DISCUSSION PAPER SERIES

IZA DP No. 312

The Value of Pain Relief

Carina Furnée
Marius Kemler
Gerard A. Pfann

June 2001

Forschungsinstitut
zur Zukunft der Arbeit
Institute for the Study
of Labor

The Value of Pain Relief

Carina Furnée
University of Chicago

Marius Kemler
Free University Hospitals, Amsterdam

Gerard A. Pfann
Business Investment Research Center, Maastricht University,
University of Chicago, C.E.P.R. and IZA, Bonn

Discussion Paper No. 312
June 2001

IZA

P.O. Box 7240
D-53072 Bonn
Germany

Tel.: +49-228-3894-0
Fax: +49-228-3894-210
Email: iza@iza.org

IZA Discussion Paper No. 312
June 2001

ABSTRACT

The Value of Pain Relief*

This paper measures the value of functional capacity improvement from electronic pain treatment among a sample of Dutch workers with peripheral nerve injuries. Randomized clinical trial data and individual medical records from injured workers are compared with administrative data of healthy workers to calibrate the treatment's net present value of capacity improvement. The value of basic improvement averages 109,000 Dutch 1995 guilders or 25 percent of the total earnings loss without treatment. The value of advanced improvement, when on-the-job learning capacity is recovered, amounts to 150,000 Dutch guilders or 32 percent for workers with university education.

JEL codes: J32, I10, I12

Keywords: Earnings losses, injury, chronic pain, treatment.

Gerard A. Pfann
The Irving B. Harris School of Public Policy Studies
The University of Chicago
1155 East 60th Street
Chicago, IL 60637
U.S.A
Tel.: +1 (773) 702 7302
Fax : +1 (773) 702 0926
Email: gpfann@uchicago.edu

* We gratefully acknowledge all the participants in the SCS treatment group to allow us using their medical records for the benefit of this work. We thank Norman Bradburn, Daniel Hamermesh, Helen Levy, and Will Manning, and workshops participants for helpful comments. All errors are our own.

1. Introduction

Two general theories have been most successful in the academic approach to pain. The Cartesian specificity theory is a mechanical model of pain that travels from the injured tissue through the spinal cord to a recipiant area in the brain. The gate control theory, introduced by Melzack and Wall in 1965, intercepts the direct relation between the intensity and the perception of pain by means of an active central control mechanism that can trigger cognitive processing to induce the experience of pain. In 1979, the International Association for the Study of Pain defined pain as an unpleasant sensory and emotional experience associated with actual and potential tissue damage, or described in such damage. Since the 1979 IASP definition pain is acknowledged to be a perception rather than a mechanical response to tissue damage. Pain is self-attributed and results from the interaction of biopsychosocial variables. Even though many resources are allocated worldwide to fight pain and its economic consequences, and while pain is acknowledged to be among the most costly illnesses for people in pain as well as for society, pain is surprisingly hard to analyze objectively. One reason is that self-reported feelings of pain are the only available variables to measure pain experience and those values are believed to suffer from potential unobserved behavioral response bias. But it is clear that the study of pain and pain relief is in the realm of economics science and undertaken in this paper.

In this paper the net present value of increased functional capacity that results from pain treatment is estimated. The medical literature that studies of cost-effectiveness of health producing treatments compares the net costs of a medical intervention with its net effectiveness (Weinstein *et al.*, 1998), or performs cost-utility analyses to estimate additional costs per quality adjusted life year (Drummond *et al.*, 1998). Those studies often rely on small and selective samples of individual field data, and tend not to account for the socio-economic consequences of health producing treatments. In health economics costs-of-illness studies develop methods to estimate the economic costs of disease and injury with estimates being abundantly based on administrative data (Salkever and Sorkin, 2000). Some authors have argued that productivity losses during illness do not contribute merely to the societal costs of illness, but have a lifetime costly impact for the workers and for their employer as well that also should accounted for (Brouwer, *et al.*, 1997). Few studies, however, have produced direct measurements of workers' lifetime values of capacity improvements from health producing treatments (Bound and Burkhauser, 1999)).

To fill that gap our study focuses on the demand side of the market for health producing treatments only, and more specifically we concentrate on earnings losses among workers in pain and potential gains from pain relief treatments. The labor market consequences of peripheral nerve injuries, like earnings losses and job loss, are often dramatic (Krueger *et al.* 1995). In our empirical analysis, we use individual medical records and data from randomized clinical trials from workers who became disabled after a peripheral nerve injury and combine those with administrative data of a representative sample of healthy workers in order to estimate the value of functional capacity improvement from a recently developed spinal cord stimulation treatment. The injured workers were healthy before the onset of pain and became fully disabled after an injury developed into a specific painful disease.

The paper is organized as follows. The next section discusses measurements of pain and presents the different data sources used. In section three estimates are presented of the net present value of expected earnings losses when no treatment would have been available. Section four calibrates values of relief from treatment. Section five concludes.

2. Data

To evaluate the treatment effects on experienced pain relief, we combine the use clinical data from randomized trials with administrative data.[1] Non-random participation and selectivity into treatment programs require difference corrections for the treated individual when compared to the representative worker. We use individual health records obtained from Maastricht University Academic Hospital in the Netherlands, and collected primary demographic and socio-economic data from the

[1] The idea to use information from different data sources to evaluate the effects of social experiments is not new. One of the early examples in economics is by Durbin (1953).

patients that were healthy and active labor market participants before the onset of the disabling pain. In addition, we obtained the workers' confidential records from the Dutch authorities concerned with the assessment and execution of the disability allowances. These data contain information on each worker's hours worked and earnings before the injury, the disability percentage, social security allowance, and their current employment status. Administrative data collected by Statistics Netherlands are used to form a control group of representative healthy workers. The 1995 wave of the socio-economic panel research (SEP: Statistics Netherlands, 1995) is a representative data set of Dutch households.

Field data from RSD workers

Chronic reflex sympathetic dystrophy (RSD, also known as the complex regional pain syndrome) is a painful, disabling disorder for which there is no proven treatment. In observational studies, spinal cord stimulation has reduced the pain associated with the disorder. Kemler *et al.* (2000) performed a randomized clinical trial involving patients who had had reflex sympathetic dystrophy for at least six months. Two-thirds of the patients were assigned to receive treatment with spinal cord stimulation plus physical therapy, and, for the comparison between the two groups, one-third was assigned to receive physical therapy alone. The spinal cord stimulator was implanted only if test stimulation was successful. The intensity of pain was measured using the visual-analogue scale from 0 cm [no pain] to 10 cm [very severe pain]) and the global perceived effect (on a scale from 1 [worst ever] to 7 [best ever]) (Jensen and McFarland, 1993). The group assigned to receive spinal cord stimulation plus physical therapy had a significant reduction of the intensity of pain within one year, as compared with a small and insignificant increase of the group that only received physical therapy. In addition, the proportion of patients with a score of 6 ("much improved") for the global perceived effect was six times higher in the spinal cord stimulation group than in the control group.

Kemler and Furnée (1999) measured the quality adjusted life years using EQ-5D scores as a measure of health status in the treatment of RSD patients. The EQ-5D score is a generic measure that can be used as a profile or an index. It defines health-related quality of life in terms of a profile of 5 dimensions – mobility, self-care, usual activity, pain/discomfort and anxiety/depression (see also Drummond *et al.* 1998). The health-related quality of life improved only in the group of patients who actually underwent implantation of a spinal cord stimulator.

The aim of this study is to measure the value of functional capacity improvement from spinal cord stimulation treatment in workers with chronic RSD. Measuring treatment effects is challenging, as individuals enrolling into programs are often non-randomly selected (Ashenfelter (1978)), and facing incentives that may blur self-reported treatment effects (Bound, 1991; Bound and Waidmann, 1992; Parsons, 1991). In this study we have chosen to use this very specific sample of injured workers whose response behavior with respect to self-reported pain is most likely not affected by outside labor market or social policy options. The choice of data is an important aspect of the analysis as one seeks to minimize the distortionary effects of behavioral response bias. The severity of the disability of all workers in our sample is such that none of them is expected to return to the labor market again ever, notwithstanding the treatment.

To ensure the diagnosis of chronic RSD in our sample, each subject had to meet the following criteria; RSD according to diagnostic criteria of the IASP (Merskey and Bogduk, 1994); RSD clinically restricted to one extremity, but at least affecting the whole hand or the whole foot; duration of RSD of at least six months during which period there was no lasting success of standard therapies including six months physical therapy, sympathetic blocks, transcutaneous electrical nerve stimulation and medication; and a mean pain intensity of at least 5, measured on a visual analogue scale (VAS) ranging from 0 - no pain - to 10 - very severe pain. Patients with neurological abnormalities not related to RSD were excluded. The study was supported by a grant from the Dutch Health Insurance Council, complied with the Declaration of Helsinki regarding investigations in humans, and was approved by the medical ethics committee of Maastricht University Academic Hospital.

In addition to general demographic and socio-economic characteristics we collected information for all RSD workers from the authorities concerned with the assessment and execution of the disability benefit. This information includes the starting date for the disability benefit; the disability percentage; the position held in last job and working hours; the last monthly salary before the injury; and the first monthly disability allowance. All patients gave prior written informed consent.

Administrative data to form the control group

For the composition of a control group, we used administrative data collected by Statistics Netherlands. The 1995 Socio Economic Panel Research (SEP) is the seventeenth wave of a representative longitudinal data collection on socio-economic conditions of households in the Netherlands. The SEP data set contains all the respondents' relevant demographic and personal information including economic activities, education, labor market experience and earnings data. The data are collected annually by computer aided personal interviewing (CAPI), representatively weighted on the basis of Statistics Netherlands population statistics, and are anonymous. We included in our control group all workers between the ages 18 and 65, holding a tenured position as an employee, working more than 8 hours per week, who reported to be healthy, and did not receive disability allowances.

Descriptive statistics

Table 1 displays summary statistics for four schooling levels of age, labor market experience, gross hourly wages, working hours per week, and the ratio of men and women in the control group (Table 1a) and the sample of RSD workers (Table 1b). For RSD workers the hourly wage refers to the wage at the time of the injury are measured in constant 1995 Dutch guilders or US dollars. Notable differences between the two samples are: (1) the relatively high percentage of RSD workers with higher level vocational schooling or a University degree; (2) the lower hourly wages for RSD workers in all education categories; (3) labor supply of lower educated RSD workers is on average higher than of the representative lower educated Dutch worker, (4) both mean age and years of work experience are considerably lower for RSD workers in all education categories, and (5) a higher percentage of female

RSD workers. Similar results were found for a study on labor market consequences of spinal cord injuries in the US (Krueger *et al.*,1995).

3. The Net Present Value of Expected Earnings Losses

The hourly earnings function reflects the evolution of productive human capital over a worker's life-cycle and can be derived from a rational decision making process. Life-time earnings profiles are a suitable model for estimating how work career interruptions affect the returns to accumulated general and job-specific productivity (Mincer and Ofek, 1982). Three fundamental factors are important. These are (*i*) a worker's human capital, usually measured in the form of the achieved educational level, (*ii*) a worker's labor market experience, usually measured as the age minus the number of years it takes to complete the level of education achieved, and (*iii*) whether the worker is a woman or a man. A worker's hourly earnings first rise with experience, since learning on the job increases productivity, peak after a certain number of years worked, and then decline at the end of a worker's active labor market career (see Figure 1). The earnings profile differs with the attained educational level, since a worker's schooling signals the capacity to learn on-the-job.

The fundamental lifetime earnings function can be written as follows

$$Y_j(E_i) = b_{0j} + b_{1j}Gender_i + b_{2j}E_i + b_{3j}E_i^2 + e_{ij}, \qquad (4.1)$$

where $Y_j(E_i)$ is the hourly wage of worker i with education level j and E_i years of labor market experience; b_{kj} , k=0,..,3 are constant parameters that vary for all educational levels j=1,..,4, and e_{ij} is an educational level specific individual residual with $E\{\varepsilon_{ij}\}=0$. We do not use the widely used log transformation of the earnings profile as to avoid retransformation problems (see also Manning, 1998). Given that the experience curve is inverted U-shaped, we expect $b_{2j}>0$ and $b_{3j}<0$. The variable 'Gender' is a dummy variable, which in our application equals 0 for female workers and 1 for male workers. In general, it is found that the earnings profile of female workers lies below that of their male counterparts, so that $b_{1j}>0$. The constant term can be interpreted as the average of the starting salary of a worker with education j and zero years experience. More years of initial schooling induce a higher expected productivity at the beginning of the working career, so that $b_{0i}>b_{0j}>0$ for all $i>j$. The SEP 1995 data are used to estimate the Mincerian earnings profile for the representative worker. Results are given in Table 2. The point at which the maximum hourly wage is reached differs indeed for different educational levels as shown in Table 3. The maximum hourly wage increases with the educational level achieved.

Lifetime earnings losses of RSD workers

In this section we estimate the net present value of expected lifetime earnings losses incurred upon RSD workers, and start with the following observations. First, social security disability allowances grow at the same rate and beneficiaries receive the same inflation compensation as wage earner (the so-called “net-net coupling” of social security allowances in the Netherlands). This implies that the real value of the disability allowance remains constant over time. Second, given the limited time frame of our data sample, the earnings profiles vary with experience, gender, and education, but not with calendar time. This implies that income profiles of the RSD workers before they were injured are comparable to the estimated experience profiles regardless of the starting date of the disease. Third, we assume that the observed preference labour supply before the injury is constant through time and does not change as a result of the injury. This implies that if a worker could fully recover from her or his disability, the hours worked would be identical to those before the injury occurred. Without treatment the post-injury earnings profile of an RSD worker will fall below that associated with having remained a healthy worker and will be flat onwards (see Figure 1).

Consider worker i with education j works H_i hours per week, and earns an hourly wage Y_{ij}. After E_i^* years of labor market experience the worker gets injured and develops RSD. The net present value of the total earnings losses from active labor input over the period E_i^* until the expected leave of the labor market E_i^T can be computed as follows. The first step is to compute worker *i*'s hourly earnings profile if the injury had not occurred. The nationwide hourly earnings profile for a representative worker *r* with education *j* is

$$\hat{Y}_j(E_r) = \hat{b}_{0j} + \hat{b}_{1j} Gender_i + \hat{b}_{2j} E_r + \hat{b}_{3j} E_r^2 . \qquad (4.2)$$

The b 's are estimated using the 1995 wave of the socio-economic surveys (SEP) in the Netherlands. Parameter estimates are given in Table 2.

The risk of an injury, the incidence of pain, and the development of RSD may not be randomly distributed among all workers. In order to control for possible selectivity bias, we compute the difference between the injured worker's observed hourly wage and the wage forecasted from the representative earnings profile holding gender and the years labor market experience constant. At the time of the injury, the hourly wage difference between worker *i* and the representative worker yields

$$d\hat{Y}_{ij} = Y_{ij} - \hat{Y}_j(E_i^*) . \qquad (4.3)$$

The term $d\hat{Y}_{ij}$ is a person specific permanent earnings component used to correct for each worker's location on the nationwide earnings distribution at the time of the injury (see Heckman (1979)). We assumed that in our sample the earnings profiles vary with experience, gender, and education, but not with calender time. The earnings profile in the case that the injury would not have affected the earnings capability of worker *i* can then be written as

$$Y_{ij}(E) = \hat{b}_{0j} + d\hat{Y}_{ij} + \hat{b}_{1j} Gender_i + \hat{b}_{2j} E + \hat{b}_{3j} E^2 , \quad \text{for} \quad E \geq E_i^* . \qquad (4.4)$$

The <u>second</u> step is to determine the worker's post RSD real hourly wage profile Y_{ij}^{*}. The injury reduces i's earnings capacity by a fraction a_i. The worker will receive an inability replacement allowance that is a function f of Y_{ij}. The new hourly income then becomes

$$Y_{ij}^{*} = (1 - a_i)Y_{ij} + a_i f(Y_{ij}) \qquad \text{iff } a_i > 0, \tag{4.5}$$

where Y_{ij}^{*} no longer depends on $E_i > E_i^{*}$. If a_i =1, then a worker is fully disabled after the injury.

The <u>third</u> step is to compute the net present value of the real income difference per hour worked, dNY_{ij}, as follows (the shaded area in Figure 1). We write

$$dNY_{ij} = \int_0^{E_{ij}^T - E_i^*} e^{-rt}(Y_{ij}(t) - Y_{ij}^*)dt\,, \qquad \text{for } Y_{ij}(t) \geq Y_{ij}^* \tag{4.6}$$

where E_{ij}^{T} is the <u>expected</u> maximum number of years of labor market experience until retirement age T of worker i given the schooling duration of education level j, or the point where $Y_j(t) = Y_{ij}^*$, and r is the annual nationwide real interest rate assumed constant through time. To compute dNY_{ij} we substitute (4.4) into (4.6). This gives

$$dNY_{ij} = \int_0^{E_{ij}^T - E_i^*} e^{-rt}(\hat{b}_{0j} + d\hat{Y}_{ij} + \hat{b}_{1j}Gender_i - Y_{ij}^* + \hat{b}_{2j}t + \hat{b}_{3j}t^2)dt\,. \tag{4.7}$$

The analytical solution for this expression is given in Appendix 1.

The <u>fourth</u> step is to compute the net present value of total income loss, NTL_{ij}, incurred upon worker i. This can be written as

$$NTL_{ij} = dNY_{ij} * H_i * W \quad , \tag{4.8}$$

where W is the number of working weeks in one year, and H_i is the number of weekly hours worked before the injury.

Estimating lifetime earnings losses for RSD workers

In the Netherlands, a worker who gets disabled as a result from illness or injury first enrols into the social security act for illnesses (*Ziekte Wet*) that replaces 90 percent of the worker's earnings before the illness or injury. After one year this program ends, and, when not cured, one will enter the social security act insuring workers against risk of unfitness for work on account of sickness or accident (*Wet Arbeids Ongeschiktheid*) that recovers 70 percent of a worker's pre-illness or pre-injury earnings. In our treatment sample, we observe each worker's earnings before the entering of the first program. Table 4 shows per education category the sample averages of the observed hourly earnings of all workers in the RSD sample, the average forecasted benchmark wage $\hat{Y}_j$ from the SEP regression for all injured workers in the sample, the difference between the benchmark and observed hourly wage, the minimum and maximum differences, the expected net present value of total earnings loss and its minimum and maximum, and the number of observations per educational category.

After computing $d\hat{Y}_{ij}$ for all RSD workers, we find that roughly 90 percent of the RSD workers earn less than their comparable healthy representative counterpart (see Table 4). This difference is unlikely to be a result of the Ashenfelter (1978) pre-enrolment earnings dip. There is no reason why workers in our treatment sample would have experienced a decline in their hourly earnings prior to the treatment. Treatment eligibility is the result of a unique event--the injury, and the data that we use isolate perfectly the before and after periods. The downward bias in the pre-injury hourly earnings suggests that the RSD workers in our sample are low wage earners--keeping gender, education, and labor market experience constant. This result is also not likely to be explained by existing hedonic wage theories where premiums are paid for riskier work. The bias is prevalent and consistent across all educational levels. The risk premium is usually found for low skilled work only (Viscusi, 1979).

But the downward bias does coincide with predictions from the hedonic psychological gate control theory of pain and pain perception. This biopsychological model focusses on pain as a self-attributed state that results from a complex interaction of behavioral variables (Melzach and Wall, 1965). Gate control theory showed that pain is a subjective experience rather than a mechanical reaction, and it allows us to think about the relationship between effort and job satisfaction and the distraction of pain experience. Two examples of anecdotal evidence thereof are that, unlike hurt civilians, the majority of soldiers being severely injured in battle do not voice the feeling of pain even days after getting wounded (Beecher, 1959); and "even severe injuries sustained in the heat of intense athletic activity may not be perceived as painful as long as the participant's concentration remains fixed on the game" (*op cit.* Eich *et al.* 1999, p159). If workers with higher hourly earnings, *ceteris paribus*, also have a higher productivity or effort level at work and a higher level of job satisfaction, they are more likely to be distracted from pain more often. Unfortunately, we cannot prove this assumption with our current data, but it directs to an important area for future research on the relationship between productivity and workers' well-being.

We observe H_i, a_i and Y_{ij}^* from the confidential records. Accounting for $d\hat{Y}_{ij}$, we can compute NTL_{ij}. From Table 4, we can conclude that the average per worker expected lifetime earnings losses yields roughly 430,000 Dutch 1995 guilders and varies with the educational level from 260,000 Dutch guilders for basic schooling to 468,000 Dutch guilders for university education.

4. Calibrating the Functional Capacity Improvement Value from the SCS Treatment

Directly measuring the functional capacity improvement value from the SCS treatment is impossible. Social security policies directed at disability illness replacement earnings subsidies procrastinate observing how medical treatments effectively restore the ability to return to work. In the

Netherlands the generous 1967 social security act insuring workers against risk of unfitness for work on account of sickness or accident (WAO) has had a widely acknowledged negative impact on employment. (Hassink, *et al*. 1997). The 1987 and 1993 social security reform acts to restrict claims on disablement benefit have reduced the inflow of beneficiaries, but have not had a very big impact on the outflow.

To calibrate the value of capacity improvement from the SCS treatment we will have to rely on a different approach. We will use the self-recorded improvements from the treatment as estimates of improved functionality. As mentioned before, our data are not likely to be subject to self-reporting behavioral bias, since none of the treated workers are expected to return to work. Our example is thus a very strong illustration of the difficulty to insure utility. We consider two possible outcomes of the treatment. One relates the improved functional capacity to the capacity to work, but without the recovery of the on-the-job learning ability (Figure 2). The treatment would then effectively decrease a_i only, while the post-treatment earnings profile remains flat. In economic terms this means that a treated worker has lost the on-the-job productivity accumulated during the years of experience before the injury, and will perform – part-time – disability adjusted low skilled work.

The second outcome assumes that the treatment not only improves the capacity to work, but also - at least in part - recovers the on-the-job learning ability of the RSD worker. The treatment would then not just decrease a_i, but also recover the working experience related human capital. This results in an inverted U-shape post-treatment earnings profile that lies below or, in case of full recovery, is equal to the worker's earnings profile before the injury (Figure 3). In economic terms this could be interpreted as the case in which a treated worker could – part time - return to her or his previous employer/job and continue profiting from the (job-) specific productivity that was gained in the time before the injury. The worker will also continue to learn on-the-job after the treatment during the remaining time until E_T.

To measure the recovery rates resulting from the SCS treatment, we rely on the measured effects the SCS treatment had on reduced pain intensity and quality-adjusted life-years gained. Self-reported EQ-5D scores as a measure of health status in the treatment of RSD workers were collected (Kemler and Furnée, 1999). The mean health-related quality of life score for RSD workers that received SCS treatment went up significantly with 22 percentage points from 0.21 to 0.43 within one year. In addition, we use visual analogue pain scores (VAS) to measure the reduction of pain intensity as a result from the SCS treatment (Kemler *et al.*, 2000). The pain reduction for the group of RSD workers who received spinal cord stimulation was measured to be 28 percentage points from 7.1 to 4.3 cm VAS within one year. We combine these results to calibrate earnings gains, provided that the capacity-to-work recovery rate from SCS equals 25 percentage points of the disability condition before the start of the treatment, being the within-group average of the two measurements of pain relief.

We computed the functional capacity improvement value as the net present value of expected lifetime earnings gains for disabled workers from the SCS treatment that effectively reduces the inability to work. Table 5 shows the calibration results. The average net present value of expected lifetimes earnings gains for disabled RSD workers receiving SCS treatment yields 109,000 Dutch guilders when on-the-job learning ability is not recovered. For workers with a lower educational background SCS produces a 35 percent gain from the increased capacity to work. Lower educated workers do not show improved earnings gains from on-the-job learning recovery. For workers with a higher education or university background SCS produces average gains of 21.3 percent, while on-the-job learning recovery would add an additional 4.9 percent value gain. The highest value is found for injured workers with university education when their on-the-job learning capability is recovered by the SCS treatment and yields 150,000 Dutch guilders or 32 percent.

5. Conclusions

This paper proposes a methodology to determine the functional capacity improvement value of a recently developed spinal cord stimulation (SCS) treatment for disabled workers with a peripheral nerve injury who developed reflex sympathetic dystrophy (RSD). Valuating capacity improvement from health producing treatments is relevant for utility based insurance policies and for governmental health policy in general. In this study we combined medical records and health data from carefully selected individuals with administrative data from a representative sample of healthy workers in the Netherlands to estimate the net present value of expected lifetime earnings losses and treatment gains.

We find a downward hourly earnings bias in our sample of injured workers. The bias is most likely associated with job satisfaction, effort and productivity and is consistent with modern gate control theory of pain perception (Melzack and Wall, 1965). Roughly 90 percent of the workers are low wage earners—holding gender, education and labor market experience constant. Accounting for this selectivity, we computed the expected lifetime earnings loss for all the workers would no treatment to recover the capacity to work have been available. The average earnings loss yields roughly 430,000 Dutch guilders and varies with educational achievement from 260,000 Dutch guilders for basic schooling to 468,000 Dutch guilders for workers with university education.

For all RSD workers in our sample, we used individual measurements of pain reduction from a randomized clinical trial designed to determine the efficacy of the SCS treatment. We estimated the functional capacity improvement value as the calibrated net present value of expected lifetime earnings gains from the treatment. The average value per worker yields 109,000 Dutch guilders when on-the-job learning ability is not recovered. For a worker with a lower educational background SCS produces a 35 percent gain with a value of 91,000 Dutch guilders from the increased capacity to work. When SCS also produces on-the-job learning recovery, the highest value is found for injured workers with university education when their on-the-job learning capability is recovered by the SCS treatment and yields 150,000 Dutch guilders per worker.

Applications of the method proposed in this paper to combine data collected from randomized clinical trials, medical records, and administrative data can be extended beyond the evaluation of the efficacy of pain treatment for RSD workers. Accounting for selection bias and circumventing possible behavioral response bias, a wide range of pain treatments can be evaluated accordingly, including treatments for pain due to workplace injuries such as repetitive strain injury and cumulative trauma disorder.

6. References

Ashenfelter, O. (1978), "Estimating the effect of training programs on earnings". *Review of Economics and Statistics*; Vol. 60, pages 47-57.

Beecher, H.K.(1959), *Measurement of subjective responses*. Oxford University Press.

Brouwer, W.B. F., M.A. Koopmanschap, and F.F.H. Rutten (1997), "Productivity costs in cost-effectiveness analysis -- numerator or denominator: A further discussion". *Health Economics;* Vol.6, pages 511-14.

Bound, J. (1991), "The health and earnings of rejected disability insurance applicants: reply". *American Economic Review*; Vol. 81, pages 1427-34.

Bound, J., and T. Waidmann (1992), "Disability transfers, self-reported health, and the labor force attachment of older men: evidence from the historical record". *Quarterly Journal of Economics*; Vol. 107, pages 1393-1419.

Bound, J., and R.V.Burkhauser (1999), "Economic analysis of transfer programs for people with disabilities". In O.C.Ashenfelter and D.Card (Eds.), *Handbook of Labor Economics;* Vol 3C, pages 3417-3528.

Durbin, J. (1953), "A note on regression when there is extraneous information about one of the coefficients". *Journal of the American Statistical Association*; Vol. 48, pages 799-808.

Drummond, M.F., B. O'Brien, G.L. Stoddart, G.W. Torrance (1998), "*Methods for the Economic Evaluation of Health Care Programs*". Oxford: Oxford University Press.

Eich E., I.A. Brodkin, J.L. Reeves, and A.F. Chawla (1999), "Questions concerning pain". In D. Kahneman, E. Diener, and N. Schwartz (Eds.): *Well-Being. The Foundations of Hedonic Psychology*. New York: Russell Sage Foundation, pages 155-168.

Hassink, W.H.J., J.C. van Ours, and G. Ridder, "Dismissal through disability". *De Economist*; Vol.145, pages 29-46.

Heckman, J.J. (1979), “Sample selection bias as a specification error”. *Econometrica*; Vol. 47, pages 153-61.

Jensen, M.P., and C.A. McFarland (1993), “Increasing the reliability and validity of pain intensity measurement in chronic pain patients”. *Pain*; Vol. 55, pages 195-203.

Kemler, M.A. (2000), “*Spinal cord stimulation for chronic reflex sympathetic dystrophy*”. Ph.D.-thesis, Maastricht University: DataWyse Press.

Kemler, M.A., G.A.M. Barendse, M. van Kleef, H.C.W. de Vet, C.P.M. Rijks, C.A. Furnée, F.A.J.M. van den Wildenberg (2000), “Spinal cord stimulation in patients with chronic reflex sympathetic dystrophy”. *New England Journal of Medicine*; Vol. 343, pages 618-24.

Kemler, M.A., and C.A. Furnée (1999), “Economic evaluation of spinal cord stimulation for chronic reflex sympathetic dystrophy”. Manuscript, Maastricht University.

Krueger, A., S. Drastal, and D. Kruse (1995), “Labor market effects of spinal cord injuries in the dawn of the computer age”. NBER Working paper No. 5302.

Manning, W.G. (1998), “The logged dependent variable, heteroscedasticity, and the retransformation problem”. *Journal of Health Economics*; Vol.17, pages 283-95.

Melzack R. And P.D.Wall (1965), “Pain mechanisms: A new theory”. *Science*; Vol. 50, pages 971-79.

Merskey, H., and N. Bogduk (1994), “Classification of chronic pain: descriptions of chronic pain syndromes and definitions of pain terms”. Seattle: IASP Press, pages 40-2.

Mincer, J., and H. Ofek (1982), “Interrupted work careers: depreciation and restauration of human capital”. *Journal of Human Resources*; Vol. 17, pages 3-24.

Parsons, D.O. (1991), “The health and earnings of rejected disability insurance applicants: comment”. *American Economic Review*; Vol. 81, pages 1419-1426.

Salkever, D.S., and A. Sorkin (2000), *"The Economics of Disability"*. Stamford: JAI Press.

Statistics Netherlands (1995), "*Sociaal-economisch panel onderzoek: variabelendocumentatie 1995*". Voorburg.

Viscusi, W. Kip (1979), *"Employment Hazards: An Investigation of Market Performance."* Harvard University Press.

Weinstein, M.C., J.E. Siegel, M.R. Gold, M.S. Kamlet, and L.B. Russell (1996), "Recommendations of the panel on cost-effectiveness in health and medicine". *Journal of the American Medical Association*; Vol. 276, pages 1253-8.

Appendix 1: Analytical Solution of dNY_i.

The analytical solution of the integral

$$\int_0^{\overline{E}} e^{-rt}(A+Bt+Ct^2)dt, \tag{A1}$$

is found by the method of substitution, and yields

$$\left[(-\frac{1}{r}e^{-rt})\left(A+B(t+\frac{1}{r})+C(t^2+\frac{2}{r}t+\frac{2}{r^2})\right)\right]_0^{\overline{E}}, \qquad \text{or} \tag{A2}$$

$$\frac{1}{r}((A+\frac{B}{r}+\frac{2C}{r^2})-e^{-r\overline{E}}(A+B(\overline{E}+\frac{1}{r})+C(\overline{E}^2+\frac{2\overline{E}}{r}+\frac{2}{r^2}))). \tag{A3}$$

To find the analytical solution of the integral of equation (4.7), we substitute

$$A \equiv \hat{b}_{0j} + d\hat{Y}_{ij} + \hat{b}_{1j}Gender_i - Y_{ij}^*, \tag{A4}$$

$$B \equiv \hat{b}_{2j}, \tag{A5}$$

$$C \equiv \hat{b}_{3j}, \qquad \text{and} \tag{A6}$$

$$\overline{E} = E_{ij}^T - E_i^* \qquad iff \qquad Y_{ij}(E_{ij}^T) \geq Y_{ij}^*, \text{ or}$$

$$\overline{E} = -\frac{1}{2}\overline{E}_1 + \frac{1}{2}\sqrt{(\overline{E}_1^2 - 4\overline{E}_2)} - E_i^* \qquad \text{otherwise} \tag{A7}$$

where E_{ij}^T is equal to the maximum number of years of labor market experience until retirement age T given the schooling duration of educational level j, $\overline{E}_1 = B/C$, and $\overline{E}_2 = A/C$.

Q.*E.D.*

Table 1a: Descriptive Statistics of Healthy Workers

The 1995 Socio-Economic Panel Research in The Netherlands[(1)]

	EDUC1[(2)]	EDUC2[(2)]	EDUC3[(2)]	EDUC4[(2)]
Duration formal schooling (in years) (DSchool)	**17**	**18**	**21**	**24**
Age (in years)	**37.9**	**37.3**	**38.6**	**40.1**
(AGE)	(10.6) [(3)]	(9.6)	(8.7)	(8.4)
Work experience (in years)	**20.9**	**19.0**	**17.7**	**16.1**
(E)	(11.2)	(10.6)	(9.6)	(9.2)
Gross hourly wage (in DFL).	**22.6**	**26.4**	**32.7**	**39.6**
(Y)	(8.7)	(10.5)	(12.6)	(15.6)
Working hours per week	**35.2**	**36.2**	**37.8**	**40.5**
(H)	(11.7)	(10.3)	(10.5)	(10.8)
Number of employees in sample	951	1,769	756	231
Female	406	707	321	62
Male	545	1,062	436	169
N (in %: row)	25.6	47.7	20.5	6.2
Female (in %: column)	42.7	40.0	42.4	26.8
Male (in %: column)	57.3	60.0	57.6	73.2

(1) Source: 1995 Socio-Economic Panel, Statistics Netherlands

(2) EDUC1 is with primary schooling only; EDUC2 is with lower level vocational training or middle secondary school; EDUC3 is with middle level vocational training or higher secondary school; EDUC4 with higher level vocational training or a University degree.

(3) Standard deviations are given in parentheses.

Table 1b: Descriptive Statistics of RSD Workers

	EDUC1[1]	EDUC2[1]	EDUC3[1]	EDUC4[1]
Age (in years)	**34.3**	**31.6**	**32.7**	**35.0**
(AGE)	(11.9) [2]	(9.5)	(9.3)	(9.0)
Work experience (in years)	**17.3**	**13.6**	**11.7**	**11.0**
(E)	(11.9)	(9.5)	(9.3)	(9.0)
Gross hourly wage (in DFL).	**16.6**	**18.8**	**18.9**	**21.7**
(Y)	(3.3)	(7.8)	(3.7)	(8.7)
Working hours per week	**37.7**	**40.1**	**37.5**	**32.4**
(H)	(18.4)	(19.3)	(12.7)	(8.9)
Number of employees in sample	4	14	14	5
Female	2	8	8	4
Male	2	6	6	1
N (in %: row)	10.5	36.8	39.5	13.2
Female (in %: column)	50.0	57.2	57.2	80
Male (in %: column)	50.0	42.8	42.8	20

(1) EDUC1 is with primary schooling only; EDUC2 is with lower level vocational training or middle secondary school; EDUC3 is with middle level vocational training or higher secondary school; EDUC4 with higher level vocational training or a University degree.

(2) Standard deviations are given in parentheses.

Table 2: The Hourly Wage Profile of Healthy Workers [1]

The 1995 Socio-Economic Panel Research in The Netherlands

	EDUC1 [2]	**EDUC2** [2]	**EDUC3** [2]	**EDUC4** [2]
$\hat{b}_0$ (Const)	**10.98** (.89) [3]	**13.56** (.75)	**15.42** (1.36)	**18.10** (3.03)
$\hat{b}_1$ (Male)	**3.46** (.52)	**4.35** (.46)	**6.66** (.81)	**3.99** (2.16)
$\hat{b}_2$ (E=Experience)	**.83** (.09)	**.87** (.08)	**1.13** (.15)	**1.92** (.39)
$\hat{b}_3$ ($E^2/100$)	**-1.38** (.21)	**-1.35** (.19)	**-1.61** (.37)	**-3.59** (1.06)
$\overline{R}^2$	.185	.195	.264	.224
N	951	1769	756	231

(1) See Equation 4

(2) EDUC1 is with primary schooling only; EDUC2 is with lower level vocational training or middle secondary school; EDUC3 is with middle level vocational training or higher secondary school; EDUC4 with higher level vocational training or a University degree.

(3) Standard errors of the means are given in parentheses

Table 3: Maximum of the Hourly Wage Profile of Healthy Workers

The 1995 Socio-Economic Panel Research in The Netherlands

	EDUC1[1]		**EDUC2[1]**		**EDUC3[1]**		**EDUC4[1]**	
Number of years of work experience when hourly wage reaches maximum: $E^{Max} = -\hat{b}_2 / 2\hat{b}_3$	**30.2**		**32.4**		**35.0**		**26.7**	
Corresponding age (E^{Max}+*DSchool)*	**47.2**		**50.4**		**56.0**		**50.7**	
Maximum hourly earnings at E^{Max}:	D*fl*	*€uro*	D*fl*	*€uro*	D*fl*	*€uro*	D*fl*	*€uro*
- for female workers: $Y^{F,Max} = \hat{b}_0 + \hat{b}_2 E^{Max} + \hat{b}_3 (E^{Max})^2 / 100$	**23.4**	**10.6**	**27.7**	**12.6**	**35.1**	**15.9**	**43.7**	**19.8**
- for male workers: $Y^{M,Max} = \hat{b}_0 + \hat{b}_1 + \hat{b}_2 E^{Max} + \hat{b}_3 (E^{Max})^2 / 100$	**27.0**	**12.3**	**32.0**	**14.5**	**41.8**	**19.0**	**47.7**	**21.6**

[1] EDUC1 is with primary schooling only; EDUC2 is with lower level vocational training or middle secondary school; EDUC3 is with middle level vocational training or higher secondary school; EDUC4 with higher level vocational training or a University degree.

Table 4: **Net Present Value of Earnings Losses for RSD Workers**

	EDUC1[1]		EDUC2[1]		EDUC3[1]		EDUC4[1]	
Y	**16.6** (3.3)		**18.8** (7.8)		**18.9** (3.7)		**21.7** (8.7)	
$\hat{Y}$	**21.5** (4.7)		**24.0** (5.4)		**29.0** (7.6)		**36.0** (11.5)	
$d\hat{Y}$	**-4.9** (2.2)		**-5.2** (7.5)		**-9.9** (7.4)		**-14.3** (11.4)	
Max ($d\hat{Y}$)	**-7.8**		**-16.4**		**-21.9**		**-33.1**	
Min ($d\hat{Y}$)	**-2.6**		**8.6**		**-2.5**		**-2.3**	
	D*fl*	*€uro*	D*fl*	*€uro*	D*fl*	*€uro*	D*fl*	*€uro*
Average total earnings loss (x 1,000)	**260**	**118**	**326**	**148**	**565**	**256**	**468**	**212**
	D*fl*	*€uro*	D*fl*	*€uro*	D*fl*	*€uro*	D*fl*	*€uro*
Maximum total earnings loss (x 1,000)	**371**	**168**	**652**	**296**	**943**	**428**	**856**	**388**
	D*fl*	*€uro*	D*fl*	*€uro*	D*fl*	*€uro*	D*fl*	*€uro*
Minimum total earnings loss (x 1,000)	**93**	**42**	**22**	**10**	**154**	**70**	**202**	**92**
N	**4**		**14**		**14**		**5**	

[1] EDUC1 is with primary schooling only; EDUC2 is with lower level vocational training or middle secondary school; EDUC3 is with middle level vocational training or higher secondary school; EDUC4 is with highest level vocational training or a University degree.

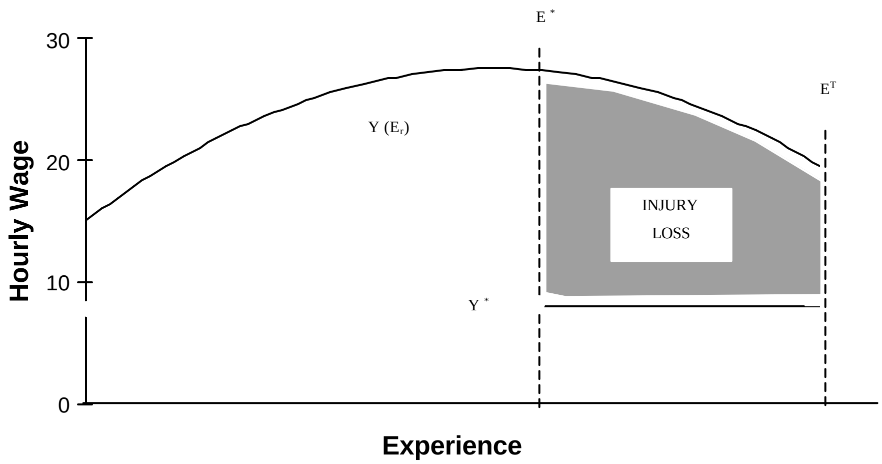
Table 5: **Functional Capacity Improvement Value from SCS Treatment**

	EDUC1[1]		**EDUC2[1]**		**EDUC3[1]**		**EDUC4[1]**	
Treatment without Learning Recovery	D*fl*	*€uro*	D*fl*	*€uro*	D*fl*	*€uro*	D*fl*	*€uro*
Average Gain (x 1,000)	**91** (35)[2]	**41** (16)	**108** (59)	**49** (27)	**111** (39)	**50** (18)	**122** (88)	**55** (40)
Percentage Gain	**35.0**		**33.1**		**19.6**		**26.1**	
Treatment with Learning Recovery	D*fl*	*€uro*	D*fl*	*€uro*	D*fl*	*€uro*	D*fl*	*€uro*
Average Gain (x 1,000)	**92** (34)	**42** (15)	**115** (33)	**52** (15)	**137** (34)	**62** (16)	**150** (42)	**68** (19)
Percentage Gain	**35.4**		**35.3**		**24.2**		**32.0**	
N	**4**		**14**		**14**		**5**	

[1] EDUC1 is with primary schooling only; EDUC2 is with lower level vocational training or middle secondary school; EDUC3 is with middle level vocational training or higher secondary school; EDUC4 is with highest level vocational training or a University degree.

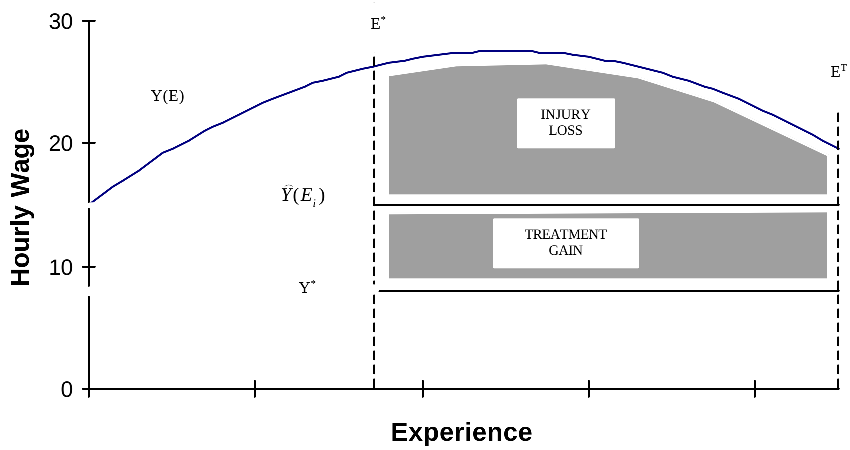
[2] Standard deviations are given in parentheses.

Figure 1: Hourly Earnings Profiles of Healthy Workers and RSD Workers



$Y(E_r)$	: Wage profile of healthy worker	E^T	: Point of labor market exit
Y^*	: Wage profile of disabled worker	E^*	: Point of injury

Figure 2a: Functional Capacity Improvement without Learning Recovery



Y(E)	: Wage profile before injury	E^T	: Point of labor market exit
Y^*	: Wage profile without SCS treatment	E^*	: Point of injury
$\widehat{Y}(E_i)$	: Wage profile with SCS treatment		

Figure 2b: Cumulative Functional Capacity Improvement without Learning Recovery

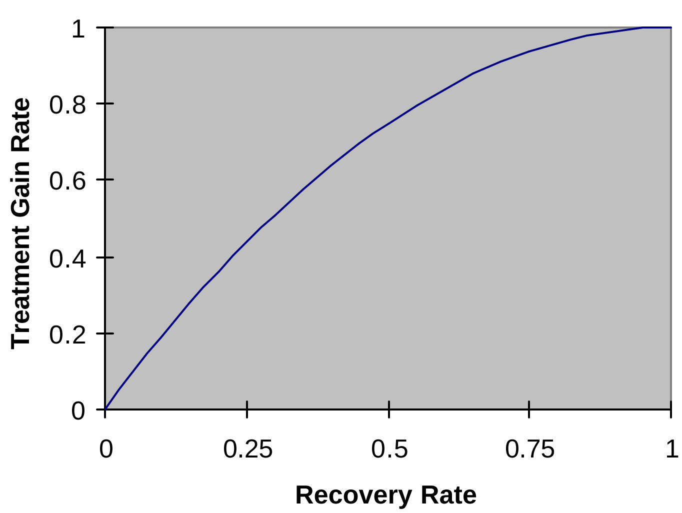
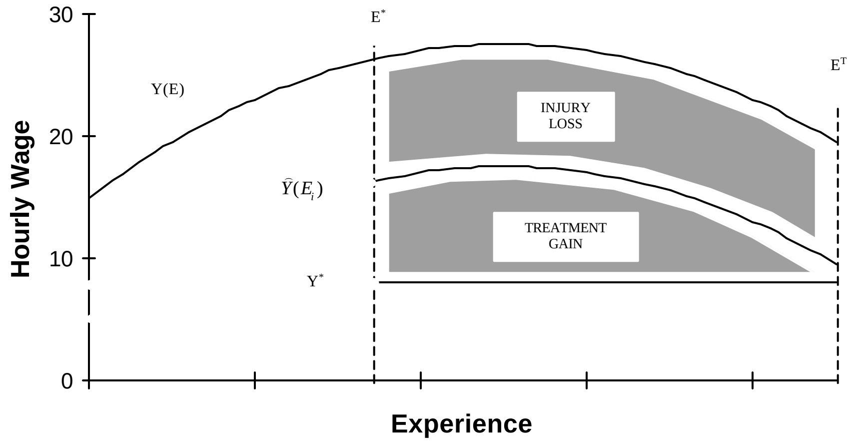


Figure 3a: Functional Capacity Improvement with Learning Recovery



Y(E) : Wage profile before injury

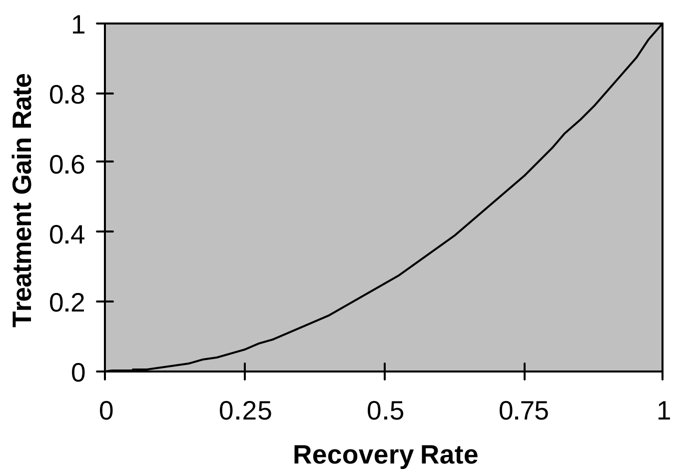
Y^* : Wage profile without SCS treatment

$\widehat{Y}(E_i)$: Wage profile with SCS treatment

E^T : Point of labor market exit

E^* : Point of injury

Figure 3b: Cumulative Functional Capacity Improvement with Learning Recovery



IZA Discussion Papers

No	Author(s)	Titel	Area	Date
231	G. Saint-Paul	The Economics of Human Cloning	5	12/00
232	E. Bardasi M. Francesconi	The Effect of Non-Standard Employment on Mental Health in Britain	5	12/00
233	C. Dustmann C. M. Schmidt	The Wage Performance of Immigrant Women: Full-Time Jobs, Part-Time Jobs, and the Role of Selection	1	12/00
234	R. Rotte M. Steininger	Sozioökonomische Determinanten extremistischer Wahlerfolge in Deutschland: Das Beispiel der Europawahlen 1994 und 1999	3	12/00
235	W. Schnedler	Who gets the Reward? An Empirical Exploration of Bonus Pay and Task Characteristics	5	12/00
236	R. Hujer M. Caliendo	Evaluation of Active Labour Market Policy: Methodological Concepts and Empirical Estimates	6	12/00
237	S. Klasen I. Woolard	Surviving Unemployment without State Support: Unemployment and Household Formation in South Africa	3	12/00
238	R. Euwals A. Börsch-Supan A. Eymann	The Saving Behaviour of Two Person Households: Evidence from Dutch Panel Data	5	12/00
239	F. Andersson K. A. Konrad	Human Capital Investment and Globalization in Extortionary States	5	01/01
240	W. Koeniger	Labor and Financial Market Interactions: The Case of Labor Income Risk and Car Insurance in the UK 1969-95	5	01/01
241	W. Koeniger	Trade, Labor Market Rigidities, and Government-Financed Technological Change	2	01/01
242	G. Faggio J. Konings	Job Creation, Job Destruction and Employment Growth in Transition Countries in the 90's	4	01/01
243	E. Brainerd	Economic Reform and Mortality in the Former Soviet Union: A Study of the Suicide Epidemic in the 1990s	4	01/01
244	S. M. Fuess, Jr. M. Millea	Pay and Productivity in a Corporatist Economy: Evidence from Austria	5	01/01

245	F. Andersson K. A. Konrad	Globalization and Human Capital Formation	5	01/01
246	E. Plug W. Vijverberg	Schooling, Family Background, and Adoption: Does Family Income Matter?	5	01/01
247	E. Plug W. Vijverberg	Schooling, Family Background, and Adoption: Is it Nature or is it Nurture?	5	01/01
248	P. M. Picard E. Toulemonde	The Impact of Labor Markets on Emergence and Persistence of Regional Asymmetries	2	01/01
249	B. M. S. van Praag P. Cardoso	"Should I Pay for You or for Myself?" The Optimal Level and Composition of Retirement Benefit Systems	3	01/01
250	T. J. Hatton J. G. Williamson	Demographic and Economic Pressure on Emigration out of Africa	1	01/01
251	R. Yemtsov	Labor Markets, Inequality and Poverty in Georgia	4	01/01
252	R. Yemtsov	Inequality and Income Distribution in Georgia	4	01/01
253	R. Yemtsov	Living Standards and Economic Vulnerability in Turkey between 1987 and 1994	4	01/01
254	H. Gersbach A. Schniewind	Learning of General Equilibrium Effects and the Unemployment Trap	3	02/01
255	H. Gersbach A. Schniewind	Product Market Reforms and Unemployment in Europe	3	02/01
256	T. Boeri H. Brücker	Eastern Enlargement and EU-Labour Markets: Perceptions, Challenges and Opportunities	2	02/01
257	T. Boeri	Transition with Labour Supply	4	02/01
258	M. Rosholm K. Scott L. Husted	The Times They Are A-Changin': Organizational Change and Immigrant Employment Opportunities in Scandinavia	1	02/01
259	A. Ferrer-i-Carbonell B. M.S. van Praag	Poverty in the Russian Federation	4	02/01
260	P. Cahuc F. Postel-Vinay	Temporary Jobs, Employment Protection and Labor Market Performance	1/3	02/01

261	M. Lindahl	Home versus School Learning: A New Approach to Estimating the Effect of Class Size on Achievement	5	02/01
262	M. Lindahl	Summer Learning and the Effect of Schooling: Evidence from Sweden	5	02/01
263	N. Datta Gupta N. Smith	Children and Career Interruptions: The Family Gap in Denmark	5	02/01
264	C. Dustmann	Return Migration, Wage Differentials, and the Optimal Migration Duration	1	02/01
265	M. Rosholm M. Svarer	Structurally Dependent Competing Risks	1	02/01
266	C. Dustmann O. Kirchkamp	The Optimal Migration Duration and Activity Choice after Re-migration	1	02/01
267	A. Newell	The Distribution of Wages in Transition Countries	4	03/01
268	A. Newell B. Reilly	The Gender Pay Gap in the Transition from Communism: Some Empirical Evidence	4	03/01
269	H. Buddelmeyer	Re-employment Dynamics of Disabled Workers	3	03/01
270	B. Augurzky C. M. Schmidt	The Evaluation of Community-Based Interventions: A Monte Carlo Study	6	03/01
271	B. Augurzky C. M. Schmidt	The Propensity Score: A Means to An End	6	03/01
272	C. Belzil J. Hansen	Heterogeneous Returns to Human Capital and Dynamic Self-Selection	5	03/01
273	G. Saint-Paul	Distribution and Growth in an Economy with Limited Needs	5	03/01
274	P. J. Pedersen N. Smith	Unemployment Traps: Do Financial Dis-incentives Matter?	3	03/01
275	G. S. Epstein T. Lecker	Multi-Generation Model of Immigrant Earnings: Theory and Application	1	03/01
276	B. Amable D. Gatti	The Impact of Product Market Competition on Employment and Wages	5	03/01

277	R. Winter-Ebmer	Evaluating an Innovative Redundancy-Retraining Project: The Austrian Steel Foundation	6	03/01
278	T. M. Andersen	Welfare Policies, Labour Taxation and International Integration	2	04/01
279	T. M. Andersen	Product Market Integration, Wage Dispersion and Unemployment	2	04/01
280	P. Apps R. Rees	Household Saving and Full Consumption over the Life Cycle	7	04/01
281	G. Saint-Paul	Information Technology and the Knowledge Elites	5	04/01
282	J. Albrecht A. Björklund S. Vroman	Is There a Glass Ceiling in Sweden?	5	04/01
283	M. Hagedorn A. Kaul V. Reinthaler	Welfare Analysis in a Schumpeterian Growth Model with Capital	7	04/01
284	H. Rapoport A. Weiss	The Optimal Size for a Minority	1	04/01
285	J. Jerger C. Pohnke A. Spermann	Gut betreut in den Arbeitsmarkt? Eine mikroökonometrische Evaluation der Mannheimer Arbeitsvermittlungsagentur	5	04/01
286	M. Fertig C. M. Schmidt	First- and Second-Generation Migrants in Germany –What Do We Know and What Do People Think	1	04/01
287	P. Guggenberger A. Kaul M. Kolmar	Efficiency Properties of Labor Taxation in a Spatial Model of Restricted Labor Mobility	3	04/01
288	D. A. Cobb-Clark	Getting Ahead: The Determinants of and Payoffs to Internal Promotion for Young U.S. Men and Women	5	04/01
289	L. Cameron D. A. Cobb-Clark	Old-Age Support in Developing Countries: Labor Supply, Intergenerational Transfers and Living Arrangements	3	04/01
290	D. A. Cobb-Clark M. D. Connolly C. Worswick	The Job Search and Education Investments of Immigrant Families	1	04/01

291	R. T. Riphahn	Cohort Effects in the Educational Attainment of Second Generation Immigrants in Germany: An Analysis of Census Data	1	05/01
292	E. Wasmer	Between-group Competition in the Labor Market and the Rising Returns to Skill: US and France 1964-2000	5	05/01
293	D. Cobb-Clark T. F. Crossley	Gender, Comparative Advantage and Labor Market Activity in Immigrant Families	1	05/01
294	Š. Jurajda	Estimating the Effect of Unemployment Insurance Compensation on the Labor Market Histories of Displaced Workers	3	05/01
295	F. Duffy P. P. Walsh	Individual Pay and Outside Options: Evidence from the Polish Labour Force Survey	4	05/01
296	H. S. Nielsen M. Rosholm N. Smith L. Husted	Intergenerational Transmissions and the School-to-Work transition of 2nd Generation Immigrants	1	05/01
297	J. C. van Ours J. Veenman	The Educational Attainment of Second Generation Immigrants in The Netherlands	1	05/01
298	P. Telhado Pereira P. Silva Martins	Returns to Education and Wage Equations	5	06/01
299	G. Brunello C. Lucifora R. Winter-Ebmer	The Wage Expectations of European College Students	5	06/01
300	A. Stutzer R. Lalive	The Role of Social Work Norms in Job Searching and Subjective Well-Being The Role of Social Work	5	06/01
301	J. R. Frick G.G. Wagner	Economic and Social Perspectives of Immigrant Children in Germany	1	06/01
302	G. S. Epstein A. Weiss	A Theory of Immigration Amnesties	1	06/01
303	G. A. Pfann B. F. Blumberg	Social Capital and the Uncertainty Reduction of Self-Employment	5	06/01
304	P. Cahuc E. Wasmer	Labour Market Efficiency, Wages and Employment when Search Frictions Interact with Intra-firm Bargaining	2	06/01

305	H. Bonin	Fiskalische Effekte der Zuwanderung nach Deutschland: Eine Generationenbilanz	1	06/01
306	H. Bonin G. Abío E. Berenguer J. Gil C. Patxot	Is the Deficit under Control? A Generational Accounting Perspective on Fiscal Policy and Labour Market Trends in Spain	2	06/01
307	G. A. Pfann	Downsizing	1/5	06/01
308	G. A. Pfann D. S. Hamermesh	Two-Sided Learning, Labor Turnover and Worker Displacement	1	06/01
309	G. Brunello	On the Complementarity between Education and Training in Europe	5	06/01
310	U. Sunde	Human Capital Accumulation, Education and Earnings Inequality	5	06/01
311	G. Brunello	Unemployment, Education and Earnings Growth	3	06/01
312	C. Furnée M. Kemler G. A. Pfann	The Value of Pain Relief	5	06/01

An updated list of IZA Discussion Papers is available on the center's homepage *www.iza.org*.