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Abstract

The consequences of spinal cord injury are profound and extend well beyond the immediate loss of mobility and sensation. Employment is a well-recognised rehabilitation goal. In this study, we examine the impact of a publicly funded "package" of services that is designed to enable people with a spinal cord injury to return to the workplace. Specifically, this package of services provided client directed assistance for assisting the recipient with the activities of daily living (e.g., bathing, food preparation, etc.). We combine primary data collection methods well developed in other scientific disciplines, but less frequently utilised within economics, with traditional econometric techniques, to present a novel approach to this methodological issue. The *Spinal Injuries Survey Instrument* was developed and administered using a matched sampling approach. Collected data included, labour market outcomes, exposure to the packages, as well as clinical and demographic covariates commonly identified by the spinal cord injury literature. Concern for endogeneity was addressed by collecting data on several variables that might serve as suitable instruments for the econometric work and measures of otherwise-unobserved sources of heterogeneity. For example, a psychological measure of "attributional style was adapted from the field of psychology in order to control for a potentially confounding source of latent individual heterogeneity, *viz.* "motivation". While our results find zero marginal effect of support packages on labour market outcomes, we find that training undertaken post-injury and age are both positively correlated with labour market participation.

Key Words: Spinal Cord Injury, Employment, Endogeneity

1 Introduction

The consequences of spinal cord injury (SCI) are profound and extend well beyond the immediate loss of mobility and sensation. In addition to ongoing biological complications (??), SCI is also associated with a significant loss of social (??)and economic wellbeing (?). Employment is a key determinate of economic wellbeing and is acknowledged as an important rehabilitation goal for persons with an SCI (?). However, a systematic review of the SCI literature reports that only 40% of people with an SCI are employed 12-months post discharge and that the highest levels of employment are reported in persons 10-12 years post SCI (?). A wide range of factors including age, level of functional dependence(?) pre- and post-injury education (?), gender and race (?) have been identified as being correlated with the labour market outcomes of people with an SCI. However, despite a pressing need the "[e]mpirical evidence is lacking in regard to the most effective methods of vocational rehabilitation among this population."(?)

In this study, we examine the impact of a publicly funded "package" of services that is designed to enable people with a SCI to return to the workplace. Specifically, this package of support provided for between 6 and 67 hours of carer support per week, the purpose of which is to help the recipient with the activities of daily living (e.g., bathing, food preparation, etc.) that are necessary preconditions for being able to go to work. These packages are administered by a public agency called Disability Services Queensland, which labels these funding packages as "Adult Lifestyle Support Packages". Conceptually the "package" of services is similar to a broader set of polices that are designed to integrate the unemployed in to the workforce by either (i) facilitating job search, (ii) improving work habits or (iii) augmenting human capital (?). Undoubtedly, the implications of our methodology have utility beyond this small, albeit important, population of people with a SCI.

The purpose of this study was to test the role that support schemes play with respect to labor market participation and employment. A search of the literature identified just three quantitative studies which analysed the effect of vocational initiatives for people with SCI. ?use a probit model to analyse the effect that computer competence has had on labour market experiences of people with a SCI, in New Jersey. They report that pre-injury computer skills are not correlated with the probability of post-injury employment but that computer use in the work place was positively correlated with the log of wages. ? also examined the impact of computer skills on a sample of people with SCI in Queensland, Australia. Logistic regression is used to report that both the level of computer skill and training were significantly correlated with employment. ?use logistic regression to report that non-participation in vocational rehabilitation was positively correlated with unemployment. However, these authors have not considered if programme participation was endogenously determined. Unobserved personality traits, which facilitate employment, may also have influenced participation in vocational initiatives.

Economics has long recognised that variable omission has the potential to compromise statistical inference when the error term is correlated with the explanatory variable. For example ?argued that when estimating a demand function, the omission of variables which captured supply side responses to price changes can lead to spurious results. Econometric solutions to omitted variable bias have included the use of instrumental variables ?, 2-stage least squares ?and the 'heckit' model (?) to control for sample selection bias. Contemporary statistical analysis from the fields of epidemiology (?), sociology (?) and political science (?) have now, also, begun to consider the implications of endogeneity.

Alternatively, other scientific disciplines have sought to control for omitted variable bias through the purposeful collection of primary data. Clearly, an opportunity exists to exploit a comparative advantage. From the discipline of economics, we drew upon a rich tradition of econometric techniques designed to control for endogeneity in datasets with a fixed set of variables. From other scientific disciplines such as psychology and epidemiology, we drew upon an extensive history of survey design and primary data collection. We therefore designed and administered, a survey instrument the *Spinal Injuries Survey Instrument* (SISI) (?)to a matched sample of members of the SIA in Queensland to collect data to serve as potential proxies and or instruments for unobserved sources of heterogeneity within the sample and then apply econometric measures to mitigate endogeneity.

The hypotheses of interest concern the effects of the publicly funded support package provided to Queenslanders living with a disability the Adult Lifestyle Support Package (ALSP) on the (i) labour market participation by people with SCIs and (ii) employment outcomes for people with SCIs. Of central importance are the following hypotheses, expressed in the null:

H_{0A}:The provision of an ALSP does not affect the labour market participation of people with SCIs; and

H_{0B}:The provision of an ALSP does not affect the chance of a person with an SCI being employed.

It is unclear whether one should expect these null hypotheses to be rejected. The ALSP's influence is theoretically ambiguous. The reasoning is as follows. First, to the extent that the ALSP assists individuals in activities of daily living, its provision could reduce the opportunity costs of employment for people with SCIs by lowering the transactions costs associated of employment (e.g., the costs of getting ready for work and getting to work). On the other hand, depending on individuals preferences and particularly the strength of the labour-leisure trade off, some individuals could be less inclined to seek paid employment if they receive support via the ALSP.

2. Materials and methods

A 43-item survey instrument the *Spinal Injuries Survey Instrument* was pilot-tested on a convenience sample of members of the Spinal Injuries Association (SIA), along with the Short Form-36 (SF-36) (**?**)and a modified version of the SF-36 (**?**). Following some amendments based on the pilot tests, the SISI was mailed to 250 people from the SIA membership list.

The SISI includes questions regarding pre- and post-injury, educational attainment, employment and income; and post-SCI sources of income, employment, paid and unpaid care, age, gender, marital status, location of residence, type of residence, health care utilization (outpatient, inpatient, pharmaceutical quantities and expenditures), conditions associated with hospitalizations (urinary, skin, digestive, musculoskeletal, psychiatric, and other health problems), perceptions of discrimination by employers against people with disabilities, time preferences, and psychological measures of "attributional style". The latter three measures were collected to control for otherwise unobserved heterogeneity in the propensity to seek employment.

The SF-36 was administered in an unmodified form, but included questions to create an "enabled" version of the SF-36. The rationale for creating the enabled version of the SF-36 is that some of the SF-36 items that pertain to locomotion use terminology that is irrelevant to the sample frame. Specifically, Question 3 from the SF-36 uses verbs such as "running" (3(a)), "climbing" (3(d), 3(e)), "bending, kneeling" or "stooping" (3(f)), and "walking" (3(g)-3(i)). Analogues were substituted for the sub-items of Question 3 using verbs such as "wheeling", "going up", "bending, or kneeling" and "going", respectively(**?**). No other items were modified. Although the "enable" version of the SF-36 was not validated, conceptually, it is preferred for the purposes of this paper, since intra-sample comparisons, rather than comparison against population norms is the preferred analytical focus.

2.1 The sample

The sample was drawn from the membership list of the SIA, which is a non-government organization that provides supports for individuals with SCIs. The membership list of the SIA is believed to encompass most people with serious spinal injuries in the State of Queensland. In Queensland, people with SCIs are invariably transferred to and treated at Princess Alexandra Hospital, which has the state's only dedicated tertiary spinal unit. This unit routinely refers its patients to the SIA for post-discharge support. The SIA had 978 members, of whom 132 received a personal support package at the time of the study. The Australian Spinal Cord Injury Register (ASCIR) has 1097 incident cases of SCI in Queensland. While the administrators of the ASCIR are confident that they have captured all traumatic cases of SCI between 1990 to 2004 there is less certainty about the ascertainment of (i) traumatic SCI admitted prior to 1990 and (ii) SCI due to medical causes, due to imperfect

access to medical records. However, as people have been readmitted to the Spinal Unit for the treatment of complications they have been added to the register. Thus, the SIA register comprises 89.2% (978/1097) of the known cases of SCI in Queensland.

The distribution of SIA members who receive an ALSP is heavily skewed towards the higher levels of impairment. Therefore, rather than conduct a random sampling of the SIA membership, a matched sampling and regression estimation was used in combination as described by **?**. Matched sampling refers to the selection of treatment units (e.g., persons who received a support package) and control units (e.g., persons who did not receive a support package) that have similar values of matching variables X (e.g., level of SCI, age and gender). Whereas regression adjustment refers to a statistical procedure that adjusts the estimates of the treatment effects by estimating the relationship between the dependent variable [e.g. employment] and X in each treatment group **?**. Matched sampling and regression adjustment can be used alone or in combination. The samples may be random or matched. Regression adjustment may or may not be performed. A problem with matching methods is that an exact match can be rare and a problem with regression is that linear models may be subject to misspecification. **?**have shown (i) when an exact match is unavailable, nearest available pair matching whereby the treatment units are ordered sequentially and a match for each treatment unit is chosen from the nearest unmatched control unit provides a good result and (ii) the combination of regression adjustment on matched samples is usually superior to either method alone. **?** extends these findings to the case of bivariate X.

Therefore, after 23 ALSP recipients were removed due to exclusion restrictions (based on non-employment, age and significant, e.g., psychiatric co-morbidities) the remaining 109 cases were matched our pre-survey knowledge of level and completeness of SCI, age and gender. As there was an insufficient number of controls to enable complete matching by all criteria a matching hierarchy was established whereby priority was given to diagnosis, followed by age, then gender. Thus, the final sample of 250 potential respondents was comprised of 109 cases and 141 controls. Several strategies were used to encourage participation. Financial incentives were provided; "Instant Scratch-It" lottery tickets were provided to all respondents and all were entered into a lottery with a first prize of $A300 cash and a second prize of $A200. Furthermore, non-respondents were followed-up for interview via telephone. These strategies resulted in a response rate of 72 % (n=181).

Table 1 below illustrates firstly that our sample is not representative of the broader population of people living with an SCI in Queensland. While 45% of the SIA membership were documented with quadriplegia, 81.6% of survey respondents and 84.1% of non-respondents were documented with quadriplegia. Secondly, note that for respondents and non-respondents, the proportions, by level of injury and gender, are quite similar, as is mean age.

We are confident therefore that inferences drawn from the respondents are valid for non-respondents and people living with an SCI in Queensland.

Table 1 Characteristics of SISI Respondents and Non-Respondents

TABLE 1 ABOUT HERE PLEASE

Source: Spinal Injuries Association (2005)

Note: 167 records were excluded from the analysis of the SIA sample frame because of non-employment age and significant psychiatric co-morbidities."

The distribution of SIA members who receive an ALSP is heavily skewed towards the higher levels of impairment. Therefore rather than conduct a random sampling of the SIA membership a matched sampling and regression estimation in combination as described by **?** was used. After 23 ALSP recipients were removed due to exclusion restrictions (based on non-employment, age and significant, e.g., psychiatric co-morbidities) the remaining 109 cases were matched on our pre-survey knowledge of level and completeness of SCI, age and gender. There were, however, an insufficient number of controls to enable complete matching by all criteria. Therefore, a matching hierarchy was established whereby priority was given to diagnosis, followed by age, then gender.

2.2 Econometric strategies

Limited dependent variable methods are used to test H_{0A} and H_{0B}.Central to this approach was a purposeful attempt to embed indicators of otherwise unobserved heterogeneity in the SISI and to create potential instrumental variables (IVs) that would improve the econometric aspects of the empirical work.

In this study, an individual is considered to be in the labour force ($Part$=1) if he/she is employed or unemployed and looking for work. The employment variable $Empl$=1 when a respondent declares any labour market earnings for the current year. The latter classification should be underscored for two reasons. First, it is conceivable that some respondents for whom $Empl$=1 were not actually employed at the time of the survey, but had been employed in the course of the year. Second, the binary classification of employment effectively treats unpaid volunteers as not employed. On the other hand, $Part$ captures volunteer activity and, to the extent that respondents answer that they are employed ($Part$=1), but indicate zero labour market earnings identifies them as volunteers. Assuming such response combinations are not erroneous, seven unpaid workers were identified within the sample.

Recall that the regressor of primary interest in this study is a binary indicator of whether an individual is a recipient ($ALSP$=1) or non-recipient ($ALSP$=0)

of an ALSP. One of the primary concerns was the potential endogeneity of *DVALSP*. Specifically: the probability of an individual receiving an ALSP could be correlated with factors that are also correlated with labour market participation and/or success. More specifically, latent factors such as the psychological disposition of individuals including their "motivation" or "attitude" might be correlated with labour market variables as well as affect the chance of being awarded an ALSP. For example, if decisions to grant or deny ALSPs were positively or negatively influenced by civil servants' assessments of the likelihood of labour market success or other heterogeneity that is unobserved by us, the ALSP could be endogenous with respect to employment.

Two strategies were used to deal with the potential endogeneity of *ALSP* and unobserved heterogeneity. First, data were collected that would serve as indicators of the latent characteristics that are not observed in most of the economic studies of labour market activity, but are probably partially observable by employers and, in this case, civil servants who assess a person's entitlement to the ALSP. This strategy can essentially be interpreted as an attempt to avoid omitted variable bias. Second, data were collected that might prove to be useful as instrumental variables (IVs): IV methods would be required if the potential for unobserved heterogeneity was not obviated by the first strategy. In effect, these two strategies are, conceptually closely related. In principle, the award of an ALSP is based on objective criteria that pertain to the nature and type of disability and the level of paid and unpaid support available to the person with an SCI. Technically, factors such as the person's level of education, attitude to working, and so on are not relevant to the award of the ALSP. From a theoretical standpoint, therefore, some of the variables referred to as "proxies" could appropriately be considered "instruments" if one accepts the argument that ALSPs are awarded on exclusively objective grounds. In this sense, so-called "proxies" of otherwise-unobservables could be argued to be instruments for unobserved heterogeneity, which are therefore correlated with the award of the ALSP but not with the error term.

One of the item sets included in the SISI was concerned with the latent "attributional style" of individuals. This construct, from the field of psychology, involves the notion that individuals have differing propensities to attribute success or failure to themselves ("internalizing" success or failure) or to other factors ("externalizing" success or failure) (**?**). In the work setting, **?**find that a positive (negative) attributional style is associated with positive (negative) work adjustment. In psychology, attributional style has been assessed by providing respondents with a scenario, involving them, that have a positive or a negative outcome, and then asking a series of questions about the scenario.

Responses to each question are recorded on a five-point Likert scale that ranges from "Strongly Disagree" to "Strongly Agree". The responses to each scenario are then used to produce an index of the strength of response, which

is then used as a correlate of the latent attributional style. The SISI included both a positive and a negative scenario, both of which were labour market examples and thereby created two indexes: ln(Attributional Style, positive scenario) and ln(Attributional Style, negative scenario). Both indexes, in levels, take values between 4 and 28. The positive scenario index is increasing (decreasing) in the strength of internal (external) attribution to the outcome in the positive labour market scenario; the negative scenario index is increasing (decreasing) in the strength of internal (external) attribution to the outcome in the negative labour market scenario.

Recall financial incentives were used to encourage a response. All respondents received instant lottery tickets, but they were also given a choice: (i) an immediate and certain payoff of instant lottery tickets of $A4.00 value, or (ii) a delayed and certain payoff $A8.00 between one to twelve weeks later. The dollar value of the delayed payoff was set for any given respondent, as was the payoff interval. However, the magnitude of the delayed payoff was varied randomly between the respondents, as was the deferred payoff interval. This exercise was designed, within the time constraints of this study, to produce data on time preferences. The rationale for collecting these data was that they might represent either indicator of otherwise unobservable (to us) preferences that might be observable (with error) by employers. Alternatively, if employers and others cannot observe the latent time preferences of the respondents answers to these questions might be IV candidates. For the purposes of this paper, the resulting responses are dichotomized as $Disc$=1 for those respondents who preferred the immediate payoff and $Disc$=0 for those who preferred a larger, deferred payoff.

Finally, respondents were asked to indicate the duration of their initial hospitalization (*ihosp*) for their SCI, as a possible instrument for ALSP. The rationale was that, once one accounts for disability, health status, and the time since discharge as indicators of the latent health capital of the individual, the initial hospitalization period should have no independent effect on labour market success or upon the chance of receiving an ALSP. By assumption, then, it may be correlated with the ALSP but uncorrelated with the employment equation(s) error term(s).

2.3 Econometric specification

In order to test hypotheses H_{0A} and H_{0B}, recognizing the possibility of unobserved heterogeneity and the endogeneity of $ALSP$, the following recursive simultaneous-equations bivariate probit model was specified

$$Part_i = \mathbf{x}_i\beta + ALSP_i\gamma + \epsilon_i \tag{1}$$

where $Part_i$= 1 indicates that the individual is in the labour force and is zero otherwise, $\mathbf{x}_i$, $ALSP$ = 1 if the person is an ALSP recipient and is zero

otherwise, γ is the *ALSP* dummy coefficient and ϵ_i is a random error term. The ALSP equation is given by indentation

$$ALSP_i = \mathbf{x}_i\alpha + f_i\delta + \mu_i \tag{2}$$

where f_i is a vector of appropriate instrumental variables, δ is the vector of coefficients on the instrumental variables and μ_i is a stochastic error term. The second specification of this model involves *Employ* as the dependent variable in (1), where *Employ*=1 indicates that the person is employed and *Employ*=0 indicates that the person is not employed.

The bivariate models described above were invoked due to a concern with endogeneity or unobserved heterogeneity. If *ALSP* is endogenous or correlated with unobservables that also correlate with *Part* (or *Employ* in the alternative formulation), a univariate probit regression of (1) would produce inconsistent parameter estimates. However, estimating (1) and (2) simultaneously via the full-information maximum-likelihood (FIML) approach will yield consistent parameter estimates when $\epsilon$and $\mu$are not independent (**?**). The simultaneous estimation of (1) and (2) via FIML is also more efficient than the alternative two-step approaches (**?**)which, in this case, would involve substituting predicted values from (2) for ALSP in (1). The efficiency gain in arises because the FIML approach, unlike the two-step procedure, takes account of the potential correlation between the disturbances of the two regressions.

A further advantage of the bivariate formulation outlined is that its output can be used to test the hypothesis that *ALSP* is endogenous. **?**have shown that a likelihood ratio (LR) test of the null hypothesis that the correlation coefficient of the error terms and is zero is equivalent to a Hausman endogeneity test on, in this case, ALSP. Thus, if the estimated is statistically insignificant, it is appropriate to resort to the univariate formulation of (1). The econometric strategy is to follow this approach to test H_{0A} and H_{0B}, commencing with an estimation of the bivariate probit models and returning to the estimation of (1) via univariate probit, if appropriate.

The econometric literature also emphasizes the importance of testing the suitability of proposed IVs. **?**, for example, cleverly demonstrate the empirical problems that can arise when IVs that are only weakly correlated with the endogenous regressor are used. Similarly, **?**and**?**stress the problem of inconsistency that can arise in IV estimates when instruments and the endogenous variable are only weakly correlated. Following other authors, such as **?**, the IV's effect on the Pseudo-R squared and likelihood ratio (LR) tests on the null hypothesis of no correlation between the selected IVs and the possibly-endogenous regressor ALSP are reported.

3. Results

We analysed our data with Stata/SE 10.1,® (**?**). Table 2 reports descriptive statistics for the variables employed in this study. Note that the respondents were predominantly male (73.5%), with a mean age of 44 years. Most of the sample (61%) was not married and the mean time since an individual's SCI was approximately 18 years (i.e., anti-log of 2.469). Approximately 39% of the respondents were in the labour force and 26% were employed, implying an unemployment rate of approximately 13% (i.e., 39%-26%). Also, note that, by design, the sample is quite well balanced as between ALSP recipients and non-recipients: 47.5% of respondents received an ALSP and just over 14% received support packages from private insurance sources, with the remainder receiving no paid support from the private or public sectors. Thus, the matching protocol and follow-up strategies appear generally to have yielded the desired sample composition.

Table 2 Descriptive statistics from the SISI

TABLE 2 ABOUT HERE PLEASE

Source: Spinal Injuries Survey Instrument (SISI) (2005).

Note, because a matched sampling technique was used to administer the SISI, the summary statistics reported in Table 2 cannot readily be compared to other labour market studies reported in the SCI literature. As this sample was heavily skewed towards people living with quadriplegia (81.6%), these data can be used to document the socioeconomic status of this important sub-population of people living with a SCI. For a more detailed discussion, we refer interested readers to the recently published paper by **?**.

Table 3 presents the results of estimating the bivariate probit specification of labour market participation of the respondents. First, note that the Wald test of the hypothesis that the errors of the two parts of this SUR probit model are uncorrelated is not rejected. The hypothesis that ALSP is exogenous is not rejected and it is appropriate to estimate the participation equation in the model as a univariate probit regression.

Table 3 Labour Market participation and ALSP; seemingly unrelated bivariate results

TABLE 3 ABOUT HERE PLEASE

Note: 1. Heteroskedasticity-consistent standard errors were applied to compute z scores.

2. Statistical significance reported at 1% ***, 5% ** and 10% * levels

Also, note however, the statistical significance of a large number of the variables in the ALSP regression in Table 2. Some of these variables (e.g., the disability index) are not commonly observed in the empirical literature reviewed in the Introduction. One might conclude either that the ALSP is truly exogenous or, simply, that the omitted variable bias problem was solved by accounting for commonly unobserved heterogeneity with the survey instrument. These contentions were tested by conducting likelihood ratio tests of the joint significance of a number of the indicators of latent heterogeneity and the potential IV (initial hospital stay) and report these, along with the changes in the pseudo-R^2 that result from their inclusion/exclusion. The univariate ALSP probit and the results of these tests are presented in Table 4. The hypothesis that these variables are jointly statistically significant cannot be rejected.

Table 4 Univariate ALSP probit results

TABLE 4 ABOUT HERE PLEASE

1. Heteroskedasticity-consistent standard errors were applied to compute z scores.

2. Statistical significance reported at 1% ***, 5% ** and 10% * levels

Returning to Table 3, note that the *de facto* Hausman test of the hypothesis that the ALSP is exogenous cannot be rejected. Thus, it is appropriate to estimate the participation equation as a univariate probit regression. The coefficient estimates from this approach are reported in Table 5.

Table 5: Labour market participation and the ALSP: univariate probit results with marginal effects reported at means

TABLE 5 ABOUT HERE PLEASE

1. Heteroskedasticity-consistent standard errors were applied to compute z scores.

2. dy/dx is for discrete change of dummy variable from 0 to 1

3. Statistical significance reported at 1% ***, 5% ** and 10% * levels

No statistically significant effect, of either the ALSP or PPSP on labour market participation was found. On the other hand, a number of other factors are significantly correlated with labour market participation. The results suggest, *ceteris paribus*, that individuals who undertook education or training post-SCI were more likely to be labour market participants;[1] females were less

[1] Bivariate probit regressions were estimated to test the assumption of the exogeneity of post-SCI training and education with respect to the award of an ALSP. The tests did not reject that assumption. In the interest of parsimony these results were not reported, but are available from the authors upon request.

likely to be labour market participants; and that a positive attributional style is associated with a higher likelihood of labour market participation. Note, a weak non-linear age effect was detected, which suggests that the probability of labour market participation is decreasing in age.[2]

The marginal effects of the participation probit, computed at the means of the independent variables, are reported in Table 5 and the mean values of the independent variables (denoted X). Note that the marginal effects reported for dummy variables are computed for a binary change in the dummy variable (i.e., from zero to unity). The marginal effects for the ALSP are statistically insignificant. Thus, the hypothesis that the ALSP has a zero effect on labour market participation cannot be rejected. A similar conclusion is reached for support packages from private insurance sources (i.e. the PPSPs).

Statistically significant marginal effects are evident for a number of other variables, though. The strongest marginal effect is for post-SCI education, which is statistically significant at the 1% level and for which the 95% confidence interval is 0.108-0.503. This suggests that post-SCI training and education has an important effect on labour market participation *ceteris paribus*. The likelihood of participation is increasing (at a decreasing rate) in age, and females are significantly less likely to be labour market participants than males. The likelihood of labour market participation is increasing in the (log) disability index: this is the expected direction of influence since *higher* values of the index are associated with *lower* levels of disability. Finally, note the probability of labour market participation is increasing in the ln(Attributional style index, positive scenario). The implication of this result is that the higher the individual's propensity to "internalise" positive employment outcomes to his/her own attributes (or "capabilities and functionings") in the sense of **?**, the more likely he/she is to be a labour market participant. In this respect, the use of attributional-style items appears to have captured some aspect of individual heterogeneity that would typically be unobserved.

The SUR bivariate probit model of labour markets earnings greater than zero on employment and the ALSP was estimated. In the interest of parsimony, the full statistical output is not reported but is available upon request. Again, the *de facto* Hausman test of the hypothesis that the ALSP is exogenous cannot be rejected. The test statistic was computed to be 0.0947, which was not statistically significant at the five percent level. Since the null hypothesis of uncorrelated errors between the employment and ALSP probits is not rejected, a probit regression of employment status is estimated and the results are reported in Table 6.

Table 6: Employment of people with spinal cord injuries: probit results and marginal effects reported at means

[2] The order-two polynomial term is negative statistically significant at the 10% level, while the polynomial order-one term is positive but statistically insignificant at the conventional levels.

TABLE 6 ABOUT HERE PLEASE

Note: 1. Heteroskedasticity-consistent standard errors were applied to compute z scores.

2. dy/dx is for discrete change of dummy variable from 0 to 1

3. Statistical significance reported at 1% ***, 5% ** and 10% * levels

In this regression, the number of years of education is a positive and statistically significant determinant of the chance that an individual with an SCI will be an income-earner. Undertaking education or training post-SCI is also a positive and independently significant determinant of the likelihood of positive labour market earnings. As with participation, females in the sample were less likely to have positive labour market earnings *ceteris paribus*. As for the participation probit, the parameter estimate on the disability index once again has the expected positive sign and is statistically significant at the 10 % level. Once again, neither the ALSP nor the PPSP has a statistically significant coefficient, but note the negative sign on each.

4. Discussion

This analysis is focused on a reasonably narrow, albeit important, source of the potential benefits that might be associated with the provision of an ALSP. The effects of the ALSP on the labour market activities or outcomes for the family members of individuals with an SCI were not examined. Nor were potential health care utilization, quality of life or health status effects that the ALSP may produce, considered. Second, the economic arguments for the provision of support to individuals with SCIs are likely to extend beyond the direct payoffs due to the provision of that support. Caring externalities and the problem of free-riding provide two such arguments for the provision of public support for people with disabilities that may be unrelated to the direct (e.g., labour market) payoffs such support may provide.

This observational study attempts to measure the impact of ALSPs on the labour market outcomes of individuals with SCIs. Non-experimental studies of this kind are subject to considerable difficulties that have been well documented in the labour economics and econometrics literatures. The innovation of this study was to attempt to control for otherwise-unobserved heterogeneity in the population of interest by collecting data that are seldom available to researchers who use administrative data. These included data on the psychological traits of individuals, their time preferences, health capital and health status, and other variables may be correlated with both labour market success and the allocation decisions of civil servants with respect to ALSPs. In large measure, it appears the sampling strategy worked: taking account of all of these factors, no evidence implying that the ALSP was endogenous with respect to the employment was found.

Our results suggest that support packages have zero, independent, marginal effect of on labour market participation or employment. Although these findings might be attributable to some remaining source of unobserved heterogeneity or omitted variable bias, the econometric tests provide no support for that hypothesis. Nevertheless, our results have important implications for policy makers seeking to facilitate the reintegration of people with a SCI into the labour market. First, note the consistent importance of education: years of schooling and post-SCI education and training are consistently positive predictors of labour market outcomes for people with SCIs. The expected signs and consistency of these results, in particular, not only provide some reassurance regarding the veracity of the findings, but also are important in their own right. If pre- and post-SCI education is a positive predictor of labour market outcomes post-SCI, these factors may enable individuals who are at higher (lower) risk of poor (good) outcomes to be identified. In particular, the value of greater investment in post-SCI education may warrant further investigation. Secondly, observe the positive correlation between age and labour market participation. People living with an SCI can and do re-enter the labour market with the passing of time. Re-employment remains a realistic goal for some people living with an SCI. It is therefore incumbent upon public health researchers to identify those polices which potentiate the return to work of people living with an SCI.

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Table 1: Characteristics of SISI Respondents and Non-Respondents

Characteristics	SIA Database (n=811)	Respondents (n= 181)	Non Respondents (n = 69)
C2	0.7%	2.4%	4.3%
C3	1.7%	5.6%	8.7%
C4	5.3%	16%	10.1%
C5	15.8%	32.8%	29%
C6	12.5%	19.6%	24.6%
C7	4.4%	3.6%	5.8%
C8	0.5%	0%	0%
Quadriplegia	45%	81.6%	84.1%
Paraplegia	40.8%	8.8%	10.1%
Medical SCI	14.2%	9.6%	5.8%
Complete SCI	41.4%	47.6%	45.3%
Female	28.6%	26.8%	27.5%
Mean age (SD)	44.9 (11.97)	42.2 (13.8)	44.0 (10.5)

Table 2: Descriptive Statistics from the SISI

Variables	Mean	S.D.	Min.	Max.	Obs.
Labour market participant (1=yes; 0=no)	0.385	0.488	0	1	179
Labour market earnings > 0 (1=yes; 0=no)	0.26	0.44	0	1	181
ln (Labour market earnings)	10.013	1.169	6.947	11.76	47
ln (SF-36 Physical Component Summary-enabled)	3.391	0.266	2.649	3.997	165
ln (SF-36 Mental Component Summary-enabled)	3.701	0.479	1.938	4.231	165
Income prior to injury	50748	58601	0	558122	158
ln (Years of education)	2.398	0.163	2.197	2.708	178
Undertook education post-injury (1=yes; 0=no)	0.478	0.501	0	1	178
Age	44.129	10.41	19	65	181
Age^2 /100	20.552	9.119	3.61	42.25	181
ln (Time since first discharge from spinal unit)	2.469	1.194	-1.655	4.014	181
Female (1=yes; 0=no)	0.265	0.443	0	1	181
ln (Disability index)	2.039	0.606	1.386	2.996	181
Adult Lifestyle Support Package (1=yes; 0=no)	0.475	0.501	0	1	181
Personal Private Support Package (1=yes; 0=no)	0.144	0.352	0	1	181
Married (1=yes; 0=no)	0.391	0.489	0	1	179
Lives with at least one other person (1=yes; 0=no)	0.47	0.5	0	1	181
ln (Attributional Style index, positive scenario)	3.039	0.213	2.197	3.332	180
ln (Attributional Style index, negative scenario)	2.863	0.288	1.609	3.332	180
Prefers larger, deferred payoff (1=yes; 0=no)	0.227	0.42	0	1	181
Lives in an outer-metropolitan area (1=yes; 0=no)	0.122	0.328	0	1	181
Lives in a rural town (1=yes; 0=no)	0.298	0.459	0	1	181
Lives in a remote town (1=yes; 0=no)	0.011	0.105	0	1	181
Initial period of hospitalization (months)	10.165	5.631	0	36	181

Table 3: Labour Market participation and ALSP; seemingly unrelated bivariate results

Labour market participant (1=yes; 0=no)	Coefficient	z-score
ln (SF-36 Physical Component Summary)	0.336	0.66
ln (SF-36 Mental Component Summary)	0.35	1.28
Income prior to injury/1000	-0.001	-0.19
ln (Years of education)	1.04	1.13
Undertook training/education post-injury (1=yes; 0=no)	*** 0.888	3.06
Age	* 0.157	1.77
Age^2 /100	* -0.182	-1.87
ln (Time since first discharge from the hospital spinal unit)	-0.074	-0.65
Female (1=yes; 0=no)	* -0.691	-1.66
ln (Disability index)	0.206	0.45
Adult Lifestyle Support Package (1=yes; 0=no)	-0.444	-0.37
Personal Private Support Package (1=yes; 0=no)	0.014	0.02
Married (1=yes; 0=no)	0.185	0.48
Lives with at least one other person (1=yes; 0=no)	-0.212	-0.72
ln (Attributional Style index, positive scenario)	** 1.394	2.04
ln (Attributional Style index, negative scenario)	-0.605	-1.16
Prefers larger, deferred payoff (1=yes; 0=no)	-0.359	-1.12
Lives in an outer-metropolitan town/suburb (1=yes; 0=no)	-0.455	-1.04
Lives in a rural town (1=yes; 0=no)	-0.178	-0.58
Lives in a remote town (1=yes; 0=no)	-0.247	-0.23
Constant	*** -10.929	-2.68

Table 3: continued

Adult Lifestyle Support Recipient (1=yes; 0=no)	Coefficient	z-score
ln(SF-36 Physical Component Summary)	0.68	1.12
ln(SF-36 Mental Component Summary)	-0.108	-0.37
Income prior to injury/1000	0.002	0.49
ln(Years of education)	1.76	1.25
Undertook training/education post-injury (1=yes; 0=no)	*** 0.849	2.62
Age	** 0.273	2.54
Age^2 /100	** -0.273	-2.33
ln (Time since first discharge from the hospital spinal unit)	* -0.328	-1.87
Female (1=yes; 0=no)	* 1.191	2.59
ln(Disability index)	*** -1.229	-4.57
Personal Private Support Package recipient (1=yes, 0=no)	*** -3.321	-4.25
Married (1=yes; 0=no)	*** -1.024	-2.98
Lives with at least one other person (1=yes; 0=no)	-0.309	-1.03
ln (Attributional Style index, positive scenario)	0.801	0.9
ln (Attributional Style index, negative scenario)	-0.018	-0.03
Prefers larger, deferred pay off (1=yes, 0=no)	-0.481	-1.5
Lives in and outer-metropolitan town/suburb (1=yes, 0=no)	** 0.838	1.99
Lives in a rural town (1=yes, 0=no)	0.368	1.11
Lives in a remote town (1=yes; 0=no)	-0.973	-0.96
Initial period of hospitalisation (months)	0.065	1.27
Constant	** -12.465	-2.47
n	141	
Wald $\chi^2(39)$	105.53	
Log-pseudolikelihood	-128.99	
\athrho (z)	-0.447	
Wald test of $\rho(\varepsilon, \mu) = 0$		
$\chi^2(1)$	0.238	
Probability $> \chi^2$	0.626	

Table 4: Univariate ALSP probit reuslts

Adult Lifestyle Support recipient (1=yes; 0=no)	Coefficient	z-score
ln (SF-36 Physical Component Summary) †	0.646	1.19
ln (SF-36 Mental Component Summary) †	-0.117	-0.39
Income prior to injury /1000 †	0.002	0.53
ln (Years of education)	1.499	1.44
Undertook education post-injury (1=yes; 0=no)	*** 0.875	2.42
Age	** 0.255	2.14
Age^2 /100	** -0.255	-1.97
ln (Time since first discharge from the hospital spinal unit)	** -0.349	-2.18
Female (1=yes; 0=no)	*** 1.198	3.13
ln(Disability index) †	*** -1.193	-4.2
Personal Private Support Package (1=yes; 0=no)	*** -3.11	-4.28
Married (1=yes; 0=no)	*** -1.017	-2.92
Lives with at least one other person (1=yes; 0=no)	-0.287	-0.9
ln (Attributional Style index, positive scenario) †	0.842	1.15
ln (Attributional Style index, negative scenario) †	-0.034	-0.06
Prefers larger, deferred payoff (1=yes; 0=no)	-0.482	-1.42
Lives in an outer-metropolitan area (1=yes; 0=no)	** 0.821	1.67
Lives in a rural town (1=yes; 0=no)	0.415	1.16
Lives in a remote town (1=yes; 0=no)	-0.972	-0.94
Initial period of hospitalization (months) †	** 0.076	2.24
Constant	** -11.534	-2.44
n	141	
Log-likelihood	-56.278	
$\chi^2(20)$	*** 82.73	
Pseudo-R^2	0.424	
Change in pseudo-R^2 of proxies and instruments marked with †	0.226	
LR Test of proxies and instruments marked with †		
$\chi^2(6)$	*** 30.54	
LR Test Prob.	<0.01	
Change in pseudo-R^2 of ALSP IV (Initial period of hospitalization only)	0.03	
LR Test of ALSP IV (Initial period of hospitalization only)		
$\chi^2(1)$	** 5.83	
LR Test Prob.	0.016	

Table 5: Labour market participation and the ALSP: univariate probit results with marginal effects reported at means

Labour market participant (1=yes; 0=no)	Probit results		Marginal effects	
	Coeff.	z-score	dy/dx	X
ln (SF-36 Physical Component Summary)	0.275	0.52	0.102	3.38
ln (SF-36 Mental Component Summary)	0.359	1.35	0.133	3.68
Income prior to injury /1000	-0.001	-0.3	-0.0001	47222
ln (Years of education)	0.876	1.04	0.326	2.4
Undertook education post-injury (1=yes; 0=no)	*** 0.825	2.92	*** 0.305	0.43
Age	0.141	1.53	0.052	44.19
Age^2 /100	* -0.17	-1.66	* -0.063	20.56
ln (Time since first discharge from spinal unit)	-0.055	-0.49	-0.021	2.39
Female (1=yes; 0=no)	*** -0.826	-2.73	*** -0.278	0.28
ln (Disability index)	* 0.383	1.66	* 0.143	2.03
Adult Lifestyle Support Package (1=yes; 0=no)	0.149	0.47	0.055	0.48
Personal Private Support Package (1=yes; 0=no)	0.344	0.86	0.132	0.15
Married (1=yes; 0=no)	0.316	1.12	0.119	0.39
Lives with at least one other person (1=yes; 0=no)	-0.151	-0.55	-0.056	0.47
ln (Attributional Style index, positive scenario)	* 1.312	1.92	* 0.488	3.05
ln (Attributional Style index, negative scenario)	-0.63	-1.19	-0.234	2.85
Prefers larger, deferred payoff (1=yes; 0=no)	-0.277	-0.91	-0.1	0.25
Lives in an outer-metropolitan area (1=yes; 0=no)	-0.542	-1.34	-0.182	0.13
Lives in a rural town (1=yes; 0=no)	-0.195	-0.64	-0.071	0.33
Lives in a remote town (1=yes; 0=no)	-0.073	-0.08	-0.027	0.01
Constant	** -10.357	-2.51		
n	141			
Wald $\chi^2(20)$	43.73			
Pseudo-R^2	0.227			
Log-pseudolikelihood	-72.92			

Table 6: Employment of people with spinal cord injuries: probit results and marginal effects reported at means

Labour market earnings > 0 (1=yes; 0=no)	Probit results		Marginal effects	
	Coeff.	z-score	dy/dx	X
ln (SF-36 Physical Component Summary)	0.224	0.42	0.061	3.38
ln (SF-36 Mental Component Summary)	-0.020	-0.07	-0.006	3.68
Income prior to injury/1000	-0.002	-0.48	-0.001	47.39
ln (Years of education)	** 2.040	2.47	** 0.553	2.40
Undertook education post-injury (1=yes; 0=no)	*** 0.928	2.97	*** 0.264	0.42
Age	0.104	0.96	0.028	44.18
Age^2 /100	-0.114	-0.95	-0.031	20.58
ln (Time since first discharge from spinal unit)	0.066	0.51	0.018	2.38
Female (1=yes; 0=no)	** -0.764	-2.29	*** -0.177	0.28
ln (Disability index)	* 0.455	1.83	* 0.123	2.04
Adult Lifestyle Support Package (1=yes; 0=no)	-0.396	-1.27	-0.107	0.48
Personal Private Support Package (1=yes; 0=no)	-0.371	-0.93	-0.089	0.15
Married (1=yes; 0=no)	0.319	1.16	0.089	0.39
Lives with at least one other person (1=yes; 0=no)	0.068	0.25	0.018	0.48
ln (Attributional Style index, positive scenario)	0.959	1.3	0.260	3.05
ln (Attributional Style index, negative scenario)	-0.599	-1.11	-0.162	2.85
Prefers larger, deferred payoff (1=yes; 0=no)	0.182	0.56	0.051	0.25
Lives in an outer-metropolitan area (1=yes; 0=no)	-0.336	-0.77	-0.081	0.13
Lives in a rural town (1=yes; 0=no)	-0.201	-0.66	-0.053	0.33
Lives in a remote town (1=yes; 0=no)	dropped			
Constant	*** -10.939	-2.58		
n	139			
Wald $\chi^2(19)$	41.03			
Pseudo-R^2	0.231			
Log-pseudolikelihood	60.32			