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Publication date:
2008

Document Version
Publisher's PDF, also known as Version of record

Citation for published version (APA):
Leth-Petersen, S., & Rotger, G. P. (2008). Long-term Labour Market Performance of Whiplash Claimants. Centre for Applied Microeconometrics. Department of Economics, University of Copenhagen.

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http://www.econ.ku.dk/CAM/

Working paper no. 2008-01

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The activities of CAM are financed by a grant from
The Danish National Research Foundation

Long-term Labour Market Performance of Whiplash Claimants

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Abstract:
A whiplash is a sudden acceleration-deceleration of the neck and head, typically associated with a rear-end car collision that may produce injuries in the soft tissue. Often there are no objective signs or symptoms of injury, and diagnosing lasting whiplash associated disorders (WAD) is difficult, in particular for individuals with mild or moderate injuries. This leaves a scope for compensation-seeking behaviour. The medical literature disagrees on the importance of this explanation. In this paper we trace the long-term earnings of a group of Danish individuals with mild to moderate injuries claiming compensation for having permanently lost earnings capacity and investigate if they return to their full pre-whiplash earnings when the insurance claim has been assessed. We find that about half of the claimants, those not granted compensation, return to an earnings level comparable with their pre-whiplash earnings suggesting that these individuals do not have chronic WAD in the sense that their earnings capacity is reduced. The other half, those granted compensation, experience persistent reductions in earnings relative to the case where they had not been exposed to a whiplash, even when they have a strong financial incentive to not reduce earnings. This suggests that moderate injuries tend to be chronic, and that compensation-seeking behaviour is not the main explanation for this group. We find that claimants with chronic WADs used more health care in the year prior to the whiplash than claimants with non-chronic cases. This suggests that lower initial health capital increases the risk that a whiplash causes persistent WAD.

JEL-Codes: I12, J29

Keywords: Whiplash, register data, labour market

Acknowledgements: We are grateful for valuable comments from David Cassidy, Thomas Bue Bjørner, Lars Gårn Hansen, Michael Svarer, and from seminar participants at the Department of Economics, University of Copenhagen, and from participants at the labour-market session of the 6th IHEA World Congress in 2007. We thank the Danish National Bureau of Industrial Injuries for providing the data. Both authors are grateful for financial support from the Danish Health Insurance Foundation (http://www.helsefonden.dk/).

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1. Introduction

Experts estimate that every year at least 1.5 per thousand of the population experience a whiplash (Lønnberg 2001). A whiplash is a sudden acceleration-deceleration of the neck and head that may produce injuries in the soft tissue, i.e. muscles, tendons, ligaments joints or nerves. The typical situation leading to a whiplash injury is a rear-end collision. In this type of collision, the cervical spine initially adopts an S-shape with hyperextension at the lower cervical spine levels, and hyperflexion at the upper levels, followed by a C-shaped configuration of the cervical spine with a hyperflexed neck in the rebound phase. This sudden extension and flexion of the cervical spine or neck is an injury-generating mechanism known as whiplash. Whiplash can also be produced with side or front collisions or in other types of situations, but rear-end impacts are the most frequent cause of whiplash injury (e.g. Spitzer et al. 1995).

A whiplash may injure muscles, ligaments, tendons, facet joints, intervertebral discs and nerve tissues; all these injuries are known as whiplash injuries. A person who has been injured by whiplash can immediately or some days after the collision experience a range of symptoms including neck pain, back pain, neck weakness, back weakness, vision disorder, dizziness, headaches, unconsciousness, or neurological symptoms. These are frequently labelled whiplash associated disorders (WAD) (Spitzer et al. 1995).

The existence of temporary symptoms is well-documented, and most people who are injured by whiplash recover within a few weeks. The particular injury producing persistent WAD is still, however, not well known, c.f. Johansen et al. (1999).[1] A discussion about the existence of chronic WAD is going on in the medical literature, with some researchers attributing chronic disorders to specific injuries and others sceptical towards the existence of persistent WAD (Livingston 2000). The first group, mainly rooted in health-care disciplines, has shown some evidence on the origin of chronic pain. The most relevant argument of this group is that a whiplash movement of the neck may injure the facet joints of spinal disc, rich in nerve endings, even with a low-speed rear-end collision, see Panjabi et al. (2004). The other group questions the existence of chronic WAD on the basis of statistical analysis. For example, in a study of 210 persons experiencing rear-end collisions in Lithuania, Obelieniene et al. (1999) found that those involved in the collisions reported no more symptoms than a group of controls[2]. Other studies find large variations in incidence and chronicity across

[1] The same type of tissue injuries in other parts of the body than the neck produces only temporary effects.

[2] This study is, however, hampered by the fact that 30-40% of the cohort had symptoms at the time of interception into the study. It is thus not surprising that the prevalence of neck pain at the follow-up was similar with that of the controls. We thank David Cassidy for pointing this out.

countries, cf. Ferrari and Russel (1999), and argue that only psychological, cultural and socioeconomic factors can explain the presence of chronic WADs. In cases with mild to moderate injuries there are often no objective signs or symptoms of injury, and diagnosing lasting whiplash associated disorders is difficult. This leaves a scope for compensation-seeking behaviour. Cassidy et al. (2000) have shown that removing the possibility for compensation for pain and suffering in a Canadian province in 1995 was associated with a reduced number of insurance claims and a more rapid recovery. Importantly, however, for many claimants the recovery was not fast or complete after the compensation scheme was changed. Moreover, recent evidence suggests that a substantial number of injured people do not recover quickly, Côté et al. (2000) and Cassidy et al. (2007), and Côté et al. (2004) shows that neck pain in the general population tends to be persistent, even when not related to motor vehicle crashes.

In Denmark a unique system for evaluating the extent of chronic WAD exists. Persons or insurance companies can have whiplash cases assessed by an independent governmental body, the National Board of Industrial Injuries (henceforth NBII), before the conflict reaches the judicial system. The NBII evaluates each case based on statements from medical experts and occupational history before and after the collision, including information about income and tax payments, and information from the employer, and decides on a degree of lost earnings capacity (henceforth LEC), which in turn decides the level of compensation paid by the insurance company according to the Damage Liability Act. The assessment made by the NBII is only advisory, but in most cases the decision of the NBII is followed by both parties without a subsequent trial. The degree of LEC is settled when the point of maximum medical improvement has been reached, and compensation is awarded when the LEC is 15% or more. The case is then closed and compensation is paid out as a lump-sum transfer. From this point the case cannot be reopened to reduce compensation if the claimant returns to full pre-whiplash earnings. In this case the claimant does not have any financial incentive to stay out of work.

The objective of this paper is to give a description of whiplash claimants with mild or moderate cases in terms of their pre-whiplash characteristics and to explore the extent to which they return to full pre-whiplash earnings when they have a strong financial incentive to do so. If they return to the pre-whiplash earnings level we take it as evidence that they are likely not to have persistent WADs and if they do not return then we take it as evidence that they are likely to have persistent WAD affecting their earnings capacity. We pursue the objective by considering the long-term labour force participation and earnings of persons

claiming to have chronic WAD and whose case has been assessed by the NBII. The NBII supplies us with an assessment of the severity of WAD in terms of their assessment of the degree of permanent LEC. The analysis focuses on a sample of persons assessed to have mild or moderate degree, i.e. maximally 30%, of permanent LEC. This selection is made because these cases are most likely to involve persons who have no physical and objective damages, thus implying a large scope for being susceptible to economic incentives and hence a potential for disagreement between claimants and insurance companies. The data set is based on records from NBII about some 1,200 persons claiming to have WAD following collisions occurring in 1996 to 1998, and who are assessed to have mild or moderate chronic WADs. These records are merged at person level to public administrative records with longitudinal information covering 1994-2002 about the purchase of prescription drugs, use of the public hospital system, earnings, information about family composition and other demographics. The same information is obtained for a 2% random sample of the Danish population serving as a control group. This information allows us to identify earnings, indicators of health, and other characteristics of WAD claimants measured before the collision occurs and to compare subsequent labour-market performance up to 5 years after the collision, i.e. after the case is closed and potential compensation paid out, with non-claimants who are otherwise similar with respect to these characteristics.

This paper is, to our knowledge, the first within the economic literature to analyse the effects of WAD on long-term labour-market performance. Measuring effects of non-work related injuries is rare since this category of injuries is usually not well-documented. We are able to examine the effects of WAD because Denmark has a unique system for assessing this type of injuries. Since a considerable fraction of the population is likely to be affected by WADs every year it is interesting in its own right to investigate the economic consequences of WADs. Measuring the long-term earnings of whiplash claimants is also interesting from a behavioural point of view, because the lack of objective damages creates a potential for individuals to choose to claim chronic WADs in order to obtain compensation without actually having chronic WADs[3]. We use economic information in the form of long-term earnings and exploit economic incentives to investigate if whiplash claims that are potentially motivated by compensation seeking behaviour are in fact likely to be associated with persistent WAD affecting earnings capacity adversely.

[3] Butler et al. (1996) provide empirical evidence suggesting "claims reporting moral hazard" in workers' compensation claims for soft tissue injuries such as sprains and strains.

This study also advances the medical literature on WADs in several ways, and the contribution derives from the richness of the data. The data set is unique along at least three dimensions. First, it contains information about an unusually large number of WAD claimants, including both individuals who were not given compensation and individuals who were given compensation for lost earnings capacity. Previous studies, except Cassidy et al. (2000) are mainly based on small samples obtained from medical trials, see for example Kwan and Friel (2003), and such trials are known to under-sample cases with mild and moderate WAD. This is because of the difficulties associated with diagnosing and implying that people are often given different diagnoses. This, in turn, implies that the statistical documentation is often incomplete, especially with regard to mild to moderate cases. As mentioned, the data exist because of the unique Danish system for evaluating WADs. Second, unlike any previous study, the data set contains a large number of variables with pre-collision characteristics of the claimants, including earnings and health indicators. This feature is unique and it permits us to give a detailed description of the selection into choosing to claim compensation for permanent LEC. Moreover, the medical literature does not present consistent evidence of any independent association between pre-whiplash health and recovery, cf. Côté et al. (2001). The pre-collision characteristics allow us to identify prognostic factors for whiplash recovery, and this is important because it facilitates clinicians and insurers to more accurately predict the outcome of patients with whiplash injuries. Third, it contains a large control group for which similar information is collected. The size of the data set, the historic information and the control group allow us to control for selection effects to a larger extent than was previously possible and to give a rich description of the heterogeneity in responses.

In the next section the compensation scheme for persons with WADs is described. In section 3 the data are presented. Details about the empirical strategy are presented in section 4. Section 5 gives results, and the final section sums up the analysis.

2. Compensation Schemes

In Denmark, whiplash injuries are included among the injuries which have incurred outside the course of work, but still provide compensation. The Damages Liability Act establishes that an injured person can be compensated among other things for temporary pain and suffering, temporary loss of earnings, permanent disability and permanent LEC.

The difficulty in detecting moderate whiplash injuries with medical screening and the uncertainty of the permanency of its symptoms complicates the determination of eligibility for LEC compensation. Frequently, the injured party's insurance company disagrees with the injured person about the severity of WAD, and in these cases an external evaluation of the effects of the whiplash injury is required. The Damages Liability Act defines the compensation scheme and eligibility conditions, and the National Board of Industrial Injuries (NBII) evaluates the extent of the injury through its board of medical consultants and experts.

Figure 1 represents a hypothesised situation where a whiplash injury produces a reduction in earnings capacity. After the injury, the individual generally experiences a drop in earnings capacity in the months immediately following the whiplash. Some months later the health of the injured reaches a stable level, but the earnings capacity does not reach its previous level. Irrespective of who is responsible for the collision, he or she is entitled to compensation from the insurance company of the other side. In many cases the insurance company or claimant will require an evaluation of LEC from the NBII. The length of the evaluation period depends on the severity of the symptoms. Concretely, in our sample, the average length period of this is approximately 9 months for the rejected applications (LEC<15%) and one year for moderately compensated applications (15%≤LEC≤30%). In spite of the differences in the length of the evaluation period, the period elapsed between the injury and the closure of the case is of similar length at approximately 2.5 years for all applicants. This is because in more severe cases the time interval between injury and claim is smaller than for mild cases.

[figure 1 about here]

The NBII estimates LEC by comparing the earnings of the individual when his health situation is stable, with earnings before the injury. In addition, NBII considers a host of individual information and medical expert statements. In this process, the assessment of the point of maximum health improvement, called the stationary point, is crucial. The NBII establishes the stationary point on the basis of the nature and scope of the injury as well as medical experience. Information on medical treatment is also used for the determination of the stationary date. Alternatively, the date where the injured returns to work can also be used as the stationary date.

Compensation for LEC applies when the estimated LEC is at least 15%, and is computed as six times the annual earnings before the injury occurred, times the LEC degree[4]. If annual earnings before the injury were more than 528,000 DKK,[5] then compensation is based on that amount. Compensation is reduced by 8.5% for each year the injured claimant was older than 55 when the injury occurred. LEC compensation is paid as a lump-sum transfer when the case is closed. If an individual thinks that he or she has been under-compensated the case may be resumed upon the claimant's request. There is, however, no monitoring of the actual earnings capacity of the compensated claimant hereafter, and the compensation law does not establish a mechanism to correct a situation of over-compensation. This lack of monitoring and the asymmetry in terms of the possibility to re-open the case provide an incentive for all claimants, whether they have been compensated or not, to exploit all of their actual earnings capacity once the case has been closed.

Besides compensation for permanent LEC it is also possible to obtain compensation from permanent injury. This is different from the compensation for LEC and is intended to cover the direct health effects of the injury and the impact on life quality, not necessarily related to the earnings capacity. The degree of permanent injury is assessed by medical consultants of the NBII when the health situation of the injured has been stabilised. The assessment is based only on the medical consequences of the injury in terms of physical and mental nuisance related to the injury, and does not depend on pre-accident earnings, education, sex or any other personal characteristics of the injured. Compensation is awarded when the degree of permanent injury is 5% or more. Compensation is proportional to the injury degree, and the maximum compensation of 302,000 DKK[6] is obtained when the degree of permanent injury is 100%. The level of compensation decreases with age if the claimant was older than 59 at the time of the injury. Compensation for LEC is typicallly much higher than for permanent injury, but it is also relatively more difficult to obtain. In our sample, 95% of the claimants obtained compensation for permanent injury while only 47% obtain compensation for LEC.

Finally, besides compensation for LEC and permanent injury, compensation is also granted for temporary pain and suffering and for temporary earnings losses in the period

[4] For example, if LEC is set at 20% and annual pre-injury earnings were 300,000 DKK then the level of compensation is 360,000=300,000×0.20×6.

[5] This threshold value is adjusted each year: in 1997 and 1998 it was 532,000 DKK and 546,000 DKK, respectively. The mean annual earnings among whiplash claimants in our sample in this period were about 160,000 DKK for women, and 210,000 DKK for men. Mean earnings in the 2% random sample was 165,000 DKK and 254,000 DKK for women and men, respectively.

[6] The exact value is adjusted each year: in 1997 and 1998 it was 304,000 DKK and 312,000 DKK, respectively.

ranging from the point of the collision and the stationary health point. This is calculated from pre-injury earnings, and is paid out only when the point of stable health has been determined.

3. Data

The data set is based on the records of NBII for the period 1996-1998 that contained information about the NBII's assessment of permanent LEC and permanent injury. These records have been merged at the person level to other administrative records containing longitudinal information covering the period 1994-2002 on personal characteristics such as age, education, and family composition, information about earnings, transfers, taxable income, and purchase of prescription drugs and use of public hospitals covering the period of 1994-2002. These data also include some financial information about individual assets and liabilities. From 1996 this information is, however, not tax assessed, and can only be used as a crude indicator of financial wealth. The same information is obtained for a 2% random sample of the Danish population that was not recorded for claiming compensation for WAD with the NBII, and was not diagnosed at any public hospital or specialist to have suffered a WAD. This sample is used to construct a control group consisting of people who had not been exposed to a whiplash. Potentially, this pool of controls could include individuals who have been exposed to whiplash, but have not experienced symptoms severe enough to claim compensation for WADs.

The initial data set comprises 1,708 persons claiming to have permanently lost earnings capacity due to a whiplash injury in 1996, 1997 or 1998, and with an NBII estimated LEC between 0 and 30%. The sample is delimited to individuals aged 20 to 54 the year before the injury. This selection criterion was made to avoid individuals who had retirement as an alternative and individuals who were eligible for a different compensation scheme. Finally, we restricted our sample to those who had their case closed within 4 years from the whiplash in order to be able to follow labour-market outcomes after the case has been closed and where the economic incentive to return to work is strong. After removing observations with missing values for the covariates and outcomes used in the application, the final sample includes 1,203 individuals.

[table 1 about here]

For these individuals the NBII has assessed the LEC as shown in table 1. Those who were granted LEC less than 15% were not eligible for compensation, and they are recorded as having no LEC. Roughly, half of the claimants were rejected. For those granted 15% or greater loss of earnings capacity the granted loss falls in discrete categories, and the main categories were 15, 20, and 25% assessed LEC. The level of compensation for a person with 20% assessed earnings loss compares to 120% of one year's pre-injury salary.

For the analysis we consider separately four sub-groups, 'Non-compensated Women' (NCW) (*N*=431), 'Compensated Women' (CW) (*N*=413), 'Non-compensated Men' (NCM) (*N*=204), and 'Compensated Men' (CM) (*N*=155). These numbers present a finding that is consistent with the finding in the medical literature that women have a much higher probability of suffering WAD and to claim compensation for persistent WAD, Cassidy et al. (2000), and to suffer persistent neck pain in general (Côté et al. 2004).

Tables A1 and A2 in the appendix present a description of the socio-economic characteristics and health status of these sub-groups of claimants. Irrespective of gender and the success of the claim, in the year *before* the whiplash, whiplash claimants use more drugs and use the hospital system more than the average individual from the population in spite of being approximately two years younger.

Taking a more detailed look at these tables, individuals who choose to claim in the future have a higher proportion of disorders and much higher use of prescription drugs. Irrespective of gender, the average whiplash claimant was using more drugs than the average control person did. The most consumed drugs are drugs targeting the muscular-skeletal system, anti-infective drugs, and drugs for the respiratory system, drugs for alimentary tract and metabolism, and drugs for the nervous system. Compensated claimants used relatively more drugs than non-compensated claimants prior to the whiplash. For example, future compensated women used 10%-points more drugs targeting the respiratory system, 9 percentage-points more drugs for the muscular-skeletal system and 8 percentage-points more anti-infective drugs than the control group, while compensated men used 12 percentage-points more anti-infectives, 10 percentage-points more drugs for targeting the muscular-skeletal system and 8 percentage-points more drugs for the respiratory system than the control group. Finally, women deciding to claim used more drugs for genitor-urinary system and sex hormones than women in the control group did.

The whiplash claimants also had a higher proportion of disorders the year before the injury. The year before the whiplash injury, irrespective of gender, claimants had on average more soft-tissue disorders, back pain, injuries to wrist or hand, and injuries to ankle or foot

than control group members in spite of being relatively younger. Previously, it has been suggested, though not consistently documented in the medical literature (Côté et al., 2001), that persons with migraine and neck pain prior to the whiplash experience slower recovery. Our findings are consistent with this. We, however, also find that claimants have a history of injuries to other parts of the body, namely wrists, hands, ankles and feet. Table A1 also shows that on average whiplash claimants have less education, are more likely to be single, earn less, have less working experience, and are less wealthy than the average individual in the control group. This is consistent with the findings of Cassidy et al. (2000).

4. Econometric Approach

The objective is to estimate the earnings loss that whiplash claimants actually experience in the long run. To do this, ideally, an experiment should be run where a group of persons are randomly assigned to be exposed to whiplash and their earnings growth following the whiplash then compared to that of the individuals in the control group. Obviously, we do not have access to data from such an experiment, and we therefore employ non-experimental methods to estimate the average long run earnings loss of individuals claiming whiplash associated disorders. This object is known as the average treatment effect on the treated, see e.g. Heckman and Vytlacil (2005), and it will be estimated by statistical matching.

4.1. Parameters of interest

Consider the counterfactual framework as a starting point for defining the average treatment effect on the treated where in this context having been exposed to a whiplash and claiming whiplash associated disorders is the treatment and individuals claiming WADs are the treated. The average effect of the whiplash on earnings growth is

$$E\left(\Delta y_{1,A} - \Delta y_{0,A} \middle| D = 1, X_B\right) = E\left(\Delta y_{1,A} \middle| D = 1, X_B\right) - E\left(\Delta y_{0,A} \middle| D = 1, X_B\right) \qquad (1)$$

$E(\ )$ is the cross-sectional expectation operator, $\Delta y_{j,A}$ is log earnings change measured across the period of the whiplash for an individual with whiplash status *j*, where $j = 1$ if a person claims WADs. B indicates pre-collision time period and A indicates post-collision time period. $D = 1$ indicates that an individual has been exposed to a whiplash and is claiming compensation for permanent LEC and X_B is a vector of observed characteristics measured

before the whiplash injury. It is not possible to construct a sample analogue of the last term on the right-hand side of (1), $E\left(\Delta y_{0,A} \middle| D=1, X_B\right)$, i.e. the growth rate of earnings conditional on X_B for whiplash claimants had they not been so. If, however, a whiplash is caused by a random event (conditional on X_B) then it is reasonable to assume ignorability-of-treatment

$$\Delta y_{0,A} \perp D \middle| X_B \tag{2}$$

where $\perp$ indicates independence. (2) implies that $E\left(\Delta y_{0,A} \middle| D=1, X_B\right) = E\left(\Delta y_{0,A} \middle| D=0, X_B\right)$, i.e. that conditional on X_B the expected growth rate of earnings for individuals claiming to have WADs had they not been claiming WADs is the same as the expected growth rate of earnings for individuals who are not claiming to have WADs. (2) implies that $E\left(\Delta y_{0,A} \middle| D=0, X_B\right)$ has a sample counterpart if there is overlap in the distribution of X_B between the groups of persons not claiming and the group of persons claiming WADs. This is stated

$$P\left(D=1 \middle| X_B\right) < 1 \qquad \text{for all } x \in \text{supp}\left(X_B \middle| D=1\right) \tag{3}$$

where $P\left(D=1 \middle| X_B\right)$ is the probability of treatment conditional on X_B. (3) requires that the probability for claiming WADs conditional on X_B must not be given with certainty, since otherwise it is not possible to find a control with the same X_B.

The implicit assumption made by (2) is that the whiplash is caused by a random event (conditional on X_B). A whiplash is typically a result of a rear-end car crash. The crucial assumption here is thus that individuals do not intentionally expose themselves to car crashes conditional on X_B. Having a higher propensity to crash is permitted to the extent that it is based on observed characteristics. Young men, for example, are at greater risk of being involved in and causing serious collisions. But, it is not permitted that individuals expose themselves deliberately to a whiplash in the anticipation that they can obtain compensation afterwards. However, the vast majority of WAD are caused by being struck by another vehicle implying that most WAD claimants are victims of collisions (Cassidy et al., 2000). It is also assumed that all persons actually having WADs adversely affecting permanent

earnings capacity will always claim, or symmetrically, that no individuals with actual permanently reduced earnings capacity following a whiplash will be in the control group. This is a reasonable assumption since the pecuniary benefits from obtaining compensation for permanently reduced earnings capacity are significant. If this assumption is correct then all truly permanently affected individuals will be in the claimant group, but the group of claimants will potentially also include individuals who have been exposed to whiplash without actually having WADs chronically affecting their earnings capacity. Such individuals will appear in the data without any lasting effects on earnings growth of the whiplash.

4.2. Matching on the Propensity Score

Under the validity of the conditional independence assumption (CIA), stated in equation (2), the only source for differences between observations is differences in covariates. Matching balances the covariates. Rosenbaum and Rubin (1983) show that given (3) assumption (2) can be stated in terms of the propensity score

$$\Delta y_{0,A} \perp D \left| P\left(X_B\right) \right. \tag{4}$$

$$P\left(D=1 \left| P\left(X_B\right)=p\right.\right) < 1 \qquad \text{for all } p \in \text{supp}\left(P\left(X_B\right) \left| D=1\right.\right) \tag{5}$$

so that $E\left(\Delta y_{0,A} \left| D=1, X_B\right.\right) = E\left(\Delta y_{0,A} \left| D=0, X_B\right.\right)$ can be replaced by $E\left(\Delta y_{0,A} \left| D=1, P\left(X_B\right)\right.\right) = E\left(\Delta y_{0,A} \left| D=0, P\left(X_B\right)\right.\right)$. This implies that if matching on X_B is valid then so is matching on $P\left(X_B\right)$.

A problem associated with implementing matching estimators is to match on a multi-dimensional covariate vector. One way to reduce the dimensionality of the problem is to estimate $E\left(D \left| X_B\right.\right)$ by a parametric model, and substitute this for the unknown propensity score. Here the propensity score is estimated using a probit specification.

The matching estimator applied here is the simplest possible. For each individual in the claimant group a single match is found from the control group that minimises the difference in the propensity score. This is called nearest neighbour matching. Matching each treated observation with one observation from the control group minimises the bias, but is generally inefficient since many observations from the control group are discarded. Matching is done with replacement, so that the same individual from the unconstrained group can act as

matched control for different constrained individuals. Reusing observations minimizes the risk that matched observations do not look like the observations in the treatment group, i.e. minimises the risk of bias. The disadvantage is that reusing observations causes loss in the precision of the estimate of the treatment effect. The variance estimator should take this into account. A schematic presentation of the matching protocol is given in table A4 in the appendix.

The main justification for this estimator is the simplicity of its implementation. Many alternative matching metrics exist. In particular, for each treated observation it is possible to match with more than one observation from the control group, either by matching more neighbours with equal weight or by matching more controls in a kernel weighted fashion as suggested by Heckman et al. (1997). This generally creates a gain in efficiency, but introduces a bias, since not only the best matches are used.[7] Moreover, matching can be performed directly on covariates by minimizing the weighted sum of squared distances between the covariates. Such estimators have been discussed by Rosenbaum and Rubin (1985) and Abadie and Imbens (2006) among others. Generally, there is no evidence that propensity score matching is less preferred than covariate matching (Zhao, 2004).

4.3. Choice of Covariates

The choice of covariates is crucial. So far the CIA has been justified based on an assumption that all relevant covariates are controlled for. In practice, the covariate set has to be selected. Unfortunately, there is no formal guide for choosing the covariates; in particular there is no justification for selecting variables based on a goodness-of-fit criterion (Heckman and Navarro-Lozano, 2004). In section 3 it was seen that the characteristics of the claimant group were quite different from those of the random sample. This suggests that balancing the covariates is important in this context. The purpose of the matching procedure is exactly to balance the covariates, and the key criterion justifying it is that (2) is satisfied.

One approach to selecting the covariate set is to first take a stance on what covariates should not be adjusted for (Imbens, 2004), and then, conditional on that, to argue what variables should be included in the covariate set. Conditional independence imposes the restriction that the covariate set is not affected by treatment itself. One way of assuring this is to include only variables that are measured before the collision occurs. Therefore, households are compared in terms of their characteristics measured in the year before whiplash claimants are exposed to a whiplash. For this to be credible it is necessary to rule out individuals

[7] We also tried to use the five nearest neighbours, but results were largely similar.

intentionally exposing themselves to the whiplash in the anticipation that they will obtain compensation. As already discussed this is likely to be satisfied in this context.

Next, in order to consider what variables should be included in the covariate set we depart from the standard framework applied in health economics. The performance by individuals in the labour market is determined by the joint inputs of human capital and health capital (Grossman, 1972). More health capital leaves the individual more resistant towards adverse health events. Human capital and health capital both influence the performance in the labour market, so that high levels of both increase total productivity in the labour market. Individuals may be heterogeneous with respect to their ability to produce human capital and health capital, and investments in human capital and health capital are potentially non-separable, so that, for example, a person with a low level of health capital also has a low level of human capital. A whiplash is an adverse shock to the health capital that may keep the individual unable to attend to his job temporary or permanently. His initial level of health capital may also influence his ability to recover from an adverse health shock. Two individuals experiencing a similar adverse shock due to a whiplash may respond differently to it in terms of absence from the job and in terms of recovery, because they have different levels of health capital prior to the shock. We assume that the level of health capital prior to the whiplash is correlated with the use of hospital services and the use of prescription drugs. A wide range of indicators for diagnoses registered at public hospitals the year before the whiplash is included. Moreover, we also include a range of indicators for the use of prescription drugs the year before the injury. It is the intention that these health status covariates control for individual heterogeneity in the health capital, which is likely to affect both propensity to claim WADs and the future performance in the labour market. These indicators are not used by the NBII to produce their estimate of permanent loss of earnings capacity.

Apart from variables indicating the level of health capital, variables describing the level of human capital of the individual are also included. Specifically, we include earnings, experience and the level of education, all measured prior to the collision. We also include controls for the financial situation prior to the collision. Specifically, indicators for the level of assets and liabilities and for spousal income are included. We also include controls for age of the individual and for the number of children in the household that the individual belongs to. Finally, it should be noted, that we do not control for initial injury severity, which is known to be prognostic for recovery, cf. Côté et al. (2001). We do, however, control for the severity of the injury to the extent that the assessment of NBII is correct.

5. Results

This section presents results from estimating the average loss of long-term earnings growth and labour-market participation of whiplash claimants. First, results from estimating the propensity score are presented along with an assessment of ability of the matching estimator to balance the covariates. Next, the main results are presented. Finally, the response heterogeneity is explored in section 5.3. The matching estimator, among other things, distinguishes itself from the most conventional regression-based estimators by allowing for heterogeneous responses in a non-parametric fashion. The heterogeneity in responses is explored along two dimensions. First, it is explored if earnings responses are correlated with any of the covariates and then quantile earnings effects are presented.

5.1. Estimating the Propensity Score and Assessing the Quality of the Matches

The propensity score is estimated using a probit model giving the probability of claiming whiplash associated disorders as a function of number of variables indicating injuries and disorders, the use of prescription drugs, and earnings, assets and liabilities for both the claimants and the spouse. Also, indicators for education and the number of children are included. All variables are measured the year prior to the whiplash collision. Probit models are estimated separately for 'Non-compensated Women' (NCW), 'Compensated Women' (CW), 'Non-compensated Men' (NCM), and 'Compensated Men' (CM).

Estimates are presented in tables A5 and A6 in the appendix[8]. There are some general patterns consistent with the descriptive analysis. The parameter estimates suggest that the propensity to claim compensation for permanent WADs tend to be negatively correlated with education, and that persons living in couples are less likely to claim compensation for reduced earnings capacity. Interestingly, earnings appear not to be a good predictor for the propensity to claim. The estimated parameters on the health variables, on the other hand, suggest that persons with diagnoses related to the functioning of the back and neck are more likely to claim compensation. For example, people with soft tissue disorders, migraine, and back pain tend to be more likely to claim. This is important because these conditions are highly prevalent in the population; see for example Côté et al. (2000). In some cases other types of diagnoses that are unrelated to injuries typically related to whiplash, also have predictive

[8] Many parameters are not estimated significantly, presumably due to the large number of parameters included in the models. We choose to maintain this large conditioning set, since Heckman et al. (1997) found that the matching estimator performed best in their study when a rich set of conditioning variables was used, and that considerable bias was induced by using a crude conditioning set.

power for the propensity to claim. The overall picture is that general health status prior to the whiplash is an important predictor for claiming compensation. In terms of a more general economic terminology this could be interpreted in the direction that lower levels of prior health capital predicts the propensity to claim compensation for permanent LEC.

Matching on the propensity score balances the propensity scores. What is really important is if the matching procedure balances the covariates. While many of the parameters are not estimated significantly the evidence suggests that the matching procedure is able to balance the covariates. To assess if the matching procedure has balanced the covariates the standardised bias[9] is calculated for all variables and for all the four cases (CM, NCM, CW, NCW) both before and after matching. The standardised bias before is presented in column 1 and 5 of table A5 and A6 in the appendix, and the standardised bias after matching has been performed is presented in column 4 and 8 of the same tables. If the standardised bias is above 20 then the bias is large (Rosenbaum and Rubin, 1985). Only for men is it possible to identify standardised biases that exceed 20, and only in two cases for both compensated and non-compensated men. In the bottom of the table a weighted average bias is also calculated to indicate if the covariates are not balanced when considered jointly. In all cases the summarised standardised bias indicates that covariates are well-balanced.

Finally, before turning to the presentation of the main results, it is crucial to assess if the common support requirement for treatment and control groups is satisfied. Figure 2 shows kernel densities of the estimated propensity scores for all the four cases, compensated/non-compensated men/women. Generally, for all cases the support of the control group appears to overlap the support of the treatment group[10]. This indicates that it should be possible to find valid controls for all the cases.

[figure 2 about here]

5.2. Main Results

The results from estimating the average effect of claiming WADs for claimants are presented in two steps. First, the estimated average employment effect of the whiplash for individuals

[9] The standardised bias is the difference between the sample means of the treated and matched controls as a percentage of the square root of the average of the sample variances in the treated and matched control groups, see Rosenbaum and Rubin (1985): $100\left(\overline{x}_{treated}-\overline{x}_{controls}\right)/\left[\left(s^2_{treated}-s^2_{controls}\right)/2\right]^{½}$

[10] For men, though, there may be limited overlap for observations with the largest estimated propensity scores. To check for the importance of this the calculations have been repeated conditioning on the difference in propensity scores between claimants and matched controls not exceeding 0.0001. This did not affect the estimates.

claiming compensation for permanent reductions in earnings capacity due to WAD is presented, and the presentation goes on to deal with earnings effects. Negative numbers indicate that whiplash claimants on average have lower employment/earnings than the matched control group. Effects are estimated for each year following the whiplash and for all four groups, compensated and non-compensated, men and women, respectively. Estimates are provided for all horizons because this offers a way to get indications as to whether symptoms following the whiplash are permanent or more likely to be temporary in nature.

First, estimated employment effects are presented in table 2. The results indicate that individuals having been awarded an LEC less than 15% on average do not experience a significant reduction in the employment propensity. Persons, who have been assessed to have experienced an LEC in the interval 15-30%, on the other hand, exhibit a reduced employment propensity at all horizons. This result is generally the same for both women and men. Moreover, there appears to be a short-term reduction in the employment propensity of 20-25% within the first two years after the whiplash, but then the employment propensity appears to recover slightly to settle at a long-term reduction in the employment propensity of about 15%.

[Table 2 about here]

The employment outcome represents the external margin. Based on these results it appears that most persons still maintain their ability to work. It is, however, possible that some people are able to participate in the labour market, but at a reduced intensity. We therefore go on to explore if claimants experience reduced earnings relative to the matched controls. Table 3 presents estimated average earnings effects. The left half of the table presents the estimated average earnings loss for all claimants irrespective of whether they participate in the labour market or not. The right half of the table shows estimated effects in logs, thereby deselecting individuals with zero earnings. The first column in the right half of the table, with the heading '%>0', gives the share of persons in the claimant group with positive earnings. We start commenting on the left part of the table. From here it appears that only the more severely injured persons, those with assessed earnings loss in the interval 15-30%, entitling them to compensation, experience a significant loss in earnings at all horizons. For this group of men the reduction in earnings appears to be fairly constant whereas for women there is a tendency for a more dramatic reduction in the short run, 1-3 years, and a slight recovery at longer horizons, 4-5 years after the collision. For persons with a smaller assessed earnings loss, not

entitling them for compensation, there does not appear to be any significant reduction in earnings at any horizon.

[Table 3 about here]

Turning to the results presented in the right side of table 3 it is seen from the '%>0' column that all groups experience a large reduction in employment as time passes. For example, for the group of compensated men the share of employed reduces from 60% in the first year after the collision[11] to 34% five years after the collision. This drop in employment is, however, the unconditional drop. Recall from table 2 that the drop over the five-year-horizon is only 15% when compared to the group of controls. In other words, claimants would have faced a considerable risk of leaving employment even if they had not been exposed to whiplash. Considering the average estimated earnings effect among persons with positive earnings it is evident from table 3 that there is an immediate earnings loss for compensated men of some 30%, but the loss reduces to 16% after five years. For women the picture is different. Here the immediate drop is 50%, but it reduces to about 6% five years after the collision. For non-compensated men and women the data suggest no average earnings loss at all horizons.

Finally, combining these results with the descriptive statistics from before an interesting pattern appears. The fact that compensated claimants used more health services than non-compensated claimants prior to the whiplash suggests that a low level of initial health capital increases the risk that a whiplash causes persistent WAD.

5.3. Heterogeneous Responses

A priori heterogeneity in response to claiming a whiplash injury should be expected. Response heterogeneity is investigated along two dimensions. First, it is investigated if responses correlate with earnings and health characteristics before the collision. Next, a quantile approach is employed to investigate how responses are distributed.

The matching estimator produces individual estimates of the effect of claiming whiplash on subsequent earnings. It is therefore possible to explore whether there are systematic differences in the responses across different observed characteristics. The compensation system offers no financial incentive to stay out of work when the case has been evaluated. Once the case is closed and a potential compensation has been paid out, claimants have a

[11] The year before the whiplash the share with positive earnings in the four claimant groups was: CM: 80%, NCM: 82%, CW: 82%, NCW: 82%.

financial incentive to return to the labour market to reap the benefits of their human capital for the rest of their working lives if they have not actually permanently lost earning capacity. Thus, individuals with high productivity, whom we identify as individuals with high earnings prior to the collision, have a strong incentive in terms of foregone earnings to return to work if the symptoms are indeed not permanent. Of course, high earners are most likely to have high levels of health capital, and thereby to recover faster than the average individual. Moreover, if compensation has been paid out this creates a potential wealth effect that may keep people out of work. To explore the importance of these factors regressions of estimated treatment effects on pre-collision earnings, health variables, and all the other covariates plus assessed LEC has been run. LEC is included because it directly determines the level of compensation.

Extracts of these regressions are shown in table 4. Table 4 contains the parameters that were significant in the regressions. The parameters in table 4 have been standardized, implying that they should be interpreted as the effect of a one standard deviation change in the explanatory variable. In this way the relative importance of the two variables presented in table 4 can be compared.

[Table 4 about here]

The results presented in table 4 indicate that for compensated men and women prior earnings is a very strong predictor for the size of the earnings loss at all horizons. The parameters indicate in both cases that persons who had higher earnings before the whiplash tend to have bigger reductions in earnings after the whiplash relative to what they would have had if they had not been exposed to a whiplash. Recall, that the compensation scheme encourages these people to return to work. Of course, the immediate objection would be that the compensation would potentially reduce labour supply. But these results are conditional on the assessed LEC that is directly proportional to the compensation. The ‘earnings effect’ is therefore an effect that comes on top of any wealth effect. LEC carries the net effect of a genuine health effect (to the extent that NBII has been able to assess the loss in earnings capacity correctly) and a wealth effect, since compensation is directly proportional to the assessed loss in earnings capacity. The parameter estimate indicates that individuals with bigger LEC experience a greater loss in earnings. Comparing the estimated standardised parameters on earnings and LEC suggests that the earnings effect is quantitatively more important than the effect of LEC. This, in turn, suggests that even in the case where LEC reflects a pure wealth effect, the health

effect dominates the wealth effect[12]. In summary, these results suggest that individuals who have been compensated actually tend to have a permanently reduced earnings capacity.

The results for non-compensated men are also clear. For this group there is no evidence that the earnings loss is related to their prior earnings level. This confirms the basic results, commented on earlier, that non-compensated men show little sign of permanent impairment of their earnings capacity. The results for non-compensated women are less clear. Results in table 4 suggest that among non-compensated women there is a tendency for women with higher pre-collision earnings to suffer bigger losses than non-compensated women with lower pre-collision incomes. This appears to be in favour of the hypothesis that among rejected women there are some who actually did experience a permanent reduction in earnings capacity. We have checked the robustness of this result by modelling pre-collision earnings with polynomials, and that analysis suggests that the result for non-compensated women is not robust, as opposed to the results for the other groups.

We now turn to explore the heterogeneity in responses along a different dimension. In table 5 results from estimating quantile effects, cf. Firpo (2007), of claiming permanent whiplash-associated disorder are presented for 1 to 5 years after the collision. The pattern that appeared in the average results is confirmed at the range of quantiles (0.2, 0.4, 0.5, 0.6, and 0.8) that we have estimated for. In particular, non-compensated individuals appear not to have reduced earnings relative to what they would have had if they had not been exposed to the whiplash, and this is the case for all the quantiles that we have estimated for. For the non-compensated groups there appears not even to be a temporary earnings loss, except for the lowest quantile for non-compensated men. For this particular group, however, earnings are regained after three years. Quantile results also confirm the average results for compensated men and women. Compensated individuals experience an immediate but temporary drop in earnings that is bigger than the long-term loss as measured 5 years after the collision. Again, this pattern holds at all quantiles, and the earnings loss increases when moving from higher quantiles to lower quantiles. For compensated men the long-term earnings loss is at least 15%, comparable with the assessed earnings loss. The long-term earnings loss for compensated women appears to be smaller than for compensated men, and this is the case at all quantiles. In fact, among the women who have achieved compensation, at least half of the group

[12] We have also tried to run these regressions interacting income with indicators for education levels. Education could be relevant if different educational groups have different job functions that are differentially sensitive to WADs. These regressions (not reported) indicated no differences in the responses to income across educational groups.

experiences an earnings loss that is very small, and indeed much smaller than the assessed permanent loss of earnings capacity.

[Table 5 about here]

6. Conclusion

In this paper we characterise a group of Danish individuals claiming compensation for having permanently lost earnings capacity and explore if they return to their full pre-whiplash earnings after the insurance claim has been assessed and the financial incentive to return to pre-whiplash earnings is strong.

The analysis is based on data about some 1,200 persons claiming to have permanently lost some earnings capacity due to chronic whiplash-associated disorders as a consequence of collisions occurring in 1996 to 1998. These records are merged at person level to public administrative records with longitudinal information about earnings, the purchase of prescription drugs, use of the public hospital system, information about family composition and other demographics. The same information was obtained for a control group consisting of a 2% random sample from the population. Unlike any previous study this made it possible to characterise claimants in terms of a rich set up pre-whiplash characteristics and to compare the development of earnings of WAD claimants from before the collision and up to five years after the collision with that of non-claimants who are otherwise similar in terms of pre-collision health indicators, earnings and other characteristics.

We find that about half of the claimants, those not granted compensation, return to an earnings level comparable with their pre-whiplash earnings suggesting that these individuals do not have chronic WAD in the sense that their earnings capacity is reduced. The other half, those granted compensation, experience persistent reductions in earnings relative to the case where they had not been exposed to a whiplash. The reduction in earnings persists after the whiplash claim has been assessed in spite that they have a strong financial incentive to not reduce earnings. This suggests that moderate injuries tend to be chronic, and that compensation-seeking behaviour is not the main explanation for this group. We find that claimants with chronic WADs used more health care in the year prior to the whiplash than claimants with non-chronic cases. This suggests that lower initial health capital increases the risk that a whiplash causes persistent WAD. This is important because it facilitates clinicians and insurers to more accurately predict the outcome of patients with whiplash injuries.

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Appendix

Table A1: Socio-economic Description of Whiplash Claimants One Year before the Whiplash

	Women						Men					
	Comp		Non Comp		Control		Comp		Non Comp		Control	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age	35.50	8.8	36.1	9.3	38.1	9.1	34.9	8.2	35.8	9.3	38.5	9.0
Partner	0.722	0.449	0.745	0.436	0.803	0.398	0.606	0.490	0.657	0.476	0.762	0.426
Children 0-2 years	0.208	0.446	0.195	0.446	0.186	0.428	0.213	0.470	0.147	0.382	0.174	0.415
Children 3-6 years	0.349	0.578	0.216	0.484	0.249	0.510	0.206	0.452	0.221	0.482	0.234	0.499
Children 7-9 years	0.223	0.445	0.144	0.364	0.168	0.408	0.090	0.288	0.137	0.385	0.155	0.393
Children 10-14 years	0.324	0.588	0.241	0.480	0.250	0.517	0.129	0.373	0.157	0.427	0.228	0.500
Children 15-17 years	0.133	0.354	0.148	0.375	0.150	0.380	0.077	0.291	0.113	0.317	0.130	0.357
Education 0	0.017	0.129	0.005	0.068	0.013	0.113	0.013	0.113	0.025	0.155	0.016	0.127
Education 1	0.337	0.473	0.348	0.477	0.334	0.472	0.316	0.466	0.235	0.425	0.278	0.448
Education 2	0.068	0.252	0.077	0.266	0.069	0.254	0.019	0.138	0.044	0.206	0.054	0.226
Education 3	0.421	0.494	0.387	0.488	0.358	0.479	0.535	0.500	0.544	0.499	0.455	0.498
Education 4	0.012	0.109	0.032	0.177	0.040	0.195	0.032	0.177	0.059	0.236	0.046	0.210
Education 5	0.123	0.329	0.121	0.326	0.155	0.362	0.052	0.222	0.069	0.253	0.092	0.289
Education 6	0.022	0.146	0.030	0.171	0.032	0.175	0.032	0.177	0.025	0.155	0.059	0.235
Experience	9.5	6.5	11.1	7.6	11.5	7.7	11.2	7.3	12.0	7.9	14.5	8.6
Earnings	155.6	114.6	167.7	119.0	165.4	121.2	203.4	151.3	219.1	158.8	253.5	177.8
Assets	251.2	354.0	268.6	362.9	264.6	530.5	354.5	510.7	540.2	929.4	531.9	1407.5
Liabilities	239.9	297.1	236.6	279.8	223.5	296.8	325.4	330.4	395.9	604.4	404.4	754.8
Partner's Income	225.5	194.9	234.9	178.8	268.4	225.6	113.3	112.4	141.4	120.3	162.5	126.6
Partner's Assets	336.2	477.5	412.4	642.5	518.5	1451.7	125.0	239.3	177.4	351.2	229.6	4270.3
Partner's Liabilities	326.8	407.6	326.0	407.3	370.1	851.2	120.7	212.7	172.3	279.9	192.2	1196.0
Num of Obs.	413		431		57,193		155		204		57,259	
1996	0.42		172		0.33		0.52		0.40		0.33	
1997	0.34		157		0.33		0.28		0.33		0.33	
1998	0.24		102		0.34		0.19		0.27		0.34	

Note: Variable names are explained in table A3.

Table A2: Health Status of Whiplash Claimants One Year before the Whiplash

	Women						Men					
	Comp		Non Comp		Control		Comp		Non Comp		Control	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
med_a	0.1211	0.3266	0.1114	0.3150	0.0679	0.2516	0.0968	0.2966	0.0784	0.2695	0.0311	0.1736
med_b	0.0097	0.0981	0.0278	0.1647	0.0065	0.0804	0.0000	0.0000	0.0147	0.1207	0.0030	0.0546
med_c	0.0412	0.1989	0.0487	0.2155	0.0387	0.1930	0.0581	0.2346	0.0294	0.1694	0.0216	0.1454
med_d	0.1743	0.3799	0.1485	0.3560	0.1070	0.3091	0.0774	0.2681	0.0735	0.2616	0.0514	0.2207
med_g	0.1985	0.3994	0.1508	0.3583	0.1241	0.3297	0.0129	0.1132	0.0049	0.0700	0.0017	0.0418
med_h	0.0412	0.1989	0.0232	0.1507	0.0177	0.1318	0.0129	0.1132	0.0245	0.1550	0.0103	0.1009
med_j	0.2591	0.4387	0.2459	0.4311	0.1728	0.3780	0.2129	0.4107	0.1422	0.3501	0.0912	0.2879
med_m	0.1525	0.3600	0.1090	0.3121	0.0621	0.2413	0.1548	0.3629	0.0980	0.2981	0.0467	0.2110
med_n	0.1114	0.3150	0.0998	0.3000	0.0673	0.2506	0.0581	0.2346	0.0833	0.2771	0.0369	0.1885
med_p	0.0508	0.2200	0.0418	0.2003	0.0247	0.1551	0.0065	0.0803	0.0196	0.1390	0.0085	0.0918
med_r	0.2082	0.4065	0.1694	0.3755	0.1078	0.3101	0.1290	0.3363	0.0686	0.2534	0.0500	0.2180
med_s	0.1356	0.3428	0.1067	0.3091	0.0830	0.2759	0.0645	0.2465	0.0294	0.1694	0.0362	0.1868
malcan	0.0024	0.0492	0.0023	0.0482	0.0036	0.0601	0.0000	0.0000	0.0049	0.0700	0.0022	0.0470
bencan	0.0145	0.1198	0.0023	0.0482	0.0100	0.0994	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
diabet	0.0024	0.0492	0.0023	0.0482	0.0017	0.0411	0.0065	0.0803	0.0098	0.0988	0.0027	0.0523
epilep	0.0000	0.0000	0.0000	0.0000	0.0012	0.0342	0.0065	0.0803	0.0000	0.0000	0.0013	0.0357
migrai	0.0121	0.1095	0.0023	0.0482	0.0019	0.0432	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
eyedis	0.0048	0.0695	0.0046	0.0680	0.0045	0.0669	0.0000	0.0000	0.0049	0.0700	0.0066	0.0812
eardis	0.0097	0.0981	0.0023	0.0482	0.0041	0.0637	0.0000	0.0000	0.0049	0.0700	0.0048	0.0688
resdis	0.0121	0.1095	0.0209	0.1432	0.0089	0.0941	0.0258	0.1591	0.0098	0.0988	0.0093	0.0959
digdis	0.0218	0.1462	0.0209	0.1432	0.0191	0.1370	0.0258	0.1591	0.0294	0.1694	0.0178	0.1322
skidis	0.0291	0.1682	0.0070	0.0832	0.0073	0.0854	0.0000	0.0000	0.0098	0.0988	0.0064	0.0795
joidis	0.0073	0.0850	0.0209	0.1432	0.0106	0.1026	0.0194	0.1382	0.0049	0.0700	0.0110	0.1042
sctiss	0.0024	0.0492	0.0070	0.0832	0.0010	0.0316	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
bapain	0.0194	0.1380	0.0348	0.1835	0.0123	0.1101	0.0452	0.2083	0.0343	0.1825	0.0115	0.1064
sotiss	0.0387	0.1932	0.0093	0.0960	0.0133	0.1144	0.0516	0.2220	0.0343	0.1825	0.0114	0.1063
bredis	0.0048	0.0695	0.0046	0.0680	0.0047	0.0683	0.0000	0.0000	0.0049	0.0700	0.0004	0.0205
uridis	0.0024	0.0492	0.0046	0.0680	0.0048	0.0691	0.0000	0.0000	0.0049	0.0700	0.0035	0.0587
pelgen	0.0484	0.2149	0.0394	0.1949	0.0277	0.1641	-	-	-	-	-	-
aborti	0.0266	0.1612	0.0278	0.1647	0.0204	0.1414	-	-	-	-	-	-
pregna	0.0073	0.0850	0.0139	0.1173	0.0134	0.1149	-	-	-	-	-	-
birthc	0.0121	0.1095	0.0278	0.1647	0.0162	0.1263	-	-	-	-	-	-
delive	0.0436	0.2044	0.0464	0.2106	0.0386	0.1927	-	-	-	-	-	-
digabn	0.0315	0.1748	0.0139	0.1173	0.0081	0.0894	0.0000	0.0000	0.0049	0.0700	0.0027	0.0521
heainj	0.0145	0.1198	0.0186	0.1351	0.0102	0.1006	0.0323	0.1773	0.0392	0.1946	0.0238	0.1525
necinj	0.0048	0.0695	0.0139	0.1173	0.0121	0.1092	0.0065	0.0803	0.0196	0.1390	0.0066	0.0810
thoinj	0.0048	0.0695	0.0046	0.0680	0.0021	0.0454	0.0065	0.0803	0.0049	0.0700	0.0046	0.0680
lbainj	0.0048	0.0695	0.0070	0.0832	0.0023	0.0474	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
uarinj	0.0194	0.1380	0.0000	0.0000	0.0037	0.0604	0.0129	0.1132	0.0147	0.1207	0.0063	0.0788
farinj	0.0169	0.1292	0.0093	0.0960	0.0056	0.1512	0.0129	0.1132	0.0098	0.0988	0.0077	0.0876
haninj	0.0436	0.2044	0.0371	0.1893	0.0234	0.1133	0.1161	0.3214	0.0539	0.2264	0.0424	0.2016
lleinj	0.0218	0.1462	0.0209	0.1432	0.0130	0.1364	0.0258	0.1591	0.0196	0.1390	0.0214	0.1446
fooinj	0.0387	0.1932	0.0325	0.1775	0.0190	0.0523	0.0516	0.2220	0.0245	0.1550	0.0253	0.1571
truinj	0.0024	0.0492	0.0046	0.0680	0.0027	0.0000	0.0194	0.1382	0.0098	0.0988	0.0042	0.0646
		413		431		57,193		155		204		57,259

Note: Diseases classified according to the first level of the 10th version of the International Statistical Classification of Diseases and Related Health Problems (ICD-10). Drugs classified according to the first level of the Anatomical Therapeutic Chemical Classification (ATC) System. Variable names are explained in table A3.

Table A3: Variable Names and Content of Variables

age	Age at Injury Year
age2	Square of Age at Injury Year
partner	Partner Dummy Year Before Injury
children 0-2	Number of Children between 0-2 Year Before Injury
children 3-6	Number of Children between 3-6 Year Before Injury
children 7-9	Number of Children between 7-9 Year Before Injury
children 10-14	Number of Children between 10-14 Year Before Injury
children 15-17	Number of Children between 15-17 Year Before Injury
education 0	No Education information Year Before Injury
education 1	Primary Education Year Before Injury
education 2	Secondary Education Year Before Injury
education 4	Theoretical 1 Education Year Before Injury
education 5	Theoretical 2 Education Year Before Injury
education 6	Theoretical 3 Education Year Before Injury
experience	Years of wage experience Year Before Injury
earnings	Annual Earnings Year Before Injury (DKK 2003)
earnings var.	Annual Earnings Variation Year Before Injury (DKK 2003)
partner's inc.	Partner Disposable Income Year Before Injury (DKK 2003)
actives	Actives of Injured Year Before Injury (DKK 2003)
partner's act.	Partner's Actives Year Before Injury (DKK 2003)
passives	Passives of Injured Year Before Injury (DKK 2003)
partner's pass.	Partner's Passives Year Before Injury (DKK 2003)
med_a	Use of Drugs for Alimentary tract and metabolism
med_b	Use of Drugs for Blood
med_c	Use of Drugs for Cardiovascular system
med_d	Dermatological Drugs
med_g	Use of Drugs for Genito-urinary system and sex hormones
med_h	Systemic hormonal preparations
med_j	Anti-infectives for systemic use
med_m	Use of Drugs for Musculo-skeletal system
med_n	Use of Drugs for Nervous system
med_p	Use of Antiparasitic products, insecticides and repellents
med_r	Use of Drugs for Respiratory system
med_s	Use of Drugs for Sensory organs
malcan	Malign Cancer
bencan	Benign Cancer
diabet	Diabetes
epilep	Epilepsy
migrai	Migraine & Headache Syndromes
eyedis	Eye Disease
eardis	Ear Disease
resdis	Respiratory System Disease
digdis	Digestive System Disease
skidis	Skin or Subcutaneous Tissue Infection
joidis	Joint Disease
sctiss	Systemic Connective Tissue Disorder
bapain	Back Pain

sotiss	Soft Tissue Disorder
bredis	Disorders of the Breast
uridis	Urinary System Diseases
pelgen	Pelvic Organs or Genital Tract Disease
aborti	Abortion
pregna	Pregnancy Disorder
birthc	Childbirth Complication
delive	Delivery
digabn	Symptoms Involving the Digestive System and Abdomen
heainj	Injuries to Head
necinj	Injuries to Neck
thoinj	Injuries to Thorax
lbainj	Injuries to Abdomen, Lower Back, Lumbar Spine or Pelvis
uarinj	Injuries to Shoulder or Upper Arm
farinj	Injuries to Elbow or Forearm
haninj	Injuries to Wrist or Hand
lleinj	Injuries to Knee or Lower Leg
fooinj	Injuries to Ankle or Foot
truinj	Injuries to Unspecified Parts of Trunk, Limb or Body Region

Table A4: The Matching Algorithm

Step 1	Estimate a probit model for the propensity score
Step 2	Draw an observation from the pool of whiplash claimants and remove the observation from this pool
Step 3	Find the observation in the control pool with the propensity score closest to that of the observation from the whiplash pool picked in step 2.
Step 4	Put the matched control observation from step 3 back into the control pool
Step 5	Go back to step 2 if there are any observations left in the pool of whiplash claimants

Table A5: Standardized Bias before Matching and after Matching. Men

	Compensated				Non-Compensated			
	SDIFF_b	**probit coef**	**probit rse**	**SDIFF_a**	**SDIFF_b**	**probit coef**	**probit rse**	**SDIFF_a**
age	-41.7	0.085	0.029	1.4	-28.8	-0.021	0.024	1.3
age2	-43.1	-0.001	0	0.5	-27.8	0	0	1.6
partner	-33.6	0.036	0.112	-11.2	-23.2	-0.152	0.084	4.9
children 0-2	8.3	0.004	0.066	-17.4	-6.8	-0.08	0.068	-5.0
children 3-6	-4.9	-0.051	0.059	5.4	-2.7	0.001	0.052	-6.3
children 7-9	-18.8	-0.134	0.082	3.7	-4.5	0.009	0.066	4.2
children 10-14	-22.3	-0.103	0.068	0.0	-15.2	-0.06	0.058	0.0
children 15-17	-16.3	-0.048	0.093	0.0	-5.2	0.041	0.069	-13.8
education 0	-3.1	-0.286	0.247	-21.4	5.7	-0.017	0.158	2.2
education 1	8.2	-0.092	0.062	12.7	-9.7	-0.176	0.059	2.3
education 2	-18.1	-0.495	0.175	6.9	-4.5	-0.224	0.118	0.0
education 4	-6.8	-0.154	0.148	6.7	5.7	0.017	0.102	-1.8
education 5	-15.7	-0.145	0.123	2.5	-8.7	-0.114	0.096	4.9
education 6	-12.6	-0.144	0.16	-9.3	-17.1	-0.332	0.139	6.1
experience	-40.9	-0.001	0.006	1.2	0.7	0.007	0.004	-1.1
earnings	-30.0	-0.475	0.255	0.5	-20.4	-0.107	0.197	-6.0
earnings var.	13.4	0.918	0.484	8.0	-2.3	-0.144	0.315	9.8
partner's inc.	-41.7	-0.745	0.501	-2.1	-17.1	0.337	0.282	-4.5
Assets	-17.3	-0.015	0.036	1.9	0.7	0.007	0.004	-1.1
partner's assets.	-24.0	0.01	0.055	1.6	-1.7	-0.056	0.11	-27.2
Liabilities	-13.2	0.027	0.025	-36.7	-1.2	0.013	0.011	-1.5
partner's liabils.	-26.3	-0.095	0.142	-2.5	-2.3	0.111	0.118	-6.5
atc_a	26.6	0.225	0.116	0.0	20.9	0.222	0.113	10.5
atc_b	-	-	-		12.5	0.471	0.263	6.2
atc_c	19.2	0.226	0.138	13.3	4.9	-0.047	0.167	2.0
atc_d	11.0	-0.091	0.114	7.9	9.2	0.02	0.102	-25.5
atc_g	13.2	0.624	0.318	15.2	5.5	0.297	0.415	3.7
atc_h	1.9	-0.261	0.251	0.0	10.9	0.202	0.176	9.2
atc_j	34.2	0.095	0.087	10.9	15.9	0.059	0.084	-1.9
atc_m	36.5	0.256	0.092	-2.2	19.9	0.152	0.098	-4.1
atc_n	10.4	-0.264	0.124	12.2	19.6	0.157	0.107	-4.2
atc_p	-2.1	-0.36	0.324	7.5	9.4	0.193	0.186	0.0
atc_r	28.2	0.165	0.102	-4.6	7.9	-0.018	0.102	-5.5
atc_s	12.7	-0.012	0.128	0.0	-3.8	-0.194	0.145	6.5
malcan	-	-	-	-	4.5	0.262	0.365	0.0
diabet	5.9	0.169	0.345	0.0	8.9	0.396	0.292	6.2
epilep	8.3	0.529	0.404	10.4	-	-	-	-
eyedis	-	-	-	-	-2.3	-0.16	0.339	0.0
eardis	-	-	-	-	0.2	0.006	0.339	0.0
resdis	12.2	0.242	0.185	-4.9	0.5	-0.068	0.234	10.1
digdis	5.1	0.045	0.177	-4.4	7.6	0.119	0.151	0.0
skidis	-	-	-	-	3.8	0.022	0.26	10.9
joidis	7.2	0.148	0.214	5.3	-6.8	-0.313	0.317	-11.0
bapain	20.3	0.461	0.155	3.9	15.3	0.303	0.143	3.3
sotiss	23.1	0.495	0.146	-3.7	15.3	0.331	0.142	6.6
bredis	-	-	-	-	8.7	0.874	0.458	9.5
uridis	-	-	-	-	2.2	0.073	0.367	0.0
digabn	-	-	-	-	3.5	0.083	0.357	0.0
heainj	4.8	-0.049	0.153	-7.8	8.8	0.106	0.128	0.0
necinj	0.3	-0.092	0.329	0.0	11.4	0.314	0.2	12.9
thoinj	2.8	0.077	0.363	-17.5	0.4	-0.077	0.347	7.1
uarinj	6.8	0.133	0.275	-26.5	8.3	0.206	0.205	-4.8
farinj	4.9	-0.009	0.251	-19.0	2.2	-0.004	0.243	-10.5

haninj	26.4	0.24	0.094	2.4	5.4	-0.005	0.105	-2.3
lleinj	2.9	-0.054	0.182	4.2	-1.2	-0.112	0.169	6.9
fooinj	13.9	0.137	0.132	-3.4	-0.5	-0.091	0.151	6.3
truinj	14.3	0.403	0.228	0.0	6.7	0.182	0.263	11.7
d1996		0.218	0.082			0.048	0.069	
d1997		0.128	0.076			0.091	0.059	
_cons		-3.987	0.507			-2.034	0.425	
Av.SDIFF				7.0				5.6
wAv.SDIFF				6.2				5.3
N				57685				57463
N1				155				204

Note: Av.SDIFF:= Average Standardised Bias. wAv.SDIFF:= T-statistic Weighted Average Standardised Bias. Variable names are explained in table A3.

Table A6: Standardized Bias before Matching and after Matching. Women.

	Compensated				Non-Compensated			
	SDIFF_b	probit coef	probit rse	SDIFF_a	SDIFF_b	probit coef	probit rse	SDIFF_a
age	-30.5	-0.029	0.021	0.8	-22.2	-0.031	0.02	6.4
age2	-30.8	0	0	0.8	-21.5	0	0	5.9
partner	-19.5	-0.131	0.063	7.4	-13.9	-0.021	0.055	-7.8
children 0-2	5.4	0.02	0.054	5.0	1.9	-0.076	0.057	-12.2
children 3-6	18.8	0.108	0.036	5.8	-6.7	-0.076	0.04	5.1
children 7-9	12.6	0.078	0.042	2.8	-6.3	-0.048	0.047	-1.2
children 10-14	13.6	0.123	0.033	-5.3	-1.8	0.011	0.036	9.3
children 15-17	-5.0	0.025	0.052	-0.7	-0.3	0.05	0.048	3.7
education 0	2.9	-0.094	0.154	-4.0	-9.0	-0.343	0.244	5.0
education 1	1.0	-0.097	0.046	-2.1	3.0	-0.012	0.043	6.4
education 2	-0.7	-0.175	0.078	1.0	2.8	-0.051	0.074	-2.7
education 4	-16.9	-0.451	0.149	-3.1	-3.8	-0.075	0.099	3.7
education 5	-9.2	-0.131	0.059	2.8	-9.9	-0.086	0.059	0.0
education 6	-6.1	-0.248	0.128	-3.0	-0.9	0.028	0.109	-4.0
experience	-27.6	-0.01	0.004	-1.1	-5.3	0.009	0.004	1.5
earnings	-8.2	0.407	0.227	-1.4	1.9	0.034	0.203	-1.0
earnings var.	4.9	-0.056	0.355	-6.3	-0.4	0.029	0.326	-5.9
partner's inc.	-20.4	-0.074	0.147	0.5	-16.5	-0.189	0.117	-3.4
actives	-2.9	-0.009	0.029	6.2	0.9	0.007	0.018	4.9
partner's act.	-17.2	-0.08	0.038	-0.7	-9.5	-0.005	0.019	-0.2
passives	5.9	0.149	0.07	7.1	4.5	0.114	0.061	2.6
partner's pass.	-6.5	0.035	0.015	3.6	-6.6	0.015	0.023	2.0
atc_a	18.4	0.067	0.07	-5.0	15.2	0.093	0.067	-4.9
atc_b	3.6	-0.048	0.196	-2.7	16.5	0.497	0.132	0.0
atc_c	1.1	-0.173	0.096	-8.6	4.9	-0.031	0.091	-9.1
atc_d	19.9	0.059	0.064	0.7	12.5	0.024	0.063	4.2
atc_g	20.2	0.076	0.059	-3.3	7.8	-0.094	0.06	-1.3
atc_h	13.7	0.115	0.107	5.7	3.9	-0.011	0.124	1.6
atc_j	21.1	-0.06	0.063	4.7	18.0	0.08	0.062	-5.7
atc_m	29.6	0.271	0.065	0.8	16.8	0.11	0.071	-6.7
atc_n	15.6	0.057	0.072	-5.1	11.7	0.026	0.072	2.5
atc_p	13.4	0.082	0.095	-2.5	9.6	0.095	0.097	-7.8
atc_r	27.4	0.156	0.064	2.7	17.9	0.112	0.065	-2.0
atc_s	16.9	0.009	0.068	5.4	8.1	-0.017	0.069	7.1
malcan	-2.3	-0.082	0.356	0.0	-2.4	-0.1	0.348	4.3
bencan	3.8	0.124	0.158	4.4	-9.8	-0.601	0.304	0.0
diabet	2.4	0.077	0.371	-11.1	1.4	0.101	0.387	5.2
migrai	12.3	0.683	0.218	0.0	1.0	-0.084	0.387	5.1
eyedis	0.8	-0.011	0.275	-3.6	0.2	0.035	0.266	3.4
eardis	6.8	0.344	0.202	2.9	-3.1	-0.195	0.347	0.0
resdis	3.2	0.069	0.177	-2.4	9.9	0.31	0.14	-1.9
digdis	2.9	-0.039	0.136	-3.5	1.2	-0.013	0.129	-5.0
skidis	16.5	0.474	0.13	-1.8	-0.5	-0.095	0.206	0.0
joidis	-3.5	-0.29	0.21	-5.2	8.2	0.212	0.137	3.7
sctiss	3.7	0.381	0.441	-11.8	9.5	0.708	0.273	3.7
bapain	5.7	0.069	0.143	-1.9	14.9	0.4	0.11	9.2
sotiss	15.5	0.32	0.109	6.1	-3.8	-0.224	0.181	0.0
bredis	0.3	-0.117	0.258	0.0	-0.1	0.049	0.247	-3.4
uridis	-3.6	-0.308	0.357	0.0	-0.2	-0.031	0.254	6.8
pelgen	10.0	0.124	0.091	10.0	6.5	0.111	0.094	1.3
aborti	3.6	0.001	0.117	4.8	4.8	0.072	0.111	-3.0
pregna	-6.0	-0.331	0.198	4.8	0.5	-0.112	0.158	2.0
birthc	-3.0	-0.113	0.169	6.2	7.9	0.193	0.124	3.2
delive	3.0	0.071	0.102	-7.4	3.9	0.132	0.103	-6.9

digabn	17.0	0.42	0.128	-5.2	5.6	0.104	0.165	6.7
heainj	4.0	0.054	0.162	-4.4	5.6	0.104	0.165	6.7
necinj	-8.1	-0.434	0.244	5.3	1.6	-0.005	0.155	-4.1
thoinj	4.7	0.252	0.311	-8.2	4.5	0.25	0.303	4.0
Lbainj	4.3	0.087	0.3	-4.1	6.9	0.327	0.255	3.4
uarinj	14.8	0.542	0.165	-4.5	-	-	-	-
farinj	10.7	0.354	0.165	-2.3	4.2	0.169	0.192	0.0
haninj	11.7	0.16	0.098	-4.1	8.0	0.111	0.1	-1.4
lleinj	6.1	0.09	0.129	7.3	6.1	0.107	0.134	1.8
fooinj	11.9	0.195	0.102	8.7	8.5	0.139	0.107	4.4
truinj	-0.7	-0.223	0.362	0.0	3.1	0.067	0.271	3.8
d1996		0.036	0.068			0.073	0.063	
d1997		0.146	0.047			0.168	0.046	
_cons		-1.905	0.369			-1.796	0.338	
Av.SDIFF				4.0				4.0
wAv.SDIFF				3.8				3.7
N				57955				57624
N1				413				413

Note: See note of table A5.

Tables to be inserted in the text

Table 1: Distribution of Claimants in terms of Lost Earnings Capacity Granted by the National Bureau of Industrial Injuries (proportion in parentheses)

Lost Earnings Capacity	Men	Women	Total
0%	204 (0.57)	431(0.51)	635(0.53)
15%	60 (0.17)	201(0.24)	261(0.22)
18%	0 (0.00)	1(0.00)	1(0.00)
20%	18 (0.05)	28(0.03)	46(0.04)
25%	73 (0.20)	75(0.21)	248(0.21)
30%	4 (0.01)	8(0.09)	12(0.01)
Total	359 (1.00)	844(1.00)	1203(1.00)

Table 2: Estimated Average Employment Effect of the Whiplash

			CM				NCM	
	N1	Lower	Estimate	Upper	N1	Lower	Estimate	Upper
1	155	-30.39%	-20.65%	-10.90%	204	-12.25%	-4.41%	3.43%
2	155	-30.71%	-20.65%	-10.58%	204	-10.62%	-2.94%	4.73%
3	155	-28.02%	-17.42%	-6.82%	204	-13.28%	-5.88%	1.52%
4	155	-27.87%	-17.42%	-6.97%	204	-10.80%	-2.94%	4.91%
5	155	-25.78%	-15.48%	-5.19%	204	-11.22%	-3.43%	4.35%
			CW				NCW	
1	413	-21.80%	-15.98%	-10.16%	431	-10.69%	-6.45%	-2.21%
2	413	-30.25%	-24.46%	-18.66%	431	-8.18%	-4.04%	0.10%
3	413	-27.41%	-21.31%	-15.21%	431	-8.21%	-3.99%	0.23%
4	413	-25.78%	-19.37%	-12.96%	431	-9.35%	-5.06%	-0.77%
5	413	-22.59%	-16.22%	-9.85%	431	-9.00%	-4.69%	-0.38%

Note: Propensity Score Estimated with Probit Model. 1 Nearest neighbour with replacement. Asymptotic Standard Errors (see Abadie and Imbens, 2006).

Table 3: Estimated Average Earnings Effect of the Whiplash for Annual Earnings and Log Positive Earnings

		[Earnings]				[Log Pos. Earnings]		
Y. after Injury	N1	Lower	Estimate	Upper	%>0	Lower	Estimate	Upper
CM								
1	155	-96.204	-71.599	-46.995	0.60	-68.90%	-33.32%	2.26%
2	155	-108.010	-81.683	-55.355	0.48	-52.94%	-14.96%	23.03%
3	155	-112.513	-84.714	-56.915	0.41	-54.11%	-27.41%	-0.70%
4	155	-128.081	-92.169	-56.258	0.37	-41.01%	-17.10%	6.80%
5	155	-117.662	-83.648	-49.633	0.34	-45.58%	-16.03%	13.52%
NCM								
1	204	-26.072	-6.888	12.297	0.80	-27.95%	-6.96%	14.03%
2	204	-13.486	8.477	30.439	0.77	-22.58%	0.12%	22.82%
3	204	-17.541	5.709	28.958	0.72	-22.15%	-3.69%	14.77%
4	204	-17.434	7.869	33.173	0.70	-22.75%	-1.72%	19.31%
5	204	-28.172	-2.653	22.865	0.67	-25.45%	-3.54%	18.37%
CW								
1	413	-54.819	-42.372	-29.924	0.66	-70.88%	-50.44%	-30.00%
2	413	-77.758	-62.933	-48.108	0.51	-41.43%	-21.45%	-1.47%
3	413	-78.136	-61.736	-45.335	0.46	-38.26%	-22.25%	-6.25%
4	413	-66.843	-50.189	-33.535	0.43	-29.04%	-10.32%	8.39%
5	413	-63.167	-46.781	-30.396	0.41	-26.72%	-6.46%	13.81%
NCW								
1	431	-13.813	-3.182	7.449	0.77	-7.33%	6.47%	20.28%
2	431	-15.680	-3.727	8.226	0.73	-1.87%	11.30%	24.47%
3	431	-14.372	0.000	14.372	0.70	0.66%	12.25%	23.84%
4	431	-21.148	-7.461	6.226	0.67	-17.17%	-2.32%	12.54%
5	431	-22.608	-7.945	6.719	0.65	-6.98%	4.51%	16.00%

Note: Propensity Score Estimated with Probit Model. 1 Nearest neighbour with replacement. Asymptotic Standard Errors (see Abadie and Imbens, 2006). N1*/N1= Employment Frequency of treated.

Table 4: Regression of the estimated earnings effect on covariates measured prior to the whiplash and LEC for one to five years after the collision.

	Years after Injury									
	1		2		3		4		5	
	Scoeff	p-value	Scoeff	p-value	Scoeff	p-value	Scoeff	p-value	Scoeff	p-value
					CM					
Earnings	-0.484	0.001	-0.502	0.000	-0.471	0.001	-0.385	0.008	-0.253	0.076
LEC	-0.261	0.007	-0.242	0.012	-0.174	0.081	-0.228	0.025	-0.183	0.067
					NCM					
Earnings	-0.130	0.255	-0.145	0.206	-0.262	0.022	-0.188	0.101	-0.181	0.113
					CW					
Earnings	-0.221	0.002	-0.311	0.000	-0.338	0.000	-0.320	0.000	-0.311	0.000
LEC	-0.120	0.023	-0.128	0.015	-0.151	0.004	-0.142	0.007	-0.101	0.060
					NCW					
Earnings	-0.148	0.069	-0.289	0.000	-0.181	0.026	-0.264	0.001	-0.258	0.002

Note: Scoeff denotes Standardised coefficients of OLS regression. p-value denotes the p-value of a significance t-test. This table summarise the estimated coefficients of earnings and assessed loss in earnings capacity for those compensated from four regressions of estimated treatment effects on the full set of covariates. The remaining covariates are left out for readability. The full set of estimated parameters is available on request.

Table 5: Estimated Quantile Earnings Effects of the Whiplash for Individuals with Positive Earnings

Year	QTT(0.2)	QTT(0.4)	MTT	ATT	QTT(0.6)	QTT(0.8)
CM						
1	-118.25%	-33.14%	-14.08%	-33.32%	-14.24%	2.59%
2	-118.28%	-60.43%	-23.75%	-14.96%	-16.81%	-8.24%
3	-88.94%	-42.14%	-22.53%	-27.41%	-19.20%	-17.90%
4	-71.61%	-30.74%	-12.53%	-17.10%	-14.37%	-14.18%
5	-87.21%	-27.73%	-14.26%	-16.03%	-16.91%	-17.84%
NCM						
1	-27.16%	-3.72%	-1.35%	-6.96%	0.11%	-1.08%
2	-10.01%	-0.32%	4.07%	0.12%	2.28%	0.30%
3	8.61%	1.85%	5.07%	-3.69%	4.01%	2.32%
4	9.63%	4.41%	4.14%	-1.72%	2.72%	5.68%
5	-0.94%	4.20%	3.05%	-3.54%	2.04%	4.05%
CW						
1	-69.19%	-21.75%	-11.62%	-50.44%	-6.59%	0.52%
2	-69.06%	-25.96%	-12.09%	-21.45%	-11.21%	-6.05%
3	-56.37%	-18.89%	-15.70%	-22.25%	-12.72%	-4.76%
4	-34.58%	-7.58%	-6.32%	-10.32%	-6.27%	-1.08%
5	-32.66%	-10.96%	-7.45%	-6.46%	-6.89%	-6.21%
NCW						
1	16.68%	6.80%	5.79%	6.47%	6.36%	2.50%
2	4.61%	5.46%	5.57%	11.30%	4.14%	5.65%
3	4.07%	4.78%	3.79%	12.25%	4.29%	5.25%
4	2.29%	3.22%	1.43%	-2.32%	2.44%	4.03%
5	1.83%	3.88%	1.51%	4.51%	1.75%	2.98%

Note: Quantile Treatment Effect Estimator of Firpo (2007). Score estimated with Probit Model. 1 Nearest neighbour with replacement. QTT(0.2): 20% quantile treatment effect, QTT(0.4): 40% quantile treatment effect, QTT(0.6): 60% quantile treatment effect, QTT(0.8): 80% quantile treatment effect, MTT: Median treatment Effect (MTT= QTT(0.5)), ATT: Average Treatment Effect from table 2.

Figures to be inserted in the text

Figure 1: Hypothesised development of earnings capacity around time of a whiplash

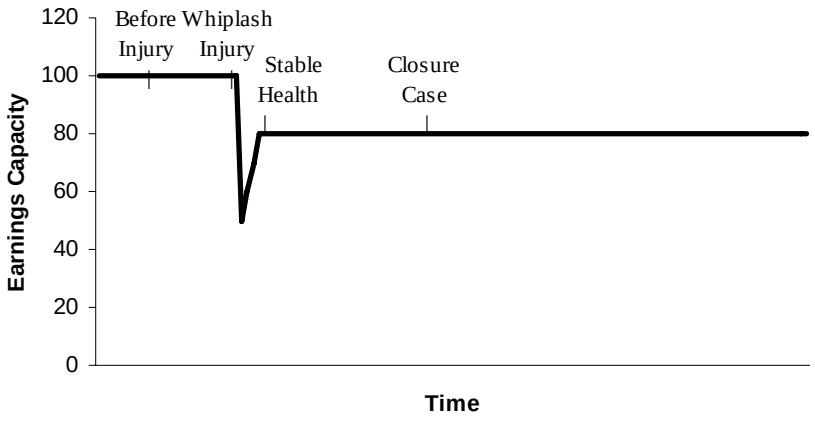
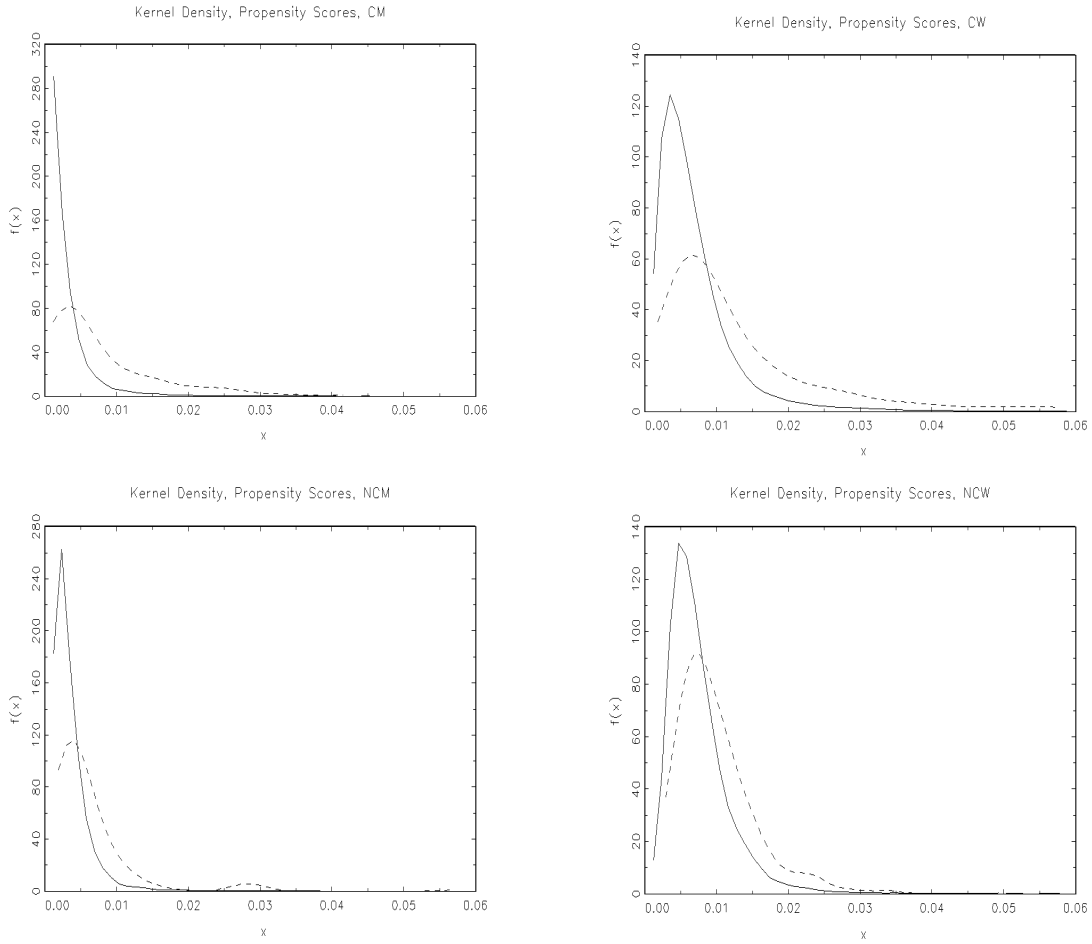


Figure 2: Kernel densities of propensity scores for compensated men (CM), non-compensated men (NCM), compensated women (CW) and non-compensated women (NCW) and for controls (unbroken lines)



Note: Kernel densities are based on the Gaussian kernel. The bandwidth is chosen according to Silverman's rule of thumb: $bw = 1.06\sigma n^{-1/5}$.