but I cannot identify any outlying observations that could cause the reduction. The reduction is also visible in Figures 10a and 11a.

Figure 9b shows that after the reform in 2012, the difference between Finland and Sweden are smaller than in 2009.Turnover does not decrease after the reform in Finland, but it increases more in Sweden which indicates that there is a weak negative effect of the reform on turnover. Nevertheless, the effect is short-time, only three quarters long.

Second, I conducted the estimations separately to construction and cleaning industries. Figure 10 illustrates the estimated turnover in construction and cleaning industries in 2008-2009 and 2011-2012. Turnover trends are identical before the reforms in 2011 in both industries and almost similar in 2008. Figure 10a presents that turnover trend is more messy in the construction industry than in cleaning industry. There are also differences in industries after the reforms. The cleaning firms' turnover

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a) 2008-2009   b) 2011-2012

Figure 10: Estimated VAT exclusive turnover of the construction and cleaning firms in Finland and Sweden. Vertical lines indicate the DHS tax credit reforms in Finland. Note: Confidence intervals are so small that they can barely see in the figures.

has increased after the reform in 2009 which indicates a positive impact of the reform. Whereas the construction firms' turnover has decreased in both countries but less in Finland than in Sweden. The effect is shorter in construction than cleaning industry. The construction firms can be more affected by the 2009 economic crisis, therefore turnover can decrease in both countries even if the amount of the DHS tax credit has been increased in Finland.

Figure 10b shows that turnover has decreased more after the reform in cleaning industry than in construction industry. Furthermore the effect of the reform is longer in cleaning industry. However, in the construction industry turnover has increased more in Sweden than in Finland which indicates that there is a weak negative impact of the reform.

Third, I divided firms into two groups. The first group includes firms which are located in the capital, i.e. in Helsinki, Espoo or Vantaa in Finland and in Stockholm in

Estimated VAT exclusive log turnover
in the capital

Estimated VAT exclusive log turnover
in the capital

Estimated VAT exclusive log turnover
outside the capital

Estimated VAT exclusive log turnover
outside the capital

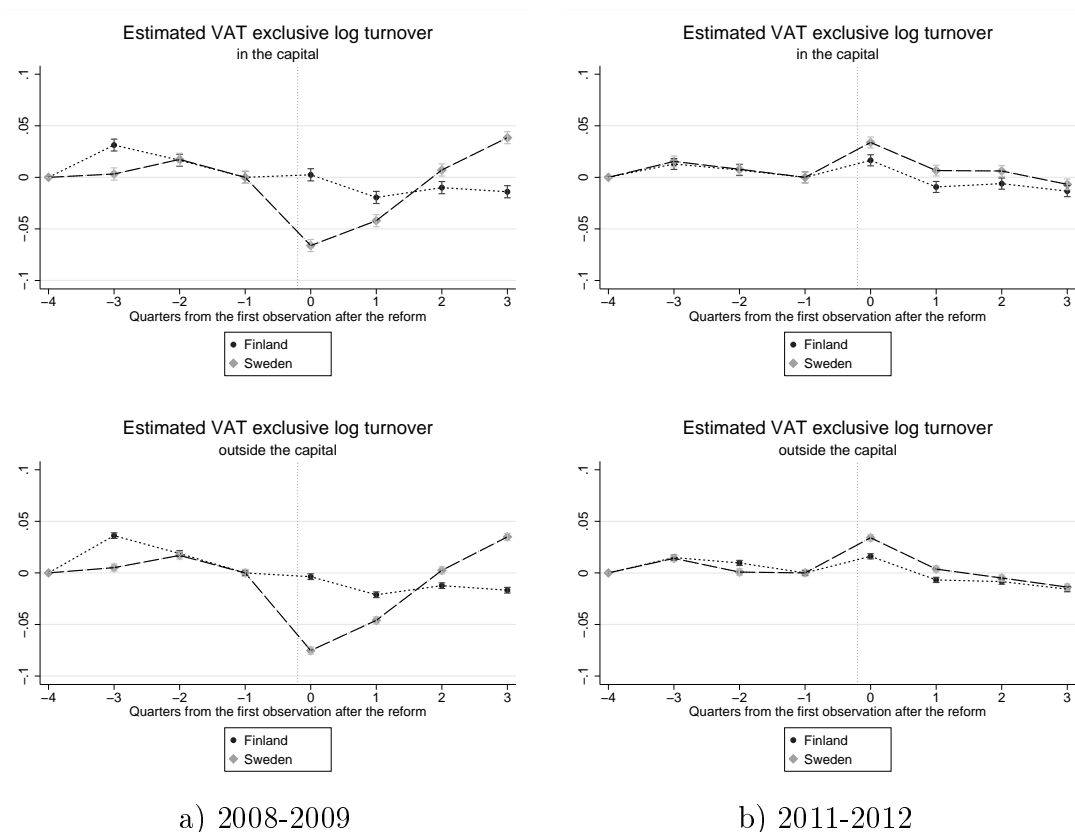a) 2008-2009   b) 2011-2012

Figure 11: Estimated VAT exclusive turnover of all firms in DHS tax credited industries in the capital and outside the capital in Finland and Sweden. Vertical lines indicate the DHS tax credit reforms in Finland. Note: Confidence intervals are so small that they can barely see in the figures.

Sweden. The second group contains firms outside the capital. I study areas separately because the firms can have different competition circumstances in the capital than outside it. Especially, in Sweden almost 30 % of all construction or cleaning firms are located in Stockholm. Figure 11 illustrates estimated turnover in 2008-2009 and 2011-2012 in different areas. Figure 11 shows that there is no large difference between location. All in all turnover trends are close to similar than in Figure 9 where there is no division. Overall, figures do not reveal any clear impacts of the reform which would support the theory predictions.

After the graphical investigation, I present the estimation results. Table 10 shows the differences-in-differences estimates of predicted VAT exclusive log turnover for the reform in 2009. I use monthly level data in estimations. Column (1) presents the results of all firms in DHS tax credited industries. The model is without controls because the

Table 10: DD estimates of predicted VAT exclusive log turnover, the reform in 2009

| | All | Industry | | Metropolitan | |
| | Simple | Construction | Cleaning | Yes | No |
	(1)	(2)	(3)	(4)	(5)
DD	0.0044	-0.0270***	0.0080	-0.0079	-0.0087
	(0.0181)	(0.0081)	(0.0070)	(0.0089)	(0.0073)
After	-0.0239***	-0.0249***	-0.0088**	-0.0202***	-0.0252***
	(0.00183)	(0.0020)	(0.0044)	(0.0025)	(0.0020)
N	3131443	1175581	812274	661768	2469675
R^2	0.0000	0.0003	0.0022	0.0005	0.0005
N of firms	186278	73898	47119	40597	145891

Standard errors in parentheses
***$p < 0.01$,**$p < 0.05$, *$p < 0.1$

Swedish data set is unclear as for controls. The time variation is controlled by using the predicted VAT exclusive log turnover as an outcome variable. The simple model does not produce any significant results of the DD estimate. Columns (2) and (3) present the DD results at the industry-level. The results differ from each other in construction and cleaning industries. The DD result in column (2) indicates that construction firms' turnover decrease 2.70 % due to the reform and the estimate is statistically significant. Whereas the effect is not statistically significant in cleaning industry. Columns (4) and (5) show that the results, divided by firms' location, are not statistically significant.

The lack of the significant results can arise from messy time trends of turnover in 2008-2009. The time variation were difficult to smooth even if I use several controls in the prediction. The macroeconomic situation in 2009 can be a reason for large variation in turnover trends. The unusual economic circumstances, as the economic crisis in 2009, can affect firms' behavior abnormally, hence it can complicated the analysis. Especially, in cleaning and construction industries the effects of the economic crisis on the demand for services can be different. Moreover, the Swedish DHS tax credit system has changed in 2008-2009 which could affect the results. In December 2008 the ROT deduction was included to the DHS tax credit system and in July 2009 the direct invoicing system was introduced and hiring an employee at home became tax credited. Overall, I cannot make trustworthy interpretation about the effects of the DHS tax credit reform on turnover. Nevertheless, if I could have relevant control variables for the estimation and

reducing the time variation, at least the quality of the results could improve. Naturally, it would not remove the problem of the changes in the Swedish tax credit system.

Theoretically an increase of the DHS tax credit could improve the demand for services. The interpretation of my empirical results is that the DHS tax credit reform has no impact on turnover, because the results are not statistically significant. Nevertheless, I cannot reach any reliable conclusions that the DHS tax credit reform has affected demand since I have not conducted the analysis of the effects of the reform on consumer prices. As I show in Section 4.2 that the demand changes only occur if turnover or consumer prices changes.

Table 11 presents the DD results of the DHS tax credit reform in 2012. Column (1) shows the DD results of all firms in DHS tax credited industries. The results indicate that firms' turnover decline 1.16 % due to the reform in 2012. Column (2) presents that the effect of the reform for construction firms is 2.32 % decrease in turnover. Instead the DD results of cleaning firms are not statistically significant. Columns (4) and (5) show that the results, divided by firms' location, are statistically significant and the impact of the reform for firms in the capital is 1.35 % reduction and outside the capital 1.09 % reduction in turnover.

Table 11: DD estimates of predicted VAT exclusive log turnover, the reform in 2012

	All	Industry		Metropolitan	
	Simple (1)	Construction (2)	Cleaning (3)	Yes (4)	No (5)
DD	-0.0116**	-0.0232***	-0.0207	-0.0135**	-0.0109*
	(0.0056)	(0.0089)	(0.0135)	(0.0056)	fns(0.0058)
After	-0.0025	-0.0047**	0.0098***	-0.0004	-0.0033**
	(0.0017)	(0.0020)	(0.0033)	(0.0028)	(0.0017)
N	3586572	1304386	989496	781322	2805250
R^2	0.0011	0.0014	0.0009	0.0003	0.0011
N of firms	228141	80509	55659	46272	162058

Standard errors in parentheses
***$p < 0.01$,**$p < 0.05$, *$p < 0.1$

The results are in line with theory predictions which imply that the DHS tax credit reduction should decrease the demand for services. The results indicate that the DHS tax credit reform in 2012 has reduced turnover from 1.09 % to 2.32 % depending on firms

location and industry. In the previous section, I show that consumer prices of cleaning services have increased 2.1-5.3 % after the reform in 2012. However, the results of the turnover estimation is not statistically significant in the cleaning industry. Therefore cleaning firms turnover does not change due to the reform. Since turnover is consumer prices times quantities sold and there were positive change in consumer prices and no change in turnover, quantities sold have to decrease. The demand changes occur. Nonetheless, the strong conclusions from the results should not be done because the analysis of consumer prices covers only prices of cleaning services and not any other services. Thus I cannot evaluate the effects of the DHS tax credit reform in other industries even though the results show a reduction of turnover.

To validate my emprical results, I should conduct robustness checks for the estimations. The placebo tests and using the control variables could improve the quality of the results. However, in this study there has been an availability problem with the Swedish data. Therefore I do not have relevant control variables in the Swedish data sets which I could use. On the other hand, I could perform the placebo tests, where I carry out same estimations than before, by setting the reform take place, for instance, year before or after the real reform. In this study of the DHS tax credit reforms, there can be three problems in the placebo estimations. First, it is not reasonable to conduct placebo tests a year after the reform because the DHS tax credit reforms can have long-run effects on demand. It is possible that consumers react slowly on the changes in the system and hence the effects can occur later than year after the reform. Second, the Finnish domestic help services tax credit system have been changed many times and these changes have been implemented near to each other. Therefore I argue that performing the placebo tests year before the reform is not wise since it could only capture the effects of the previous reform. Third, in Sweden there was no DHS tax credit system before 2007 hence the placebo tests cannot carry out by setting the reform before 2008 from which I get back to second problem. Without the robustness checks, the results are only tentative.

6   Concluding Remarks

In this thesis I focus on the domestic help services tax credit reforms in Finland. Especially, I concentrate on the Finnish government's motivation to increase the demand for domestic help services. I aim to provide an empirical analysis of the effects of the domestic help services tax credit reforms on the demand for services in Finland. In addition, I investigate the price responses of the DHS tax credit reforms on Finnish cleaning firms since the demand effects can only occur if consumer prices of services or firms' turnover change.

I examine the Finnish DHS tax credit reform using the differences-in-differences method and fixed effects estimation. I exploit firm-level data from both Finnish and Swedish Tax Administrations. Both countries' data sets include information about firms' VAT payments of sales and yearly level control variables and all DHS tax credit applications from years 2006-2013. For the study of the price responses, I utilize data which contains consumer prices of cleaning services. In the demand analysis, I use few required data restrictions to smooth out the time variation of the turnover trends in order to fulfill the identifying assumption of the DD method, the parallel time trends without the treatment.

The empirical results of my study are not entirely consistent with the theory predictions of the changes in the DHS tax credit. The results of the price responses suggest that the DHS tax credit reform in 2012 increased the consumer prices of cleaning services by 2.1-5.3 %. This results are not in line with the theory predictions. Theoretically, the decrease in the domestic help services tax credit should reduce consumer prices and also quantities purchased if supply does not shift. Moreover, the empirical results of turnover analysis are more or less unclear. The results of the reform in 2012 are consistent with the theory predictions, but without the robustness checks the quality of the results are questionable. Turnover, excluded of VAT, decreased from 1.09 % to 2.32 % depending on firm location and industry after the reform in 2012. Since consumer prices increased and turnover decreased or was unchanged due to reform, the quantities sold must have changed also. However, I cannot conduct the analysis on consumer prices in industries other than cleaning. Hence the interpretation of the effects of the DHS tax credit reform is incomplete. Conversely, the reform in 2009 did not affect turnover and I cannot perform the price analysis in that year. Therefore, I cannot reach any conclusions of the effects of the DHS tax credit increase on the demand for and consumer prices of services.

This study does not provide unambiguous results of the effects of the DHS tax credit reform on demand. However, the methods, which I apply, are relevant to analyze the policy reforms, but the lack of good control variables and consumer price data reduce the quality of the results. Better data, such as an information about quantities sold, could produce better estimates and enable the analysis of the changes in demand. These problems in the analyses prevent me from providing policy recommendations.

Overall, my results suggest that the DHS tax credit system is difficult to study since the system has been changed many times in Finland and Sweden and furthermore these changes are implemented near to each other. Finding a sufficiently long period without changes in the DHS tax credit system is a challenge. Therefore I only investigate the short-run effects of the DHS tax credit reforms. However, the changes in the DHS tax credit system can affect demand also later than year after the reform because consumers could notice the reform, for instance, over year later. Especially, in Finland the delayed reaction is more possible since consumers do not apply the DHS tax credit in same year than they purchase the services. Thus the study of long-run effects could be more productive than the estimation of short-run impacts. One possibility to study long-time effects is to utilize the Finnish DHS tax credit experiment of two different variants which was in used between 1997 and 2001. These variants would provide more than a four year research period and a natural comparison of analyzing the efficiency of the variants.

The demand analysis of this study also raises two questions, namely are the demand effects real or does demand change because of a decrease in the shadow economy and do firms shift material costs to labor costs since the domestic help tax credit is applied only to labor costs. The DHS tax credit can give incentives to convert undeclared work to declared work and change the material costs to labor costs. Hence the real change in demand is not necessarily what the estimates suggest. Meaningful demand analysis could not be conducted without the examination of the firm's behavior. Furthermore the possible effects of the DHS tax credit on the shadow economy is the question which could be studied.

My analysis contributes previous literature of the DHS tax credit in three ways. First, I conduct the first econometric analysis of the Finnish tax credit system. Previous studies of the Finnish DHS tax credit have concentrated on the descriptive analysis. Second, the DD approach has not been used before to estimate the effects of the DHS tax credit reforms on demand. The impact of the domestic help services tax credit on demand has earlier studied only with simulation model (Flipo *et al.*, 2007). They study

an increase in the tax credit and conclude that the increase has improved the demand for services. Therefore my results support previous studies since a decrease of the DHS tax credit in 2012 reduced turnover and increased consumer prices which implies that demand was also reduced. And last, this study is also the first to analyze the effects of the DHS tax credit reform using both Finnish and Swedish data.

Many interesting questions remain without answers. Particularly, the Finnish government's other motivations for introducing the domestic help services tax credit could provide interesting research topics. One motivation was to increase labor supply and demand in the DHS tax credited industries. The potential employment effects of the DHS tax credit are a natural follow-up question from my study. Since if the demand for services increases or decreases, employment should also change. However, data limitations did not allow me to study the effects of the DHS tax credit on employment. Further studies using data of wage or labor costs or number of employees could be done.

All in all, this study is the first analysis which attempts to evaluate the effects of the Finnish domestic help services tax credit reforms. Even if my empirical analysis of the demand effects does not provide coherent results, the study is the opening for forthcoming research. Furthermore, the impacts of services tax credits could be investigated by using data from other countries, which have implemented a domestic help or other form of services tax credit. Thus the understanding of the effects of the tax instruments, such as tax credits, could broaden.

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A Description of Survey Data

The survey data of consumer prices of cleaning services is collected by VATT Institute for Economic Research. Consumer prices was collected from randomly chosen Finnish cleaning firms in three different time points: end of 2011 (t=1), beginning of 2012 (t=2) and end of 2012 or beginning of 2013 (t=3). The survey data contains consumer prices from 192 cleaning firms. The price collection was made by phone or via the internet. The collection questionnaires contains 13 characteristic and 9 price questions. All 9 prices of services were collected in every time points from each firms. All prices are presented in Table 12. Questions of firms' characteristic collected the information about, e.g. does the firm belong to chain or not, does the firm have a facebook page, what is the quality of firm's web page and can a consumer use a service voucher for purchasing services.

Table 12: Prices1-9

Price1: Cleaning from Monday to Wednesday
Price2: Cleaning from Thursday to Friday
Price3: Cleaning on Saturday
Price4: Cleaning on Sunday
Price5: Price1 after the DHS tax credit
Price6: Sale price of cleaning services
Price7: Kilometre allowance (x€/km)
Price8: Price of office cleaning
Price9: Price of construction cleaning