Why Adults with Autism Spectrum Disorder Have Lower Labor Supply than the Other Disability Groups?

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Abstract

Why adults with Autism Spectrum Disorder (ASD) have a lower labor supply than the other disability groups and what might help to increase it. I describe statistical determinants of the Labor Force Participation (LFP) and weekly hours of work of adults with ASD. I then investigate what might explain their lower labor supply compared with individuals with the other developmental, cognitive and physical disabilities. The estimated Average Marginal Effect of completing high school on the probability of LFP and weekly hours of work is the highest for those with ASD compared with those with other disabilities. The estimated effects are higher for the younger adults than for older ones. These findings suggest that improving education attainments for younger individuals with ASD could be more effective in increasing their labor supply. Findings from decomposing the lower LFP and weekly hours of work of adults with ASD compared with the other disabilities show that their observable individual characteristics do not explain a considerable proportion of their lower labor supply. This finding suggests that individuals with ASD might be subject to stigma and discrimination relatively more often than the others with disabilities. My findings have important implications for policy interventions to increase the labor supply of adults with ASD.

Keywords: Adult Autism Spectrum Disorder, Education, Labor supply, Disability.

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1 Introduction

Autism Spectrum Disorder (ASD) is a lifelong developmental condition that affects the way an individual relates to their environment and interacts with other people. The estimated worldwide prevalence of ASD for all age groups is about one percent. More than 21.7 million individuals had ASD at 2013 (Vos et al., 2015) and approximately 515 thousands of them lived in Canada. There has been a rise in childhood prevalence of ASD since Kanner (1943) first described ASD. It was estimated that one in 2,500 children had ASD forty years ago. One in 68 school age children had been diagnosed with ASD in the US at 2014 (Center for Disease Control and Prevention , CDC). It is 30% higher than the prevalence for 2008 (1 in 88); 60% higher than that for 2006 (1 in 110) and 120% higher than the estimates for 2002 and 2000 (1 in 150).[1] Adults with ASD have the lowest labor force outcomes compared to those with the other developmental, cognitive and physical disabilities (for two recent systematic reviews of the adult outcome studies over the years 1976 to 2011, see Howlin and Moss, 2012; Henninger and Taylor, 2013.[2] Only half of the adults with ASD have ever worked for pay where one-fifth of them are in sheltered employment in the US (Roux et al., 2013).[3] Lifespan cost of an individual with ASD is considerably high whereas loss of adult employment accounts for one-third of the total cost (Dudley and Emery, 2014; Buescher et al., 2014).[4] With the rise in childhood prevalence of ASD and considerable lifespan costs associated with lost adult employment, a better understanding of determinants of their lower labor supply is critical. However, there is very little empirical evidence on determinants of their lower labor supply.

In this paper, I describe the statistical determinants of Labor Force Participation (LFP) and weekly work hours of adults with ASD. I further investigate what might explain their lower LFP and weekly hours work hours than a comparison group including those with the other developmental, cognitive and physical disabilities. First, I estimate Probit and linear models of LFP and Log weekly work hours for each disability group. The lower labor supply of adults with ASD could be attributed in part to their individual characteristics; specifically deficit in higher order social and cognitive skills which are important for success in the labor force.

[1] For more information see: `https://www.cdc.gov/media/releases/2014/p0327-autism-spectrum-disorder.html`.

[2] ASD does not necessarily preclude an individual from fully participating in the society and the labor force. The manifestation of ASD is on a spectrum, and the symptoms can occur in any combination. It can range from severe disabilities; individuals who are locked into disruptive repetitive behaviors to high functioning individuals who may have active but distinctly odd social approaches, narrowly focused interests and verbose, pedantic communications (Hendricks, 1994, 2010). Some of the adults with ASD especially those with Asperger Syndrome could be enormously talented (Hendricks, 1994).

[3] Sheltered employment refers to the service provisions wherein people with disabilities assisted with obtaining and maintaining employment mainly through job coach and person-centered approaches. In some sheltered employment programs an employer pays wages and benefits in a competitive workplace where in some others wages and benefits are paid by a disability insurance program.

[4] The estimated lifespan costs of an individual with ASD is about $1.4 million in the US and UK. The costs are much higher if an individual has intellectual challenges in addition to ASD. The estimated costs are $2.4 million in the US and $2.2 million in the UK (Buescher et al., 2014). The universal finding is that the considerable proportion of the lifespan cost of having ASD is accounted by the lost adult employment. The remainder of the cost is accounted for by the service use which includes special education and medical services.

The lower labor supply also could in part be attributed to lower returns to their individual characteristics. They might face greater unobserved barriers such as discrimination and stigma related to their behavioral issues (Baldwin and Johnson, 2000; Johnson and Baldwin, 1993; Thomason et al., 1998; Baldwin and Johnson, 1995, 1994). Second, I use a Blinder-Oaxaca decomposition framework and decompose the lower LFP and Log weekly work hours of adults with ASD than each comparison group to two parts; one part explained by differences in their observable individual characteristics and an unexplained part, reflecting the effect of behavioral issues, discrimination and stigma.

I use Statistics Canada's 2012 Canadian Survey on Disability (CSD) for my empirical analysis. I further investigate the robustness of my finding using the 2006 Participation Activity and Limitation Survey (PALS). The CSD and PALS are both post-surveys of Canadian Censuses. Individuals based on their responses to the disability screening questions in the corresponding Census are selected to be surveyed for these data sets. These data sets include information on individuals' demographic characteristics, disability and labor force outcomes. My study sample includes working age individuals (16-64 years old) who have reported having ASD, other developmental, cognitive or physical disabilities.

My estimate of the prevalence of ASD for 16-64 years old population in Canada in 2011 is one in 771. Adults with ASD have the lowest LFP and weekly work hours compared with those with the other developmental, cognitive and physical disabilities whereas about 20% of them participate in the labor force with average weekly work hours of 17. My findings show that the Average Marginal Effect of completing high school on the probability of LFP and weekly work hours is the highest for adults with ASD. The estimated effects however are quite heterogeneous where the estimated effects are higher for the younger adults. Findings from my Blinder-Oaxaca decomposition show that a large proportion of the lower LFP and weekly work hours of adults with ASD compared with the other disability groups is due to lower returns to their individual characteristics (i.e., education attainment). This finding suggests that adults with ASD might be subject to discrimination and social stigma more often than the other disability groups.

My findings have important implications for policy interventions to increase the labor supply of adults with ASD. One of the very consistent findings from many long-term ASD studies is that the severity of ASD decreases when they grow older (see for instanceKanner 1973; Howlin et al. 2004; Shattuck et al. 2007; Esbensen et al. 2009; Farley et al. 2009). Higher returns to education on the probability of LFP of younger adults with ASD suggests that policies for improving education attainments of younger individuals with ASD could be effective for improving their adult labor supply. Awareness of and monitoring population with ASD is critical, as they may be in need of additional services and support for successful transition into employment. These findings, however, should be interpreted cautiously since they might be biased, caused by endogeneity and self-reported errors.

The remainder of this paper is organized as follows. Section 2 describes the data and variables used. Section 3 presents the empirical analysis. Finally, Section 4 concludes and draws policy implications.

2 Data and sample selection

I use Statistics Canada's master file of the 2012 Canadian Survey on Disability (CSD) and the 2006 Participation Activity and Limitation Survey (PALS) to investigate the LFP and weekly work hours of the adults with ASD. The CSD and PALS are post-surveys of respectively 2006 and 2011 Canadian Census.[5] The surveyed individuals are selected based on their responses to the filter questions in the corresponding census.[6] The primary purpose of these surveys is to provide information about Canadian adults whose daily activities are limited because of a health-related condition. This information is used to plan and evaluate services, programs, and policies for adults with disabilities to help enable their full participation in society.

The questionnaire of the CSD and PALS include questions about respondents' primary and secondary disabilities and the extent to which their disabilities limit their everyday activities. Responses are then combined to create variables indicating individuals' disability type and its severity. A scale for severity of a disability is defined based on the intensity and frequency of activity limitations. The severity scale includes mild, moderate, severe or very severe. I have grouped individuals with mild and moderate disabilities as less severe and those with severe and very severe disabilities as more severe. The Statistics Canada has used ICD-10 codes to classify the reported disabilities. I use these codes to identify individuals with ASD.[7] I define the ASD group as individuals who have reported "childhood Autism" or "Asperger syndrome" as their primary or secondary disabilities.[8] The CSD and PALS also have variables indicating learning, memory and psychological disabilities. I group individuals with at least one of these disabilities, excluding those with ASD, as those with cognitive disabilities. I group respondents who have answered "yes" to the question *"Has a doctor, psychologist or other health care professional ever said that you had a developmental disability or disorder? It may include Down syndrome, autism, Asperger Syndrome or mental impairment due to lack of oxygen at birth."* –excluding those with ASD– as those with developmental disabilities. The CSD and PALS also include indicator variables for several other disabilities including hearing, seeing, mobility, agility, pain, and communication. I group individuals with at least one of these disabilities –excluding those with other developmental, cognitive and ASD– as those with physical disabilities. I use the groups of individuals with the other developmental, cognitive and physical disabilities as

[5]The Canadian Census is renamed "National Household Survey" starting from 2011.

[6]More information on sample design of the 2012 CSD and the 2006 PALS is provided in Appendix B.

[7]The ICD-10 is the 10th revision of the International Classification of Diseases, a medical classification list by the World Health Organization (WHO). It contains codes for diseases, signs, and symptoms, abnormal findings, complaints, social circumstances and external causes of injury or diseases.

[8]The ICD-10 codes corresponding to "childhood autism" and "Asperger syndrome" are respectively "F84.0" and "F84.5". I have performed my analysis including individuals with "Atypical Autism" (F84.1), "Rett Syndrome" (F84.2) and "Pervasive Developmental Disorder" (F84.9) in my study sample. These conditions are quite rare and including them in the study sample does not affect the findings.

comparison groups.

The outcome variables of interest are LFP and Log weekly work hours. Both CSD and PALS have variables indicating individuals' weekly hours of work and labor force status defined as employed, unemployed or out of labor force. I construct an LFP indicator which takes the value of one for those participating in the labor force (employed or unemployed) and zeroes otherwise. I also use the following set of control variables; sex (male, female), age groups (15-19, 20-24, 25-34 and 35-64 years), marital status (married/common-law relationship, single/separated/widowed), education attainments (less than high school, high school and above), severity of disability (less severe and more severe), province of residence and the annual amount of disability benefits. My study sample includes 15-64 years old individuals with ASD and the other developmental, cognitive or physical disabilities. After dropping all observations with missing values for at least one of the variables, the total number of observations in CSD and PALS are respectively 13,780 and 14,200. The number of individuals with ASD is 430 and 190 respectively in CSD and PALS.

Descriptive statistics of all variables of interest are presented in Table 1. Panel (a) and (b) present the statistics respectively for CSD and PALS. In each table, Panel A presents the demographic statistics. Labor force statistics are presented in Panel B. About 3.1 percent of all disabilities in CSD are ASD while the corresponding ratio in PALS is 1.3 percent. The increase in the share of ASD disabilities between 2001 and 2006 could be partly due to the increase in diagnosing of ASD. It also might be related to the differences in sampling process between CSD and PALS. Males are affected with ASD more frequently than females with an average male-to-female ratio of 5 to 1. For the other developmental, cognitive and physical disabilities the corresponding the ratio is about one to one. These findings are consistent with those from the clinical ASD studies (for instance see; Volkmar et al. 2005). ASD is a lifelong condition whereas most physical disabilities occur later in life. The average age in the ASD group is much lower than the other groups. A relatively smaller portion of individuals with ASD, developmental and cognitive disabilities are married, or common law whereas about half of the individuals with physical disabilities are married. Although ASD does not have the highest portion of individuals with more severe disabilities, it has the highest portion of individuals who have never completed high school.

Adults with ASD have the worst labor force outcomes compared with the other groups. The LFP rate is defined as the proportion of adult population who are employed or unemployed. They have the lowest LFP rate with the lowest employment and the highest unemployment rates. They also have the lowest annual employment income and average weekly work hours, but they do not receive much higher disability benefits relative to others. Those who are employed, mostly work in sale and service sector.

3 Empirical Analysis

I describe the statistical determinants of LFP and weekly work hours of adults with ASD and investigate what might explain their lower outcomes than those with the other developmental, cognitive and physical disabilities. I estimate the Average Marginal Effects (AME) of observable individual characteristics on the probability of LFP from Probit models. I further estimate the effects of the individual characteristics on Log weekly hours of work from a linear model. I then use a Blinder-Oaxaca decomposition framework to investigate the extent to which the lower LFP and Log weekly work hours of adults with ASD could be attributed to their observable individual characteristics.

I assume that an individual decides to participate in the labor force if they receive higher utility from participation than non-participation. Individuals' obtained utility is not directly observable, but their labor participation decision is. The dependent variable LFP_i which indicates the LFP decision of individual i is equal to one if they decide to participate in the labor force (i.e., employed or unemployed) and zero otherwise. That is:

$$LFP_i = \begin{cases} 1 & U_{i1} \geq U_{i0} \\ 0 & \text{otherwise} \end{cases}$$

where U_{i1} and U_{i0} denote utility of individual i when respectively participating and not participating in the labor force. I assume that the utility of individual i denoted by U_i is specified as:

$$U_i = \beta_0 + \beta_1 Age_i + \beta_2 Age_i^2 + \beta_3 Sex_i + \beta_4 MaritalStatus_i + \beta_5 Severity_i + \beta_6 HighSchool_i + \epsilon_i$$

where a set of dummy variables for sex (male acting as the reference group), age groups (15-19, 25-34 and 35-64 with 20-24 years acting as the reference age group), marital status (married/common-law relationship, single/separated/widowed with the latter group acting as the reference), education attainment (completed high school with those who have not acting as the reference group), severity of disability (less severe acting as the reference level and more severe), province of residence (Ontario acting as the reference province).[9] ϵ_i is an error term which captures any unobserved factors affecting individuals' LFP decision such as their ability or taste for work. I assume that the distribution of ϵ_i is normal and therefore I can use a Probit model to estimate AME of individual characteristics on the probability of LFP. The conditional probability of LFP is specified as:

$$\begin{aligned} \mathbb{P}[LFP_i = 1|X_i] = \Phi(\beta X_i) = \Phi \Big\{ & \beta_0 + \beta_1 Age_i + \beta_2 Age_i^2 + \beta_3 Sex_i + \beta_4 MaritalStatus_i \\ & + \beta_5 Severity_i + \beta_5 HighSchool_i \} \end{aligned} \tag{1}$$

where X_i denotes all observable characteristics of individual i on the right side of (1). β is

[9] Yukon, Nunavut and Northwest territories are excluded from the study sample.

a vector of parameters from the model. $\Phi(\cdot)$ is the Cumulative Distribution Function of the Normal distribution. I use the Maximum Likelihood Estimation method to estimate β. The likelihood function depends only on $\frac{\beta}{\delta}$ where δ denotes the standard error of ϵ. Standard error of an error term is not identified unless assuming $\delta = 1$. Since a constant term is included in the model, without loss of generality, I assume $E(\epsilon) = 0$. Assuming that (1) is correctly specified, estimated coefficients are consistent. I estimate (1) separately for those with ASD and each comparison group.

Marginal effect of change in average individual characteristics x with continuous values (i.e. age) on conditional probability of LFP is $\frac{\partial \mathbb{P}[LFP=1|X]}{\partial x} = \Phi'(X'\beta)\beta_x$, where β_x is the estimated coefficient of characteristics x from (1). For characteristics with discrete values (i.e. education attainments) the marginal effect is calculated as changes from the base level (i.e. never completed high school). Since calculated marginal effect depends on individual characteristics X, I calculate AME as $N^{-1}\sum_i(\Phi(X_i'\widehat{\beta})\widehat{\beta}_x)$ where N denotes the sample size and $\widehat{\beta}$ denotes the estimated coefficients from the Probit model.

To further investigate the effects of the observable individual characteristics on labor supply in intensive margin, I also estimate a linear model of Log weekly work hours as:

$$\begin{aligned} Log(WeeklyWorkHours) = \alpha_0 + \alpha_1 Age_i + \alpha_2 Age_i^2 + \alpha_3 Sex_i + \alpha_4 MaritalStatus_i \\ + \alpha_5 Severity_i + \alpha_6 HighSchool_i + \eta_i \end{aligned} \tag{2}$$

where η_i is the error term and captures any unobserved factors affecting individuals weekly hours of work. The estimated coefficients indicate a correlation between individual characteristics and weekly work hours and are not meant to be interpreted as causal as they are biased.

3.1 Results

The estimated effects on LFP and Log(Weekly work hours) from observable individual characteristics using the 2012 CSD are presented in Table 2. This table shows the estimated effects for individuals with ASD, developmental, cognitive and physical disabilities. The first and fifth column of each table present the estimates from the base models specified in (1) and (2) where sex, age, age square, marital status[10], high school completion, the severity of disability, province of residence and occupation (only for Log(Weekly work hours)) are included in the model. After controlling for these observable individual characteristics, the estimated probability of LFP of adults with ASD is 0.20. It is remarkably smaller than those for the other comparison groups which are 0.34, 0.40 and 0.60 respectively for adults with the other developmental, cognitive and physical disabilities. The findings on Log(Weekly work hours) are similar where the adults with ASD have the lowest work hours.

[10]There is no variation in marital status of adults with ASD since almost none of them are married or in a common-law relationship. I, therefore, exclude the marital status variable from analysis of adults with ASD. I have included the marital status variable in the analyses of the other groups.

The estimated effect of completing high school on LFP is the highest for adults with ASD. Completing high school is associated with 0.20 increase in the probability of LFP for adults with ASD while the corresponding estimates for those with the other developmental, cognitive and physical disabilities are respectively 0.15, 0.19 and 0.10. These estimated are all significant at the conventional levels. Completing high school is also associated with an increase in weekly work hours of adults with ASD and the estimated effect is the highest for them. However, the estimated effects are not significant at the conventional levels.

The negative association between the severity of a disability and LFP is the smallest for adults with ASD among the others. In my base model, having a more severe ASD is associated with 0.10 decrease in the probability of LFP while the corresponding estimates for those with other developmental, cognitive e and physical disabilities respectively are 0.12, 0.24 and 0.22. My finding on the effects of the severity of ASD on Log(Weekly work hours) is similar.

In the model specified in (1) and (2), I have implicitly assumed that the effect of disability on labor supply is constant across the age groups and education levels. The impact of the severity of a disability, in fact, could be more or less pronounced depending on the age or education level of affected individuals. It is important to understand these heterogeneous effects in order to frame policies to increase the labor supply of adults with ASD. The inclusion of *severity*×*age* and *severity*×*education* interaction terms in (1) and (2) could partly capture such interrelationships. The estimated effects from the model including these interaction terms are presented in the last three columns of each panel in each table of Table 2. The last column of each panel shows the estimated effects from the fully specified model where both interaction terms are included. For all disability types, the estimated effects of completing high school on LFP from the fully specified model are similar to those from the base model presented in the first column. However, the estimated effect of completing high school on Log(Weekly work hours) for adults with ASD from the fully specified model is much higher than the base model presented in the fifth column. The negative association between severity of ASD and LFP from the fully specified model is quite larger than the one from the base model where it is the largest among all the others. These findings imply that the severity of a disability has heterogeneous effects on labor supply of adults with ASD depending on their age and education level.

Table 3 presents the estimated effects of observable individual characteristics on labor supply using the 2006 PALS. The estimated effect of completing high school on LFP of adults with ASD is quite similar to those for the other groups. The estimated effects, however, are not significant on the conventional level. The estimated effect of completing high school on Log(Weekly work hours) for adults with ASD is much higher than the others, although not significant on the conventional levels. The negative association between the severity of a disability and LFP for adults with ASD is quite similar to the others. These findings could be caused by a relatively smaller sample size of adults with ASD in the 2006 PALS than the 2012 CSD which might be due to different sampling methods in these two surveys. The CSD sampling included more individuals with non-physical disabilities than the PALS.

Understanding statistical determinants of labor supply of adults with ASD is important for effective policy interventions to enhance their labor supply, but it is challenging. The first issue is related to "omitted variables" where individuals may differ in many aspects other than the observable individual characteristics. For instance, behavioural issues influence LFP but it is almost impossible to isolate these effects. The second issue is the "measurement error" in a self-reported survey which induces the endogeneity issue. Some respondents might use the presence of disability as a basis for not participating in the labor force or working fewer hours. Those who do not participate in the labor force might be more likely to report a disability than the others with a similar condition who do participate. The risk of losing disability benefits might also affect respondents' willingness to report their labor supply. Another issue is the potential simultaneity in the relationship between the severity of a disability and labor supply. Health production theory suggests that employment, income and health are determined simultaneously (Grossman, 1972). On the one hand, the severity of disability could be influenced by the attributes related to the labor supply such as social support and enhanced self-esteem. On the other hand, the severity of a disability influences the labor supply. Overlooking any of these issues might result in biased estimates, and my findings, therefore, should be interpreted cautiously.

3.2 Blinder-Oaxaca Decomposition

I use Blinder-Oaxaca decomposition (Blinder, 1973; Oaxaca, 1973) and an extension of it (Yun, 2004) to investigate respectively the lower Log(Weekly work hours) and LFP of adults with ASD than those with the other developmental, cognitive and physical disabilities. Blinder-Oaxaca decomposition of average difference in probability of LFP (Log(Weekly work hours)) between two groups is an algebraic manipulation of the Probit model specified in (1) (model specified in (2)). The decomposition divides the difference in the average probability of LFP (Log(Weekly work hours)) of adults with ASD and a comparison group to two components. The first component is explained by observable individual characteristics which is called the endowment effect (E) where the second component is not explained. The unexplained component includes the coefficient effect (C) and the interaction effect (I). The coefficient effect is due to the estimated coefficients and interaction effect accounts for simultaneous endowment and coefficient effects. That is:

$$\overline{LFP}_G - \overline{LFP}_{ASD} = E + C + I \tag{3}$$

where $\overline{LFP}_{ASD}$ and $\overline{LFP}_G$ are the average probability of LFP (Log(Weekly work hours)) of respectively adults with ASD and a comparison group G. More specifically:

$$E = \overline{\Phi(X_G\widehat{\beta}_{ASD})} - \overline{\Phi(X_{ASD}\widehat{\beta}_{ASD})} \tag{4}$$

$$C = \overline{\Phi(X_{ASD}\widehat{\beta}_G)} - \overline{\Phi(X_{ASD}\widehat{\beta}_{ASD})} \tag{5}$$

$$I = \overline{\Phi(X_G\widehat{\beta}_G)} - \overline{\Phi(X_G\widehat{\beta}_{ASD})} + \overline{\Phi(X_{ASD}\widehat{\beta}_{ASD})} - \overline{\Phi(X_{ASD}\widehat{\beta}_G)} \tag{6}$$

where the overbar represents a sample's average. $\widehat{\beta}$ represents the estimated coefficients from the Probit model (linear model) for the corresponding group. The endowment effect intuitively reflects a hypothetical increase in the probability of LFP (Log(Weekly work hours)) of adults with ASD if their observable individual characteristics were the same as those of the comparison group. The coefficient effect quantifies the increase in the probability of LFP (Log(Weekly work hours)) of those with ASD if returns to their individual characteristics would have been the same as those of the corresponding comparison group.

Results from Blinder-Oaxaca decomposition

For Blinder-Oaxaca decompositions, I use the fully specified models where the *severity*× *age* and *severity*× *education* interaction terms and are all included in the model specified in (1) and (2).[11] Decomposition estimates for categorical variables depends on the choice of the base category. To avoid this issue, I follow (Yun, 2005) and compute the decompositions based on the deviation from the grand average, called the normalized effect.

Panel (a) of Table 4 presents the results from decomposing the lower LFP and Log(Weekly work hours) of adults with ASD compared with those with the other developmental and cognitive disabilities using the 2012 CSD. Thee observable individual characteristics explain more than half of the lower LFP and Log(Weekly work hours) of adults with ASD than those with the other developmental disabilities. The observable characteristics explain a relatively smaller portion of the lower labor supply of adults with ASD than those with cognitive disabilities. The unexplained portion of the lower labor supply is due to lower returns to observable characteristics of the adults with ASD. It could be due to their behavioural issues which makes their labor supply more challenging than those with the other developmental and cognitive disabilities (Ameri et al., 2015).

Panel (b) of Table 4 presents the results from decomposing the lower LFP and Log(Weekly work hours) of adults with ASD, other developmental and cognitive disabilities compared with those with physical disabilities using the 2012 CSD. The observable individual characteristics explain a relatively more significant portion of the lower labor supply of adults with other developmental and cognitive disabilities. These findings suggest that adults with ASD might be subject to discrimination and stigma more often than the other comparison groups.

Table 5 presents the decomposition analysis using the 2006 PALS. The observable individual characteristics explain a relatively smaller portion of the lower labor supply of adults with ASD than those with the other developmental and cognitive disabilities. The observable individual characteristics explain a more substantial portion of the lower LFP than Log(Weekly work hours) when compared with physical disabilities.

[11]Since there is no variation in the marital status of adults with ASD, I have excluded it from the decomposition analysis.

4 Policy Implications and Conclusions

The prevalence of ASD is much higher than it was forty years ago. One in 68 children were diagnosed with ASD in 2014 where it was one in 2,500 forty years earlier. A large proportion of the lifetime cost of an individual with ASD is accounted for by lost adult employment since adults with ASD have much lower labor supply compared with those with other disabilities. My findings show that the LFP and Weekly work hours of adults with ASD is the lowest among those with the other developmental, cognitive and physical disabilities. From a policy perspective, it is of interest to understand the determinants of such low labor supply and to know what could be done to improve this.

Furthermore, it is of interest to understand whether the lower labor supply of adults with ASD is due to their observable characteristics (i.e. education) or lower returns to their characteristics. Evidence explaining the source of the lower labor supply of adults with ASD would help designing better policies and to target heterogenous groups.[12] It also would help to evaluate heterogeneous effects of the labor supply promoting programs for groups with different age and severity of the condition.

I use Statistics Canada's 2012 CSD and the 2006 PALS surveys to investigate statistical determinants of labor supply of adults with ASD and what might explain their lower LFP and Log(Weekly work hours) than the other disability groups. A great feature of these data sets is that the self-reported disabilities are coded using ICD-10 codes. It allows me to identify adults with ASD and the other developmental, cognitive and physical disabilities. I estimate Probit models of LFP and linear models of Log(Weekly work hours) for each disability group. I then perform Blinder-Oaxaca decompositions to investigate how much of the lower LFP and Log(Weekly work hours) of adults with ASD compared with the other comparison groups is due to their observable individual characteristics versus lower returns to the characteristics. My findings suggest that the marginal effects of completing high school are the largest for adults with ASD. My findings also indicate that the severity of ASD is less restrictive than for the other comparison groups.

Furthermore, the severity of ASD has heterogeneous effects on LFP depending on an individual's age and education level. Findings from my decomposition analysis indicate that a more substantial portion of the lower labor supply of adults with ASD than those with physical disabilities is due to the lower returns to their characteristics where their observable individual characteristics explain only a small proportion. Although, comparatively more significant portions of the lower labor supply of adults with ASD than those with the other developmental and cognitive disabilities are due to their observable characteristics, yet a considerable proportion is due to the lower returns to their observable characteristics. These findings imply that adults with ASD might face barriers to participate in the labor force and they might be subject to discrimination and social stigma more often than those with the other developmental and cognitive disabilities.

[12] For instance, the $15 million budget of the Economic Action Plan 2014 of the Canadian federal government. For more information see `http://www.budget.gc.ca/2014/docs/plan/ch3-1-eng.html`

Heterogeneity of the policy instruments

My findings suggest that a considerable proportion of the lower LFP of adults with ASD compared with those with the other developmental, cognitive and physical disabilities is not explained by their observable characteristics and is due to the lower returns to their characteristics. Policy interventions for improving observable characteristics of individuals with ASD still could be effective in increasing their LFP. The estimated marginal effects of completing high school on the LFP is the highest for adults with ASD. This finding suggests that improving their education attainments could be more effective in increasing their LFP. Policy interventions to improve the educational attainments could potentially be used as policy instruments. From a policy perspective, however, it is of interest to better understand the heterogeneous effects of these instruments within the age groups and severity of the disability.

To further investigate the heterogeneous effect of completing high school on the LFP, I compute the fitted marginal effects across the disability groups from the Probit model specified in (1). The fitted values from the CSD 2012 and PALS 2006 are respectively presented in Figure 1 and 2. Panel (a) of each figure shows the fitted values within the age groups and Panel (b) shows the values within the severity of disability. There are two notable findings. First, the marginal effects of completing high school are the highest for those with ASD both within the age and severity of disability compared with the other disability groups. Second, the marginal effects of completing high school are higher for younger individuals with less severe ASD.

Although my analysis provides new insight into labor supply of adults with ASD, it is limited. The estimates are biased and should be interpreted cautiously.

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Tables

Table 1: Summary statistics

(a) CSD 2012

	Autism Spectrum Disorder	Developmental Disabilities	Cognitive Disabilities	Physical Disabilities
A. Demographic statistics (%)				
Portion of all disabilities	3.1	7.9	43.9	45.0
Male	82.8	56.1	45.3	46.8
Age (years)	29.1	36.6	45.2	50.3
Age disability started at (years)	15.0	15.4	28.1	36.5
Married/Common law	NA	25.8	44.2	68.1
High school graduate	31.1	42.1	69.0	77.5
More Severe disability	46.8	72.7	70.2	32.5
Province of residence				
-Newfoundland and Labrador	8.1	12.8	8.4	9.9
-Prince Edward Island	3.50	3.50	5.4	7.3
-Nova Scotia	6.2	8.0	10.6	9.8
-New Brunswick	10.6	11.4	10.0	8.5
-Quebec	10.9	11.8	10.1	9.8
-Ontario	12.5	9.4	11.4	9.5
-Manitoba	13.2	11.4	11.0	12.7
-Saskatchewan	10.6	9.7	10.2	12.1
-Alberta	9.7	11.6	11.7	10.5
-British Columbia	14.6	10.5	11.1	9.7
B. Labor force statistics (%)				
Labor force participation	19.9	34.2	40.4	60.4
- Employment (%)	14.4	24.1	33.5	56.2
- Unemployment (%)	32.1	23.1	16.5	7.0
Annual employment income ($)	1,280	8,820	13,760	26,340
Average annual disability benefits($)	9,934	7,604	7,124	5,237
Weekly work hours	17.4	28.3	34.6	37.3
Occupation				
- Management/Business/Finance	10.1	10.4	17.7	24.9
- Science/Health	NA	7.4	12.2	16.0
- Education/Art/Sport	NA	7.1	14.80	16.1
- Sale/service	51.9	49.5	34.0	23.2
- Manufacturing/utility	NA	6.1	4.1	3.9
Number of Obs.	430	1,090	6,060	6,200

(b) PALS 2006

	Autism Spectrum Disorder	Developmental Disabilities	Cognitive Disabilities	Physical Disabilities
A. Demographic statistics (%)				
Portion of all disabilities	1.3	8.1	28.4	61.3
Male	83.1	55.4	43.2	47.7
Age (years)	29.5	37.7	44.2	48.4
Married/Common law	NA	24.1	44.7	64.5
High school graduate	22.7	35.9	66.8	75.5
More Severe disability	56.3	75.1	72.3	28.5
Province of residence				
-Newfoundland and Labrador	12.0	12.4	9.5	11.0
-Prince Edward Island	NA	4.5	6.0	7.8
-Nova Scotia	9.9	11.5	11.9	10.7
-New Brunswick	14.6	9.6	10.3	10.6
-Quebec	13.5	13.1	10.9	11.0
-Ontario	11.5	10.4	12.9	10.6
-Manitoba	14.1	10.3	9.5	10.3
-Saskatchewan	7.8	10.2	9.6	9.6
-Alberta	7.3	9.2	8.6	9.8
-British Columbia	7.8	8.8	10.8	8.4
B. Labor force statistics (%)				
Labor force participation	20.3	29.5	31.0	53.8
- Employment (%)	23.1	23.7	30.1	50.7
- Unemployment(%)	33.1	16.2	15.8	7.1
Annual employment income ($)	3,400	6,400	9,840	21,450
Average annual disability benefits($)	5,100	5,660	6,100	3,960
Weekly work hours	16.9	24.1	27.0	33.7
Occupation				
- Management/Business/Finance	NA	9.7	14.3	15.1
- Science/Health	14.6	18.1	21.8	25.3
- Education/Art/Sport	10.4	14.0	13.0	19.2
- Sale/service	25.0	31.8	34.4	33.1
- Manufacturing/utility	NA	26.4	16.5	7.3
Number of Obs	190	1,150	4,030	8,830

Note: This table presents summary statistics from the 2012 Canadian Survey on Disability (CSD 2012) and 2006 Participation Activity and Limitation Survey (PALS 2006). The study sample includes 15-64 years old individuals who have reported having Autism Spectrum disorder, developmental, cognitive and physical disabilities. Survey weights generating estimated frequencies in the target population are used. The total number of observations is not weighted. Following Statistics Canada's guidelines, statistics are flagged as NA when the corresponding sample size is too small to be reported.

Table 2: Estimated effects of observable individual chractrericts on labor supply by disability groups (CSD 2012)

(a) Autism Spectrum Disorder

	Labor Force Participation				Log(Weekly hours of work)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Male	-0.05	-0.06	-0.06	-0.06	-0.10	-0.08	-0.12	-0.13
	(0.06)	(0.06)	(0.07)	(0.06)	(0.27)	(0.28)	(0.25)	(0.26)
Age	-0.01	-0.04*	-0.01	-0.03*	0.44	0.46	0.47	0.47
	(0.01)	(0.02)	(0.01)	(0.01)	(0.27)	(0.27)	(0.27)	(0.28)
Age square	0.00	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)
High school graduate	0.20**	0.20***	0.20**	0.20***	0.48	0.50	0.75*	0.75*
	(0.06)	(0.05)	(0.06)	(0.05)	(0.29)	(0.29)	(0.34)	(0.34)
More Severe	-0.10	-0.44***	-0.10	-0.44***	-0.39	0.40	0.34	0.01
	(0.05)	(0.06)	(0.05)	(0.06)	(0.20)	(1.32)	(0.38)	(1.23)
Predicted mean/Constant	0.20***	0.20***	0.20***	0.20***	-2.73	-3.07	-3.26	-3.13
	(0.02)	(0.02)	(0.02)	(0.02)	(3.03)	(3.13)	(3.08)	(3.20)
Province of residence	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupation	No	No	No	No	Yes	Yes	Yes	Yes
Married/Common law	No	No	No	No	No	No	No	No
Age × Severity	No	Yes	No	Yes	No	Yes	No	Yes
High school × Severity	No	No	Yes	Yes	No	No	Yes	Yes
Number of Obs.	430	430	430	430	100	100	100	100
PR2/R2	0.21	0.24	0.21	0.24	0.31	0.32	0.37	0.37

(b) Developmental disabilities

	Labor Force Participation				Log(Weekly hours of work)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Male	-0.14*	-0.14	-0.14*	-0.13	0.18	0.15	0.19	0.14
	(0.07)	(0.07)	(0.06)	(0.06)	(0.17)	(0.16)	(0.16)	(0.15)
Age	0.03**	0.03**	0.03**	0.03**	0.07	0.06	0.07	0.05
	(0.01)	(0.01)	(0.01)	(0.01)	(0.05)	(0.05)	(0.05)	(0.05)
Age square	-0.00***	-0.00***	-0.00***	-0.00***	-0.00	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Married/Common law	0.28*	0.27*	0.29*	0.27*	0.29	0.23	0.29	0.22
	(0.11)	(0.11)	(0.10)	(0.12)	(0.21)	(0.21)	(0.21)	(0.21)
High school graduate	0.15	0.15	0.15	0.15	0.13	0.18	0.23	0.43*
	(0.07)	(0.07)	(0.07)	(0.07)	(0.16)	(0.15)	(0.19)	(0.18)
More Severe	-0.12*	-0.25	-0.12*	-0.27*	-0.11	-0.76	-0.01	-0.69
	(0.05)	(0.13)	(0.05)	(0.05)	(0.13)	(0.39)	(0.21)	(0.38)
Predicted mean/Constant	0.34***	0.34***	0.34***	0.34***	1.77*	2.20**	1.76*	2.29**
	(0.04)	(0.04)	(0.04)	(0.04)	(0.81)	(0.81)	(0.81)	(0.80)
Province of residence	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupation	No	No	No	No	Yes	Yes	Yes	Yes
Age × Severity	No	Yes	No	Yes	No	Yes	No	Yes
High school × Severity	No	No	Yes	Yes	No	No	Yes	Yes
Number of Obs.	1,090	1,090	1,090	1,090	310	310	310	310
PR2/R2	0.13	0.14	0.14	0.14	0.28	0.30	0.29	0.31

(c) Cognitive disabilities

	Labor Force Participation				Log(Weekly hours of work)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Male	0.03	0.03	0.03	0.03	0.13*	0.13*	0.13*	0.13*
	(0.89)	(0.95)	(0.86)	(0.92)	(0.05)	(0.05)	(0.05)	(0.05)
Age	0.02***	0.02***	0.02***	0.03***	0.04**	0.04**	0.04**	0.04**
	(3.53)	(3.52)	(3.61)	(3.63)	(0.01)	(0.01)	(0.01)	(0.01)
Age square	-0.00***	-0.00***	-0.00***	-0.00***	-0.00*	-0.00*	-0.00*	-0.00*
	(-4.19)	(-4.06)	(-4.27)	(-4.08)	(0.00)	(0.00)	(0.00)	(0.00)
Married/Common law	0.04	0.04	0.05	0.05	0.07	0.07	0.07	0.07
	(1.13)	(1.12)	(1.18)	(1.17)	(0.06)	(0.06)	(0.05)	(0.05)
High school graduate	0.19***	0.19***	0.19***	0.19***	0.08	0.08	0.14*	0.13*
	(5.03)	(5.03)	(4.90)	(4.87)	(0.06)	(0.06)	(0.07)	(0.07)
More Severe	-0.24***	-0.15	-0.24***	-0.11	-0.15**	-0.02	-0.04	0.03
	(-6.94)	(-1.49)	(-6.81)	(-1.20)	(0.05)	(0.15)	(0.10)	(0.16)
Predicted mean/Constant	0.40***	0.40***	0.40***	0.40***	2.59***	2.57***	2.56***	2.55***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.24)	(0.25)	(0.25)	(0.26)
Province of residence	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupation	No	No	No	No	Yes	Yes	Yes	Yes
Age × Severity	No	Yes	No	Yes	No	Yes	No	Yes
High school × Severity	No	No	Yes	Yes	No	No	Yes	Yes
Number of Obs.	6,060	6,060	6,060	6,060	2,340	2,340	2,340	2,340
PR2/PR	0.13	0.13	0.13	0.13	0.15	0.15	0.15	0.15

(d) Physical disabilities

	Labor Force Participation				Log(Weekly hours of work)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Male	0.05	0.05	0.05	0.05	0.16***	0.16***	0.16***	0.16***
	(1.71)	(1.70)	(1.72)	(1.70)	(0.03)	(0.03)	(0.03)	(0.03)
Age	0.05***	0.05***	0.05***	0.05***	0.04***	0.05***	0.04***	0.05***
	(6.21)	(6.20)	(6.19)	(6.19)	(0.01)	(0.01)	(0.01)	(0.01)
Age square	-0.00***	-0.00***	-0.00***	-0.00***	-0.00***	-0.00***	-0.00***	-0.00***
	(-7.12)	(-7.02)	(-7.10)	(-7.00)	(0.00)	(0.00)	(0.00)	(0.00)
Married/Common law	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03
	(0.48)	(0.52)	(0.47)	(0.51)	(0.05)	(0.05)	(0.05)	(0.05)
High school graduate	0.10**	0.10**	0.10**	0.10**	-0.02	-0.02	-0.03	-0.03
	(2.65)	(2.63)	(2.65)	(2.63)	(0.05)	(0.05)	(0.05)	(0.05)
More Severe	-0.22***	-0.34**	-0.22***	-0.34**	-0.07	-0.36	-0.11	-0.40
	(-7.23)	(-2.70)	(-7.24)	(-2.70)	(0.04)	(0.19)	(0.12)	(0.22)
Predicted mean/Constant	0.60***	0.60***	0.60***	0.60***	2.60***	2.62***	2.61***	2.63***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.20)	(0.20)	(0.20)	(0.20)
Province of residence	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupation	No	No	No	No	Yes	Yes	Yes	Yes
Age × Severity	No	Yes	No	Yes	No	Yes	No	Yes
High school × Severity	No	No	Yes	Yes	No	No	Yes	Yes
Number of Obs.	6,200	6,200	6,200	6,200	3,320	3,320	3,320	3,320
PR2/R2	0.13	0.13	0.13	0.13	0.09	0.09	0.09	0.09

Note: This table presents the estimated Average Marginal Effects (AME) of observable individual characteristics on the probability of Labor Force Participation from a Probit model specified in (1) and the effects of individual characteristics on weekly hours of work from a linear model specified in (2). The study sample includes 15-64 year individuals from 2012 Canadian Survey on Disability (CSD 2012) with Autism Spectrum Disorder, developmental, cognitive and physical disabilities. The reference group in each table includes 15-19 years old single males with less severe disabilities who reside in Ontario and have never finished high school. The survey weights generating estimated frequencies in the target population are used in all the estimates. The robust standard errors are presented in parenthesis.

$*p < 0.10, **p < 0.05, ***p < 0.01$

Table 3: Estimated effects of observable individual chractrericts on labor supply by disability groups (PALS 2006)

(a) Autism Spectrum Disorder

	Labor Force Participation				Log(Weekly hours of work)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Male	0.12	0.15*	0.12	0.15*	2.10	1.75	1.64	1.76
	(0.07)	(0.06)	(0.06)	(0.06)	(1.56)	(1.72)	(1.74)	(1.92)
Age	0.02	0.05	0.02	0.04	-0.20	-0.31	-0.40	-0.40
	(0.02)	(0.02)	(0.02)	(0.02)	(0.45)	(0.63)	(0.66)	(0.67)
Age square	-0.00	-0.00*	-0.00	-0.00	-0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)
High school graduate	0.16	0.11	0.15	0.11	2.72	3.65	4.77	4.95
	(0.12)	(0.12)	(0.10)	(0.10)	(1.91)	(3.39)	(3.99)	(3.87)
More Severe	-0.27**	0.16	-0.28**	0.05	-0.17	4.98	1.59	-3.22
	(0.09)	(0.14)	(0.08)	(0.24)	(0.05)	(8.00)	(1.83)	(10.45)
Predicted mean/Constant	0.21***	0.21***	0.20***	0.21***	2.32	5.44	6.73	5.82
	(0.04)	(0.04)	(0.04)	(0.04)	(7.59)	(12.20)	(12.05)	(13.29)
Province of residence	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupation	No	No	No	No	Yes	Yes	Yes	Yes
Married/Common law	No	No	No	No	No	No	No	No
Age × Severity	No	Yes	No	Yes	No	Yes	No	Yes
High school × Severity	No	No	Yes	Yes	No	No	Yes	Yes
Number of Obs.	170	170	170	170	30	30	30	30
PR2/R2	0.27	0.30	0.29	0.30	0.77	0.79	0.82	0.83

(b) Developmental disabilities

	Labor Force Participation				Log(Weekly hours of work)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Male	0.05	0.04	0.05	0.04	-0.16	-0.16	-0.19	-0.19
	(0.05)	(0.04)	(0.05)	(0.04)	(0.20)	(0.20)	(0.21)	(0.22)
Age	0.04***	0.04***	0.04***	0.04***	0.02	0.02	0.01	0.01
	(0.01	(0.01)	(0.01)	(0.01)	(0.06)	(0.07)	(0.06)	(0.07)
Age square	-0.00***	-0.00***	-0.00***	-0.00***	-0.00	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Married/Common law	0.03	0.03	0.03	0.03	0.59	0.59	0.59	0.59
	(0.08)	(0.07)	(0.08)	(0.07)	(0.38)	(0.38)	(0.38)	(0.38)
High school graduate	0.14*	0.14*	0.14*	0.14*	-0.12	-0.12	0.07	0.06
	(0.05)	(0.05)	(0.05)	(0.05)	(0.30)	(0.30)	(0.32)	(0.32)
More Severe	-0.09	-0.30*	-0.09	-0.31*	-0.53*	-0.36	-0.35	-0.27
	(0.05)	(0.12)	(0.05)	(0.12)	(0.21)	(0.67)	(0.36)	(0.69)
Predicted mean/Constant	0.29***	0.29***	0.29***	0.29***	3.49**	3.48**	3.50**	3.49**
	(0.03)	(0.03)	(0.03)	(0.03)	(1.10)	(1.09)	(1.11)	(1.10)
Province of residence	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupation	No	No	No	No	Yes	Yes	Yes	Yes
Age × Severity	No	Yes	No	Yes	No	Yes	No	Yes
High school × Severity	No	No	Yes	Yes	No	No	Yes	Yes
Number of Obs.	1,150	1,150	1,150	1,150	270	270	270	270
PR2/R2	0.10	0.11	0.10	0.11	0.19	0.19	0.19	0.19

(c) Cognitive disabilities

	Labor Force Participation				Log(Weekly hours of work)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Male	0.05	0.05	0.05	0.05	0.22	0.21	0.22	0.21
	(0.02)	(0.02)	(0.02)	(0.02)	(0.13)	(0.13)	(0.13)	(0.13)
Age	0.02***	0.02***	0.02***	0.02***	0.03	0.03	0.03	0.03
	(0.00)	(0.00)	(0.00)	(0.00)	(0.03)	(0.03)	(0.03)	(0.03)
Age square	-0.00***	-0.00***	-0.00***	-0.00***	-0.00	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Married/Common law	0.08**	0.08**	0.08**	0.08**	0.10	0.09	0.09	0.08
	(0.02)	(0.02)	(0.02)	(0.02)	(0.12)	(0.13)	(0.12)	(0.13)
High school graduate	0.10***	0.10***	0.11***	0.11***	0.48*	0.48*	0.11	0.08
	(0.02)	(0.02)	(0.02)	(0.02)	(0.22)	(0.22)	(0.16)	(0.16)
More Severe	-0.20***	-0.13	-0.19***	-0.16	-0.32**	0.18	-0.78**	-0.24
	(0.02)	(0.08)	(0.02)	(0.08)	(0.12)	(0.33)	(0.29)	(0.38)
Predicted mean/Constant	0.31***	0.31***	0.31***	0.31***	1.84***	1.69***	2.13***	1.97***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.51)	(0.51)	(0.55)	(0.54)
Province of residence	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupation	No	No	No	No	Yes	Yes	Yes	Yes
Age × Severity	No	Yes	No	Yes	No	Yes	No	Yes
High school × Severity	No	No	Yes	Yes	No	No	Yes	Yes
Number of Obs.	4,030	4,030	4,030	4,030	1,300	1,300	1,300	1,300
PR2/R2	0.13	0.13	0.13	0.13	0.08	0.08	0.09	0.09

(d) Physical disabilities

	Labor Force Participation				Log(Weekly hours of work)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Male	0.07***	0.07***	0.07***	0.07***	0.18**	0.18**	0.18**	0.18**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.06)	(0.06)	(0.06)	(0.06)
Age	0.05***	0.05***	0.05***	0.05***	0.07***	0.07***	0.07***	0.07***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.02)	(0.02)	(0.02)	(0.02)
Age square	-0.00***	-0.00***	-0.00***	-0.00***	-0.00***	-0.00***	-0.00***	-0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Married/Common law	0.00	0.01	0.00	0.01	0.10	0.10	0.10	0.10
	(0.00)	(0.03)	(0.00)	(0.03)	(0.07)	(0.07)	(0.07)	(0.07)
High school graduate	0.13***	0.13***	0.13***	0.13***	0.21*	0.21*	0.25*	0.25*
	(0.02)	(0.02)	(0.02)	(0.02)	(0.10)	(0.10)	(0.11)	(0.11)
More Severe	-0.24***	-0.43***	-0.24***	-0.43***	-0.22*	-0.62	-0.06	-0.46
	(0.02)	(0.06)	(0.02)	(0.06)	(0.09)	(0.35)	(0.19)	(0.39)
Predicted mean/Constant	0.54***	0.54***	0.54***	0.54***	1.65***	1.65***	1.62***	1.62***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.32)	(0.32)	(0.33)	(0.33)
Province of residence	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupation	No	No	No	No	Yes	Yes	Yes	Yes
Age × Severity	No	Yes	No	Yes	No	Yes	No	Yes
High school × Severity	No	No	Yes	Yes	No	No	Yes	Yes
Number of Obs.	8,830	8,830	8,830	8,830	4,720	4,720	4,720	4,720
PR2/R2	0.15	0.16	0.15	0.15	0.04	0.04	0.04	0.04

Note: This table presents the estimated Average Marginal Effects (AME) of observable individual characteristics on the probability of Labor Force Participation from a Probit model specified in (1) and the effects of individual characteristics on weekly hours of work from a linear model specified in (2). The study sample includes 15-64 year individuals from the Participation Activity and Limitation Survey (PALS 2006) with Autism Spectrum Disorder, developmental, cognitive and physical disabilities. The reference group in each table includes 15-19 years old single males with less severe disabilities who reside in Ontario and have never finished high school. The survey weights generating estimated frequencies in the target population are used in all the estimates. The robust standard errors are presented in parenthesis.

$*p < 0.10, **p < 0.05, ***p < 0.01$

Table 4: Decomposing the differences in labor supply of adults with Autism Spectrum Disorder and other disabilities (CSD 2012)

(a) Autism Spectrum Disorder compared with Developmental and Cognitive disabilities

Outcome variable	**Labor Force Participation**				**Log(Weekly work hours)**			
Comparison group	Developmental Disabilities		Cognitive Disabilities		Developmental Disabilities		Cognitive Disabilities	
	Coefficient	% of Difference	Coefficient	% of Difference	Coefficient	% of Difference	Coefficient	% of Difference
Overall Effect								
Autism Spectrum Disorder	0.20***		0.20***		2.62***		2.62***	
	(0.00)		(0.00)		(0.01)		(0.01)	
Comparison group	0.34***		0.40***		3.12***		3.42***	
	(0.00)		(0.00)		(0.00)		(0.00)	
Difference	-0.14***		-0.20***		-0.50***		-0.81***	
	(0.00)		(0.00)		(0.01)		(0.01)	
Endowment Effect (E)	-0.08***	57.1	0.01***	5.0	-0.27***	54.0	-0.25***	30.9
	(0.00)		(0.00)		(0.01)		(0.00)	
Coefficient Effect (C)	-0.21***		-0.32***		-2.61***		-4.37***	
	(0.00)		(0.00)		(0.18)		(0.30)	
Interaction Effect (I)	0.15***		0.11***		2.37***		3.81***	
	(0.00)		(0.00)		(0.18)		(0.30)	
Endowment Effect								
Male	-0.04***		0.01***		0.04***		0.04***	
	(0.00)		(0.00)		(0.00)		(0.00)	
Age	-0.25***		-0.21***		-1.02***		-0.90***	
	(0.01)		(0.02)		(0.04)		(0.01)	
Married/Common law	-0.07***		-0.01***		-0.09***		-0.03***	
	(0.00)		(0.00)		(0.00)		(0.00)	
High school	-0.02***		-0.04***		0.01***		-0.01***	
	(0.00)		(0.00)		(0.00)		(0.00)	
Severity	0.03***		0.03***		0.03***		0.02***	
	(0.00)		(0.00)		(0.00)		(0.00)	
Occupation					0.01***		-0.03***	
					(0.00)		(0.00)	
Coefficient Effect								
Male	0.02***		-0.01***		0.14***		0.14***	
	(0.00)		(0.00)		(0.02)		(0.02)	
Age	-1.10***		-1.17***		13.05***		16.71***	
	(0.07)		(0.09)		(1.08)		(1.29)	
Married/Common law	0.27***		0.12***		1.17***		1.54***	
	(0.02)		(0.02)		(0.13)		(0.19)	
High school	-0.04***		-0.01***		-0.26***		-0.08***	
	(0.00)		(0.00)		(0.01)		(0.01)	
Severity	0.00*		-0.01***		-0.29***		-0.28***	
	(0.00)		(0.00)		(0.02)		(0.01)	
Occupation					-0.18**		-0.04	
					(0.06)		(0.06)	
Interaction Effect								
Male	0.01***		-0.02***		-0.06***		-0.08***	
	(0.00)		(0.00)		(0.01)		(0.01)	
Age	0.24***		0.30***		-5.30***		-8.37***	
	(0.02)		(0.03)		(0.44)		(0.64)	
Married/Common law	0.10***		0.08***		-0.88***		-1.46***	
	(0.00)		(0.01)		(0.12)		(0.19)	
High school	-0.01***		-0.01***		0.02***		-0.04***	
	(0.00)		(0.00)		(0.00)		(0.00)	
Severity	0.00*		-0.01***		0.07***		0.04***	
	(0.00)		(0.00)		(0.01)		(0.00)	
Occupation					-0.06***		-0.00	
					(0.01)		(0.01)	
Number of Obs.	1,520		6,500		410		2,440	

(b) Autism Spectrum Disorder, Developmental and Cognitive disabilities compared with Physical disabilities

Outcome variable	**Labor Force Participation**						**Log(Weekly work hours)**					
Comparison group	Autism Spectrum Disorder		Developmental Disabilities		Cognitive Disabilities		Autism Spectrum Disorder		Developmental Disabilities		Cognitive Disabilities	
	Coefficient	% of Difference	Coefficient	% of Difference	Coefficient	% of Difference	Coefficient	% of Difference	Coefficient	% of Difference	Coefficient	% of Difference
Overall Effect												
Comparison group	0.20***		0.34***		0.40***		2.62***		3.12***		3.42***	
	(0.00)		(0.00)		(0.00)		(0.01)		(0.00)		(0.00)	
Physical disabilities	0.60***		0.60***		0.60***		3.54***		3.54***		3.54***	
	(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)	
Difference	-0.40***		-0.26***		-0.20***		-0.93***		-0.42***		-0.12***	
	(0.00)		(0.00)		(0.00)		(0.01)		(0.00)		(0.00)	
Endowment Effects (E)	-0.09***	22.5	-0.07***	26.9	-0.06***	30.0	-0.23***	24.7	-0.11***	26.2	-0.05***	41.7
	(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)	
Coefficient Effects (C)	-0.54***		-0.19***		-0.12***		-6.25***		-0.15***		-0.02***	
	(0.00)		(0.00)		(0.00)		(0.44)		(0.01)		(0.00)	
Interaction Effects (I)	0.23***		-0.00		-0.01***		5.55***		-0.16***		-0.05***	
	(0.01)		(0.00)		(0.00)		(0.44)		(0.01)		(0.00)	
Number of Obs.	6,630		7,290		12,260		3,420		3,630		5,660	

Note: Panel (a) of this table presents the estimated Blinder-Oxaca decompositions of the differences in Labor Force Participation and Log(Weekly hours of work) of individuals with Autism Spectrum Disorder compared with individuals with Developmental and Cognitive disabilities. Panel (b) presents the estimated decomposition of the differences Labor Force Participation and Log(Weekly hours of work) of individuals with Autism Spectrum Disorder, Developmental and Cognitive disabilities compared with individuals with Physical disabilities. The study sample includes 16-64 years in the 2012 Canadian Survey of Disability (CSD 2012) with Autism Spectrum Disorder, Developmental, Cognitive and Physical disabilities. Survey weights generating estimated frequencies in the target population are used in all the estimates.
$*p < 0.10, **p < 0.05, ***p < 0.01$

Table 5: Decomposing the differences in labor supply of adults with Autism Spectrum Disorder and other disabilities (PALS 2006)

(a) Autism Spectrum Disorder compared with Developmental and Cognitive disabilities

Outcome variable	**Labor Force Participation**				**Log(Weekly work hours)**			
Comparison group	Developmental Disabilities		Cognitive Disabilities		Developmental Disabilities		Cognitive Disabilities	
	Coefficient	% of Difference	Coefficient	% of Difference	Coefficient	% of Difference	Coefficient	% of Difference
Overall Effect								
Autism Spectrum Disorder	0.44***		0.44***		2.48***		2.48***	
	(0.01)		(0.01)		(0.04)		(0.04)	
Comparison group	0.63***		0.57***		2.96***		2.96***	
	(0.00)		(0.00)		(0.01)		(0.00)	
Difference	-0.19***		-0.13***		-0.48***		-0.49***	
	(0.01)		(0.01)		(0.04)		(0.04)	
Endowment Effect (E)	-0.02**	10.5	0.06***	46.1	0.03*	6.2	-0.14***	28.6
	(0.01)		(0.00)		(0.02)		(0.01)	
Coefficient Effect (C)	-0.42***		-0.37***		-3.04***		-2.61***	
	(0.01)		(0.03)		(0.11)		(0.15)	
Interaction Effect (I)	0.25***		0.18***		2.53***		2.27***	
	(0.02)		(0.03)		(0.12)		(0.15)	
Endowment Effect								
Male	0.04***		0.04***		-0.04***		0.09***	
	(0.00)		(0.00)		(0.00)		(0.00)	
Age	-0.94***		-0.58***		-0.20***		-0.37***	
	(0.04)		(0.01)		(0.04)		(0.02)	
Married/Common law	0.00		-0.02***		-0.14***		-0.05***	
	(0.00)		(0.00)		(0.01)		(0.00)	
High school	0.00**		-0.00**		0.00*		-0.13***	
	(0.00)		(0.00)		(0.00)		(0.01)	
Severity	0.00***		0.00		0.25***		0.12***	
	(0.00)		(0.00)		(0.01)		(0.00)	
Occupation					-0.09***		0.02***	
					(0.01)		(0.00)	
Coefficient Effect								
Male	-0.00		-0.01*		-0.94***		-1.03***	
	(0.01)		(0.01)		(0.05)		(0.06)	
Age	0.89**		1.00***		-8.49***		-9.49***	
	(0.32)		(0.22)		(1.54)		(1.65)	
Married/Common law	0.00		0.00***		2.02***		3.04***	
	(0.00)		(0.00)		(0.05)		(0.09)	
High school	0.02		0.02		-1.12***		-0.47***	
	(0.02)		(0.01)		(0.07)		(0.03)	
Severity	-0.16***		-0.13***		-0.12***		0.25***	
	(0.03)		(0.02)		(0.03)		(0.03)	
Occupation					0.14*		0.27***	
					(0.06)		(0.05)	
Interaction Effect								
Male	0.00		0.00*		0.59***		0.74***	
	(0.00)		(0.00)		(0.04)		(0.05)	
Age	-0.27**		-0.27***		2.27***		3.04***	
	(0.10)		(0.07)		(0.42)		(0.53)	
Married/Common law	-0.00		0.00***		-1.26***		-2.76***	
	(0.00)		(0.00)		(0.05)		(0.08)	
High school	-0.00		-0.00		-0.10*		-0.58***	
	(0.00)		(0.00)		(0.04)		(0.05)	
Severity	0.01***		0.00		-0.17***		-0.06*	
	(0.00)		(0.00)		(0.04)		(0.03)	
Occupation					-0.05*		-0.09***	
					(0.02)		(0.01)	
Number of Obs.	440		2,030		300		1,330	

(b) Autism Spectrum Disorder, Developmental and Cognitive disabilities compared with Physical disabilities

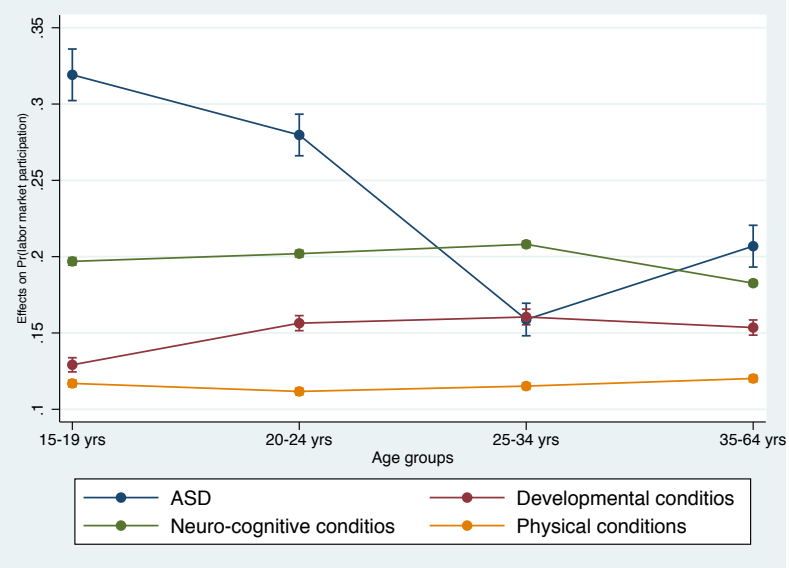
Outcome variable	**Labor Force Participation**						**Log(Weekly work hours)**					
Comparison group	Autism Spectrum Disorder		Developmental Disabilities		Cognitive Disabilities		Autism Spectrum Disorder		Developmental Disabilities		Cognitive Disabilities	
	Coefficient	% of Difference	Coefficient	% of Difference	Coefficient	% of Difference	Coefficient	% of Difference	Coefficient	% of Difference	Coefficient	% of Difference
Overall Effect												
Comparison group	0.44***		0.63***		0.57***		2.48***		2.96***		2.96***	
	(0.01)		(0.00)		(0.00)		(0.04)		(0.01)		(0.00)	
Physical disabilities	0.76***		0.76***		0.76***		3.30***		3.30***		3.30***	
	(0.00)		(0.00)		(0.00)		(0.00)		(0.00)		(0.00)	
Difference	-0.31***		-0.13***		-0.18***		-0.82***		-0.34***		-0.33***	
	(0.01)		(0.00)		(0.00)		(0.04)		(0.01)		(0.00)	
Endowment Effect (E)	-0.18***	58.1	-0.09***	69.2	-0.07***	38.9	-0.27***	32.9	-0.22***	64.7	-0.13***	39.4
	(0.00)		(0.00)		(0.00)		(0.01)		(0.00)		(0.00)	
Coefficient Effect (C)	-0.58***		-0.14***		-0.14***		-2.99***		0.07***		-0.12***	
	(0.03)		(0.00)		(0.00)		(0.20)		(0.01)		(0.00)	
Interaction Effect (I)	0.45***		0.11***		0.03***		2.44***		-0.20***		-0.08***	
	(0.03)		(0.00)		(0.00)		(0.20)		(0.01)		(0.00)	
Number of Obs.	6,070		6,440		8,030		4,750		4,990		6,030	

Note: Panel (a) of this table presents the estimated Blinder-Oxaca decompositions of the differences in Labor Force Participation and Log(Weekly hours of work) of individuals with Autism Spectrum Disorder compared with individuals with Developmental and Cognitive disabilities. Panel (b) presents the estimated decomposition of the differences Labor Force Participation and Log(Weekly hours of work) of individuals with Autism Spectrum Disorder, Developmental and Cognitive disabilities compared with individuals with Physical disabilities. The study sample includes 16-64 years in the 2006 Participation Activity and Limitation Survey (PALS 2006) with Autism Spectrum Disorder, Developmental, Cognitive and Physical disabilities. Survey weights generating estimated frequencies in the target population are used in all the estimates.
$*p < 0.10, **p < 0.05, ***p < 0.01$

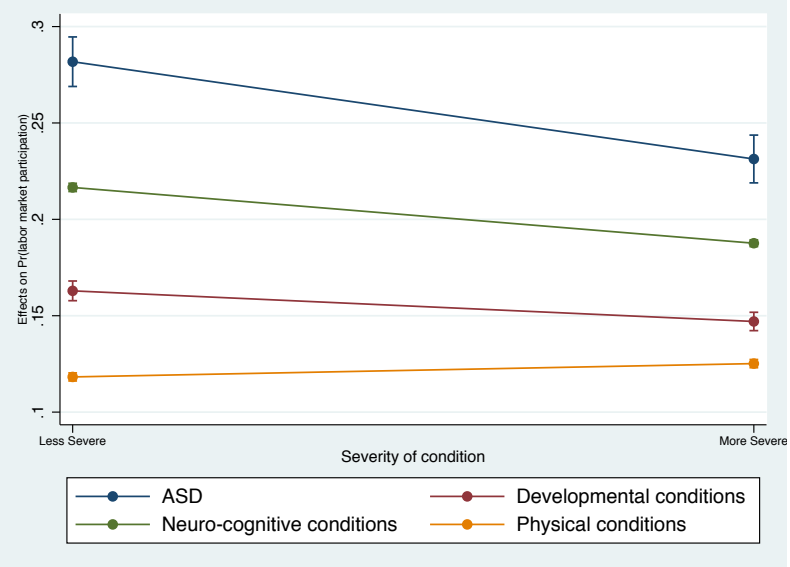
Figures

Figure 1: Fitted Average Marginal Effects (AME) of completing high school on the probability of Labor Force Participation (LFP) across disbility groups (CSD 2012)

(a) Within age groups



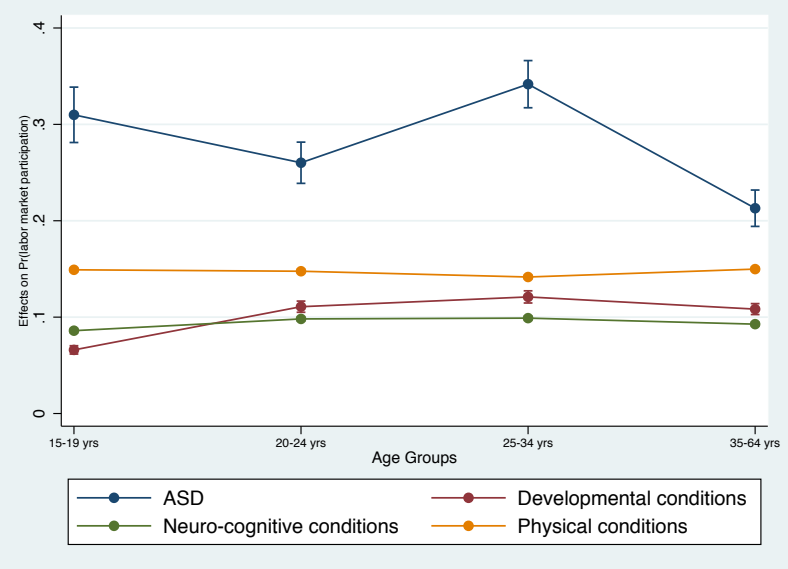
(b) Within severity of disability



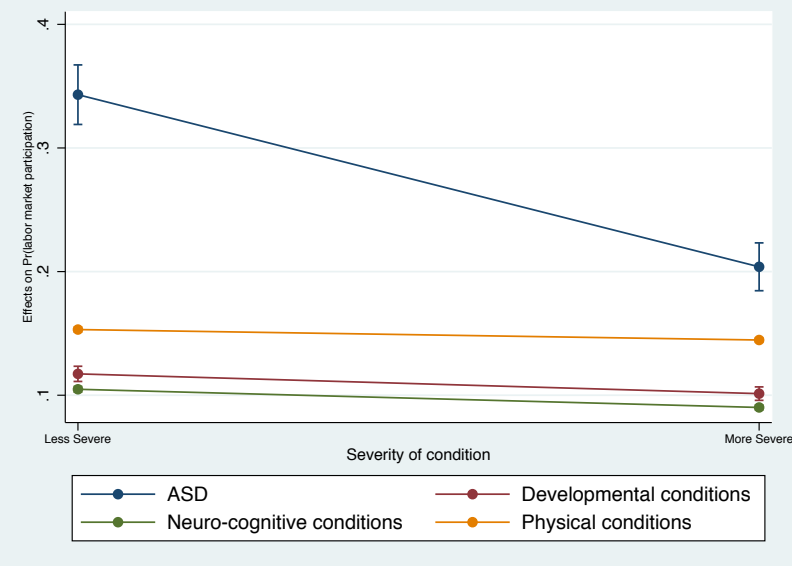
Note: This figure plots the fitted Average Marginal Effects (AME) of completing high school on the probability of Labor Force Participation (LFP) across the disability types estimated from the Probit model specified in (1). The study sample includes 15-64 years old individuals from the 2012 Canadian Survey on Disability (CSD 2012) who have reported having ASD, developmental, cognitive and physical disabilities. Survey weights generating estimated frequencies in the target population are used in all the estimates. Panel (a) plots the fitted AME within the age groups and Panel (b) plots them within the severity of disabilities.

Figure 2: Fitted Average Marginal Effects (AME) of completing high school on the probability of Labor Force Participation (LFP) across disbility groups (PALS 2006)

(a) Within age groups



(b) Within severity of disability



Note: This figure plots the fitted Average Marginal Effects (AME) of completing high school on the probability of Labor Force Participation (LFP) across the disability types estimated from the Probit model specified in (1). Study sample includes 15-64 years old individuals from the 2006 Participation Activity and Limitation Survey (PALS 2006) who have reported having ASD, developmental, cognitive and physical disabilities. Survey weights generating estimated frequencies in the target population are used in all the estimates. Panel (a) plots the fitted AME within the age groups and Panel (b) plots them within the severity of disabilities.

Appendix

A Institutional background on disability benefit programs in Canada

Federal and provincial disability benefit programs in Canada are designed to provide a partial earning replacement to individuals who a medically determinable physical or non-physical disability limits kind or amount of paid work they can do. Federal government's benefits include Employment Insurance (EI), Sickness benefits (one must have accumulated at least 600 hours of insurable employment in the qualifying period to receive up to 15 weeks of benefits), Canada Pension Plan (CPP) and Quebec Pension Plan (QPP) disability benefits (to be eligible, one must have enough contributions to the CPP/QPP), Child Disability benefit (CDB) (a tax-free benefit for families who care for a child under 18 with a severe and prolonged disability), Special Benefits for Parents of Critically Ill Children (PCIC) (for eligible parents who take leave from work to provide care or support to their critically ill or injured child for up to 35 weeks) and Employment Insurance Compassionate Care Benefits (for those take time off work to provide care or support to a family member who is gravely ill and is at risk of dying within six months).[13] Access to federal disability benefits program is based on employment history or benefits are available only for a short period. Individuals with lifelong and severe disabilities, therefore, would not be eligible to receive these benefits or even if they are eligible, since these programs are short-term, they would need more assistance. Canadian provinces including Alberta, Ontario, British Columbia and Saskatchewan provide social assistance to disabled individuals who are not eligible for the federal disability benefits program.[14] Provincial programs are operated under different ministries in each province, but they all provide income support and supplementary benefits to their beneficiary. The amount of the benefits and size of the programs differ however substantially within the provinces, Alberta's program is the most generous one, and Ontario's is the largest one.

[13] More information on federal government's disability benefit programs: `http://www.fcac-acfc.gc.ca/Eng/forConsumers/lifeevents/livingDisability/Pages/Federalp-Prestati.aspx`, Accessed on Feb 29, 2016.

[14] More information on provincial disability benefit programs: `http://www.fcac-acfc.gc.ca/Eng/forConsumers/lifeEvents/livingDisability/Pages/Resource-Ressourc.aspx`, Accessed on Feb 29, 2016.

B Sample design and variable definitions

Sample Design in the 2006 PALS and the 2012 CSD

A two-phase stratified design is used for identifying and selecting individuals with disabilities in the PALS and CSD. The first phase in the PALS consists of the systematic distribution of the census long form to approximately every fifth household, which contains two disability filter questions: 1) *Do you have any difficulty hearing, seeing, communicating, walking, climbing stairs, bending, learning, or doing any similar activities?* and 2) *Does a physical disability or mental disability or health problem reduce the amount or the kind of activity you can do at home, at work or school or in other activities?* Second phase strata is based on the characteristics defining the strata: province/territory, age group, severity of disability according to the census (defined by response categories "often" and "sometimes") and probability of selection in the first phase. Then, individuals are selected from those who responded "yes" to at least one of the two disability filter questions, based on the strata. The CSD uses a similar sampling process. A two-phase design is used for identifying and selecting individuals from the National Household Survey (NHS) in the CSD. The filtering questions are the same; however the definition of disabilities are slightly different.

As the PALS and CSD are surveys based on a probability sampling plan, each person selected for the survey represents themselves as well as a certain number of other persons in the target population who are not part of the sample. Therefore, the weight variable in these datasets gives the number of persons represented by each record. The weights of the individuals have been calculated based on the probability of selection and have been adjusted so that these samples are representative of the population of interest. Because of those adjustments and because certain individuals had unequal probabilities of selection, the weights might vary significantly from one person to another. The weight must, therefore, be used for all estimates and analyses that are based on these datasets; otherwise, the results will be biased.

Table B.1: Variable definition for dependent and independent variables

	Definition
Outcome variable	
Labour Force Participation	= 1 if participating in the labour market, =0 otherwise
log(Weekly hours of work)	
Age	
Age 15-19 years	= 1 if aged 15-19 years, = 0 otherwise
Age 20-24 years	= 1 if aged 20-24 years, = 0 otherwise
Age 25-34 years	= 1 if aged 25-34 years, = 0 otherwise
Age 35-64 years	= 1 if aged 35-64 years, = 0 otherwise
Sex	
Male	= 1 if is a male
Female	= 1 if is a female
Marital status	
Single or divorced	= 1 if is single or divorced
Married or common law	= 1 if is married or in a common law relationship
Severity of condition	
Less severe	= 1 if condition is less severe, = 0 otherwise
More severe	= 1 if condition is more severe, = 0 otherwise
Educational	
Less than High School	= 1 if highest level of education is less than high school, = 0 otherwise
High School	= 1 if respondent is graduated from high school, = 0 otherwise
Province of residence	
Newfoundland and Labrador	= 1 if resides in Newfoundland and Labrador, = 0 otherwise
Prince Edward Island	= 1 if resides in Prince Edward Island, = 0 otherwise
Nova Scotia	= 1 if resides in Nova Scotia, = 0 otherwise
New Brunswick	= 1 if resides in New Brunswick, = 0 otherwise
Quebec	= 1 if resides in Quebec, = 0 otherwise
Ontario	= 1 if resides in Ontario, = 0 otherwise
Manitoba	= 1 if resides in Manitoba, = 0 otherwise
Saskatchewan	= 1 if resides in Saskatchewan, = 0 otherwise
Alberta	= 1 if resides in Alberta, = 0 otherwise
British Columbia	= 1 if resides in British Columbia, = 0 otherwise