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DO WAGE-SUBSIDIES INCREASE EMPLOYMENT IN FIRMS?*

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Abstract: The literature evaluating active labour market programmes concentrates on the subsequent labour market performance of the unemployed work force that has undergone training or has spent a certain period in a subsidised job. The effects of programmes on firms have rarely been evaluated. Here we examine whether subsidised jobs have contributed to the employment of firms or merely substituted for non-subsidised ones. We also consider whether other firms have suffered or benefited from subsidies given to firms in a particular industry or geographical location. We analyse a large sample of firms, taken from the registers compiled by the Finnish Tax Authority. Our data set is an unbalanced panel of some 26,000 firms that are followed annually from 1995-1999. Our results indicate that wage subsidies have increased employment in subsidised firms, but the effect has not been large enough. Public subsidies appear to substitute private employment expenditure. However, subsidised firms have not harmed other firms in the same industry or geographical area. In other words, we find a substitution effect, but not a displacement effect.

Key words: Evaluation, employment, wage subsidies; JEL: J23

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Tiivistelmä: Tässä tutkimuksessa arvioidaan Työministeriön hallinnoimien työllistämistukien vaikuttavuutta tukea saavien yksityisten yritysten työllistämiseen vuosina 1995-1999. Lisäksi tutkitaan, vaikuttivatko kaikki yritysten saamat tuet muihin saman toimiala ja/tai maantieteellisen alueen yritysten työllistämiseen. Tulokset osoittavat, että tuen ansaintavuonna työllisyystuet korvaavat yritysten omia työllistämismenoja siten, että tukien vapauttamia varoja, joita ennen tukea meni palkkakuluihin, käytetään tukien aikana muuhun tarkoitukseen. Substituutio vaikutus on 25 %. Tuen jälkeisenä vuonna substituutiovaikutus on 46 %. Lisäksi havaittiin, että yritystukea saaneet yritykset eivät ole vaikuttaneet samalla toimialalla ja/tai maantieteellisellä alueella toimivien yritysten työllistämiseen.

Asiasanat: Vaikuttavuuden arviointi, työllisyys, työllistämistuki

Yhteenveto

Tausta

Kansainvälisesti tarkasteltuna tutkimus- ja kehitystoiminta ja investoinnit ovat yritystuen yleisimmät käyttökohteet. Työllisyystukia käytetään vähemmän, vaikka esimerkiksi Saksojen yhdistymisen yhteydessä arvioitiin, että investointitukien suosiminen työllisyystukien kustannuksella pahensi maan työttömyysongelmaa. Työllisyystuilla voi siis olla positiivisia vaikutuksia talouden ja yhteiskunnan kannalta.

Työllisyystukien joukossa perinteenä on ollut suosia työvoimakoulutusta suoran tukityöllistämiseen verrattuna. Tämä näkyy erityisesti anglosaksisissa maissa. Suomessa sen sijaan tukityöllistäminen on ollut työvoimakoulutusta suositumpaa. Esimerkiksi vuonna 1999 Suomessa oli noin 50 000 tukityöllistettyä ja noin 40 000 ihmistä työvoimakoulutuksessa.

Työllisyystukien vaikuttavuutta on yleensä arvioitu tarkastelemalla niihin osallistuneiden ihmisten menestymistä työmarkkinoilla työvoimakoulutuksen tai tukitöiden jälkeen. Työllisyystukien vaikutuksia yritysten toimintaan ei ole kuitenkaan juuri tutkittu.

Tavoite

Tässä tutkimuksessa arvioidaan Työministeriön hallinnoimien työllistämistukien vaikuttavuutta tukea saavien yksityisten yritysten työllistämiseen vuosina 1995-1999. Lisäksi tutkitaan, vaikuttiko yritysten saamat tuet muihin saman toimiala ja/tai maantieteellisen alueen yritysten työllistämiseen.

Menetelmä

Tutkimus suoritetaan nojaamalla viime vuosina nopeasti kehittyneisiin ekonometrisiin arviointimenetelmiin, joilla mitataan julkisen politiikan vaikutusta politiikan kohteena oleviin ihmisiin, kotitalouksiin tai yrityksiin. Vaikuttavuuden mittaamisessa on ongelmana se, että emme voi tietää yhdenkään tukea saaneen yrityksen työllisyyttä ilman tukea. Samalla tavalla emme voi havaita minkään tukea saamattoman yrityksen työllisyyttä tuen kera. Tämän ongelman vuoksi tuen vaikutus tukea saaneisiin yrityksiin on estimoitava ekonometrisin menetelmin. Tavoitteena on luoda tukea saaneille yrityksille sellainen verrokkiryhmä, jotka poikkeavat tukea saaneista ainoastaan tuen saannin osalta. Muutoin tukea saaneiden ja ilman jääneiden yritysten pitäisi olla mahdollisimman samanlaisia.

Tässä työssä työllisyystuen vaikutus estimoidaan kiinteiden vaikutusten paneelimallilla, jossa selitettävänä muuttujana käytetään vaihtoehtoisesti

yrityksen henkilölukumäärää ja palkkasummaa. Työllisyystuen saantia mitataan dummy-muuttujalla, joka saa tutkimusperiodin alussa kaikilla yrityksillä arvon nolla. Arvo muuttuu ykköseksi tuetuilla yrityksillä sinä vuonna kun tuki alkaa. Kontrollimuuttujina käytetään yrityksen liikevaihtoa, kiinteää pääomaa, nettovoittoa, keskimääräistä palkkaa ja muita yritystukia kuten KTM:n investointi ja toimintatukea sekä TEKES:n t&k-tukea.

Tämän kaltaiset julkisen politiikan vaikuttavuuden arvioinnit ovat olleet Suomessa tähän saakka harvinaisia. Euroopan Unionin rakennerahastoja on tosin arvioitu, mutta ne ovat olleet lähinnä ohjelmien prosessien arviointia eikä niissä ei ole pystytty mittaamaan rahastojen taloudellista vaikuttavuutta puhtaasti. Tämän vuoksi nyt käsillä oleva tutkimus jatkaa Suomessa kovin ohutta mutta sitäkin tärkeämpää tutkimuslinjaa.

Menetelmän tärkeyttä korostaa myös se, että sillä voidaan puolueettomasti arvioida eri tukilähteiden tuen vaikuttavuutta ilman että täytyisi tyytyä tuen antajien itsensä tekemiin arvioihin. Julkisen rahan jaon kannalta on olennaista, että tiedetään käyttökohteen ohella sen vaikuttavuus, jotta voidaan arvioida julkisten varojen käytön järkevyyttä.

Työllisyystuki

Tukityöllistämisen tuki on keskimäärin noin € 620 kuukaudessa ja sitä annetaan keskimäärin 6 kuukauden ajalle. Työllistämistuen alainen työpaikka on kuten mikä tahansa työ, joten työntekijälle maksetaan voimassa olevan työehtosopimuksen mukainen palkka. Tyypillisimpiä työpaikkoja ovat sosiaalialan työ, kiinteistönhoito- ja siivoustyö sekä toimisto ja sihteerityö. Työnantaja maksaa palkan ja tuen välisen erotuksen. Sijoitusammattien keskimääräinen palkka on noin €1 560 kuukaudessa. Näin ollen yrityksen osuus tukityöllisen palkasta on noin 60 % ja tuen osuus 40 %. Tämä tarkoittaa että yhden euron tuenlisäyksen täytyy lisätä yrityksen omaa (yksityistä) työllisyyttä 1,5 euroa, jotta tuki olisi työllisyyttä lisäävää. Yrityksen oma (yksityinen) työllisyys tarkoittaa tässä yrityksen koko työllisyyttä vähennettynä julkisin varoin tuettu työllisyys.

Jos tuki saa aikaan pienemmän kasvun yrityksen omassa (yksityisessä) työllisyydessä, sen voi katsoa syrjäyttäneen yrityksen työllisyyteen varattuja varoja ja siirtää niitä muuhun käyttöön, kuten markkinointiin, investointeihin, osingonjakoon ym.

Aineisto

Analysoimme tutkimuksessa yritysten tilinpäätösaineistoa johon on liitetty tiedot mahdollisista yritystuista. Analysoimamme paneeliaineisto sisältää noita tietoja noin 26 000 yrityksestä viiden vuoden ajalta (1995-1999). Aineisto on verohallituksen rekisteriaineisto, jonka käytölle tutkijat ovat hankkineet käyttöluvan.

Näin ollen tutkijat hyödyntävät julkisin varoin muutenkin hankittua ja ennestään olemassa olevaa aineistoa.

Aineiston yrityksistä 36 prosenttia on saanut jotain tukea vähintäänkin yhden kerran mainittuna aikana. Yleisin tuki on Työministeriön työllistämistuki. Tuetuista yrityksistä 85 % on saanut työllistämistukea pelkästään tai työllistämistukea muiden tukien ohella. Työllistämistuet ovat pienimpiä ja TEKES:n tuen suurimpia. Kaikkien yritysten joukossa määrällisesti eniten kuitenkin on jaettu KTM:n tukia. Toimialoittain tarkasteltuna työministeriön tukea jaetaan eniten teollisuudessa, jossa myös yritystä kohti laskettu tuen keskimääräinen koko on muita toimialoja suurempi.

Tulokset

Tulokset osoittavat, että tuen ansaintavuonna Työministeriön työllisyystuet syrjäyttävät osan yritysten omista työllistämismenoista siten, että tukien vapauttamia varoja, joita ennen tukea meni palkkakuluihin, käytetään tukien aikana muuhun tarkoitukseen (taulukko 1). Jotta tuki olisi työllisyyttä lisäävä, tuen pitäisi lisätä yrityksen omia palkkamenoja vähintään puolitoistakertaisesti tukeen nähden. Tulosten mukaan kuitenkin keskimääräinen tuki (€3 891) lisää yritysten omia palkkamenoja €1 462 liian vähän. Korvausvaikutus on tällöin 25 % (€5 837 - €3 891 / €5 837). Tämä erotus käytetään työllisyyden ulkopuoliseen tarkoitukseen. Raha joko säästetään tai käytetään esimerkiksi markkinointiin, investointeihin, osinkoihin, jne. Tämän osuuden lopullista käyttöä tässä tutkimuksessa ei voitu kuitenkaan yksityiskohtaisesti selvittää.

Tuen jälkeisenä vuotena substituutiovaikutus on korkeampi. Tällöin yrityksen täytyisi lain mukaan pitää tukitöissä ollut henkilö ja maksaa itse hänen koko palkkansa. Tulosten mukaan kuitenkin yritykset pitävät henkilön yrityksessä vain keskimäärin 6 – 7 kuukautta. Verrattuna tilanteeseen että yritykset pitäisivät tukitöissä olleen henkilön myös tukikauden jälkeen ilman että he irtisanoisivat muuta määräaikaista työvoimaansa, saatu tulos osoittaa että tuen vaikutus on 46 % liian pieni.

Taulukko 1. Mallin ennuste tuen palkkatuen vaikutuksille

	$D_t = 0$, $D_{t-1} = 0$	$D_t = 1$, $D_{t-1} = 0$	$D_t = 0$, $D_{t-1} = 1$
1. Tuen k.m. vaikutus palkkasummaan, €	Vertailu-kohta	4,375	10,489
2. Tavoite (ei substituutiota), €		5,837	19,500
3. Erotus (1-2), €		-1,462	-9,011
4. Substituutiovaikutus, %		25	46

Huomio. Yhtälöt laskettu kontrollimuuttujien keskiarvoilla.

Noin 25 % korvausvaikutus tuen ansaintavuonna todennäköisesti hieman aliarvioi todellista vaikutusta, sillä aineistosta ei saatu selville mihin ajankohtaan vuoden sisällä keskimäärin 6 kuukauden työllistämistuki ajoittui. Näin ollen vuoden ensimmäisellä puolikkaalla saatujen tukien tapauksessa yrityksen on täytynyt maksaa itse koko työllistämistuella olleen henkilön palkka vuoden toisen puolikkaan aikana. Ilman näitä yrityksiä arvioitu korvausvaikutus olisi ollut estimoitua suurempi. Toisaalta tuen ansaintavuoden jälkeen saatu 46 % korvausvaikutus todennäköisesti yliarvioi todellista vaikutusta samasta syystä. Yritykset, jotka ovat saaneet työllistämistukea yhden vuoden ensimmäisellä puolikkaalla työllistävät tätä ihmistä yhteensä yhden kalenterivuoden, mikäli heille pätee keskimääräinen 6 – 7 kuukauden työllistämisvaikutus tukivuoden jälkeisenä vuonna.

Tulosten mukaan kaikkia yritystukia (Työministeriön työllistämistukea, Kauppa- ja teollisuusministeriön investointi- ja toimintatukea tai Tekesin T&K-tukea) saaneet yritykset eivät ole vaikuttaneet samalla toimialalla ja/tai maantieteellisellä alueella toimivien yritysten työllistämiseen. Näin ollen tutkimuksessa ei havaita tuen syrjäytysvaikutusta.

Johtopäätökset

Työllistämistuen vaikuttavuudessa on siis parantamisen varaa. On kuitenkin otettava huomioon, että aikaisemmat tutkimukset ovat havainneet työllistämistukien hieman parantavan tukitöissä olleiden ihmisten työnsaantia tukiperiodin jälkeen. Lisäksi tuen saannin vapauttamat varat ovat voineet tukea yrityksen menestymistä esimerkiksi lisääntyneiden markkinointi- tai investointiresurssien muodossa. Tämän vuoksi emme voi sanoa työllistämistuen lopullista kokonaisvaikutusta yhteiskunnan kannalta.

Selkeä positiivinen tulos on kuitenkin se, että niin työllistämistukea kuin muutakaan tukea (Kauppa- ja teollisuusministeriön investointi- ja toimintatukea tai Tekesin T&K-tukea) saaneet yritykset eivät ole vaikuttaneet samalla toimialalla ja/tai maantieteellisellä alueella toimivien yritysten työllistämiseen.

Tutkimuksen liitteenä raportoitujen tulosten mukaan KTM:n ja TEKES:n tuilla on määrällisesti hyvin pieni ja tilastollisessa mielessä merkityksetön vaikutus yritysten työllistämiseen. KTM:n tukien osalta tulos on hieman yllättävä, sillä KTM:n tukien ainakin epäsuorana tavoitteena on edistää työllisyyttä. TEKES:n tukien osalta tulos on ymmärrettävä, sillä T&K-projektit ovat pitkäkestoisia ja riskialttiita, joten niiden vaikutus yrityksen työllisyyteen pitäisikin näkyä vasta kahta vuotta pidemmällä aikavälillä. Joka tapauksessa näiden molempien tukien vaikutus voi näkyä pidemmällä kuin kahden ensimmäisen tuen saantivuoden aikana, johon tämä tutkimus aineistosyistä pystyi porautumaan.

Contents

1. Introduction

The purpose of active labour market programmes is to maintain and enhance the human capital of the work force through training and periods in subsidised jobs. Traditionally, the evaluation of these programmes has concentrated on the subsequent labour market performance of unemployed persons who have participated in the programmes (Blundell and Costa Dias, 2000; Fay, 1996; Heckman, et al., 1999; Heckman 2000). A common question of possible dead weight effects is usually raised in this context: Would the unemployed have found jobs even without subsidies? A consensus is that the effectiveness of active labour market measures has been rather weak and varies according to the sector where subsidies are applied. In Finland, a general finding is that labour subsidies applied in the private sector generate small positive effects, whereas those applied in the public sector do not (Aho et al., 1999; Hämäläinen, 1999; Tuomala, 2000).

Among labour market programmes, training has been favoured over subsidised jobs. For instance, in the USA the amount of labour market training relative to all labour market measures was 20 per cent in 1996, whereas the share of subsidised jobs was 5 per cent. The EU average is not so unbalanced; the average amount of labour market training relative to all labour market measures was 28 per cent, whereas the share of subsidised jobs was 25 per cent (Martin, 1998). In Finland, however, subsidised jobs have been favoured over training programmes. The share of labour market training programmes relative to the total sum of active labour market measures was 33 per cent in 1996, whereas that of subsidised jobs was as high as 38 per cent (Martin, 2000).[i] Moreover, Finland relies rather heavily on labour market measures. For example, in 1997 the share of all labour market measures relative to GDP was 4.8 per cent, whereas the OECD average was 2.3 per cent.

Very few studies have investigated the effects of active labour market programmes on the demand for labour at the firm level, however. From the firm perspective, the analysis of subsidised jobs is more fruitful than that of training, as subsidised jobs lower the average cost of labour in subsidised firms. In this context, relevant questions are whether subsidised jobs improve employment in firms, or whether employees in subsidised jobs simply substitute non-subsidised employees. Furthermore, have non-subsidised firms suffered from subsidies given to firms in a particular industry or geographical location, i.e. have

[i] Moreover, the number of people in subsidised jobs has traditionally been higher than that in the labour market training programmes (Ministry of Labour, 2000). For example, in 1999 the number of people in subsidised jobs was a little over 50,000, whereas that in labour market training was a little less than 40,000. Both figures are very substantial in a country with about 2.4 million people in active employment. Note, however, that a large number of subsidised jobs are in the public sector (municipalities), and the total amount of all direct subsidies to private firms is less than the EU average (Venetoklis, 2001).

subsidised firms displaced jobs in non-subsidised ones? Addressing these questions would provide new insights into the evaluation of active labour market programmes, as traditional analysis using individual data cannot address questions of substitution or displacement effects possibly occurring at the firm level.

This paper scrutinises these two questions using empirical data that spans from 1995 to 1999. We analyse a large sample of firms taken from the registers compiled by the Finnish Tax Authority. In an international context, this administrative data is unique and rare; it covers the whole population of firms that pay taxes in Finland, including information on their financial statement accounts and possible business subsidies. One common feature of evaluation studies on business subsidies is that they concentrate only on manufacturing firms due to the limited availability of data. Our data deviates from this in that it includes firms from various industries (manufacturing, construction, transportation, wholesale and retail trade, business services, etc.)

We find that wage subsidies have increased employment in subsidised firms, but the effect has not been large enough. Public subsidies appear to substitute private employment expenditure. However, subsidised firms have not harmed other firms in the same industry or geographical area. In other words, we find evidence for the substitution effect, but not the displacement effect.

The rest of the paper is organised as follows. Section 2 provides a description of the subsidy scheme in Finland. Section 3 presents the evaluation methods and section 4 summarises the data at hand. Section 5 analyses and comments on the measured impact of subsidies, while section 6 discusses the results and section 7 concludes.

2. Subsidy scheme in Finland

Wage subsidies in Finland are delivered on the basis of job specific applications submitted by firms. The Finnish legislation related to subsidies is rather vague in defining which firms should be eligible, but basically it stipulates that the potential recipients should be profitable or should have the prerequisites to become so.

Subsidies are distributed through local Labour offices that appoint unemployed workers to the subsidised jobs. Subsidised jobs are designed for the unemployed who cannot find themselves a job or labour market training through the local Labour office, who are long term unemployed or are facing the threat, or are under 25 year of age. The purpose of wage subsidies is to improve the human resources development of the unemployed work force as well as to encourage firms to increase employment. In other words, wage-subsidies are directed to firms who employ the kind of unemployed whose productivity and qualifications are lower than the levels needed in active labour markets. These workers are not easily employable with the prevailing minimum wage level of the sector in question. Wage subsidies are used to fill the gap between wages that firms are willing to pay to these people and the prevailing wage level. The subsidies are grants, in that the recipient firm is not obliged to pay the money received back to the distributor.

The wage subsidies are based on an amount of up to approx. €770 per month for up to 10 months (in 2002). On average, however, the length of the subsidised period is 6 months. The level of the worker's human capital in the subsidised job partly determines the exact amount of subsidy. Also, the longer the worker has been unemployed prior the subsidy, the higher the subsidy. Similarly, a lower level of education increases the subsidy.

Workers in subsidised jobs are usually paid according to the prevailing wage rate. As the typical subsidised jobs are for cleaners, clerks, secretaries, office workers, unskilled manufacturing workers and salesmen, we have estimated that, on average, firms pay 60 per cent of the employment payroll of a worker in a subsidised job. That is, for each euro received as subsidy, the firm must on average put in € 1.5 of its own money when creating a subsidised job (1.5/(1+1.5)=0.60).[ii] This estimation is based on the centralised union wage agreement.

Apart from their subsidised status, these jobs in private firms have exactly the same specifications as the non-subsidised ones. When receiving a wage subsidy the firm must be able to demonstrate that the job is new, the worker has a

[ii] According to the Ministry of Labour, the average wage subsidy was €620 a month in 1999. The average gross monthly wage in subsidised jobs was €1,560.

permanent contract, and the firm has not laid off workers from similar jobs prior the subsidy period. From the point of view of our analysis, wage subsidies directly affect the payroll and the numbers of personnel, as the subsidies are part of the total payroll firms pay during a financial year.

3. Framework of empirical analysis

3.1 Effect of treatment on the treated

We estimate the effect of wage-subsidies in the following fashion. Let D=1 denote the event of receiving a subsidy and D=0 denote the event of not receiving a subsidy. Let y represent the logarithm of a firm's own (private) employment (subsidised employment is subtracted from the firm's total employment)[iii]. Let y0 and y1 be the log of a firm's own employment when the project is not subsidised (D=0) and when it is subsidised (D=1), respectively.

The 'benefit' to the firm's own employment from receiving the subsidy is $\Delta yt = y1t - y0t$, where Δyt is the effect of subsidy that we would like to determine. In this context, a positive Δyt indicates that extra employment that would have not been created without the subsidy is indeed presently created. During the subsidy period the effect must be large enough, however. As discussed above, the firm must cover 60 per cent of the employment costs of the subsidised job. Therefore, wage-subsidies are economically effective only if one euro of subsidies stimulates the firms' own (private) employment expenditures by more than €1.5. If the effect is less than that, the subsidy substitutes for the firm's own employment, either because (i) all of the resources released by the subsidy are directed not to other employment expenditures but to other activities such as marketing, or (ii) in the extreme case, the subsidised project simply crowds out other non-subsidised employment.

A subsidy can also affect the firms' employment after the subsidy period. In this case, a subsidised worker is kept in the firm without simultaneously firing other workers. Furthermore, after the period a positive Δyt of any size indicates that a subsidy has raised the firm's employment, as no public subsidy is received and all employment effects are depicted in the firm's own (private) employment.

The main econometric problem is that the effect of the subsidy cannot be precisely computed for any individual firm, because data on the counterfactual is missing (Heckman et al. 1999). We do not know what the 'y0' would have been for firms that indeed received subsidies. Thus, Δyt has to be estimated. We estimate the effect of treatment on the treated using the difference-in-differences method of estimation. This method compares the difference in outcomes before and after the intervention for groups affected by it to the respective difference for unaffected groups (Blundell and Costa Dias, 2000; Bertrand et al., 2002). In practice, we measure the effect of subsidies by estimating the change in

[iii] In this paper we proxy employment by the number of personnel and payroll. We can approximate own employment in terms of payroll only. We do this by subtracting the amount of subsidy from the total payroll of firm. Unfortunately we cannot do the subtraction from the number of personnel.

employment in firms that start receiving subsidies compared with those that have not received subsidies throughout the period. The firms who receive no subsidies throughout the period serve as an approximation of counterfactuals.

We assume that conditional on the firm not having a subsidy at time t-1, receiving a subsidy at t shifts expected employment expenditure by β. Then,

$$E(y1t \mid Dt=1, Dt-1=0) = E(y0t \mid Dt=1, Dt-1=0) + \beta \quad (1)$$

and

$$\beta = E(y1t-y0t \mid Dt=1, Dt-1=0) = E(\Delta t \mid Dt=1, Dt-1=0). \quad (2)$$

Accordingly, one may assume the same effect to be recorded by following firms that received subsidies in t-1, and part of them cease receiving subsidies in t.

If the treatment and control group were randomly selected, an unbiased estimator would be the simple difference in the mean employment between subsidised firms and controls. In other words, we would obtain an unbiased estimator, as there are no common or correlated factors determining both the probability of receiving a subsidy and employment.

However, in our case, as in most public policy interventions, the target group (the firms) is not randomly selected to receive subsidies. First, the firms themselves come forward and apply for subsidies. This creates the so-called self-selection bias. Second, in order to be considered for financing they have to fulfil certain general and basic criteria imposed by the programme under which the subsidies are distributed. Finally, the probability of receiving a subsidy and the growth rates of employment certainly differ between industries. In all of these cases, y0t is not mean independent of D.

We aim at achieving this mean independence by conditioning the expected mean employment both in subsidised and non-subsidised groups of firms based on their observable and unobservable characteristics. When conditioning on observables, we regress employment on the subsidy variable and additional regressors that are correlated with the subsidy status and employment.

Let us consider the observables. First, profitability eases liquidity constraints and creates room for future expansions, thus correlating with both subsidy status and employment growth.[iv] Therefore, we add profitability to control for this issue. The form of the variable is the net profit/loss.[v] We also add to the regression the

[iv] As mentioned above, the legislation stipulates that subsidies are given to profitable firms or those that have the prerequisites of becoming profitable.

[v] We do not take the logarithm of this variable, as a fraction of the firms make gross losses every year (losses are negative, thus cannot be logged).

amount of sales and fixed capital in their logarithmic form and well as the average wage computed as the payroll per member of the personnel. These variables control differences between firms in output, wages and investments, all of which contribute to employment. Sales are also used in the literature as a proxy for future profitability (Klette and Moen, 1998; Lach, 2000). Thus, in essence, we estimate a standard labour demand function.

Finally, we control for other possible subsidies that firms may receive during the period of analysis, such as investment and operation subsidies or R&D subsidies.

In addition to the observables, we also take into account the effect of unobservable characteristics. Some of these are firm specific but time-invariant. Others are common to all firms in one year but vary over time. We use time dummies to capture effects that are common to all the firms but vary over time. Time dummies and the average wages control for inflation, making the use of nominal, rather than real figures, sufficient.

In terms of firm-specific effects, there might be, first, regional differences in the economic environment or in industrial policies, or the legal form of firms could matter. Regional Labour office personnel within these offices may apply standards for applicant firms differently from each other. Some offices or officers may grant money to firms more easily than others, partially due to the fact that in some regions there may simply be more applicant firms (Venetoklis, 1999). Second, there are clear differences in growth rates between industries. Also, firms in one industry may be more inclined to apply for subsidies than those in another industry. Hence, a joint 'effect' is that the industrial classification must be controlled. We remove all these time-invariant factors (some of which are firm-specific and the others industry- or region-specific) by estimating fixed effect models.

Moreover, the use of fixed effects alleviates the problem of self-selection, which arises from the fact that we cannot observe all firm-specific factors that determine the probability of receiving subsidies and employment.[vi]

The aforementioned fact that the wage subsidies directly affect the payroll and personnel of the firm causes problems with the choice of an endogenous variable for the regression analysis. Since subsidies are part of the firms' total payroll expenditure and total number of personnel, their appearance in both sides of the

[vi] One could argue that individual effects fail to do their work if firms planning to expand their production, and hence their workforce, are more likely to apply for wage subsidies. Thus, growing firms would be more likely to receive subsidies and consequently these firms would increase their employment more than the others. We doubt, however, that growth-seeking firms would rely on wage subsidies in their growth plans, as these types of subsidies are directed to low-wage and low-skill jobs and to the unemployed work force. Growth-seeking firms would probably not rely on these people to satisfy their growth needs, but on a more qualified work force.

equation makes the estimation less straightforward. However, we can overcome this by simply subtracting from the firm's employment payroll the amount of subsidies received (firm's own payroll = firm's total payroll – the amount wage subsidy). We call this adjusted variable the firm's own (or private) payroll. Unfortunately, we cannot perform a similar modification for the number of personnel. We run alternative regressions, where three proxies for employment are the respective endogenous variables, namely the number of personnel, payroll and own payroll.

Thus, using all controls and methods of analysis mentioned above, we estimate the following equation:

$$Eit = \alpha + \beta Dit + \chi Xit + vt + \eta i + \varepsilon it \qquad (3)$$

where E can be (i) employment (number of personnel), (ii) total payroll or (iii) the firm's own (private) payroll; X is a vector of control variables (correlates with both E and D); v is a vector of time dummies, and η shows fixed effects. D equals a dummy for subsidised firms (i.e. it changes from 0 to 1 when a firm starts receiving a subsidy and remains zero throughout the period for the control group). Coefficients β and χ measure the structural, selection-corrected effect of the observables on E, whereas η is the 'selection effect' (omitted variable bias) relating employment and the observables. The variables used in estimations are described in Table A1 of Appendix 1.

We also add lagged explanatory variables to the estimated model. This allows us to examine what happens after the subsidy period. The legislation on wage subsidies stipulates that a firm hiring a worker with a wage subsidy must sign a permanent contract with the worker. Therefore, we should observe positive effects after the subsidy period, if firms do not, or cannot, bypass this rule, e.g. by firing other (non-subsidised) workers when continuing the contract with the worker who had a subsidised job in the previous period.

3.2 Displacement effect

Until now we have discussed the estimation of the effects of wage subsidies on the subsidised firms, controlling for observable and unobservable fixed characteristics. This approach is somewhat limited in scope, since it only accounts for the exogenous direct effects of the received subsidies solely on the subsidised firms.

There could be cases, however, where subsidy effects "leak" from subsidised firms and affect other firms, either subsidised or non-subsidised (Calmfors, 1994, Hietala, 1997). When the effect is measured on the units exposed to the treatment only (that is, only on the subsidised firms), then we talk of partial equilibrium

effects. On the other hand, when we account in our estimation for leakages to other non-subsidised firms as well, then the evaluation is wider in scope and we move towards a general equilibrium approach (Smith, 2000).

In our case, where we deal with a restricted sample of firms, it is impossible to apply a truly general equilibrium approach; it is impossible to account with precision for all potential effects to the whole potential population of firms exposed and not exposed to the treatment. Nevertheless, a trade-off can be achieved if, for example, we were to look at how subsidies received in certain sectors and regions affect the endogenous variable of all the firms in our sample. A leakage effect might occur when a firm, having received wage subsidies, displaces jobs in non-subsidised firms.

What sources of displacement could there be? We hypothesise that if subsidies were to generate displacement leakage it would most probably happen among firms within the same industrial sector and/or geographical region. Thus, three potential sources of displacement are estimated. They are based on the displacement effects generated by other firms having the same (i) industrial sector, (ii) region, or (iii) industrial sector and region, as the subsidised firms during a specific year. The potential displacement generated at the level of an industrial sector and region is more targeted than at the level of the industrial sector or region alone.

To create the industry-specific displacement variable we first added together all relevant subsidies (the total subsidies or the wage subsidies only) delivered within each industry in a year. Second, we summed the industry-specific subsidy amounts for each firm. Finally, we deducted from this aggregate subsidy the amount of subsidies the firm in question received that year. Of course, in the case of non-subsidised firms the amount that was deducted was zero. The variable created shows for each firm the total amount of subsidies given to the other firms in the industry in question. The same approach was followed to create the other displacement variables, i.e. region-specific or region-industry-specific variables.

In formal notation, the calculations of the displacement variable, D, were based on the following formulas:

$$D(industry)_{i,y} = \Sigma_{i=1}^{N}(S_{i,y,k}) - S_{i,y}, i \in k \quad (4)$$

$$D(region)_{i,y} = \Sigma_{i=1}^{N}(S_{i,y,r}) - S_{i,y}, i \in r \quad (5)$$

$$D(region\&industry)_{i,y} = \Sigma_{i=1}^{N}(S_{i,y,k,r}) - S_{i,y}, i \in k,r \quad (6)$$

where

S = amount of subsidies,

i = firm (i = 1..n),

y = year (y = 1995..1999),

k = industry,

r = region.

We estimate the displacement effects of all subsidies (wage, investment and R&D subsidies) on one of the endogenous variables previously utilised, the own payroll. This is conducted simply by adding each displacement variable in turn to equation (3) above. We also test whether the effect of displacement differs between subsidised and non-subsidised firms by adding to the equation an interaction term of the subsidy dummy and the displacement variable in question.

4. Description of the data set

Our sample has been taken from the registers compiled by the Finnish Tax Authority. These registers cover the whole population of firms that pay taxes in Finland, including information on their industrial sector, size, financial statement accounts and possible business subsidy receipts. The data set under analysis spans from 1995 to 1999.

Prior to the analysis, we restricted the number of firms and observations in order to obtain a data set that includes the required information on fully functioning ordinary-sized firms.[vii] First, we eliminated very small firms and those firms that did not have an active operation through out the financial year. In practice, we excluded firms whose yearly turnover in any year of the period examined was under €20,000, whose yearly payroll was less than €11,700, or which employed less than one fulltime person. Second, to account for outlier effects, we dropped firms that had yearly payrolls of over €1.68 million; those that had extremely (implausible) low or high average wage costs per employee; and firms whose subsidy yearly receipts exceeded a certain very high threshold per subsidy type.[viii] To eliminate the effects of take-overs and mergers, we dropped firms whose logarithm of sales had changed more than (+/-) 2.0 times over a year. Finally, we kept only those firms that had at least three consecutive years of records (between 1995 and 1999) in the data set. This last restriction facilitated the before-after estimation, the use of lagged variables in our impact estimations and made the panel more balanced.

After applying restrictions, the total number of observations is 108,065 (Table 1). The observations are quite evenly distributed among years, although 1997 has the most. Most of the firms appear in the data for the full 5 years. In terms of external validity, our data set is not the best possible. Although we examine approximately 11% of all firms in Finland, we cannot claim that the sample is necessarily representative of the total firm population, since it was not randomly selected.

Tables 2 and 3 list several descriptive statistics of the analysed panel, the former based on the number of observations, the latter on a per firm basis. The data set includes 20,506 subsidy records during the 5-year period (Table 2). The remaining 87,559 observations concerned firms that did not receive any subsidies from any source during the period. On a per-firm basis, the aforementioned observations referred to a total of 26,027 firms, of which 9,334 were subsidised

[vii] The initial sample consisted of 230,929 firms, of which 40,535 had at least once (during one year) in the period 1995–1999 received some type of subsidy, namely wage, investment and operation or R&D subsidies. The remaining 190,394 firms had received no subsidies during the same period.

[viii] For wage subsidies the drop limit was €168 000; for investment and operation subsidies €336,000; and for R&D subsidies €672,000.

at least once and 16,693 were not subsidised at all (Table 3). Wage subsidies are the most common type, although the average amount of wage subsidies is clearly smaller than that received from other sources. R&D subsidies are delivered least as often, but their average size is the largest. Investment subsidies comprise the largest total amount delivered during the period.

Table 1. Yearly observations in the data set after restrictions

	Years					
Consecutive records for	1995	1996	1997	1998	1999	Totals
3 years	5,966	6,200	9,641	3,675	3,441	28,923
4 years	1,252	2,788	2,788	2,788	1,536	11,152
5 years	13,598	13,598	13,598	13,598	13,598	67,990
Totals	20,816	22,586	26,027	20,061	18,575	108,065

Table 2. Summary statistics for subsidies, 1995-1999 (yearly observations)

Subsidy type (source)	N			Sum of subsidies, € 1000	%	Average subsidy, €
Wage (TM)	15,503			73,710	18	4,755
Investment (KTM)	6,403			187,206	46	29,237
R & D (TEKES)	1,949			144,590	36	74,187
Totals	*20,506			405,506	100	19,775
		%	%	Sum, € 1000		Average, €
Wage only (TM)	12,795	12	62	54,532	13	4,262
Investment only (KTM)	3,648	3	18	92,486	23	25,353
R & D only (TEKES)	954	1	5	74,701	18	78,303
TM + KTM only	2,114	2	10	8,207	2	38,823
TM + TEKES only	354	0.3	2	32,832	8	92,745
KTM + TEKES only	401	0.3	2	42,587	11	106,202
TM + KTM + TEKES	240	0.2	1	26,295	6	109,565
Total with subsidies	20,506	19	100	405,506	100	19,775
Total without subsidies	87,559	81				
Total observations	108,065	100				

* This total number of observations (20506) does not correspond to breakdown per source (15503+6403+1949). As can be seen, there are firms that have received subsidies from more than one source during one year.

Table 3. Summary statistics for subsidies, 1995-1999 (aggregates at the firm level)

Subsidy type (source)	N			Sum of subsidies, € 1000	%	Average subsidy, €
Wage (TM)	7,925			73,710	18	9,301
Investment (KTM)	3,100			187,206	46	60,389
R & D (TEKES)	970			144,590	36	149,062
Total	11,995			405,506	100	43,444
		%	%	Sum, € 1000	%	Average, €
Wage only (TM)	5,872	23	63	42,655	11	7,264
Investment only (KTM)	1,007	4	11	39,017	10	38,746
R&D only (TEKES)	195	1	2	30,046	7	154,082
TM + KTM only	1,485	6	16	109,289	27	73,596
TM + TEKES only	167	1	2	31,284	8	187,332
KTM + TEKES only	207	1	2	44,696	11	215,924
TM + KTM + TEKES	401	2	4	108,519	27	270,620
Total with subsidies	*9,334	36	100	405,506	100	43,444
Total without subsidies	16,693	64				
Total firms	26,027	100				

* This total number of firms with subsidies (9,334) does not correspond to breakdown per source (11,995). As can be seen, there are firms that have received subsidies from more than one source

The size distribution of firms (measured in terms of number of employees) is highly skewed to the right (Table 4). Almost two-thirds of firms employ 10 people or less, and the proportion of large firms, employing more than 250 people, is just one per cent. The skewedness of the distribution of firms is a very common finding throughout the western world. Over 84 per cent of the firms that have received either wage subsidies exclusively or wage subsidies in addition to subsidies from other sources employed 50 persons or less. Among firms receiving wage subsidies, three quarters received wage subsidies exclusively. The average amount of wage subsidies seems to correlate positively with the size of the firms, indicating that larger firms tend to receive wage subsidies more often and they tend to simultaneously employ more subsidised workers.

*Table 4. Average amount of wage subsidies** in relation to the size of firms (1995-1999)*

	Number of personnel* (size)						
Subsidy type	1	2-10	11-50	51-250	250-	(N)	%
Wage only (TM)							
Average over the period	3,810	5,405	7,527	12,399	27,201	7,264	
N	24	2,900	2,333	500	115	5,872	74
TM + KTM only							
Average over the period	8,970	8,727	11,504	22,087	32,359	13,773	
N	2	285	851	299	48	1,485	18
TM + TEKES only							
Average over the period	-	13,587	15,245	16,777	25,543	17,963	
N	0	20	58	49	40	167	2
TM + KTM + TEKES							
Average over the period	-	6,723	13,889	20,661	35,000	18,961	
N	0	38	158	141	64	401	5
	4,207	5,763	8,950	16,723	29,750	9,301	
Subsidised firms							
Total obs.	26	3,243	3,400	989	267	7,925	100
%	0.3	41	43	12	3.4	100	
Non-subsidised firms							
Total obs .	1,823	11,041	3369	413	47	16,693	
%	11	66	20	3	0.2	100	
All firms							
Total obs.	1,849	14,184	6,769	1,402	314	24,618	
%	7,5	57,6	27,5	5,7	1,3	100	

* The number of personnel is the average for each subsidised firm during the period 1995 – 1999.
** Aggregate average wage subsidy per firm for whole period 1995-1999.

One novelty in the data set is that it includes firms outside the manufacturing sector. Manufacturing firms have received 29% of wage subsidies, whereas the corresponding proportion among non-subsidised firms is only 13% (Table 5). The other industrial sectors absorb a smaller proportion of wage subsidies relative to their number of firms. Also, the average amount of wage subsidies over the whole period is higher in manufacturing than elsewhere, indicating that manufacturing firms tend to receive wage subsidies more often and at the same time employ more subsidised workers than others.

Table 5. Industrial structure and wage-subsidies

Industry	Non-subsidised firms	%	Subsidised firms	%	All firms	%	Average subsidy per firm*
Manufacturing	2,218	13	2,299	29	4,517	18	11 441
Other industrial production	2,320	14	1,012	13	3,332	14	8 959
Wholesale and retail trade	4,950	30	2,265	29	7,215	29	8 130
Business services	4,256	25	1,276	16	5,532	22	9 167
Other private services	2,949	18	1,073	14	4,022	16	7 669
Totals	16,693	100	7,925	100	24,618	100	9 300

* Aggregate average wage subsidy per firm for the whole period 1995-1999.

Finally, we take a look at firms whose subsidy status does not change at all during 1995-1999, and compare them to firms who start or stop receiving subsidies between any of the year-pairs 1995-1996, 1996-1997, 1997-1998 or 1998-1999 (Table 6). In our data there are 3,799 observations of firms that receive subsidies in t but not in t-1 (all year-pairs combined); 4,721 observations of firms that receive subsidies in t-1 but not in t; 4,717 observations of firms that receive subsidies in both periods, and 60,319 observations of firms that do not receive subsidies at all between 1995 and 1999.

Table 6. Mean employment of subsidised and control firms in the year t-1 and t

	No subsidies in t-1 or t	Start receiving subsidies	Cease receiving subsidies	Subsidies in both periods
Personnel, t-1, number	15.4	29.3	32.2	59.2
(observations)	(60,319)	(3,799)	(4,721)	(4,717)
Personnel, t, number	16.5	34.5	33.3	67.4
(observations)	(60,319)	(3,799)	(4,721)	(4,717)
Difference	1.0	5.2	1.1	8.2
Log(difference)	0.065	0.164	0.034	0.130
Diff.-in-Diff.	0.164-0.065=0.099		0.130-0.034=0.096	

It appears that the mean employment of firms who receive subsidies neither in t-1 nor t increases from 15.4 to 16.5 between t-1 and t (all year-pairs combined), whereas the respective figure for firms that start receiving subsidies grows from 29.3 in t-1 to 34.5 in t. Respectively, firms that receive wage subsidies in both periods increase their number of personnel from 59.2 in t-1 to 67.4 in t, and firms that cease receiving subsidies increase theirs from 32.2 to 33.3. If we computed a basic differences-in-differences estimate between firms that start receiving and those that do not receive subsidies at all, the effect of subsidies would be 10.4 per

cent ($e^{0.099}$-1=0.104). Accordingly, the estimate between firms that receive subsidies in both periods and those that cease receiving subsidies in t is 10.1 per cent ($e^{0.096}$-1=0.101).

Unfortunately, solely on the basis of this result we cannot conclude that subsidies have a positive and substantial impact on the employment of firms. This approach fails to take into account two things. First, wage subsidies directly affect the number of personnel, causing a spurious correlation between wage subsidies and employment. As mentioned earlier, firms receiving wage subsidies *must* employ someone with the money they get from the public source. Second, there is a possibility that firms receiving subsidies grow at a different pace than others, due to reasons subject to their other characteristics, such as demand for their products, capital intensity, skill level of the personnel, and so on.

As mentioned earlier, we can alleviate the first problem by using the firms' own payroll as the endogenous variable. The second problem refers to omitted variables and calls for regression analysis, an investigation which follows next.

5. Results

5.1 Substitution effect

The first results are from fixed effect regressions of different employment variables on a subsidy dummy and controls. For the purposes of panel estimation we further restrict our sample so that no firm has received any subsidies in period t-1, and the treated firms start receiving them in period t. Depending on the total number of years that a subsidised firm appears in the sample (from three to five), the subsidy dummy is zero from two to four times prior to the subsidy period and then turns to one in the final year. For all the non-subsidised firms the dummy is zero every year. Thus, firms that receive subsidies before we observe them in our data have a minimal effect on the results. Further, we are able to get before and after observations for our treatment group; and in our fixed effect set up, the subsidy dummy captures the differences-in-differences effect of subsidies on employment.

In the personnel equation, the effect of wage subsidies is more than 10 per cent (e0.0993-1 = 0.104) (Table 7), which is virtually the same as the effect in the plain comparison of means above. In the payroll equation, the estimated effect is 5.2 per cent.

Table 7. Effect of wage-subsidies; N = 67,197; individual fixed effects

Equation	D_t	Robust t-value	Effect, %	R^2-within
Ln(Personnel)	0.099	11.3	10.4	0.49
Ln(Payroll)	0.050	7.2	5.2	0.53
Ln(Own Payroll)	0.031	4.3	3.1	0.53

Note: We compute the Huber/White/Sandwich estimator of variance to remove heteroscedasticity. The column labelled D_t gives the coefficient on the subsidy dummy. Control variables include year dummies, net profit, average wage as well as the log of the current period sales and fixed capital. In all equations we also include controls for firms that have received other types of subsidies, i.e. R&D and investment subsidies.

These results again suffer from the fact that subsidies directly affect our personnel variable. To correct the problem in the payroll equation, we re-estimate it using an adjusted variable in which possible subsidies are subtracted from the total payroll (own payroll). In the personnel and total payroll equations, the effect of wage subsidy is included in the coefficient, whereas it should be absent in the own-payroll equation. Indeed, the effect drops in the own-payroll equation. According to the adjusted equation, wage-subsidies have positive and statistically significant effect on the own payroll. However, the result also suggests that the

wage subsidies do not entirely substitute the firms' own payroll expenditure, but rather complement it, at least partially. We shall elaborate further on the magnitude of this effect in the Discussion.

For the reasons discussed above, we investigate next what happens after the subsidy period. In order to receive before and after observations for the treatment group, we drop from the sample all firms that receive subsidies in t-2 or earlier. This means that the subsidy period begins in period t-1 at earliest and (depending on the number of consecutive years a firm appears in the data) the subsidy dummy is zero from one to three years before the subsidy period starts. For non-subsidised firms the dummy remains zero throughout the period. In the regressions, we include dummies for both the current and lagged subsidies. We also allow lags for all control variables.

In each equation, the current period effect is somewhat smaller than the results presented in Table 7 above. The effect is highest in the personnel equation and lowest in the own-payroll equation (Table 8), suggesting again that the current period coefficient in the personnel and payroll equations are biased upwards. In the payroll and own-payroll equations the lagged effects are rather similar, implying that after the subsidy period there is no subsidy directly increasing the payroll, or biasing the estimate. The lagged coefficients are also statistically significant, supporting the hypothesis that firms keep the subsidised worker even after the subsidy period without simultaneously firing other workers to an equal extent. The complete list of coefficients is reported in Table A2 of Appendix 2. Results by industrial sector are show in Table A3 in the Appendix.

Table 8. Effect of wage-subsidies with a lag; Individual fixed effects; N = 51,983

Equation	D_t	Robust t-value	Effect, %	D_{t-1}	Robust t-value	Effect, %	R^2
Ln(Personnel)	0.075	9.3	7.8	0.036	4.5	3.6	0.54
Ln(Payroll)	0.042	7.0	4.3	0.052	8.3	5.3	0.57
Ln(Own payroll)	0.022	3.7	2.2	0.054	8.5	5.5	0.57

Notes: Columns D_t and D_{t-1} give the coefficient on the wage subsidy dummies.

Are these latter estimates unbiased? Do firms with subsidies somehow differ from others? One way of testing this is by checking the average employment between subsidised and non-subsidised firms prior to the subsidy period. Furthermore, one may wonder whether the control variables, measured at the same period as the receipt of subsidies, capture all observable differences between the treatment and control group. Indeed, there can be differences between applicant firms, which are observed by Labour Offices prior to the subsidy period while choosing firms to be funded. In order to check whether this

could account for any portion of the result, we lag control variables up to two periods in the own-payroll equation (note that no firm has received subsidies in t-2, so we do not need two period lagged subsidy variables). This also excludes firms for which we do not have observations in t-2 or further back.

It appears that it is necessary to control for differences between firms prior to the subsidy period. If no controls are added for this period, firms that start receiving subsidies in the period following the current one grow much faster than others (the upper row in Table 9). In contrast, when we control for observable differences in the period prior to the subsidies, there are no statistical differences in the own payroll between the future treatment and control group (the bottom row in Table 9). Having these controls we find that firms having no subsidies this period, but having wage subsidies in the following period, do not grow faster now. In brief, we should be quite confident about our subsidy effect estimates, once we control for differences prior to the subsidy period.

Table 9. Wage subsidies in lead models; Individual fixed effects; N = 51,983

Own-payroll equation with	D_{t+2}	Robust t-value	D_{t+1}	Robust t-value	R^2-within
Controls for t+1 and t+2	0,246	8,4	0,324	11,2	0,03
Controls also for t	-0,007	-0,7	0,003	0,3	0,29

Note: The coefficient on D_t cannot be computed as no firm has received subsidies in t.

The 2-year lagged control variables do not appear to matter much for the results, however. If anything, they tend to increase the effect, a result which suggests that subsidised firms might even have below-average track records in the past; controlling for lagged performance, the subsidy estimate effect rises slightly. Compared to the non-subsidised firms, firms having subsidies in the previous period still have 6.0 per cent more employment in this period (Table 10).

Table 10. Effect of wage subsidies with and without subsidies in t-2

Own-payroll equation with 2 years lagged controls	D_t	Robust t-value	Effect, %	D_{t-1}	Robust t-value	Effect, %	R^2
t-2 subsidies excluded; N = 51,983	0.025	2.4	2.5	0.058	5.6	6.0	0.60
t-2 subsidies included; N = 46,695	0.001	0.1	0.1	0.028	4.8	2.8	0.60

Note: Firm fixed effects estimation. Lags of up to two years in both equations.

The length of the subsidy period varies among subsidised firms. There are firms that receive subsidies both in t-1 t. In addition, there are firms that receive wage

subsidies either in t-1 or t. Compared to the non-subsidised firms, firms having subsidies two years in a row grow 4.3 percent faster in the year following the subsidy. When firms receive subsidies in one year only (t-1 or t), they grow 8.5 percent faster in the period after subsidies. The 6 per cent effect reported in Table 10 is the average of the two types.[ix]

Finally, it turns out to be extremely important to have the restriction that firms first do not have subsidies and later some of them start receiving subsidies (the bottom row in Table 10). When the own-payroll equation is estimated with firms having had subsidies in period t-2 in the sample, the current period estimate now drops to one tenth of the previous one, even though we control for subsidies received in t-2.

5.2 Displacement effect

We test for a displacement effect in the sample where no subsidies are delivered in period t-2. We measure subsidies in the periods t-1 and t, and lag control variables by up to two periods.

As found above, wage subsidies have indeed improved employment in subsidised firms; a relevant follow-up question is whether the subsidies have affected other (non-subsidised) firms. If subsidies harm non-subsidised firms, the public subsidies displace private employment. One possible channel for this is the product market. As the wage subsidies decrease the average cost of labour in the subsidised firms, they have a competitive edge over non-subsidised firms. Thus, subsidised firms may win market shares from the non-subsidised firms. In addition, the substitution effect may increase the odds for the displacement effect, since the subsidised firms are be able to reallocate the subsidies to uses other than employment. For example, due to the subsidy, they may decrease their product prices or intensify marketing with the money released from employment expenditure. We conduct the analysis utilising the amounts of all subsidies received (wage, investment and R&D), aggregating them at the level of 5-digit SIC industries and the level of regions resembling 85 local labour markets.

We do not find signs of displacement effects. For example, when we estimate the effect of all subsidies delivered within industries on other firms, we even observe positive effects on other firms (row number 2 in Table 11). This suggests that, rather than winning market shares, subsidies given to an industrial sector increase the orders of subsidised firms from their subcontractors in the same industry, resulting in spill-over benefits to the other firms. This result, however, is not statistically strong.

[ix] We also run the regression with data from which we dropped firms that had received subsidies in t-3. In this case there are only two estimable periods, and the number of subsidised firms is so low that we do not present the results. However, the results are qualitatively similar to those presented here.

The case for the displacement effect should be even stronger when we combine industries and regions. In this case, firms in one industry and geographical location should be competing with each other even more than firms in the same industry all over Finland. However, we cannot find any negative impacts (row number 5 in Table 11). The same finding also applies to all firms (irrespective of industry) in one location (row number 9). The effects are even weaker when we try other industrial aggregation or wage subsidies instead of all subsidies (results not shown).

Table 11. Displacement effect

	D_t	Robust t-value	D_{t-1}	Robust t-value	D_t and D_{t-1} combined
Subsidies in the same industry*					
1. Subsidised firms	0.051	0.2	0.125	3.8	0.176
2. All subsidies	0.001	1.7	0.001	0.8	0.002
3. Interaction term (1*2)	-0.002	-0.8	-0.005	-2.0	-0.007
Subsidies in the same industry and region					
4. Subsidised firms	0.031	2.7	0.059	4.7	0.089
5. All subsidies	0.001	1.3	0.000	0.6	0.001
6. Interaction term (4*5)	0.000	-0.1	0.001	0.5	0.001
Subsidies in the same region					
7. Subsidised firms	0.003	0.0	0.024	0.3	0.027
8. All subsidies	0.001	0.6	0.000	-0.1	0.001
9. Interaction term (7*8)	0.002	0.4	0.003	0.5	0.005

Note: In all equations the control variables are lagged by up to two periods. * as the firm in question.

6. Discussion

According to our estimations, the current period effect of subsidies on a firm's own payroll is 2.5 per cent (Table 10). How large is this effect? We analyse the magnitude by solving the estimated equation.

The model can quite accurately forecast the mean own payroll (Table 12). The mean difference between the observed and forecasted mean is €1.1 (see the first two columns). Our baseline case is the one where all other variables are at their means, but the wage subsidy dummies are zero. Then, the average own payroll is €174,834 (column 3). Compared to this case, the expected mean own payroll is €4,375 higher when the current period wage-subsidy dummy is one and the lagged remains zero. However, it should have been €5,837 higher, since the average subsidy is €3,891. As discussed above, for each euro received as a subsidy, the firm must on average put in €1.5 of its own money when creating a subsidised job (firm's share is 60%). Thus, the target value is €5,837 (1.5*€3,891). The average wage subsidy stimulates firms' own payroll €1,462 less than intended, indicating that in the period the subsidy is delivered firms substitute 25% of the subsidy for other than employment uses.

Table 12. The model forecast with different values of wage subsidy dummies

	All at means	Mean own-payroll	$D_t = 0$, $D_{t-1} = 0$	$D_t = 1$, $D_{t-1} = 0$	$D_t = 0$, $D_{t-1} = 1$	$D_t = 1$, $D_{t-1} = 1$
1. Expected value: Ln(own payroll)	13.86	13.86	13.85	13.88	13.91	13.94
2. Expected value, €	175,780	175,781	174,834	179,209	185,323	189,961
3. Difference, €		1.1	Baseline	4,375	10,489	15,127
4. Target, €				5,837	19,500*	25,337
5. Balance, €				-1,462	-9,011	-10,210
6. Substitution effect, %				25	46	40

Note: All control variables evaluated at their means. *) the average annual wage in subsidised jobs.

Wage subsidies appear to generate more positive effects after the subsidy period. After the subsidy period, the own payroll of subsidised firms is 6.0 per cent higher than that of non-subsidised ones (Table 10). Compared to the baseline, subsidies received in the previous period increase the average own payroll in the current year by €10,489 (Table 12). After the subsidy period the firm pays all costs of the worker who was in a subsidised job in the last period. As the average payroll in a subsidised job was € 1,560, the result suggests that on average firms keep the subsidised worker for an extra 6.7 months (€10,489/€1,560) after the

subsidised period. The effect is a bit more that half of that targeted, pointing towards a substitution effect of 46 per cent.[x]

[x] On the other hand, the effect is not very small. If we think of the amount of subsidy delivered as a bench mark, the subsidy should increase the firm's own payroll by at least €9,728 (€3,891+€5,837) in the period after the subsidies. The estimated effect of €10,489 would then indicate that firms indeed keep the subsidised workers even after the subsidy period, at least to an extent comparable to the amount of subsidy. However, in terms of mean wages in the analysed sample (€29,700 a year), or even mean wages in subsidised jobs (€19,500 a year), the estimated effect of €10,489 is not enough to employ a full time worker.

7. Conclusion

This paper evaluated the effect of wage subsidies on the employment of subsidised and non-subsidised firms during 1995-1999. The main findings were that wage subsidies have increased employment in subsidised firms, but the effect has not been large enough to avoid the substitution effect. Subsidised firms have not, however, harmed other firms in the same industry or geographical area. In other words, we found a substitution effect, but not a displacement effect.

In the period the subsidy is delivered, firms substitute 25% of the subsidy for uses other than employment. These may include marketing expenditure, dividend payouts, etc. However, this estimate is at the lower limit. As the average subsidy period is 6.3 months (€3,891/€620per month=6.3)[xi] and some subsidy periods start at the beginning of the year, firms with subsidy periods of this kind should pay the whole wage for the subsidised worker during the latter half of the year. Without these firms the estimated substitution effect would have been much larger.

After the subsidy period the firm pays all costs of a worker who was in a subsidised job during the previous period. Results show that, on average, firms keep the subsidised worker for 6.7 months after the subsidy period. The effect is slightly more than half of that targeted, pointing towards a substitution effect of 46 per cent. Another explanation is that subsidised firms continue employing on a permanent basis the person who had a wage subsidy in the previous period, but they simultaneously fire other workers. This results if firms cannot bypass the law, which obliges the firms to sign a permanent contract with the worker in a subsidised job.

This lagged estimate is at the upper limit. As firms that had a subsidised worker during the first half of a year, have paid the full wage of this worker during the latter half of the year. During the following year they continue paying the full wage. If some of these firms continue employing the subsidised worker for the average of 6.7 months after the year subsidy was delivered, the spell of employment lasts a whole 12 months (6 months last year and 6.7 months this year) and the firms perform a zero substitution effect. The exact substitution effect after the substitution period depends on the fraction of subsidy periods starting at the beginning of a year.

Finally, we found that the lagged effect of wage subsidy among firms having subsidies two years in a row appeared to be 4.3 per cent. When firms receive subsidies in one year only (t-1 or t), the effect was 8.5 per cent. The higher lagged effect in the latter model implies that continuation of wage subsidy period

[xi] According to the Ministry of Labour, the average wage subsidy was €620 a month in 1999. The average gross monthly wage in subsidised jobs was €1,560.

enables a firm to substitute part its own-payroll expenditure for the extended wage subsidies. Therefore, it seems that its is not optimal to give many wage-subsidy periods for one firm in a row.

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Tables

Table 13. Yearly observations in the data set after restrictions

	Years					
Consecutive records for	1995	1996	1997	1998	1999	Totals
3 years	5,966	6,200	9,641	3,675	3,441	28,923
4 years	1,252	2,788	2,788	2,788	1,536	11,152
5 years	13,598	13,598	13,598	13,598	13,598	67,990
Totals	20,816	22,586	26,027	20,061	18,575	108,065

Table 14. Summary statistics for subsidies, 1995-1999 (yearly observations)

Subsidy type (source)	N			Sum of subsidies, € 1000	%	Average subsidy, €
Wage (TM)	15,503			73,710	18	4,755
Investment (KTM)	6,403			187,206	46	29,237
R & D (TEKES)	1,949			144,590	36	74,187
Totals	*20,506			405,506	100	19,775
		%	%	Sum, € 1000		Average, €
Wage only (TM)	12,795	12	62	54,532	13	4,262
Investment only (KTM)	3,648	3	18	92,486	23	25,353
R & D only (TEKES)	954	1	5	74,701	18	78,303
TM + KTM only	2,114	2	10	8,207	2	38,823
TM + TEKES only	354	0.3	2	32,832	8	92,745
KTM + TEKES only	401	0.3	2	42,587	11	106,202
TM + KTM + TEKES	240	0.2	1	26,295	6	109,565
Total with subsidies	20,506	19	100	405,506	100	19,775
Total without subsidies	87,559	81				
Total observations	108,065	100				

* This total number of observations (20506) does not correspond to breakdown per source (15503+6403+1949). As can be seen, there are firms that have received subsidies from more than one source during one year.

Table 15. Summary statistics for subsidies, 1995-1999 (aggregates at the firm level)

Subsidy type (source)	N			Sum of subsidies, € 1000	%	Average subsidy, €
Wage (TM)	7,925			73,710	18	9,301
Investment (KTM)	3,100			187,206	46	60,389
R & D (TEKES)	970			144,590	36	149,062
Total	11,995			405,506	100	43,444
		%	%	Sum, € 1000	%	Average, €
Wage only (TM)	5,872	23	63	42,655	11	7,264
Investment only (KTM)	1,007	4	11	39,017	10	38,746
R&D only (TEKES)	195	1	2	30,046	7	154,082
TM + KTM only	1,485	6	16	109,289	27	73,596
TM + TEKES only	167	1	2	31,284	8	187,332
KTM + TEKES only	207	1	2	44,696	11	215,924
TM + KTM + TEKES	401	2	4	108,519	27	270,620
Total with subsidies	*9,334	36	100	405,506	100	43,444
Total without subsidies	16,693	64				
Total firms	26,027	100				

* This total number of firms with subsidies (9,334) does not correspond to breakdown per source (11,995). As can be seen, there are firms that have received subsidies from more than one source

*Table 16. Average amount of wage subsidies** in relation to the size of firms (1995-1999)*

	Number of personnel* (size)						
Subsidy type	1	2-10	11-50	51-250	250-	(N)	%
Wage only (TM)							
Average over the period	3,810	5,405	7,527	12,399	27,201	7,264	
N	24	2,900	2,333	500	115	5,872	74
TM + KTM only							
Average over the period	8,970	8,727	11,504	22,087	32,359	13,773	
N	2	285	851	299	48	1,485	18
TM + TEKES only							
Average over the period	-	13,587	15,245	16,777	25,543	17,963	
N	0	20	58	49	40	167	2
TM + KTM + TEKES							
Average over the period	-	6,723	13,889	20,661	35,000	18,961	
N	0	38	158	141	64	401	5
	4,207	5,763	8,950	16,723	29,750	9,301	
Subsidised firms							
Total obs.	26	3,243	3,400	989	267	7,925	100
%	0.3	41	43	12	3.4	100	
Non-subsidised firms							
Total obs .	1,823	11,041	3369	413	47	16,693	
%	11	66	20	3	0.2	100	
All firms							
Total obs.	1,849	14,184	6,769	1,402	314	24,618	
%	7,5	57,6	27,5	5,7	1,3	100	

* The number of personnel is the average for each subsidised firm during the period 1995 – 1999.
** Aggregate average wage subsidy per firm for whole period 1995-1999.

Table 17. Industrial structure and wage-subsidies

Industry	Non-subsidised firms	%	Subsidised firms	%	All firms	%	Average subsidy per firm*
Manufacturing	2,218	13	2,299	29	4,517	18	11 441
Other industrial production	2,320	14	1,012	13	3,332	14	8 959
Wholesale and retail trade	4,950	30	2,265	29	7,215	29	8 130
Business services	4,256	25	1,276	16	5,532	22	9 167
Other private services	2,949	18	1,073	14	4,022	16	7 669
Totals	16,693	100	7,925	100	24,618	100	9 300

* Aggregate average wage subsidy per firm for the whole period 1995-1999.

Table 18. Mean employment of subsidised and control firms in the year t-1 and t

	No subsidies in t-1 or t	Start receiving subsidies	Cease receiving subsidies	Subsidies in both periods
Personnel, t-1, number	15.4	29.3	32.2	59.2
(observations)	(60,319)	(3,799)	(4,721)	(4,717)
Personnel, t, number	16.5	34.5	33.3	67.4
(observations)	(60,319)	(3,799)	(4,721)	(4,717)
Difference	1.0	5.2	1.1	8.2
Log(difference)	0.065	0.164	0.034	0.130
Diff.-in-Diff.		0.164-0.065=0.099		0.130-0.034=0.096

Table 19. Effect of wage-subsidies; N = 67,197; individual fixed effects

Equation	D_t	Robust t-value	Effect, %	R^2-within
Ln(Personnel)	0.099	11.3	10.4	0.49
Ln(Payroll)	0.050	7.2	5.2	0.53
Ln(Own Payroll)	0.031	4.3	3.1	0.53

Note: We compute the Huber/White/Sandwich estimator of variance to remove heteroscedasticity. The column labelled D_t gives the coefficient on the subsidy dummy. Control variables include year dummies, net profit, average wage as well as the log of the current period sales and fixed capital. In all equations we also include controls for firms that have received other types of subsidies, i.e. R&D and investment subsidies.

Table 20. Effect of wage-subsidies with a lag; Individual fixed effects; N = 51,983

Equation	D_t	Robust t-value	Effect, %	D_{t-1}	Robust t-value	Effect, %	R^2
Ln(Personnel)	0.075	9.3	7.8	0.036	4.5	3.6	0.54
Ln(Payroll)	0.042	7.0	4.3	0.052	8.3	5.3	0.57
Ln(Own payroll)	0.022	3.7	2.2	0.054	8.5	5.5	0.57

Notes: Columns D_t and D_{t-1} give the coefficient on the wage subsidy dummies.

Table 21. Wage subsidies in lead models; Individual fixed effects; N = 51,983

Own-payroll equation with	D_{t+2}	Robust t-value	D_{t+1}	Robust t-value	R^2-within
Controls for t+1 and t+2	0,246	8,4	0,324	11,2	0,03
Controls also for t	-0,007	-0,7	0,003	0,3	0,29

Note: The coefficient on D_t cannot be computed as no firm has received subsidies in t.

Table 22. Effect of wage subsidies with and without subsidies in t-2

Own-payroll equation with 2 years lagged controls	D_t	Robust t-value	Effect, %	D_{t-1}	Robust t-value	Effect, %	R^2
t-2 subsidies excluded; N = 51,983	0.025	2.4	2.5	0.058	5.6	6.0	0.60
t-2 subsidies included; N = 46,695	0.001	0.1	0.1	0.277	4.8	2.8	0.60

Note: Firm fixed effects estimation. Lags of up to two years in both equations.

Table 23. Displacement effect

	D_t	Robust t-value	D_{t-1}	Robust t-value	D_t and D_{t-1} combined
Subsidies in the same industry*					
1. Subsidised firms	0.051	0.2	0.125	3.8	0.176
2. All subsidies	0.001	1.7	0.001	0.8	0.002
3. Interaction term (1*2)	-0.002	-0.8	-0.005	-2.0	-0.007
Subsidies in the same industry and region					
4. Subsidised firms	0.031	2.7	0.059	4.7	0.089
5. All subsidies	0.001	1.3	0.000	0.6	0.001
6. Interaction term (4*5)	0.000	-0.1	0.001	0.5	0.001
Subsidies in the same region					
7. Subsidised firms	0.003	0.0	0.024	0.3	0.027
8. All subsidies	0.001	0.6	0.000	-0.1	0.001
9. Interaction term (7*8)	0.002	0.4	0.003	0.5	0.005

Note: In all equations the control variables are lagged by up to two periods. * as the firm in question.

Table 24. The model forecast with different values of wage subsidy dummies

	All at means	Mean own payroll	$D_t = 0$, $D_{t-1} = 0$	$D_t = 1$, $D_{t-1} = 0$	$D_t = 0$, $D_{t-1} = 1$
1. Expected value: Ln (own payroll)	13.86	13.86	13.85	13.88	13.91
2. Expected value, €	175,780	175,781	174,834	179,209	185,323
3. Difference, €		1.1	Baseline	4,375	10,489
4. Target, €				5,837	19,500*
5. Balance, €				-1,462	-9,011
6. Substitution effect, %				25	46

Note: All control variables evaluated at their means. *) the average annual wage in subsidised jobs.

APPENDIX 1.

Table A1. Description of variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Endogenous variables					
Number of personnel	108,065	27.4	165.3	1	13102
Payroll, FIM 1000	108,065	4,963	36,900	70	4,260,000
Own payroll, FIM 1000	108,065	4,959	36,900	27.6	4,260,000
Ln (personnel)	108,065	2.035	1.333	0.000	9.481
Ln(payroll, FIM)	108,065	13.927	1.393	11.156	22.172
Ln(own payroll, FIM)	108,065	13.925	1.394	10.226	22.172
Subsidy dummies					
Wage subsidies	108,065	0.143	0.351	0.000	1.000
Investment subsidies	108,065	0.059	0.236	0.000	1.000
R&D subsidies	108,065	0.018	0.133	0.000	1.000
Control variables					
Net profit, FIM 1000	107,081	1,370	26,900	-4,030,000	3,070,000
Sales, FIM 1000	104,966	27,400	258,000	120.9	29,300,000
Fixed capital, FIM 1000	103,139	6,980	81,700	-183	4,910,000
Payroll / personnel	108,065	176,601	221,837	70,000	8,826,774
Ln(sales, FIM)	104,966	15.161	1.593	11.703	24.100
Ln(fixed capital, FIM)	103,137	12.,606	2.142	0.000	22.315

APPENDIX 2.

In Table A2 it appears that lagged subsidies of all types (wage, investment, R&D) affect a firm's own payroll more strongly than the current ones. The wage subsidies tend to increase the own payroll in a more robust way than other types. Demand, approximated by the sales of firms, is positively associated with employment. Similarly, fixed capital has a positive coefficient. These results are consistent with respective findings in the literature (Hamersmesh, 1993). In contrast, the coefficients on the average wage have positive signs. This is accounted for by its construct. Since the [average] payroll per member of the personnel is used, the same (payroll) variable appears in both sides of the equation, causing the positive sign of the variable.

In terms of investment and R&D subsidies, Table A2 shows that the subsidy dummies barely reach statistical significance. The magnitude of the coefficients suggests the following. During the first two years of receiving investment subsidies, firms receive on average €45,000. These investment subsidies generate €12,800 of extra payroll. The average R&D subsidies given in two years (€11,800) generate €34,500 of extra payroll. These amounts are small relative to the average payroll, which is €176,000 per year (Table A1). Note, however, that the primary purpose of investment or R&D subsidies is not to generate employment during the first two years that were investigated here.

Table A2. Effects of business subsidies on the own payroll of firms; fixed effects

Variable	Coefficient	Robust t-value
D(wage subsidy)$_t$	0.025	2.4
D(wage subsidy)$_{t-1}$	0.058	5.6
D(Investment subsidy)$_t$	0.028	1.2
D(Investment subsidy)$_{t-1}$	0.043	1.7
D(R&D subsidy)$_t$	0.073	1.8
D(R&D subsidy)$_{t-1}$	0.106	1.9
Net profit $_t$/1billion	0.071	1.6
Net profit $_{t-1}$/1billion	-0.140	-2.4
Net profit $_{t-2}$/1billion	0.339	1.6
Year 1998	0.010	2.4
Year 1999	0.396	61.0
Ln(sales)$_t$	0.334	18.4
Ln(sales)$_{t-1}$	0.111	8.9
Ln(sales)$_{t-2}$	0.058	5.5
Ln(fixed capital)$_t$	0.033	6.2
Ln(fixed capital)$_{t-1}$	0.026	5.4
Ln(fixed capital)$_{t-2}$	0.009	1.9
Average wage $_t$/1 million	0.281	9.6
Average wage $_{t-1}$/1 million	0.027	1.2
Average wage $_{t-2}$/1 million	0.018	0.5
Constant	5.290	15.2
N; R^2-within		32,686; 0.60

Note: We compute the Huber/White/Sandwich estimator of variance to remove heteroscedasticity.

APPENDIX 3.

Finally, we check whether there is any difference in the effect of wage subsidies across the industrial sector of firms (Table A3). It turns out that wage subsidies stimulate employment in each industry. The effect is the highest in wholesale and retail trade sectors and second highest in manufacturing. The effect appears to be lowest in 'Other private services', which includes business services, transportation, restaurants and hotels.

Table A3 *Effects of wage subsidies by industry in the own-payroll equation*

	Dt	Robust t-value	Effect %	Dt-1	Robust t-value	Effect %	N	R2-within
Manufacturing	0.022	1.2	2.3	0.058	3.2	6.0	9,428	0.61
Whole sale and retail trade	0.032	1.9	3.3	0.080	4.6	8.3	9,815	0.60
Other private services	0.017	1.0	1.7	0.038	2.1	3.9	13,443	0.61

Note: In all equations control variables lag by up to two periods.

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