IFAU – INSTITUTE FOR
LABOUR MARKET POLICY
EVALUATION

The effects of wage compression on training:
Swedish empirical evidence

Thomas Ericson

WORKING PAPER 2004:15

The Institute for Labour Market Policy Evaluation (IFAU) is a research institute under the Swedish Ministry of Industry, Employment and Communications, situated in Uppsala. IFAU's objective is to promote, support and carry out: evaluations of the effects of labour market policies, studies of the functioning of the labour market and evaluations of the labour market effects of measures within the educational system. Besides research, IFAU also works on: spreading knowledge about the activities of the institute through publications, seminars, courses, workshops and conferences; creating a library of Swedish evaluational studies; influencing the collection of data and making data easily available to researchers all over the country.

IFAU also provides funding for research projects within its areas of interest. There are two fixed dates for applications every year: April 1 and November 1. Since the researchers at IFAU are mainly economists, researchers from other disciplines are encouraged to apply for funding.

IFAU is run by a Director-General. The authority has a traditional board, consisting of a chairman, the Director-General and eight other members. The tasks of the board are, among other things, to make decisions about external grants and give its views on the activities at IFAU. A reference group including representatives for employers and employees as well as the ministries and authorities concerned is also connected to the institute.

Postal address: P.O. Box 513, 751 20 Uppsala
Visiting address: Kyrkogårdsgatan 6, Uppsala
Phone: +46 18 471 70 70
Fax: +46 18 471 70 71
ifau@ifau.uu.se
www.ifau.se

Papers published in the Working Paper Series should, according to the IFAU policy, have been discussed at seminars held at IFAU and at least one other academic forum, and have been read by one external and one internal referee. They need not, however, have undergone the standard scrutiny for publication in a scientific journal. The purpose of the Working Paper Series is to provide a factual basis for public policy and the public policy discussion.

ISSN 1651-1166

The effects of wage compression on training: Swedish empirical evidence*

by

Thomas Ericson#

November 23, 2004

Abstract

This paper investigates the relation between workers' on-the-job training activities and the degree of wage compression in their occupation. With respect to general training – as opposed to firm-specific training – human capital theory implies that the worker initiates and finances the training when there is a negative relationship. A positive relation between general training and wage compression, on the other hand, shows that the employer pays for and benefits from training. The empirical results show that the intensity of general training in Sweden *decreases* with wage compression. The paper also reveals differences between men and women.

* I thank Thomas Andrén, Dominique Anxo, Anders Björklund, Lennart Flood, Matthew Lindquist, Erik Mellander and Per Skedinger for helpful comments and suggestions. Lennart Forssén at Statistics Sweden has provided the data. I have also received comments from seminar participants at the Department of Economics in Uppsala University, Göteborg University, Stockholm University, and at The Research Institute of Industrial Economics in Stockholm.

School of Economics and Commercial Law at Göteborg University, Department of Economics, Box 640, SE-405 30 GÖTEBORG, Sweden.
E-mail: Thomas.Ericson@economics.gu.se

Table of contents

1 Introduction

During recent years, workers' acquisition of skills has obtained increasing attention among social scientists and politicians. One question considered is the following: What determines the incidence and intensity of general on-the-job training?[1] There are basically two competing theories in the economic literature: (*i*) a "supply-side approach" where the workers accept lower wages to initiate and finance general training, and (*ii*) a "demand-side approach" where the employer pays for, and benefits from, general training. The former approach relies on human-capital theory and the assumption of competitive labour markets, while the latter approach is based on human-capital theory complemented with institutional considerations and imperfectly competitive labour markets.

According to theory (*i*), a compressed wage structure with respect to workers' skills will reduce workers' incentive to invest in general training. On the other hand, according to theory (*ii*), a compressed wage structure could increase employers' incentives to finance general training. In line with this latter theory, an occupation characterized by little wage compression could produce less general training than another occupation that is characterized by a higher degree of wage compression.

A method to test these conflicting hypothesises is to study the isolated effect of wage compression on the incidence and intensity of training. This has recently been done on a cross-country level within the European Union, where it is found that increasing wage compression seems to stimulate both firm-specific and general training.[2] The result supports theory (*ii*), but it is inconsistent with theory (*i*). The present paper presents a similar test within a separate country, Sweden, which was not included in the previous studies. Using data on training from the Swedish labour force survey and combining these data with statistics on wage compressions for 146 occupations, we analyse how and to what extent the wage structure influences training.

[1] Becker (1962), (1964) introduced the central distinction between general training and specific training. The general training is useful for all other employers that would be interested in hiring the worker. Specific training, on the other hand, will only affect the worker's productivity at the present workplace.

[2] See Brunello (2002) and Bassanini & Brunello (2003)

The Swedish labour market is characterized by a high rate of union density and wages that to a large extent are based on collective agreements between trade unions and employers' organisations. This has lead to a relatively high degree of wage compression. Compressed wage structures can be found both between industry sectors and occupations as well as within occupations. This study will focus on the wage compression *within* occupations. Does wage compression within occupations reduce or stimulate on-the-job training on the Swedish labour market?

The current policy debate about how to stimulate life-long learning and workers' acquisition of skills makes it is important to understand the economic mechanisms behind training. To be able to design an appropriate policy, it is crucial to know why the present training is inefficient. Theory (*i*) claims that workers are credit constrained, and that market imperfections on the capital market are preventing workers from financing their human-capital investments by loans. The policy solution in this case would be to take steps to release workers' credit-market constraints to stimulate their incentives to finance training. Theory (*ii*), on the other hand, argues that wage rigidities and information asymmetries on the labour market create positive external effects from training. That is, competing employers will benefit as the workers move to new positions in other firms than the ones who financed the training. This results in too small investments in staff training by the employers. The policy solution in this case would be to encourage employers to organize and finance staff training through clubs of providers that are sharing the costs and benefits of training.

The objective of the present study is thus to investigate whether wage compression has a positive or a negative effect on training in Sweden. Both the incidence and the intensity of training are analysed, and we make a distinction between general and firm-specific training. In contrast to earlier studies, we find no evidence that wage compression stimulates general training.

The rest of the paper is organized as follows: Section 2 presents and discusses the theoretical background about the relation between wage compression and training. Section 3 presents the empirical strategy for testing the theoretical predictions. Section 4 reviews the data. The results are analysed in section 5. Concluding remarks follow in section 6.

2 Theory

2.1 Perfectly competitive labour markets

2.1.1 Basic framework

Let us assume a perfectly competitive labour market as our point of departure: Neither the employer nor the employee can influence the market wage. Both parties are risk neutral and have identical information about the workers marginal productivity on the workplace. There is free entry and exit of workers.

Under these assumptions, the standard model of wage setting predicts that competition on the labour market will drive the market wage, w, to equal the worker's marginal productivity, f. The equality between w and f implies that firms' profits are equal to zero.

By introducing on-the-job training into the model, the neo-classical human-capital analysis presents a theory why wages might deviate from workers' marginal productivity.[3] Training will generate investment costs originating from lower worker productivity during training because of reduced time spent in production (indirect costs). There will also be expenditures from travel, material, course fees, etc. (direct costs). Let us denote the sum of these costs $c = c(t_w, t_e)$, where t_w and t_e are the amounts of training chosen by the worker and the employer respectively, $\partial c/\partial t_i \equiv c^i > 0$, for all $t_i > 0$, $\partial^2 c/\partial t_i \partial t_j > 0$ and $\partial^2 c/\partial t_i^2 > 0$. In addition, the worker's expected future marginal productivity will be $f(t)$, where $t = t_w + t_e$, $f' > 0$, $f'' < 0$, for all $t > 0$.

There are two periods: period 1 "during training" and period 2 "after training". In period 1, the worker and the employer decide the amount of training and set wages during training. The sharing of training costs is specified in the employment contract, but the employer and the worker choose the level of training investment non-cooperatively, where both parties base their investment-decisions on their expectations about an optimal investment-decision by the other party.[4, 5] In period 2, the worker's marginal productivity

[3] See Becker (1962), (1964)

[4] The sharing agreement is pending on parties' willingness to participate in training activities. If the employer is not willing to invest in worker training, then the employment contract specifies all training costs to be carried by the worker, and vice versa. In cases where both parties want to invest in training, the contract specifies a fixed sharing agreement.

[5] The assumption about non-cooperative training investments is reasonable, when considering that these investments often are too complicated to be specified in an employment contract. If

$f(t)$ is revealed and wages are renegotiated. Furthermore, there is an exogenous probability of separation, q in period 2. For simplicity, we assume a zero discount rate between period 1 and period 2.

2.1.2 Incidence of training in perfectly competitive labour markets

Let us first look at the incentives to engage in *general* training. The worker's productivity after general training increases equally at his present and other potential workplaces. We say that the worker's marginal productivity is $f(1)$ if he has received training and $f(0)$ otherwise, where $f(1) > f(0)$ and $f(0) \equiv w$. The worker carries a share of the training costs $\gamma c(1)$, where $0 \leq \gamma \leq 1$. Consequently, the worker's total wage over the two periods will be either $w(1) = (1 - q)f(1) + qf(1) + w - \gamma c(1)$ or $w(0) = f(0) + w$. The employer's profit will be $\pi(1) = (1 - q)[f(1) - f(1)] + f(0) - w + \gamma c(1) - c(1) = -(1 - \gamma)c(1)$. The zero profit condition implies that $\gamma = 1$ and, hence, that the worker has to bear the total cost of training, obtaining the net earnings $f(1) - c(1)$. It follows that the worker will invest in general training if

$$f(1) - f(0) \geq c(1). \qquad (1)$$

Next, we assume that training is *firm-specific*. In this case, the worker's productivity after training increases only at his present workplace. As a result, both the employer and the employee are exposed to a risk: If the employment relation comes to an end, the payoff from the training investment will be lost. The employer and the employee will share this risk by sharing the training costs and the training payoff. An intuitive explanation goes as follows: Let us assume that the employer would pay the training costs. As the market wage w is not affected by training, this might seem to be a reasonable assumption. However, the worker might quit the firm after training due to unexpectedly high realized value of specific capital in an alternative employment, and the employer will lose $c(1)$. In order to induce the worker to stay in the firm, the employer will want to make a deal with the employee implying that the employee pays a share of the costs $\gamma c(1)$ and obtain a share of the revenues, say $\beta[f(1) - w]$, for $0 \leq \beta \leq 1$. On the other hand, should the worker bear all the costs and obtain all the payoffs, so that $\gamma = 1$ and $\beta = 1$, then the worker, in

investments were specified, a court of law would be unable to verify whether or not they had carried out the investments as specified by the contract.

turn, would lose $c(1)$ in the event he got laid off after training. Thus, by sharing the costs and payoffs, the probability that both parties stay in the employment relationship after training is maximized.[6]

Let β reflect the worker's bargaining power when the wage is renegotiated after training. In the case of specific training, the worker will obtain $w(1) = (1 - q)\{w + \beta[f(1) - w]\} + qw + w - \gamma c(1) = 2w + (1 - q)\beta[f(1) - w] - \gamma c(1)$. Since total earnings without training over the two periods is $w(0) = 2w$, the worker will participate in specific training if $(1 - q)\beta[f(1) - w] \geq \gamma c(1)$. The employer's profit from specific training, on the other hand, will be $\pi(1) = (1 - q)\{f(1) - w - \beta[f(1) - w]\} + f - w - (1 - \gamma)c(1)$. The participation constraints can thus be written

$$(1 - q)(1 - \beta)[f(1) - w] \geq (1 - \gamma)c(1), \qquad \text{(employer)} \qquad (2a)$$

$$(1 - q)\beta[f(1) - w] \geq \gamma c(1). \qquad \text{(worker)} \qquad (2b)$$

2.1.3 Intensity of training in perfectly competitive labour markets

Let us now analyse the chosen intensity of training. In the case of general training, only the worker has incentive to invest in general training, and has to pay the training costs by himself. A worker that satisfies the participation constraint (1) will earn $w - c(t_w, 0)$ in period 1, and $w(t_w) \equiv f(t_w)$ in period 2, where t_w is the amount of training chosen in period 1. The worker chooses the amount of general training that maximizes the present value of $(1 - q)w(t) + qw(t) + w - c(t_w, 0)$. The chosen amount of training t_w^* will satisfy the first-order condition

$$w'(t_w^*) = c^w(t_w^*, 0). \qquad (3)$$

As a consequence, t_w^* is the socially efficient amount of training, since perfectly competitive labour markets and general training ensure that $w'(t) = f'(t)$.

In the case of specific training, a worker who satisfies the participation constraint (2b) will earn $w - \gamma c(t_w, t_e)$ in period 1, while in period 2 $w(t) = w + \beta[f(t) - w]$ if he stays in the firm, and w if he leaves the firm. The worker chooses t_w to maximize $(1 - q)(w + \beta[f(t) - w]) + qw + w - \gamma c(t_w, t_e)$. On the other hand, employers who satisfy the participation constraint (2a) will choose

[6] A formal proof of this result is provided by Hashimoto (1981).

t_e that maximizes $(1-q)[f(t)-w(t)]+f-w-(1-\gamma)c(t_w, t_e)$, which, by inserting the equation for $w(t)$ becomes $(1-q)(1-\beta)[f(t)-w]-(1-\gamma)c(t_w, t_e)$. This results in the first-order conditions

$$(1-q)(1-\beta)f'(t) = (1-\gamma)c^e(t_w, t_e), \quad \text{(employer)} \quad (4a)$$
$$(1-q)\beta f'(t) = \gamma c^w(t_w, t_e). \quad \text{(worker)} \quad (4b)$$

In contrast to the case of general training in competitive labour markets (3), the worker's and the employer's incentives to invest decrease with the probability of separation in period 2. In addition, the smaller the share of the increasing productivity the worker or employer gets, the lower becomes his level of investment. In other words, the renegotiation of contracts in period 2 creates a hold-up problem, which results in inefficient investments.[7]

2.2 Imperfectly competitive labour markets

2.2.1 Wage compression

We now turn to an imperfectly competitive labour market. Here the employers cannot compete for the employees on equal terms, since various labour market imperfections will provide the present employer with some monopsony power.[8] The worker's outside options after training, say $v(t)$, will be lower than his value of marginal product at the present firm, even in the case of general training. And since the worker's wage $w(t)$ will be based on his outside options $v(t)$ there will be rents in the employment relation accruing to the employer, $f(t) - w(t) > 0$. The market imperfections also implies that the workers' wage after general training will not increase as much as their productivity at the firm, $f'(t) - w'(t) > 0$. This is what is referred to as a compressed wage structure.[9]

2.2.2 Incidence of training in imperfectly competitive labour markets

As demonstrated by Acemoglu & Pischke (1999), the presence of a compressed wage structure has strong implications for the incentives to invest in general

[7] See Malcomson (1997) for a survey on the hold-up problem in labour markets.
[8] The labour market imperfections may, for example, be a result of asymmetric information between employers about the workers' skills (see Chiang & Chiang (1990), Katz & Ziderman (1990), Chang & Wang (1996)), complementarities between specific and general skills, (see Acemoglu & Pischke (1999), Stevens (1996)) and rigid wage hierarchies within firms (Loewenstein & Spletzer (1998), Acemoglu & Pischke (1999)).
[9] See Acemoglu & Pischke (1999).

training. Let the worker's outside possibilities after general training be $v(1)$, and without training $v(0)$. The compressed wage structure implies that $f(1) - f(0) > v(1) - v(0)$, or more densely written, $\Delta f - \Delta v > 0$. The worker's marginal productivity increases faster with training than what his outside options do, which creates rents from general training for the employer. The proof in the Acemoglu & Pischke model is the following: The worker's wage in an imperfectly competitive labour market will be based on his outside options and his bargaining power vis-à-vis the employer. In case of general training, the workers expected wage in period 2 will be $w_2(1) = (1 - q)\{v(1) + \beta[f(1) - v(1)]\} + qv(1)$. If there is no general training, then the worker's expected wage in period 2 will be $w_2(0) = (1 - q)\{v(0) + \beta[f(0) - v(0)]\} + qv(0)$. The employer's profit in case of general training becomes $\pi(1) = (1 - q)[f(1) - w_2(1)] + f(0) - w - (1 - \gamma)c(1)$, which, by inserting the equation for $w_2(1)$, can be rewritten as $\pi(1) = (1 - q)(1 - \beta)[f(1) - v(1)] - (1 - \gamma)c(1)$. By the same reasoning, the employer's profit without training becomes $\pi(0) = (1 - q)(1 - \beta)[f(0) - v(0)]$. The employer will invest in general training if $\pi(1) \geq \pi(0)$, which results in

$$(1 - q)(1 - \beta)[\Delta f - \Delta v] \geq (1 - \gamma)c(1). \qquad (5a)$$

This constraint reveals that in imperfectly competitive labour markets, the employer may have incentive to pay for the worker's general training, and the probability that this happens should *increase* with wage compression.

The worker wants to participate in general training if $w(1) \geq w(0)$, which results in $v(1) - v(0) + (1 - q)\beta[f(1) - v(1)] - (1 - q)\beta[f(0) - v(0)] \geq \gamma c(1)$, or more densely written

$$\Delta f - (\Delta f - \Delta v) + (1 - q)\beta[\Delta f - \Delta v] \geq \gamma c(1). \qquad (5b)$$

It follows that for $q < 1$ and $\beta < 1$, the worker's willingness to pay for general training *decreases* with wage compression.

This model demonstrates that the result obtained for the incidence of general training in a perfectly competitive labour market, (1), is a special case where $\Delta f - \Delta v = 0$. In addition, the model shows that the incidences of firm-

specific training in a perfectly competitive labour market, (2a) and (2b), are yet other special cases where $\Delta v = 0$ and $f(0) = v(0) = w$.[10]

2.2.3 Intensity of training in imperfectly competitive labour markets

We finally analyse the intensity of general training for those workers and employers that satisfy the participation constraints (5a) and (5b) in the previous section.[11] The worker's outside options is assumed to follow the usual conditions for concavity, $v'(t) > 0$, $v''(t) < 0$. Furthermore, to obtain interior solutions it is assumed that $f'(0) > v'(0)$ and $v''(t) \geq f''(t)$. As in the previous sections, there is an exogenous probability of separation in period 2 equal to q. The worker's wage in period 2 will be set according to $w(t) = v(t) + \beta[f(t) - v(t)]$. An employer who satisfies the participation constraint (5a) will choose t_e in period 1 that maximizes $(1 - q)[f(t) - w(t)] + f - w - (1 - \gamma)c(t_w, t_e)$, which results in the first-order condition

$$(1 - q)(1 - \beta)[f'(t) - v'(t)] = (1 - \gamma)c^e(t_w, t_e). \tag{6a}$$

This condition shows that the employer's optimal investment in general training should increase with raising wage compression $f'(t) - v'(t)$. A higher probability of separation in period 2 (q) and a stronger bargaining position for the worker (β) decreases the employer's investments, while more training costs allocated to the worker (γ) increases the employer's investments.

A worker that satisfies the participation constraint (5b) will choose t_w in period 1 that maximizes $(1 - q)w(t) + qv(t) + w - \gamma c(t_w, t_e) = (1 - q)\{v(t) + \beta[f(t) - v(t)]\} + qv(t) + w - \gamma c(t_w, t_e)$. The first-order condition becomes

$$f'(t) - [f'(t) - v'(t)] + (1 - q)\beta[f'(t) - v'(t)] = \gamma c^w(t_w, t_e). \tag{6b}$$

More wage compression has a positive effect on training through the third term on the left-hand side, since the worker can bargain for a greater surplus. However, more wage compression decreases the second term, which reflects the marginal effect of training on the worker's outside options. Thus, the total

[10] Intuitively, specific training is an extreme case of monopsony and imperfect labour markets. Consequently, the participation constraint for *specific* training in imperfectly competitive labour markets coincides with (2a) and (2b).

[11] The intensity of *specific* training coincides with specific training in perfectly competitive labour markets (4a) and (4b).

effect of more wage compression should be less investment in general training by the worker. A lower probability of separation (q) and a stronger bargaining position for the worker (β) increases the worker's investments.

2.3 Summary

Competitive labour market theory suggests that the worker is the sole investor of general training. This view has been challenged by imperfectly competitive labour market theory, which puts forward that the employer benefits from general training because of wage compression. Both the probability that the employer participates in general training investments and the intensity of these investments will increase with wage compression. Increasing incidence and intensity of general training with wage compression indicate that employers are financing general training.

Should the worker bear some of the training costs through a lower wage during training, total general training investments may both increase and decrease with wage compression, since the worker's incentive to invest decreases with wage compression.

Specific training can be regarded as a special case of extreme wage compression, where training does not influence the market wage at all, so that $\Delta f - \Delta v = \Delta f$. The employer and the worker are sharing the costs and benefits of specific training, and the wage structure is dependent on the parties bargaining power after training and their share of the training costs during training.

3 Empirical strategy

The theoretical discussion in the previous section can be summarized by two propositions:

Proposition 1: The worker bears the costs of general training, because wage compression has a *negative* effect on the incidence and intensity of general training, which is greater than the corresponding effect on specific training when training costs are shared between the worker and the employer.

Proposition 2: The employer bears the costs of general training, because wage compression has a *positive* effect on the incidence and intensity of general

training, which is greater than the corresponding effect on specific training when training costs are shared between the worker and the employer.

By investigating whether wage compression has a positive or a negative effect on general training, and compare with the effect on specific training, we will be able to test whether the worker or the employer bears the costs of general training.

3.1 The incidence of training

The first step in the empirical analysis is to investigate how wage compression influences the incidence of training. When employers bear the total costs of general training ($\gamma = 0$), equation (5a) states that increasing wage compression increases the probability that training takes place. When the workers bear the total costs of general training ($\gamma = 1$), equation (5b) states that wage compression has a negative effect on the probability that training takes place. When employers and workers are sharing the costs of general training ($0 < \gamma < 1$), then wage compression has an ambiguous effect on the probability that both (5a) and (5a) are satisfied and that training takes place. In the case of specific training, by (2a) and (2b), wage compression increases the probability that training take place when employers and workers are sharing the costs of training ($0 < \gamma < 1$).[12]

To measure wage compression, $\Delta f - \Delta v$, we need to know both workers' changing productivity from participation in training, Δf, and workers' changing outside options Δv. However, such data are not available in Sweden. Only information on workers' participation in training and estimates of the training wage premium $\Delta w = w(1) - w(0)$ are presently available. Consequently, we will treat the productivity gain from training Δf as an omitted variable and draw conclusions about the relation between wage compression and training on the basis of the worker's training wage premium Δw.

As pointed out by Bassanini & Brunello (2003), individual productivities and wage premia are positively correlated. As a result, the omission of increasing individual productivity in the data should bias our estimates to find a positive relation between wage premium and training. Hence, the estimates can

[12] Note that in case of specific training the concept of wage compression is simply the worker's increasing productivity after training Δf, since $\Delta v = 0$.

be interpreted as a lower bound estimate of the positive impact of wage compression on employer sponsored training.[13]

By writing $\Delta w = (1 - q)\beta\Delta f - \gamma c(1)$ for specific training and $\Delta w = \Delta v + (1 - q)\beta[\Delta f - \Delta v] - \gamma c(1)$ for general training, and inserting Δw in (2a), (2b), (5a) and (5b), we obtain the following participation constraints:

$(1 - q)\Delta f + q\Delta v - \Delta w \geq c(1)$, (employer; general training)
$(1 - q)\Delta f - \Delta w \geq c(1)$, (employer; specific training)

$\Delta w \geq 0$. (worker)

If the worker bears the costs of training alone, then only the worker's participation constraint is satisfied, implying that Δw has a positive effect on training incidence. Conversely, if the employer bears the costs of training alone, then only the employer's participation constraint is satisfied, and Δw has a negative effect on training incidence. When the employer and the worker are sharing the costs of training, both participation constraints above have to be satisfied, which leads to an ambiguous effect of Δw on the probability that training take place. A positive relation between Δw and training incidence thus rule out the employer as the sole investor in training, while a negative relation between Δw and training incidence exclude the worker as a single financier of training.

Let us define W as a measure of the training wage premium. Next, we define a dummy variable T for individual i. Let T be equal to 1 if the individual has obtained training, and 0 otherwise. The empirical relation between W and T can be specified as

$$T_i = \alpha + X_i\beta + J_i\gamma + \delta k_i + \eta g_i + \lambda W_i + \varepsilon_i, \quad (7)$$

where X_i is a vector of individual background variables (including age, schooling, experience, tenure, etc.), J_i is a vector of occupation dummies, k_i is a gender dummy, g_i is a dummy for occupation in the public sector, and ε_i is the

[13] If Δf increases with Δw, then actual wage compression decreases less than what is indicated by the increasing Δw. As a consequence, if it is found that increasing Δw leads to increasing training incidence, then wage compression could have a less negative, or even positive, effect on training incidence.

error term. X captures individual properties that might influence quit rates (q), bargaining power (β), individual productivity (f) and training costs (c). J captures effects on the incidence of training from the various tasks and qualifications that are required in different occupations. k catches possible differences between men and women, and g captures structural differences in training in the private sector and in the public sector. Conditional on these variables, λ should reflect the isolated effects of the training wage premium on the incidence of training.

Following Brunello (2002) and Almeida-Santos & Mumford (2004), the training wage premium W is measured by wage inequality, using the log of the ratio of the 90^{th} percentile wage to the 10^{th} percentile wage [$\log(90^{th}/10^{th})$] for workers with gender k in occupation J, and in public or private sector.[14] In order to analyse the upper and lower wage distribution separately, we will also use the $90^{th}/50^{th}$-percentage wage ratios and the $50^{th}/10^{th}$-percentage wage ratios. With these specifications, a higher value of W implies more wage inequality, a higher wage premium from training, and consequently lower wage compression for the workers in the particular occupation, sector and gender. Thus, a negative estimate of λ indicates that wage compression stimulates the incidence of training.

It has been pointed out by Booth & Zoega (2004) that $\Delta f - \Delta v$ should be called *absolute* wage compression, in order to make a distinction to *relative* wage compression which is defined as $\Delta f / \Delta v$. They demonstrate that it is possible for absolute wage compression to rise without an increase in relative wage compression, while increased relative wage compression implies increased absolute wage compression. To check if this influences our results in the empirical section, we will compare our relative wage compression estimates with the estimates of absolute wage compression that are obtained by using $\log (90^{th} - 10^{th})$.

3.2 The intensity of training

In the second step of the analysis, we investigate how our chosen measure of wage compression influences the intensity of training for those workers who obtained training in (7).

[14] Brunello (2002) also distinguishes between age groups. Separation between ages, however, was not available in the data that was used in the present study.

By the theoretical model, the second-period wage is set according to $w(t) = w + \beta [f(t) - w]$ in the case of specific training, and $w(t) = v(t) + \beta[f(t) - v(t)]$ in the case of general training. Differentiating and inserting these equations in (4a), (4b), (6a) and (6b) results in the following first-order conditions for optimal investments in training in period 1:

$$(1 - q)[f'(t) - w'(t)] = (1 - \gamma)c^e(t_w, t_e) \qquad \text{(employer)}$$

$$(1 - q)w'(t) + qv'(t) = \gamma c^w(t_w, t_e) \qquad \text{(worker; general training)}$$
$$(1 - q)w'(t) = \gamma c^w(t_w, t_e) \qquad \text{(worker; specific training)}$$

These first-order conditions demonstrate that the intensity of employer-financed general training ($\gamma = 0$) increases with wage compression, and, consequently, decreases with $w'(t)$. On the other hand, the intensity of worker-financed general training ($\gamma = 1$) increases with $w'(t)$. When employers and workers are sharing the costs of general training ($0 < \gamma < 1$), then $w'(t)$ has an ambiguous effect on the intensity of general training, since $w'(t)$ has opposite effects for the employer and the worker. In the case of specific training, the employer and the worker also share the cost of training ($0 < \gamma < 1$) and the effect of $w'(t)$ on the intensity of training is ambiguous.

In the empirical model, we use our earlier measure of the wage premium, W, as an indicator on the rate of increasing wage after training $w'(t)$:

$$t_i = \alpha + X_i\beta + J_i\gamma + \delta k_i + \eta g_i + \theta G_i + \kappa S_i + (\lambda_G G_i + \lambda_B B_i + \lambda_S S_i)W_i + u_i, \qquad (8)$$

where t is a strictly positive and continuous variable, $G_i = 1$ if the worker obtained *mainly general training* and zero otherwise, $S_i = 1$ if the worker obtained *mainly specific training* and zero otherwise, and $B_i = 1$ if the worker obtained *partly general and partly specific training* and zero otherwise. This model allows us to test Proposition 1 that was formulated in the beginning of this section: If $\lambda_G > 0$ and $\lambda_G > \lambda_B > \lambda_S$, then wage compression does have a *negative* effect on general training *per se*, and Proposition 1 cannot be rejected. Similarly, it allows us to test Proposition 2: If it is found that $\lambda_G < 0$, or if $\lambda_S > \lambda_B > \lambda_G > 0$, then wage compression does have a *positive* effect on general training *per se*, and Proposition 2 cannot be rejected.

There is a potential selection problem in equation (8). The sample of individuals with positive observations on t is dependent on the selection

process in (7). That is, t is only observed when $T = 1$. It follows that equation (8) has an incidental truncation that will produce inconsistent parameter estimates.[15] It is possible that unobservable variables in ε_i, which influence the training incidence positively or negatively, also are included in u_i and influence the intensity of training. For example, unobserved worker behaviour and motivation may influence the selection process as well as the intensity of training for the workers who receive training. To test if this is a problem, the Heckman's two-step estimation procedure will be compared with the OLS estimates on (8) in the empirical section.

Furthermore, there is a potential problem with endogenous independent variables in (7) and (8). The wage inequality W might be affected by the workers' participation in training, since workers' wages should be dependent on training incidence and training intensity. As a consequence, the error terms in (7) and (8) might be correlated with W, which would produce biased estimates on λ. However, we should keep in mind that our data on workers' wage inequalities are not based on individual observations. Therefore, workers' individual participation in training cannot influence W in the same way as it might influence workers' individual wages. The theoretical model, on the other hand, predicts that workers' and employers' observation of the aggregated wage structure will affect their training decisions.

As a precautionary measure for this potential problem, the data on wage inequality will be lagged one year relative to the year of training incidence and training intensity. In that way, training cannot have a direct effect on observed wage structure. Furthermore, Appendix A tests if the lagged wage inequality is exogenous to the training intensity in (8). We assume that W_{it} is an endogenous explanatory variable in (8), and use W_{it-1} and W_{it+2} as instrumental variables for W_{it} in a 2SLS estimation. The Sargan test for overidentifying restrictions cannot reject the hypothesis that W_{it-1} is a valid instrumental variable for W_{it}, provided that W_{t+2} also is an exogenous variable.[16]

[15] See Heckman (1979)

[16] W_{t+2} is the latest observations on wage inequalities (year 2003). An alternative strategy would be to use W_{t-2} as the additional instrumental variable. However, compatible occupational data were not available for the year 1999.

4 The data

The data on training incidence and training intensity come from the 2001 Staff training supplement to the Labour force survey, which was conducted by Statistics Sweden. The Labour force survey collects a broad range of data on working conditions and individual characteristics. The supplementary training survey is conducted twice a year, consisting of a rotating panel where the sample is the same during one year and 1/3 remains in the sample during two years.[17] The sample size is around 13,000 individuals between 16 and 64 years of age who are registered to be living in Sweden and participating in the labour force. The response rate for these individuals was about 80 percent, resulting in a sample of about 10,000 individuals. The number of individuals who had a job at the time of the interview was around 7,000.

The individuals were asked the following question: "During the last 6 months, did you participate in any education, conference or seminar that was totally or partly paid by your employer/your company?"[18] Those who answered "No" on this question would get a second question: "During the last 6 months, have you participated in any course, been taught by a supervisor to do new tasks or conducted studies on your own?" Those who answered "No" on this question too were recorded as not having received any staff training. Those who answered "Yes" on this second question got a third question: "Has your employer/your company paid any part of the education (any of the courses), for example paid for work hours used for studies, course fees, travel expenses, books or technical study equipment?" Those who answered "No" on this third question would also be recorded as not having obtained any staff training. The criteria for having received staff training thus include a very broad range of training activities, both on-the-job training and off-the-job training, which are partly or totally paid by the employer. Furthermore, the questions are formulated in such a way that mostly formal training is included in the survey. The informal training, such as instructions from colleagues, is not asked for specifically. However, informal training cannot be ruled out, since workers

[17] The panel in the Labour force survey consists of 8 groups, where 1 group is substituted each quarter. The sample for the Staff training supplement consists of the first 6 groups. It follows that every year there will be 4 new groups (2/3) and 2 groups (1/3) will remain in the sample for two years.

[18] Author's translation

might have recalled the informal training they received as being formal training. In addition, some workers were conducting studies on their own, which could have been of an informal nature.

Unfortunately, there are no data on wages in the Labour force survey that can be matched with the observations on training. Instead, we use data on the wage structure from Statistical yearbook of salaries and wages 2000, published by Statistics Sweden. The statistics on wages in the public sector are based on all public employees, whereas the statistics on wages in the private sector is based on a sample of around 11,000 private firms.[19] The wage structure is reported for 71 groups of occupations in the public sector and 86 groups in the private sector.[20] The occupations are organized in a hierarchical framework, which is based on the kind of work performed and the skill and specialization that is required in the job.[21] First, the occupations are divided into 10 Major groups. Each of the ten Major groups can be divided into a number of Sub-major groups. These Sub-major groups, in turn, are split up into several Minor groups. The wage-inequality statistics for 146 Minor groups of occupations with separate measures for men and women were matched with the individuals' occupations in the Staff-training survey. The two Major groups *Armed forces* and *Skilled agricultural and fishery workers* were excluded from the sample because of too few observations. All self-employees were also excluded. The final simple size for the year 2001 used in this study is 6,376 individuals. *Table 1* shows the three measures of wage inequality – $90^{th}/10^{th}$ percentile, $90^{th}/50^{th}$ and $50^{th}/10^{th}$ – for the 8 Major groups of occupations according to the SSYK classification.

The percentage that participated in staff training during the last six months for the 8 Major groups of occupations are also presented in *Table 1*. It clearly illustrates that occupations with the highest wage inequality (*Legislators,*

[19] However, the statistics is based on *all* employees in firms with more than 500 employees, and employees in the Swedish church, which was separated from the state in 2000. Among firms with less than 10 employees, about 3 percent where included in the survey. This implies that around 50 percent of the employees in the private sector were included, but only 5 percent of all private firms and organizations.

[20] The occupations are classified according to the *Swedish Standard Classification of Occupation 1996* (SSYK 96), which is a national adaptation of the *International Standard Classification of Occupation* (ISCO-88).

[21] It should be noted that the individuals' occupation is based on the tasks he or she were carrying out at the time of data collection. Thus, the individual's occupation need not be directly related to the individual's formal education.

senior officials and managers [1], *Professionals* [2] and *Technicians* [3]) are the ones with the highest incidence of training, between 76 and 85 percent. The lowest training incidence has *Elementary occupation* [9] with 28 percent, who also has the lowest wage inequality. The other Major groups of occupations (*Clerks* [4], *Service workers and shop sales workers* [5], *Craft and related trade workers* [7], and *Plant and machine operators and assemblers* [8]) span over the mid-range between 43 and 56 percentage participation in training. The average number of days for those who received training follows a similar pattern. Occupations [1]–[3] have an average between 9 and 13 days, while the other occupations [4]–[9] have an average between 2 and 5 days. The higher incidence and intensity of training for occupations with a high wage inequality shown in the table is consistent with a negative relation between wage compression and training. However, to be able to conclude whether the relation is indeed negative, we have to isolate the effect of the wage structure on training by means of regression analysis.

Table 1. Measures of wage inequality for the year 2000 and incidence and intensity of staff training for the year 2001 for 8 Major groups of occupations

SSYK Major groups	N	Wage inequality 90/10 %	Wage inequality 50/10 %	Wage inequality 90/50 %	Partici-pation in training %	Average number of days in training (Std dev)
1. *Legislators, senior officials and managers*	241	2.368	1.455	1.607	85	12.9 (25.0)
2. *Professionals*	1,089	1.822	1.324	1.366	82	10.3 (24.5)
3. *Technicians*	1,274	1.691	1.236	1.355	76	9.2 (24.1)
4. *Clerks*	702	1.470	1.188	1.235	56	4.6 (17.0)
5. *Service workers and shop sales workers*	1,367	1.438	1.183	1.213	52	3.6 (12.2)
7. *Craft and related trade workers*	692	1.488	1.221	1.218	47	3.2 (11.2)
8. *Plant and machine operators, assemblers*	664	1.406	1.176	1.195	43	3.5 (12.3)
9. *Elementary occupations*	347	1.334	1.138	1.172	28	1.4 (7.4)
Total	6,376	1.589	1.229	1.282	61	6.14 (18.26)

Note: *Armed forces* [0] and *Skilled agricultural and fishery workers* [6] were excluded because of too few observations.

Later on in the survey, the workers who participated in training were asked: "Was the course/education mainly firm-specific or general?" There were three alternative answers: (a) "Mainly firm-specific", (b) "Mainly general", (c) "Partly firm-specific and partly general". The respondent could mention up to 5 training events. For each of these events, they could chose between alternatives a, b and c. *Table 2* shows the number of individuals that answered (a) "Mainly firm-specific" for all training events, and how many individuals that answered (b) "Mainly general" for all training events. The rest of the workers who stated different alternatives for different courses or selected (c) "Partly firm-specific and partly general" have been gathered in the third category in *Table 2*.

Table 2. Distribution of general and specific training

	N	Percentage
Mainly firm-specific	1,837	47.5
Mainly general	704	18.2
Partly firm-specific and partly general	1,324	34.3
Total	3,865	100

Almost 50 percent stated that the education was firm-specific. This is a surprisingly high share. As a comparison, Regnér (2002) finds in the Level of living survey (LNU) that only 16 percent answered "No" on the following question: "Do you know other employers where you would have good use for what you have learned in your current job?" Evertsson (2004), based on the Swedish survey of living conditions (ULF), found that during 1994 to 1998 only 5 percent answered "No" on the following question: "Can this training [the latest during three years] be used with other employers?" Obviously, the respondents in *Table 2* could have misunderstood the meaning of general training. It is possible that they thought of general education as something that was not related to their current occupation. "Mainly general" is thus a conservative measure of general training.

The differences in training incidence across other categorical variables are illustrated in *Table 3*. For all individuals, the training incidence is lower in the private sector (56 percent) than in the public sector (69 percent). A higher share of the women obtains training than men. However, this is due to the fact that around 75 percent of the women work in the public sector while only around 25 percent of the men do so; training is more common in the public sector. We

also see that people who are married or cohabitate are more likely to receive training. Among workers born outside the Nordic countries, only 44 percent receive training in the private sector and 48 percent in the public sector. Furthermore, it is quite clear that training incidence increases with the workers' level of education. Among workers with 9-year elementary schooling or less, only around 40 percent obtain training.[22] Secondary school increases the training incidence around 20 percentage points, and college and university studies raises the share another 20 percentage points to around 80 percent of the workers.

The employment contract should influence the training incidence, since an expected separation in the near future will diminish the payoff from the human-capital investment. Consequently, in the private sector the percentage training for employees with open-ended contracts is twice as high as for employees with fixed-term contracts. The difference is slightly lower in the public sector. In addition, the working hours will influence the training incidence. Full-time employees have a higher percentage of training than part-time workers. The firm size, finally, increases the incidence of training.[23] Private firms with up to 9 workers have a 35 percent incidence of training, while firms above 1000 workers have around 70 percent.[24] Descriptive statistics of all variables can be found in Appendix B.

[22] The 50 percent figure for Elementary less than 9 years in the public sector can be due to the few number of observations.
[23] See Barron, Black & Loewenstein (1987)
[24] The high share of training for smaller workplaces in the public sector can be due to the few number of observations in each cell.

Table 3. Participation in training and background characteristics, private and public sector

		Percentage participation in training (N = 6376)	**Percentage participation in training for *private sector* (N = 4095)**	**Percentage participation in training for *public sector* (N = 2348)**
All		60.6	55.6	69.3
Gender	Man	59.3	56.7	70.6
	Woman	61.8	54.0	68.8
Civil status	Single	52.3	47.6	62.0
	Married/Cohabitate	64.2	59.4	71.9
Place of birth	Sweden	61.6	56.4	70.5
	Other Nordic countries	60.9	56.7	68.6
	Outside Nordic countries	45.6	44.3	48.4
School education	Elementary less than 9 years	41.1	38.1	50.6
	Elementary 9 years	39.6	39.4	40.2
	Gymnasia maximum 2 years	58.2	54.5	64.5
	Gymnasia more than 2 years	55.6	55.9	55.0
	College	73.2	68.1	79.4
	University	82.0	75.6	86.4
	Doctoral	81.1	94.1	75.0
Employment contract	Open ended	65.4	60.1	75.0
	Fixed term	36.3	30.7	44.3
Hours of work	Full time	64.9	59.7	75.8
	Part time (20–34 hours per week)	53.1	46.8	58.3
	Part time (1–19 hours per week)	23.5	17.5	37.0
Firm size	–9	36.3	36.1	66.7
	10–49	48.4	47.8	75.0
	50–99	53.0	51.9	67.6
	100–249	57.4	56.1	74.4
	250–499	63.2	61.5	78.4
	500–999	65.8	67.3	63.0
	1000–	69.0	68.2	69.3

5 The results

5.1 The incidence of training

The first step in the empirical analysis is to estimate the following *Probit* model

$$Prob[T_i = 1] = \Phi[\alpha + X_i\beta + J_i\gamma + \delta k_i + \eta g_i + \lambda W_i], \quad (9)$$

where Φ is the normal distribution function for the unobservable effects that are assumed to be captured by ε_i in model (7).

The dependent variable T equals one if the individual has reported any training during the last six months, and zero otherwise. The independent variables in X include Personal characteristics: the worker's age, a dummy variable for being married or cohabitating, and dummy variables for individuals that were born in other Nordic countries than Sweden and for those who were born outside the Nordic countries. The workers' Education is captured by four dummy variables: Secondary school (Gymnasium) for a maximum of 2 years, secondary school for more than 2 years, university studies for less than three years, and university for 3 years or more The omitted reference category is elementary schooling for 9 years or less. The effects of the individuals' Employment conditions are captured by the number of years at the present employer/firm (tenure), number of years with the present tasks (experience), a dummy variable for temporary employment, and a dummy variable for part-time. There are five dummy variables for the firm size. The omitted reference variable is firm size with 1,000 employees or more. Furthermore, there are 7 dummy variables J for the eight Major groups of occupations; the omitted reference variable is [9] Elementary occupations, and a dummy variable k for gender, which is equal to one for women. A dummy variable equal to one for occupation in the public sector allow different effects across sectors of wage compression on the incidence of training. Finally, the independent variables for wage inequality W is captured by the logarithms of the $90^{th}/10^{th}$-percentage wage ratio, the $90^{th}/50^{th}$-percentage wage ratio and the $50^{th}/10^{th}$-percentage wage ratio. *Table 4* reports the estimated marginal effects on the probability to obtain training for all workers, as well as separate estimates for men and women in the private and public sector.

Table 4. Probit estimates of training probabilities, marginal effects. Robust standard errors and correction for dependent observations within clusters of wage inequality

	(1) All	(2) Private Men	(3) Private Women	(4) Public Men	(5) Public Women
Personal characteristics					
Age	.013**	.003	.022***	.020	.020***
Age^2	.000	.000	.000	.000	.000
Married/Cohabitate	.023	.041	.027	.008	.031
Birth other Nordic countries	-.015	-.022	.061	.075	-.078
Birth outside Nordic countries	-.129***	-.146***	-.033	-.155**	-.160***
Education					
Elementary	*Reference*				
Gymnasia max 2 years	.049**	.047	.033	-.070	.079**
Gymnasia more than 2 years	.047**	.022	.075*	-.051	.070**
College	.094***	.094**	.057	-.007	.131***
University	.115***	.089*	.045	-.024	.203***
Employment conditions					
Tenure	.009***	.013***	.011*	.012	.002
Tenure^2	.000	.000	.000	.000	.000
Experience	-.014***	-.011**	-.024***	-.009	-.012***
Experience^2	.000	.000	.001***	.000	.000
Fixed term	-.216***	-.240***	-.145***	-.230**	-.198***
Part time	-.108***	-.150***	-.061**	-.231***	-.104***
Firm size					
- 9	-.223***	-.235***	-.231***	-.158	-
10 – 49	-.128***	-.135***	-.143***	.022	-.043
50 – 99	-.117***	-.063*	-.208***	-.097	-.074
100 – 499	-.088***	-.087***	-.096***	-.145	-.012
500 – 999	-.020	-.013	-.005	-.068	-.060
1000 -	*Reference*				
Occupation					
Legislator, manager etc.	.310***	.197**	.408***	.259***	.260***
Professionals	.322***	.221**	.391***	.408***	.280***
Technicians	.309***	.212**	.359***	.266***	.305***
Clerks	.199***	.080	.225***	.165	.225***
Service workers	.187***	.134	.194***	.236***	.243***
Craft and trade	.151***	.092	.141	.139*	-
Plant operators, assemblers etc.	.115**	.074	.063	.099	-
Elementary occupations	*Reference*				
Gender					
Woman	.018	-	-	-	-
Sector					
Public sector	.033	-	-	-	-

Table 4. (Cont.)

Wage inequality					
Log (90 / 10) %	.049	.314***	-.131	.010	-.035
Log (90 / 50) %	.032	.149*	-.221	-.045	-.256
Log (50 / 10) %	.012	.418	-.102	.012	-.054
Number of cases	6,376	2,464	1,576	568	1,764
Log pseudo-likelihood	-3627.366	-1444.172	-936.335	-227.089	-910.598
Pseudo R2	.151	.143	.139	.195	.1681

* significant at 10 % level; ** significant at 5 % level; *** significant at 1 % level.

Note: (i) Marginal effects on the probability to receive training are computed by evaluating the estimated marginal effect at every observation and then using the sample average of the individual effects. The effects of the dummy variables are calculated as the difference in probability to receive training.

(ii) The estimates on Log (90 / 50) % and Log (50 / 10) % are based on separate Probit regressions, whose estimated marginal effects for the other explanatory variables are not reported in the table.

(iii) Robust standard errors and adjusted for clustering on Log (90 / 10) %.

Looking at the Personal characteristics, the worker's age has a positive and significant effect on the incidence of training for women, while the effect on men is not significant.[25] For women, one additional year increases the probability of receiving training by 0.02. Being married or cohabitating has a positive but insignificant effect for both men and women.[26] Workers who were born in the other Nordic countries besides Sweden do not seem to have significantly lower probability of obtaining training. For workers born outside the Nordic countries, however, the effect is negative and statistically significant, except for women in the private sector.[27] The negative effect is about the same for men as for women (0.15–0.16 lower probability than Swedish born). When it comes to Education, women with secondary schooling who work in the public sector have around 0.08 higher probability to receive training than the reference category elementary schooling, while the effects are insignificant for men. A shorter period of university studies (College) and university studies for at least 3 years (University) increases the probability of

[25] Workers' age usually has a negative impact on the probability to receive training in other studies, see e.g. Booth (1991) and Barron, Berger & Black (1997) pp. 68–81. In Sweden, Orrje (2003) has found that the probability of receiving training increases with age until a maximum point at age 39, and then the probability decreases. Her study is however based on other data (The Level of living survey) than what is used in this study.

[26] Marriage is found to increase the probability of receiving training in other studies, see e.g. Lynch (1992).

[27] Foreign ethnicity is found to decrease the probability of receiving training in other studies as well, see e.g. Booth (1991), Lynch (1992) and Veum (1993).

obtaining training with 0.09 for men in the private sector, while the effects 0.13 and 0.20, respectively, for women in the public sector. Thus, the effect of longer university studies on training is much larger for public-sector women than for men in the private sector. The employment conditions show that tenure has a positive and significant effect in the private sector (0.01 higher probability per year of experience).[28] Experience has a negative effect, as expected, for both men and women (about 0.01 lower probability per year of experience). Workers with temporary employment are less likely to obtain training (about – 0.2) than permanent employees. Part-time workers have a lower probability of obtaining training than full-time employees (about – 0.2 for men and about – 0.1 for women). The firm size has a significant effect on the incidence of training. Workers in larger private firms have a higher probability of obtaining training. Workers in private firms with less than 10 employees have about 0.2 lower probability to receiving training than workers in firms with 1000 employees or more. The workers occupation is shown to have a significant effect on training in most cases. The results clearly show that *Legislators, senior officials and managers*, *Professionals*, and *Technicians* have between 0.20 and 0.40 higher probability of obtaining training than the reference category *Elementary occupations*. *Clerks* and *Service workers* have 0.15 to 0.20 higher probability of receiving training, although the effects are less significant for men. *Craft and related trade workers* and *Plant and machine operators and assemblers* have 0.10–0.15 higher probability of receiving training in comparison with workers in *Elementary occupations*. The estimates in *Table 4* also show that there is no isolated gender effect and no isolated public-sector effect on the probability of receiving training.

The isolated effects of wage inequality on the training incidence are illustrated by the three final variables. For $90^{th}/10^{th}$ percentage wage ratio, higher wage inequality has a positive and significant effect on the 1-percent level for men in the private sector, while the effect is negative but not statistically significant for women in neither the private sector, nor in the public sector. This indicates that *increasing* wage compression has a *negative* effect on training for men in the private sector, but no statistically significant effect for women in the private sector and on all workers in the public sector. When

[28] Tenure is often found to decrease the probability of training in other studies. The fact that both age and tenure increases the probability of training in Sweden could be explained by a more common practise to use training as a tax-deductible benefit.

dividing the measure of wage inequality into the two variables for the $90^{th}/50^{th}$-percentage wage ratio and the $50^{th}/10^{th}$-percentage wage ratio, we see that the positive effect of wage inequality for men in the private sector increases for the $50^{th}/10^{th}$-ratio, but becomes statistically insignificant. The effect is smaller but still significant for the $90^{th}/50^{th}$-percentage ratio. For women, there are negative but not significant effects of wage inequality on the incidence of training for both the upper part as well as the lower part of the wage distribution, in both the private and the public sector.

These results do not change significantly when we use the alternative measure of wage absolute compression: log ($90^{th} - 10^{th}$), log ($90^{th} - 50^{th}$) and log ($50^{th} - 10^{th}$).

In summary, the results in *Table 4* indicate that wage inequality has a statistically significant *positive* effect on training incidence for men in the private sector. The effects for women and for men in the public sector, on the other hand, are not statistically significant. This leads to the conclusion that wage compression has a *negative* effect on the incidence of training for men in the private sector, which rule out the employer as the sole investor in training. However, we cannot find any significant effects of wage compression on the training incidence for women and for men in the public sector.

5.2 The intensity of training

The second part of the empirical analysis investigates the dependency between the number of days the workers obtained training, t, and the degree of wage inequality W in their occupations. From model (8) we have:

$$ln\ t_i = \alpha + X_i\beta + J_i\gamma + \delta k_i + \eta g_i + \theta G_i + \kappa S_i + (\lambda_G G_i + \lambda_B B_i + \lambda_S S_i)W_i + u_i, \quad (10)$$

The dependent variable and the continuous independent variables (*age*, *tenure*, *experience*) are transformed into logarithms in order to decrease the impact of extreme values and to obtain estimated elasticities. To control for potential selection problems, equation (9) was used as a selection equation in Heckman's two-stop estimation procedure. Personal characteristics (*age*, *civil status*, *place of birth*) in X were used as identifying variables that only affected the probability to receive training but not the number of days in training.[29]

[29] When these variables were included in the OLS regression, they had no significant effect on the number of days in training.

However, the estimated parameters did not significantly deviate from the parameters obtained by OLS.

Table 5 reports the estimated percentage changes in number of days in training for the OLS model.[30] The estimated percentage impact from higher education than *Elementary* is 16 percent for *Gymnasia max 2 years* (usually vocational schooling).[31] The corresponding figures for *Gymnasia more than 2 years*, *College* and *University* are 13 percent, 22 percent and 27 percent, respectively. University education does not have significant effects for men and women in the private sector (column 2 and 3), but in the public sector the duration increases by around 75 percent. Shorter university studies (*College*), however, does have a significant effect for men in the private sector (27 percent).

Tenure only seems to have a significant effect for women in the public sector. A 10 percent increase in tenure increases the duration of training by about 1.7 percent. *Experience*, on the other hand, has a statistically significant and negative effect in the private sector (10 percent longer experience decreases training duration by 1.8 percent for men and 1.4 for women), while the effect is smaller or statistically insignificant in the public sector. *Fixed term employment* decreases training duration in the private sector by around 32 percent for both men and women. *Part-time employment* has a larger effect on men than women in the private sector: 35 percent shorter duration for men while 11 percent for women. In the public sector, part-time decreases training duration for women by 29 percent while the effect is statistically insignificant for men.

Work places with fewer employees than 500 have statistically shorter training duration in the private sector. The figures vary between 7 and 35 percent shorter duration than for workers in firms with more than 1000 employees. The group of occupation, finally, has statistically significant effects in the private sector mainly. Occupations that require higher qualifications (*Legislator, manager etc*., *Professionals*, *Technicians*) have between 50 and 120 percent longer training duration than *Elementary occupations*.

We now test whether or not the data is consistent with the hypothesis that follows from Proposition 1:

[30] The Heckit estimates can be obtained upon request.

[31] The percentage impact of a dummy variable on t is calculated as $e^{\beta} - 1$, where β is the estimated parameter. See Halvorsen & Palmquist (1980) and Kennedy (1981).

H_0: $\lambda_G > 0$ and $\lambda_G > \lambda_B > \lambda_S$,

and the hypothesis that follows from Proposition 2:

H_0: $\lambda_G < 0$, or $\lambda_S > \lambda_B > \lambda_G > 0$.

In column (1), workers who have received "mainly general" training have around 65 percent shorter duration than workers whose training was "partly firm-specific and partly general". However, it is possible that workers who had longer spells of training and/or more frequent training should more often encounter both firm-specific and general training. The variables *Gen*Log 90 / 10 %*, *Both*Log 90 / 10 %* and *Spec*Log 90 / 10 %* produce estimates of λ_G, λ_B and λ_S respectively. These estimates indicate that $\lambda_G > \lambda_B > \lambda_S$ in columns (1)–(4), which suggests that Proposition 1 cannot be rejected for any group, except for women in the public sector. However, the confidence intervals of the estimates intersect, which increases the probability of incorrectly accepting a false null hypothesis (Type II Error). *Table 6* shows the probabilities that pairs of λ_G, λ_B, and λ_S are equal.

With respect to the log ($90^{th}/10^{th}$) measure of wage inequality, *Table 6* reveals that λ_G is significantly different from zero and larger than λ_B for men in the private sector. For women in the private sector, on the other hand, λ_G is significantly different from zero and larger than λ_S. These results indicate that wage compression has a negative effect on the intensity of general training in the private sector. Moving on the public sector, we notice that both λ_G and λ_B are significantly greater than zero and greater than λ_S for men, while for women λ_G and λ_B are not significantly different from zero but λ_G is significantly greater than λ_B and λ_S. This indicates that wage compression still has a negative effect on the intensity of general training for men in the public sector, while the effect is statistically insignificant for women in the public sector.

When splitting up the wage distribution between log ($90^{th}/50^{th}$) and log ($50^{th}/10^{th}$), we find that for log ($50^{th}/10^{th}$) the estimate of λ_G for men is significantly different from zero and greater than λ_S in the private sector. This suggests that wage compression in the *lower* part of the wage distribution has a negative effect on the intensity of general training for privately employed men. For women in the private sector, on the other hand, there are no statistically

significant effects of wage compression, which indicates that the support for Proposition 1 is weaker for women than for men.

For men in the public sector, λ_B for log ($90^{th}/50^{th}$) is significantly different from zero and greater than λ_S, which implies that wage compression in the *upper* part of the wage distribution has a negative effect on the intensity of general training. For women in the public sector, there are still no significant effects on the intensity of general training. For log ($50^{th}/10^{th}$), we notice that λ_S is statistically significant and negative, which implies that wage compression has a positive effect on specific training. This finding, however, is consistent with both Proposition 1 and 2.

Table 5. OLS estimates on log of number of days in training. Robust standard errors and corection for dependent observations within clusters of wage inequality

	(1) All	(2) Private Sector Men	(3) Private Sector Women	(4) Public Sector Men	(5) Public Sector Women
Constant	1.362***	1.476***	1.206***	1.241***	1.272***
Education					
Elementary	*Reference*				
Gymnasia max 2 years	.151***	.141	.038	.310	.353***
Gymnasia more than 2 years	.122*	.045	-.041	.497	.429***
College	.197***	.240**	-.171	.562	.484***
University	.237***	.031	.100	.564**	.561***
Employment conditions					
Log Tenure	.091***	.067	.044	.005	.169***
Log Experience	-.136***	-.183***	-.135**	-.091	-.078***
Fixed term	-.195***	-.376***	-.399***	-.025	-.028
Part time	-.297***	-.427***	-.116*	-.201	-.347***
Firm size					
- 9	-.137	-.069***	-.424***	-.253	-
10 – 49	-.150	-.243***	-.209*	-.453	.225
50 – 99	-.116	-.226**	-.256*	.118	.862
100 – 499	-.193***	-.185***	-.357***	-.098	-.164
500 – 999	-.057	-.176	-.119	.061	.018
1000 -	*Reference*				
Occupation					
Legislator, manager etc.	.610***	.636**	.738***	-.565	.708***
Professionals	.456***	.523***	.627***	-.292	.274
Technicians	.442***	.401***	.789***	.020	.153
Clerks	.180	.231	.289	-.324	.164
Service workers	.080	.306**	.415**	-.172	-.197
Craft and trade	.118	.205	.497*	-.282	.420***
Plant operators, assemblers etc.	.166	.292*	.317	-.971***	-
Elementary occupations	*Reference*				
Gender					
Woman	.-.035	-	-	-	-
Sector					
Public sector	.065	-	-	-	-
Training type					
General	-1.032***	-1.234***	-.858**	-1.107***	-1.113***
Specific	-.392***	-.436*	-.102	.193	-.535**

Table 5. (Cont.)

Wage compression					
Gen*Log (90 / 10) %	.937***	1.302***	1.029*	2.045**	.757
Both*Log (90 / 10) %	.184	.233	.638	1.295**	-.494
Spec*Log (90 / 10) %	-.078	.089	-.282	.092	-.444
Gen*Log (90 / 50) %	.416	.306	1.094	2.748	.544
Both*Log (90 / 50) %	.128	-.298	-.021	3.214***	-.396
Spec*Log (90 / 50) %	-.244	.158	-.263	-1.189	.023
Gen*Log (50 / 10) %	1.352***	2.362***	1.174	1.265	.934
Both*Log (50 / 10) %	.070	.852	1.942	-.289	-.616
Spec*Log (50 / 10) %	-.099	-.181	.296	.249	-1.017***
Number of cases	3,865	1,396	851	401	1,217
R^2	.152	.167	.196	.141	.181

* significant at 10 % level; ** significant at 5 % level; *** significant at 1 % level.

Note: The estimates on Log 90 / 50 % and Log 50 / 10 % origin from separate OLS regressions, whose estimated parameters for the other explanatory variables are not reported in the table.

Table 6. Summary of the results in Table 5

Sector	Gender	Wage inequality	Parameter estimates	Effects on general training	Probability that $\lambda_G = \lambda_B$, $\lambda_G = \lambda_S$, $\lambda_B = \lambda_S$		
All		90 / 10 %	λ_G* > λ_B > λ_S	Negative	.001	.000	.223
		90 / 50 %	λ_G > λ_B > λ_S	?	.515	.128	.416
		50 / 10 %	λ_G* > λ_B > λ_S	Negative	.020	.006	.622
Private sector	Men	90 / 10 %	λ_G* > λ_B > λ_S	Negative	.008	.001	.703
		90 / 50 %	λ_G > λ_S > λ_B	?	.445	.855	.701
		50 / 10 %	λ_G* > λ_B > λ_S	Negative	.224	.038	.522
	Women	90 / 10 %	λ_G* > λ_B > λ_S	Negative	.560	.024	.111
		90 / 50 %	λ_G > λ_B > λ_S	?	.553	.371	.841
		50 / 10 %	λ_B > λ_G > λ_S	?	.798	.697	.390
Public sector	Men	90 / 10 %	λ_G* > λ_B* > λ_S	Negative	.378	.050	.070
		90 / 50 %	λ_B* > λ_G > λ_S	Negative	.855	.145	.002
		50 / 10 %	λ_G > λ_S > λ_B	?	.370	.539	.028
	Women	90 / 10 %	λ_G > λ_S > λ_B	?	.029	.057	.949
		90 / 50 %	λ_G > λ_S > λ_B	?	.483	.761	.809
		50 / 10 %	λ_G > λ_B > λ_S*	?	.298	.152	.747

* = Estimates on λ reported to be statistically different from zero at 10 % level.

6 Concluding remarks

Based on data from the Swedish Labour force survey 2001 and statistics on wage inequality in the year 2000, this paper has found that both the incidence and the intensity of training in most cases are negatively related to the degree of wage compression. This result supports the supply-side approach to on-the-job training, where the worker pays for and receives the payoff from general training.

This result is in contrast to two recent studies that have found a positive relation between wage compression and training. Bassanini & Brunello (2003) use cross-country data within the European Union and measure wage compression as the differential between the median wage growth of trained and untrained employees. They find a negative correlation between this variable and incidence of general training. Almeida-Santos & Mumford (2004) use linked data for workplaces and employees in Britain, and use the same measure of wage compression as in this paper. They find that wage compression is positively related to both training incidence and training duration. In contrast to these studies, the present study cannot find any positive relation between wage compression and training.

The fact that the distinction between general and specific training differs in the three studies might partially explain the different results. Bassanini & Brunello approximate general training as off-site training while specific training is defined as training at the workplace. Almeida-Santos & Mumford do not distinguish between general and specific training at all, while the present study use a direct question whether training was "mainly general" or "mainly firm-specific".

In addition to the problem of defining general training, there might be difficulties associated with the measurement of general training. The reported share of general training in total training is much smaller in the data set used in the present study than in other Swedish data sets. If general training is underestimated in this study *and* the degree of underestimation is positively related to the degree of wage compression, this will bias the results towards a negative relation between wage compression and training.

With respect to the intensity of training, a third explanation for the difference in results between this and the abovementioned previous studies might be that the measured durations of training are shorter in this study than in many other European countries. For short training spells the effect on employee

productivity might be small. As a result, the link between the wage structure and the training might be quite weak. The lack of significant effects for women in the public sector found in this study is consistent with this explanation.

This paper demonstrates that wage compression has different effects on training in the private sector and the public sector, as well as for men and for women. In particular, the effect of wage compression on general training seems to be stronger for men than for women, and training for men in the private sector is affected by the compression in the lower part of wage distribution ($50^{th}/10^{th}$ percentile) while male training in the public sector is influenced by the upper wage distribution ($90^{th}/50^{th}$ percentile).

These results indicate that there are different mechanisms behind the prevalence of on-the-job training in Sweden. Accordingly, policy measures that are appropriate for, e.g., men in the private sector might not be beneficial in the public sector. How a policy system should be designed in order to meet the diverse conditions for training on the labour market is an important topic for future research.

References

Acemoglu, Daron & Jörn-Steffen Pischke (1999) "The Structure of Wages and Investment in General Training" *Journal of Political Economy*, vol 107:3, p 539-72.

Almeida-Santos, Filipe & Karen Mumford (2004) "Employee Training and Wage Compression in Britain" *Discussion Papers in Economics No 2004/11*, The University of York.

Barron, John M., Mark C. Berger & Dan A. Black (1997) *On-the-job training*, Kalamazo: W. E. Upjohn Institute for Employment Research.

Barron, John M., Dan A. Black & Mark A. Loewenstein (1987) "Employer Size: The Implications for Search, Training, Capital Investment, Starting Wages, and Wage Growth" *Journal of Labor Economics*, vol 5:1, p 76-89.

Bassanini, Andrea & Giorgio Brunello (2003) "Is Training More Frequent When Wage Compression is Higher? Evidence from European Community Household Panel" *IZA Discussion Paper No. 839*.

Becker, Gary S (1962) "Investment in Human Capital: A Theoretical Analysis" *Journal of Political Economy*, vol 70, p 9-49.

Becker, Gary S (1964) *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*, University of Chicago Press.

Booth, Alison L (1991) "Job-related formal training: who receives it and what is it worth?" *Oxford Bulletin of Economics and Statistics*, vol 53, p 281-94.

Booth, Alison L. & Gylfi Zoega (2004) "Is wage compression a necessary condition for firm-financed general training?" *Oxford Economic Papers*, vol 56, p 88-97.

Brunello, Giorgio (2002) "Is Training More Frequent when Wage Compression is Higher? Evidence from 11 European Countries" *Fondazione Eni Enrico Mattei*: Milano.

Chang, Chun & Yijiang Wang (1996) "Human Capital Investment under Asymmetric Information: The Pigovian Conjecture Revisited." *Journal of Labor Economics*, vol 14, p 505-19.

Chiang, Shih-Chen & Shin-Hwan Chiang (1990) "Sharing the Cost of Investment in General Training" *Australian Economic Papers*, vol 29, p 266-72.

Evertsson, Marie (2004) "Formal On-the-Job Training: A Gender-Typed Experience and Wage-Related Advantage?" *European Sociological Review*, vol 20:1, p 79-94.

Halvorsen, Robert & Raymond Palmquist (1980) "The Interpretation of Dummy Variables in Semilogarithmic Equations" *American Economic Review*, vol 70:3, p 474 - 75.
Hashimoto, Masanori (1981) "Firm-Specific Human Capital as a Shared Investment" *American Economic Review*, vol 71:3, p 475-82.
Heckman, James J (1979) "Sample Selection Bias as a Specification Error" *Econometrica*, vol 47:1, p 153-61.
Katz, Eliakim & Adrian Ziderman (1990) "Investment in General Training: The Role of Information and Labour Mobility" *Economic Journal*, vol 100, p 1147 - 58.
Kennedy, Peter E (1981) "Estimation with Correctly Interpreted Dummy Variables in Semilogarithmic Equations" *American Economic Review*, vol 71:4, p 801.
Loewenstein, Mark A. & James R. Spletzer (1998) "Dividing the Costs and Return to General Training" *Journal of Labor Economics*, vol 16:1, p 142-71.
Lynch, Lisa M. (1992) "Private sector training and the earnings of young workers" *American Economics Review*, vol 82, pp. 299-312.
Malcomson, James M. (1997) "Contracts, Hold-Up, and Labor Markets." *Journal of Economics Literature*, vol 35, p 1916 - 57.
Orrje, Helena (2003) "The Incidence of On-the-Job Training, An Empirical Study using Swedish Data" *Swedish Institute for Social Research, Stockholm University*.
Regnér, Håkan (2002) "The effects of on-the-job training on wages in Sweden" *International Journal of Manpower*, vol 23:4, p 326-44.
Stevens, Margaret (1996) "Transferable training and poaching externalities," in *Acquiring Skills: Market Failures, their Symptoms and Policy Responses*. Alison L. Booth and Dennis J. Snower eds: Cambridge University Press, p 19-40.
Veum, Jonathan R. (1993) "Training among Young Adults: Who, What Kind, and for How Long?" *Monthly Labor Review*, vol 116:8, p 27-32.

Appendix A

Testing the assumption of exogenous W in equation (8)

The empirical model of training intensity (8) is reformulated as

$$t_{it} = \alpha + X_{it}\beta + J_{it}\gamma + \delta k_{it} + \eta g_{it} + \lambda W_{it} + u_{it}, \qquad \text{(A1)}$$

where the sub-index t stands for observation made at year 2001, and where the dummy variables for general and specific training in (8) have been left out. We suspect that W_{it} is an endogenous explanatory variable, and thus correlated with u_{it}. Therefore we need an instrumental variable, which is correlated with W_{it} but uncorrelated with the error term u_{it}. Wage inequality from year 2000, W_{it-1}, is found to be highly correlated with W_{it}. Hence we want to test if W_{it-1} is uncorrelated with u_{it}. If this is the case, then we conclude that W_{it-1} is an exogenous explanatory variable that can be used directly in (8).

Introducing an additional instrumental variable, W_{it+2} (wage inequality from year 2003), allow us to estimate the structural model (A1) by 2SLS with W_{it+2} as the only instrumental variable and obtain estimates on u_{it}. It is then possible to check if W_{it-1} is uncorrelated with the estimated error term, by regressing $\hat{u}_{it}$ on all exogenous variables. The null hypothesis that both instrumental variables are uncorrelated with u_{it} cannot be rejected if the obtained Sargan static (*number of observations*) $\times R^2$ is smaller than the 5 % critical value in the Chi-square distribution with as many degrees of freedom as there are overidentifying restrictions.

This test resulted in $nR^2 = 3.0712$, which is smaller than the 5 % critical value in the Chi-square distribution with one degree of freedom, 3.84. Thus, the null hypothesis that W_{it-1} and W_{it+2} are uncorrelated with u_{it} could not be rejected.

Appendix B

Descriptive statics

		Mean Total (N = 6376)	Mean Private sector (N = 4040)	Mean Public sector (N = 2336)
Training participation		.61	.56	.69
Gender	Man	.48	.61	.24
	Woman	.52	.39	.76
Civil status	Single	.30	.32	.27
	Married/Cohabitate	.70	.68	.73
Place of birth	Sweden	.91	.90	.92
	Other Nordic countries	.03	.03	.03
	Outside Nordic countries	.06	.07	.05
School education	Elementary max 9 years	.17	.21	.11
	Gymnasia maximum 2 years	.31	.31	.31
	Gymnasia more than 2 years	.20	.24	.13
	College	.15	.13	.18
	University	.16	.10	.26
Employment contract	Open ended	.84	.85	.81
	Fixed term	.16	.15	.19
Hours of work	Full time	.76	.81	.68
	Part time	.24	.19	.32
Firm size	– 9	.07	.11	.00
	10 – 49	.17	.25	.01
	50 – 99	.07	.11	.01
	100 – 499	.15	.21	.03
	500 – 999	.07	.08	.07
	1000 –	.47	.24	.87
Class of occupation	Legislator, managers etc.	.04	.04	.03
	Professionals	.17	.12	.26
	Technicians	.20	.20	.21
	Clerks	.11	.14	.06
	Service workers	.21	.13	.37
	Craft and trade	.11	.16	.02
	Plant operators, assemblers etc.	.10	.16	.01
	Elementary occupations	.05	.06	.05

Descriptive statics (cont.)

Training duration	(Days)	6.14	4.94	8.23
		(18.26)	(15.06)	(22.60)
Age	(Years)	40.32	38.75	43.04
		(12.57)	(12.61)	(12.04)
Tenure	(Years)	9.68	8.46	11.79
		(10.31)	(9.99)	(10.51)
Experience	(Years)	6.64	5.90	7.91
		(8.08)	(7.75)	(8.47)

Publication series published by the Institute for Labour Market Policy Evaluation (IFAU) – latest issues

Rapporter/Reports

2004:1 Björklund Anders, Per-Anders Edin, Peter Fredriksson & Alan Krueger "Education, equality, and efficiency – An analysis of Swedish school reforms during the 1990s"

2004:2 Lindell Mats "Erfarenheter av utbildningsreformen Kvalificerad yrkesutbildning: ett arbetsmarknadsperspektiv"

2004:3 Eriksson Stefan & Jonas Lagerström "Väljer företag bort arbetslösa jobbsökande?

2004:4 Forslund Anders, Daniela Fröberg & Linus Lindqvist "The Swedish activity guarantee"

2004:5 Franzén Elsie C & Lennart Johansson "Föreställningar om praktik som åtgärd för invandrares integration och socialisation i arbetslivet"

2004:6 Lindqvist Linus "Deltagare och arbetsgivare i friårsförsöket"

2004:7 Larsson Laura "Samspel mellan arbetslöshets- och sjukförsäkringen"

2004:8 Ericson Thomas "Personalutbildning: en teoretisk och empirisk översikt"

2004:9 Calmfors Lars & Katarina Richardson "Marknadskrafterna och lönebildningen i landsting och regioner"

2004:10 Dahlberg Matz & Eva Mörk "Kommunanställda byråkraters dubbla roll"

2004:11 Mellander Erik, Gudmundur Gunnarsson & Eleni Savvidou "Effekter av IT i svensk industri"

2004:12 Runeson Caroline "Arbetsmarknadspolitisk översikt 2003"

2004:13 Nordström Skans Oskar "Har ungdomsarbetslöshet långsiktiga effekter?"

Working Papers

2004:1 Frölich Markus, Michael Lechner & Heidi Steiger "Statistically assisted programme selection – International experiences and potential benefits for Switzerland"

2004:2 Eriksson Stefan & Jonas Lagerström "Competition between employed and unemployed job applicants: Swedish evidence"

2004:3 Forslund Anders & Thomas Lindh "Decentralisation of bargaining and manufacturing employment: Sweden 1970–96"

2004:4 Kolm Ann-Sofie & Birthe Larsen "Does tax evasion affect unemployment and educational choice?

2004:5 Schröder Lena "The role of youth programmes in the transition from school to work"

2004:6 Nilsson Anna "Income inequality and crime: The case of Sweden"

2004:7 Larsson Laura & Oskar Nordström Skans "Early indication of program performance: The case of a Swedish temporary employment program"

2004:8 Larsson Laura "Harmonizing unemployment and sickness insurance: Why (not)?"

2004:9 Cantoni Eva & Xavier de Luna "Non-parametric adjustment for covariates when estimating a treatment effect"

2004:10 Johansson Per & Mårten Palme "Moral hazard and sickness insurance: Empirical evidence from a sickness insurance reform in Sweden"

2004:11 Dahlberg Matz & Eva Mörk "Public employment and the double role of bureaucrats"

2004:12 van den Berg Gerard J, Maarten Lindeboom & Peter J Dolton "Survey non-response and unemployment duration"

2004:13 Gunnarsson Gudmundur, Erik Mellander & Eleni Savvidou "Human capital is the key to the IT productivity paradox"

2004:14 Nordström Skans Oskar "Scarring effects of the first labour market experience: A sibling based analysis"

2004:15 Ericson Thomas "The effects of wage compression on training: Swedish empirical evidence"

Dissertation Series

2002:1 Larsson Laura "Evaluating social programs: active labor market policies and social insurance"

2002:2 Nordström Skans Oskar "Labour market effects of working time reductions and demographic changes"

2002:3 Sianesi Barbara "Essays on the evaluation of social programmes and educational qualifications"

2002:4 Eriksson Stefan "The persistence of unemployment: Does competition between employed and unemployed job applicants matter?"

2003:1 Andersson Fredrik "Causes and labor market consequences of producer heterogeneity"

2003:2 Ekström Erika "Essays on inequality and education"