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DISABILITY, DISCRIMINATION, AND THE EFFECTIVENESS OF WAGE SUBSIDIES: A JOB-SEARCH APPROACH

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Disability, discrimination, and the effectiveness of wage subsidies: A job-search approach

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Abstract/Résumé

In this paper we develop and estimate a job search model with matching and bargaining in the presence of employer taste-based discrimination. The model is estimated using a longitudinal panel data from Canada's Survey of Labour and Income Dynamics (SLID). Estimates suggest that employer discrimination and individual labour costs explain the majority of labour market disparities between persons living with and without disabilities. We use our model to estimate several counterfactuals. We find that implementing a hiring wage subsidy policy could increase the employment rate of persons with disabilities by 7 percentage points. Eliminating discrimination, on the other hand, would have an even greater impact, raising the employment rate by 14 percentage points for men, and 19 percentage points for women. Combining both measures — removing discrimination and introducing a hiring wage subsidy — would lead to an employment rate increase of 20 percentage points for men, and 24 percentage points for women. This combined approach would significantly reduce the existing employment rate gap between persons with and without disabilities. In particular, the employment rate gap is predicted to fall to 33 percentage points for men (relative to 53 percentage points in the data) and to 13 percentage points for women (relative to 39 percentage points in the data).

Dans cet article, nous développons et estimons un modèle de recherche d'emploi avec appariement et négociation en présence d'une discrimination fondée sur les préférences de l'employeur. Le modèle est estimé à l'aide d'un panel de données longitudinales provenant de l'Enquête sur la dynamique du travail et du revenu (EDTR) du Canada. Les estimations suggèrent que la discrimination de l'employeur et les coûts individuels du travail expliquent la majorité des disparités sur le marché du travail entre les personnes handicapées et non handicapées. Nous utilisons notre modèle pour estimer plusieurs scénarios contrefactuels. Nous constatons que la mise en œuvre d'une politique de subvention salariale à l'embauche pourrait augmenter le taux d'emploi des personnes handicapées de 7 points de pourcentage. L'élimination de la discrimination, quant à elle, aurait un impact encore plus important, augmentant le taux d'emploi de 14 points de pourcentage pour les hommes et de 19 points de pourcentage pour les femmes. La combinaison des deux mesures - élimination de la discrimination et introduction d'une subvention salariale à l'embauche -

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entraînerait une augmentation du taux d'emploi de 20 points de pourcentage pour les hommes et de 24 points de pourcentage pour les femmes. Cette approche combinée réduirait de manière significative l'écart de taux d'emploi existant entre les personnes handicapées et non handicapées. En particulier, l'écart de taux d'emploi devrait tomber à 33 points de pourcentage pour les hommes (par rapport à 53 points de pourcentage dans les données) et à 13 points de pourcentage pour les femmes (par rapport à 39 points de pourcentage dans les données).

Keywords/Mots-clés: Disability, discrimination, Job search models, Wage subsidies / Handicap, discrimination, Modèles de recherche d'emploi, Subventions salariales

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1 Introduction

A majority of countries face important challenges to integrate persons with disabilities in the labour market and Canada is no exception (Statistics Canada, 2023[1]). Persons with disabilities generally have lower earnings and employment rates relative to persons without disabilities (e.g.DeLeire (2001)). Such gaps can be explained by numerous factors, notably the co-existence of differences in underlying worker productivity and labour market discrimination (Malo and Pagán (2012); DeLeire (2001); Baldwin and Johnson (1994)).

Labour market discrimination against persons with disabilities is particularly prevalent. According to the Canadian Human Rights Commission, disability issues are the primary cause of discrimination complaints and in its most recent report, Commission (2022) notes that 47% of all disability related complaints were considered acceptable for review (relative to 31% and 19% of race and gender related complaints, respectively). What is more, 61% of all complaints received were employment related. Correspondence studies provide additional direct empirical support for the presence of sizable discrimination in Canada (see e.g. Bellemare et al. (2023)).

Wage subsidies represent a prominent public policy instrument used to encourage employment of persons with disabilities. Wage subsidies aim to sufficiently offset lower productivity levels of persons with disabilities in order for firms to consider such hires. Evidence that wage subsidies successfully increase employment of persons with disabilities is mixed – while several studies suggest subsidies have limited impacts on employment outcomes (see Mangan (1990), Jiménez-Martín et al. (2019), Baert (2016)), others find that subsidies can raise employment rates even after expiration of the subsidies (Angelov and Eliason (2018), Jaenichen and Stephan (2011)). Despite the robust co-existence of productivity differentials and labour market discrimination facing persons with disabilities, the literature has yet to analyze whether labour market discrimination can crowd-out part of the potentially beneficial effects of wage subsidies. Crowding-out could occur because subsidies, even when calibrated to accurately compensate for true productivity differentials, may nonetheless be insufficient to incentivize discriminating firms to hire persons with disabilities.

Canada has a geographically heterogeneous approach to the provision of wage subsidies for persons with disabilities, with only one province (Québec) with a limited government sponsored initiative (the *Contrat d'intégration au travail*, hereafter the CIT) explicitly targeting job seekers with disabilities.[2] An important policy question is whether a significant rollout of wage subsidies can have a predicted beneficial effect on employment outcomes in the presence of sizeable discrimination in the labour market. A related question is whether reducing discrimination would affect the predicted effectiveness of wage subsidies.

[1]https://www150.statcan.gc.ca/n1/pub/71-222-x/71-222-x2024002-eng.htm

[2]It is estimated that close to one million persons from the province of Québec have a disability, 40% of which with a severe or very severe disability (Cloutier-Villeneuve (2024)). Moreover, only around 4500 CIT contracts were active as of 2023.[3] It follows that the share of CIT contracts amongst the population with severe disabilities is extremely small, implying that wage subsidies targeting this population are in practice almost absent from the labour market.

Addressing these questions requires a model-based approach in order to identify counterfactual outcomes from data in a given labour market with persistent discrimination. In this paper, we specify and estimate a job search model with matching and bargaining related to Flabbi (2010b). We assume that the market comprise two types of employers: prejudiced employers who suffer disutility when employing persons with disabilities and unprejudiced employers who do not treat persons with and without disabilities differently. The model allows for two types of job separation behaviour: exit into non-participation, and exit into unemployment.[4] Taking into account non-participation is particularly important in our data – non-participation rates of men and women are respectively 5.38% and 19.86% for non-disabled persons, and 55.79% and 58.74% for disabled persons. As shown in Flabbi (2010a), the model separately identifies discrimination from unobserved productivity differentials. In particular, discrimination due to the presence of prejudiced employers results in a truncated distribution of accepted wages (relative to a counterfactual labour market without discrimination), reflecting the fact that prejudiced employers will only employ the most productive persons with disabilities. This separation allows us to simulate the effects of counterfactual policies including those of wage subsidies of various levels with and without labour market discrimination. We estimate the model using longitudinal data from the Canadian Survey of labour and Income Dynamics (SLID). The data contain information on disability status, wages, durations in each labour market state (employment, unemployment and non-participation), transitions between the states themselves, as well as socio-economic characteristics of respondents. However, the data does not contain information about possible wage subsidies. Given the extremely low prevalence of wage subsidies documented above relative to the size of the population of persons with disabilities, we estimate the model assuming that wage subsidies are not present in the labour market. We then use the estimated model parameters to simulate the effects of a large scale roll out of wage subsidies on employment outcomes of persons with disabilities.

The estimation results show that, in addition to individual disutility for work, discrimination is the most relevant factor explaining differences in labour market outcomes between persons with and without disabilities. In particular, model estimates suggest that the share of prejudiced employers is 57.5% when hiring men, and 68.2% when hiring women. We use our model estimates to simulate the impact of a counterfactual wage subsidy rollout in the current labour market (with discrimination) as well as in a labour market without prejudiced employers (without discrimination). Simulations are performed using to different levels of wage subsidies – corresponding to 20% and 85% of the existing minimum wage.[5] We find that implementing a high-level hiring wage subsidy policy (85% of the minimum wage) could increase the employment rate of persons with disabilities by 7 percentage points. Eliminating discrimination, on the other hand, would have an even greater impact, raising the employment rate by 14

[4]Search models have been estimated in a variety of settings to study labour market outcomes (see Eckstein and Van den Berg (2007) for a survey). However, only a few search models have jointly modelled labour market outcomes and discrimination, notably gender and race-based discrimination (see Bustelo et al. (2019), Flabbi (2010a), Bowlus and Eckstein (2002) and Borowczyk-Martins et al. (2017)). Importantly, these models have not been applied to the analysis of disability-based discrimination as we do here.

[5]The subsidy level of 85% was chosen for the simulation because its corresponded to the maximum subsidy level covered by the CIT initiative over the sample period. This maximum has since been reduced to 80%.

percentage points for men and 19 percentage points for women. Combining both measures — removing discrimination and introducing a high-level hiring wage subsidy — would lead to an employment rate increase of 20 percentage points for men and 24 percentage points for women. This combined approach would significantly reduce the existing employment rate gap between persons with and without disabilities. In particular, the employment rate gap is predicted to fall to 33 percentage points for men (relative to 53 percentage points in the data) and to 13 percentage points for women (relative to 39 percentage points in the data).

The rest of the paper is structured as follows. Section 2 presents the job search model we estimate. Section 3 presents the data used in the paper. Section 4 discusses the econometric approach used and the identification strategy. Section 5 presents our main estimation results while Section 6 presents our counterfactual policy simulations varying the level of discrimination in the labour market. Section 7 concludes.

2 The Model

2.1 Environment

The model is in continuous time within a stationary environment, populated by two groups of agents living forever: the workers and the employers. There is a fraction M of workers who suffer permanently from a disability. We denote $i \in \{A, D\}$ the disability status of a given individual, where $i = D$ denotes an individual with a disability and $i = A$ denotes an individual without a disability. Individuals can be employed (E), unemployed (U), or non-participating (NP) in the labour market. The utility of an individual is derived from leisure, home production, and earnings. There is stochastic variation in the value of non-market time in addition to stochastic variation in the wage offers received by agents.

Individuals who do not participate in the labour market receive social welfare benefits b_i^{NP}, and additionally obtain value of leisure and home production, denoted z, which is distributed according to $Q_i(z)$. At each period, z may be subject to shock (illness, children, inheritance, etc.) with probability η_i. A negative shock on z can incite a non-participant to enter the labour force as unemployed.[6] For participants (either unemployed or employed), a positive shock on z can make them retire from the labour force. In the unemployment state, individuals receive unemployment benefits b_i^U and meet a potential employer at a rate generated by a Poisson process with a constant exogenous parameter λ_i^U. When they meet, the employer and the worker observe a match-specific productivity value x distributed according to $G_i(x)$ and engage in Nash bargaining over a wage before deciding whether or not to discontinue or not the match. If the match is accepted, the job can later be terminated following a Poisson process at an instantaneous rate δ_i. If the match is discontinued, the individual returns to the unemployed state and continues searching for a new match.

Importantly, a fraction π of employers are assumed to hold a prejudice against individuals with

[6]We assume that there is not direct transition from non-participation to employment.

disabilities and incur a disutility cost d when hiring an individual with a disability. We denote $j \in \{N, P\}$ the type of the employer, where $j = N$ denotes unprejudiced employers and $j = P$ denotes prejudiced employers. Finally, the interest rate is denoted as r.

2.2 Value functions

The value $V_i^{NP}(z)$ of a non-participating (NP) individual of type i receiving social welfare benefits given home production z is defined by the following Bellman equation:[7]

$$rV_i^{NP}(z) = z + b_i^{NP} + \eta_i \mathbb{P}(z' \leqslant z_i^{*NP})(V_i^U - V_i^{NP}(z)) \tag{1}$$

The value of non-participation depends on the value of home production z, social welfare benefits b_i^{NP}, the probability of a negative shock η_i, and the expected utility difference associated with entering the labour market to search for a job. For the latter, we denote by z_i^{*NP} the threshold for non-participation. It follows that an individual does not participate in the labour market if the value of leisure is superior to z_i^{*NP}.

The present value rV_i^U of unemployment (U) for a worker of type i is given by

$$\begin{aligned} rV_i^U &= b_i^U + \eta_i \int_{z_i^{*NP}} (V_i^{NP}(z) - V_i^U) dQ_i(z) \\ &+ \lambda_i^U \left[\pi \int_{x_{iP}^*} (V_i^E(w_{i,P}(x)) - V_i^U) dG_i(x) + (1-\pi) \int_{x_{iN}^*} (V_i^E(w_{i,N}(x)) - V_i^U) dG_i(x) \right] \end{aligned} \tag{2}$$

Inspection of (2) reveals that this value is a function of the unemployment benefits plus the next period expected surplus given two possible transitions – leaving the labour market and becoming a non-participant and alternatively matching with an employer (either prejudiced or not). We define $x_{i,N}^*$ and $x_{i,P}^*$ as the productivity thresholds for an individual of type i when meeting an unprejudiced or prejudiced employer, respectively.

The value of employment for a worker of type i working for a given employer and receiving wage w is defined through

$$(r + \delta_i + \eta_i \mathbb{P}(z' \geqslant z_i^{*NP}))V_i^E(w) = w + \delta_i V_i^U + \eta_i \int_{z_i^{*NP}} (V_i^{NP}(z)) dQ_i(z) \tag{3}$$

This value is the sum of the current instantaneous wage and the expected values of transitioning towards one of the other two possible states either due to job loss or removal from the workforce.

[7]The detailed derivation of the value functions is presented in the online appendix A.1.

2.3 Wage determination and equilibrium

The match surplus is divided between employer j and the worker i through a Nash bargaining process. Nash-Bargaining is a standard assumption in job search models which implies that the bargained wage maximizes a geometric average of the surplus of the employer and the worker, each weighted by a measure of their relative bargaining power. We denote α the bargaining power of the worker. Then the wage solves the following problem

$$w_{ij}(x) = \arg\max_{w} \left[(V_i^E(w) - V_i^U)^{\alpha} (x - w - d\mathbb{1}_{\{i=D,j=P\}})^{1-\alpha} \right] \tag{4}$$

where the first term $(V_i^E(w) - V_i^U)$ corresponds to the worker's surplus while the second term $x - w - d\mathbb{1}_{\{i=D,j=P\}}$ is the employer's surplus. Taste-based discrimination enters through $\mathbb{1}_{\{i=D,j=P\}}$, a dummy variable equal to one when the worker is disabled $(i = D)$ and the employer is prejudiced $(j = P)$, and equal to zero otherwise. It follows that the surplus of prejudiced employers is decreased by an amount d when hiring a worker with a disability.

Solving (4) yields the following expression for w

$$w_{ij}(x) = (1-\alpha)\left(rV_i^U - \eta_i \int_{z_i^{NP*}} (V_i^{NP}(z) - V_i^U dQ_i(z)) \right) + \alpha(x - d\mathbb{1}_{\{i=D,j=P\}}) \tag{5}$$

We will now detail the optimal decision rule that is characterized by the reservation values. The non-participation threshold z_i^{NP*} is defined as the value of leisure making agents indifferent between non-participation and unemployment so that $V_i^{NP}(z_i^{NP*}) = V_i^U$. The reservation value is then obtained through Eq.(1):

$$z_i^{NP*} + b_i^{NP} = rV_i^U \qquad \text{with } i = A, D \tag{6}$$

The productivity reservation threshold x_{ij}^* satisfies $V_i^E(w_{i,j}(x_{i,j}^*) = V_i^U$. It is defined as the productivity value that makes agents indifferent in terms of accepting or rejecting the match. In other words, a worker will accept a job with a productivity higher than $x_{i,j}^*$ when unemployed. Imposing this condition on Eqs. (3) and (5) leads to:

$$x_{ij}^* \quad = \quad rV_i^U - \eta_i \int_{z_i^{*NP}} (V_i^{NP}(z) - V_i^U) dQ_i(z) + d\mathbb{1}_{\{i=D,j=P\}} \text{ with } i = A, D, j = N, P \tag{7}$$

and we derive the expression of the minimum accepted wage

$$w_i^* \quad = \quad rV_i^U - \eta_i \int_{z_i^{*NP}} (V_i^{NP}(z) - V_i^U) dQ_i(z) \tag{8}$$

$$\quad = \quad x_{ij}^* - d\mathbb{1}_{\{i=D,j=P\}} \text{ with } i = A, D \tag{9}$$

Equations (7) and (8) show that the reservation wage w_i^* is equal to the reservation match value x_{iN}^*

when the employer is not prejudiced and is equal to the reservation match value x^*_{iP} minus the disutility toward hiring disabled individuals d in the case of prejudiced employers. The reservation productivity value thus depends on the type of the employer – it is higher when a worker with disabilities meets a prejudiced employer.

Given a vector of parameters $\Omega = (\lambda_i, \delta_i, r, b_i^{NP}, b_i^U, \eta_i, \alpha, d, \pi)_{i=A,D}$ and the distribution functions $G_i(x)$ and $Q_i(z)$, an equilibrium of the model is defined with two vectors of three elements $(V_i^U, u_i, l_i)_{i=A,D}$ where u_i is the share of the population in unemployment and l_i is the share of the population in the labour force (employed and unemployed).[8]

2.4 Policy experiments

The estimated model can be used to simulate the effects of implementing wage subsidies of various levels in order to hiring workers with disabilities. We suppose that the employers receive a subsidy ζ when they hire an individual with disabilities. The subsidy is financed by a lump-sum tax $t(\Omega, \zeta)$ paid by all workers. This policy affects both profits and wages. The employer's adjusted surplus (profit) π_{ij} is given by

$$\pi_{ij} = x_{ij} - w_{ij} - d\mathbb{1}_{\{i=D,j=P\}} + \zeta\mathbb{1}_{\{i=D\}}. \tag{10}$$

The worker's wage net of the tax is given by

$$w_{ij}(x, V_i^U, V_i^{NP}) - t(\Omega, \zeta) \tag{11}$$

The wage remains determined by Nash Bargaining upon observing types and productivity :

$$\begin{aligned} w_{ij}(x, V_i^U, V_i^{NP}, t(\Omega, \zeta)) = {} & \alpha \left(x_{ij} - d\mathbb{1}_{\{i=D,j=P\}} + \zeta\mathbb{1}_{\{i=D\}} \right) \\ & + (1-\alpha) \left(rV_i^U - \eta_i \int_{z_i^{*NP}} (V_i^{NP}(z) - V_i^U) dQ_i(z) + t(\Omega, \zeta) \right) \end{aligned} \tag{12}$$

Inspection of equation (12) reveals that the impact of a wage subsidy is unambiguously positive on the observed wage of workers with disabilities for a given level of productivity.

The productivity reservation threshold becomes:

$$x^*_{ij} = rV_i^U - \eta_i \int_{z_i^{*NP}} (V_i^{NP}(z) - V_i^U) dQ_i(z) + d\mathbb{1}_{\{i=D,j=P\}} + t(\Omega, \zeta) - \zeta\mathbb{1}_{\{i=D\}} \tag{13}$$

The impact of a wage subsidy on the productivity level is ambiguous. This follows because values of the unemployment, non-participation and the lump-sum tax are all endogenous. The reservation wage is then given by

$$w_i^* = rV_i^U - \eta_i \int_{z_i^{*NP}} (V_i^{NP}(z) - V_i^U) dQ_i(z) + t(\Omega, \zeta) \tag{14}$$

[8]The derivation of these equilibrium conditions is detailed in the online appendix A.

The tax value is calculated by setting the total lump-sum tax equal to the total wage subsidy, considering the entire labour market for both men and women. The lump-sum tax is uniformly paid by all individuals, with both disabled and non-disabled workers included. We assume that there is an equal number of men and women in the population. The tax value $t(\Omega, \zeta)$ is given by:

$$t(\Omega, \zeta) = \zeta \frac{p_m e_{mD} + p_f e_{fD}}{e_m + e_f} \tag{15}$$

where e_{mD} and e_{fD} are the respective employment rates of men and women with disabilities, p_m and p_f are the respective probabilities to have a disability among men and women and e_m and e_f are the respective employment rates among men and women. These employment rates are calculated as follows

$$e_m = e_{mD} p_m + e_{mA}(1 - p_m)$$

and

$$e_f = e_{fD} p_f + e_{fA}(1 - p_f)$$

where e_{mA} and e_{fA} are the respective employment rates of men and women without disabilities.

3 Data

The model is estimated using the Canadian's Survey of Labour and Income Dynamics (SLID). Started in 1993, this longitudinal survey contains data from six overlapping sub-panels : 1993-1998 for panel 1, 1995-2001 for panel 2, 1999-2004 for panel 3; 2002-2007 for panel 4; 2005-2010 for panel 5 and 2008-2011 for panel 6. Respondents are interviewed from one year to the next for a period of six years except for the last panel, which lasted four years. The sample covers all individuals in Canada excluding residents of Yukon, the Northwest Territories and Nunavut, residents of penal institutions, and persons living on Indian reservations or in military bases. Starting in 1999, SLID used a new set of filter questions to identify persons with disabilities. Consequently, our analysis will be restricted to data from the last four panels, thus covering the period from 1999 to 2011.

3.1 The Sample

Disability status is measured using a dummy variable indicating *whether or not the respondent has a physical or mental condition or health problem that reduces the amount or type of activity they can do at work or school*. As we do not address the issue of change in disability status over time, we restrict our sample to individuals with the same disability status across all years. We focus on respondents aged 25-55 who are not self-employed. For each respondent, labour market status (non-participant, unemployed or employed) is identified at their first interview, and we follow their employment trajectory over the successive years in the panel. The hourly wage is observed at the end of the reference year. We trim the latter at the 5^{th}

and 95th percentiles of wages.

For all years, we observe the monthly labour market status of each respondent. The SLID data also contain some retrospective information. In the first interview, individuals are asked the length of their current job spell (in months) if they are employed or the number of months since their last job if they are not employed (unemployed or non-participants). We use this information to construct the elapsed and residual durations for each labour market status. We restrict our analysis to the first two spells. In particular, we will model the duration of the first spell and the transition to the second state, without modelling the duration of the second state, due to key data constraints. The six-year observation window limits the completeness of longer-term data, and the second state is highly censored, providing little additional information. By concentrating on the most robust and informative portions of the data, we ensure the reliability and efficiency of the analysis while minimizing bias from incomplete observations.

3.2 Descriptive statistics

Table 1 presents some descriptive statistics of our sample, which is composed of 12,841 male respondents and 15,322 female respondents. Disability prevalence in the sample is relatively similar across gender, with 8.76% of men and 10.00% of women reporting a disability. The shares of unemployed respondents is very similar across disability status and gender, varying between 3.30% and 3.78%. Non-participation and employment rates on the other hand vary across disability status and also gender. In particular, the share of non-participating men is 5.38% amongst those without a disability, but rises to 55.79% for men with a disability. The employment rate of men without a disability is 90.86%, more than twice the employment rate of men with a disability (40.43%). Similarly, the non-participation rates of women with and without disabilities are 58.74% and 19.86% respectively, while employment rates of women with and without a disability are 37.96% and 76.65% respectively. There are also important differences in wages across disability status. Hourly wages of men and women with disabilities are, respectively, 20.46% and 16.74% lower than wages of men and women without disabilities.

Table 2 presents average state-specific spell durations (in months) by disability status and gender. We find that unemployment and non-participation spell durations are shorter for persons without disabilities relative to those with disabilities. In particular, average non-participation spell duration is 92.45 months for men with disabilities relative to 17.71 months for men without disabilities. Similarly, average non-participation spell duration is 85.95 months for women with disabilities relative to 57.05 months for women without disabilities.

Some spells are censored in the data. Amongst persons without disabilities, 76.3% and 71.9% of the employment spells are right censored and 23.0% and 46.7% of the non-participation spells are right censored for men and women respectively. Among men and women with disabilities, 54.6% and 53.0% of the employment spells are right-censored with a higher right-censored percentage for the non-participation spells (82.9% and 79.4% respectively). No unemployment spells are right-censored for persons with and without disabilities.[9]

Table 3 presents transition rates between the different labour market states for male respondents. Persons with disabilities experience higher transition rates from unemployment to non-participation than persons without disabilities. Transition rates from employment to unemployment or non-participation are higher for persons with disabilities relative to those without disabilities.

4 Econometric estimation

We estimate the model using maximum likelihood. We derive the likelihood function following Van den Berg and Ridder (1998). We first consider the labour market status of the respondent at the date of the first interview. We denote $\delta_i + \eta_{i,2}$, the hazard rate out of employment toward unemployment or non-participation with

$$\eta_{i,2} = \eta_i(1 - Q_i(z_i^{NP*}))$$

We denote $h_i + \eta_{i,2}$, the hazard rate out of unemployment toward employment or non-participation with

$$h_i = \lambda_i[(1-\pi)(1 - G_i(x_{i,N}^*)) + \pi(1 - G_i(x_{i,P}^*))]$$

Then, the hazard rate out of non-participation toward unemployment is

$$\eta_{i,1} = \eta_i Q_i(z_i^{NP*})$$

Finally, we can define the density of the accepted wage for a worker of type i as[10]

$$f_e(w_i | w > w_i^*) = \left[\frac{\frac{1-\pi}{\alpha} g_i\left(\frac{w_i - (1-\alpha)x_{i,N}^*}{\alpha}\right)}{1 - G_i(x_{i,N}^*)} + \frac{\frac{\pi}{\alpha} g_i\left(\frac{w_i + \alpha d \mathbb{1}_{\{i=D, j=P\}} - (1-\alpha)x_{i,P}^*}{\alpha}\right)}{1 - G_i(x_{i,P}^*)} \right] \tag{16}$$

For each individual, calculate their contribution to the likelihood.[11].

The identification for d and π strongly depends on the observed wage distribution. As shown in Flabbi (2010b), the shape of the wage distribution of the minority group (persons with disabilities) is differently affected by skill differences and prejudice parameters. Specifically, when all employers are prejudiced, the mass near the reservation value is much lower compared to the wage distribution that results when both prejudice parameters are set to zero. This is because matches with prejudiced employers are not viable for very low levels of productivity. When π is a number between zero and one, the wage distribution of the minority group is a mixture of the wage distributions among prejudiced

[9] Recall that we only measure the duration of the first observed labour market status.
[10] see its derivation in the Online appendix B.2.
[11] A detailed derivation of the likelihood can be found in the appendix B.2

and non-prejudiced employers. In addition, π and d affect the shape of the minority's wage distribution differently. While π mainly affects the central tendency of the distribution, d flattens the distribution to the left of the mode. Figure 1 presents distributions of the observed wage for men and women with and without disabilities. We see a difference in the shape of the wage distribution.

The identification of the model under certain assumptions is demonstrated in Flinn and Heckman (1982). In particular, we need to assume a parametric distribution of wage offers with support on a subset of $\mathbb{R}_+$. Without this assumption, only the hazard rate can be identified with duration data. We will suppose that productivity is log-normally distributed with parameters (μ_i, σ_i) :

$$g_i(x) = \frac{1}{\sigma_i x}\phi\left(\frac{ln(x) - \mu_i}{\sigma_i}\right), \quad x > 0$$

with ϕ the standard Gaussian probability distribution function. As suggested by Flinn and Heckman (1982), we first estimate the reservation value by the minimum of the observed wage, so that

$$\hat{w_i}^* = \min_i\{w_i\}$$

The parameters (r, b_i) are not separately identified. We have two wage equations, $w^*_{i=A,D}$ with three unknown parameters (r, b^U_A, b^U_D). Then, we fix the value of r so that the discount rate is 5%. This allows to recover b^U_D an b^U_A using

$$b^U_i = w^*_i - \frac{\alpha\lambda^U_i}{r + \delta_i + \eta_{i,2}}\left[\pi\int_{x^*_{iP}}(x - d\mathbb{1}_{\{i=D,j=P\}} - w^*_i)dG_i(x) + (1-\pi)\int_{x^*_{iN}}(x - w^*_i)\,dG_i(x)\right] \tag{17}$$

We also need another assumption on the distribution of the value of leisure and home production for not participating individuals. Following Flabbi (2010b) we choose a negative exponential distribution for the non-participation distribution.

$$Q_i(z) = 1 - exp(-\gamma_i z)$$

where γ_i is the participation decision parameter. Finally, we set the bargaining power parameter α to the value of 0.5.[12]

5 Estimation Results

We estimated our model on men and women separately. Table 4 presents our results. Our estimates for the location and scale parameters (μ and σ) of the log-normal distribution of the productivity imply an average productivity that is higher among individuals with disabilities than among individuals with-

[12]The Nash bargaining power parameter is not identified without firm data side. We then set it at 0.5 for all workers like in Flabbi (2010a).

out.[13] Average productivity of men with disabilities is 38 dollars an hour, 10% more than productivity of men without disabilities (estimated at 34.6 dollars an hour). For women with disabilities, their average productivity is estimated at 34.1 dollars an hour, 24% more than women without disabilities (estimated at 27.4 dollars an hour). Our productivity parameters are estimated conditionally on participation in the labour market. Consequently, we estimate the average productivity of the most productive individuals, that is those who have already overcame important barriers to participation.

We find that 58% and 68% of employers are prejudiced towards men and women, respectively. This result is in line with several studies that highlight an important intersection between disability status and gender and show that women with disabilities suffer the most from discrimination in the labour market (Kavanagh et al., 2015; Brown and Moloney, 2019; Pettinicchio and Maroto, 2017). For prejudiced employers, the penalty d parameter is estimated to be equal to 18.7 dollars an hour for men and 19.2 dollars an hour for women. To quantify this discrimination effect, we compute the ratio of the absolute value of discrimination d over the average productivity $E(x_i|i)$ of persons without disabilities. We find a ratio of 70% for women and 54% for men.

We find that the arrival rate of job at each period (month) is 15.9% for men with disabilities, and 6.5% for men without disabilities (for women, these rates are respectively 11.5% and 11.6%). This may be explained by lower search efforts or a less efficient search for men with disabilities. In addition, workers with disabilities have a slightly higher job destruction rate than persons without disabilities.

The probability of a shock on leisure value is much lower for women than for men and is also much lower for individuals with disabilities which explains that women and individuals with disabilities stay longer in the non-participation state. Finally, the parameter estimates of preference for leisure and/or home production or distaste for work show that women have stronger value than men for home production and that men and women with disabilities also have much stronger preference for non-participation than individual without disabilities.

All in all, the main factors explaining the differences in labour market outcomes are differences in preferences for leisure, job offer arrival rates (for men only) and prejudices of employers.

6 Model fit and policy experiments

We use the estimated structural parameters of Table 4 to evaluate the fit of the model and to perform counterfactual policy experiments. Our results are presented in Table 5. We begin by assessing the model fit by comparing the equilibrium predicted by our model with what is observed in the data. The comparison of predicted outcomes (column 1) with sample statistics (column 2) in Table 5 shows that our model predicts very well the average observed wage among men and women without disabilities, but slightly overestimates the average wage of men and women with disabilities. It also slightly overestimates the share of unemployment among individuals with disabilities. Overall, the fit of the model

[13] The expectation of the productivity for a worker of type i is $E(x_i) = \exp(\mu_i + 0.5\sigma_i^2)$.

is very good for both men and women.

Starting with our benchmark equilibrium, we first predict outcomes in the counterfactual scenario where there is no discrimination ($d = 0$ and $\pi = 0$). Our results are presented in column 3 of Table 5. We find that the non-participation rate strongly decreases, resulting in an increase in both the unemployment share and the employment rate. The employment rate for men with disabilities is predicted to increase to 53.6%, up 14.2 percentage points from the benchmark rate of 39.4%. Similarly, the employment rate of women is predicted to increase by 18.5 percentage points in the absence of discrimination. These predictions highlight the central role of discrimination in explaining labour market outcomes of persons with disabilities. Given the latter value home production more strongly, their minimum accepted wages are predicted to increase strongly.

We next simulate the effects of a hiring subsidy roll-out to encourage employment of persons with disabilities. We do this by first setting the subsidy at 1.4 dollars per hour, which corresponds to 20% of the minimum wage (fixed to CAD $ 7). We also performed the simulation by setting the wage subsidy at 85% of the minimum wage. This will allow us to assess the effects of increasing wage subsidies on employment outcomes. Importantly, we simulate the effect of these hiring subsidies both in the current labour market (with discrimination) and in a counterfactual labour market without discrimination (setting $\pi = 0$, $d = 0$). Columns 4 to 7 of Table 5 present the results.

In the current labour market with discrimination, a small subsidy is predicted to decrease non-participation rates for men with disabilities from 55.8% to 54.1% (-3.0%), and increase their employment rate by 4.1% from 39.4% to 41.0%. For women, it is predicted to decrease non-participation rates for women with disabilities from 58.7% to 56.9% (-3.1%), and increase their employment rates by 4.5% from 38.2% to 39.9%. The unemployment share would also increase by 2.1% for men. We also find that individuals without disabilities are predicted to barely be affected by the policy as the amount of the lump-sum tax would be very low: 0.06 dollars an hour (less than 1% of the minimum wage).

The implementation of a large subsidy (85% of the minimum wage) would decrease non-participation rates for men with disabilities from 55.8% to 48.4% (-13.3%), and increase their employment rate by 17.8% from 39.4% to 46.4%. It would also decrease non-participation for women with disabilities from 58.7% to 50.9% (-13.3%), and increase their employment rate by 19.9% from 38.2% to 45.8%. The unemployment share is also predicted to increase by 8.3% for men, and by 3.2% for women. While the minimum accepted wage is predicted to increase, the average observed wages is predicted to decrease as more persons with disabilities are employed by prejudiced employers whose surplus is lower due to the high penalty. The equilibrium tax amount is estimated at 0.289 dollars an hour, which is 4% of the minimum wage. All in all, the impact of the subsidy is predicted to be modest. Despite a subsidy level set at 85% of the minimum wage, we still observe low employment rates and lower wages for persons with disabilities.

What is the role of discrimination in explaining this effect ? We answer this question by simulate an economy where the subsidy exists but where prejudiced employers are absent. We then compare the impact of a large subsidy and no discrimination (column 7) to a world without subsidy and without discrimination (column 3). We find that the decrease in non-participation is similar with and without discrimination. However, in a world without discrimination, the unemployment share of men increases less than in the presence of discrimination (+1.8% versus +8.3%) and 0.0% instead of +3.2% for women for women. We also observe that average wages are predicted to increase by 5.3% for men and by 6.4% for women. As there is no associated penalty with wages, workers and employers benefit more from work. However, the equilibrium tax amount would be higher, estimated at 0.372 dollars an hour. The impact on persons without disabilities is then slightly higher.

Overall, a significant employment gap remains for both men and women. Many persons with disabilities face a high disutility from work, which discourages their participation in the labour market. However, while the combination of a substantial wage subsidy and the elimination of prejudice does not completely close the employment gap, removing discrimination goes a long way in significantly narrowing it.

7 Conclusion

We developed and estimated a job search model with taste-based discrimination of employers toward persons with disabilities. The estimated parameters suggested that discrimination (both the estimated disutility of hiring persons with disabilities and estimated share of prejudiced employers) as well as preferences for leisure are the main factors explaining differences in labour market outcomes between persons with and without disabilities. The estimated model further revealed that non-disabled persons have higher job search rates and lower job destruction rates than persons with disabilities.

The counterfactual policy experiments revealed that implementing a hiring wage subsidy roll out could increase the employment rate of persons with disabilities by 7 percentage points. Eliminating discrimination, on the other hand, would have an even greater impact, raising the employment rate by 14 percentage points for men, and 19 percentage points for women. Together, our analysis suggests that removing discrimination and rolling out hiring wage subsidies would lead to an employment rate increase of 20 percentage points for men, and 24 percentage points for women. This combined approach would significantly reduce the existing employment gap between persons with disabilities and persons without: from 53 percentage points to 33 for men, and from 39 percentage points to 13 for women. These results highlight that policies aimed at reducing discrimination may have a greater impact than hiring subsidies in reducing gaps in employment outcomes between persons with and without disabilities.

This paper did not explore implementation of other alternative policies and practices, notably hiring quotas (e.g. Szerman (2022), De Souza (2023)) or telework (see Ne'eman and Maestas (2023) and Bloom et al. (2024) for recent evidence during and after the COVID-19 pandemic). This would require modelling quota compliance behavior or productivity trade-offs between telework and on-site work, all of which would require additional data. Nonetheless, we conjecture that these alternative policies and practices, much like hiring subsidies, would not be predicted to negate the dominating effects of discrimination on labour market outcomes documented in this paper.

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Table 1: labour market status and hourly wages by gender

	Men		Women	
	No disability	With disability	No disability	With Disability
Unemployment (%)	3.76	3.78	3.48	3.30
Non-participation (%)	5.38	55.79	19.86	58.74
Employment (%)	90.86	40.43	76.65	37.96
Wage (CAD)	21.16	16.83	17.20	14.32
Wage Std. Dev.	7.90	5.63	7.51	5.41
N	11,716	1,125	13,790	1,532

Notes: SLID 1999-2011 restricted to respondents 25-55 years of age. Wages trimmed at the top and bottom 5% percentiles.

Table 2: State-specific labour market durations

	Men		Women	
	No disability	With disability	No disability	With Disability
Durations (in month)				
Employment	135.69*	121.22*	122.14*	106.60*
Unemployment	4.84	8.92	5.37	6.26
Non-participation	17.71*	92.45*	57.05*	85.95*
N	11,716	1,125	13,790	1,532

Notes: Sample averages computed using SLID 1999-2011 restricted to respondents 25-55 year of age.

Table 3: Transition probabilities across labour market status

	From Employment to		From Unemployment to		From Non participation to	
	Unemployment	Non participation	Employment	Non participation	Employment	Unemployment
Men						
Without disability	15.05	8.65	92.28	7.72	-	76.96
With disability	22.07	23.36	71.20	28.80	-	20.13
Women						
Without disability	13.99	14.12	83.04	16.96	-	53.27
With disability	17.78	29.22	84.76	15.24	-	18.83

Notes: Sample averages computed using SLID 1999-2011 restricted to respondents 25-55 year of age.

Figure 1: Observed distribution of accepted wages

(a) Men (b) Women

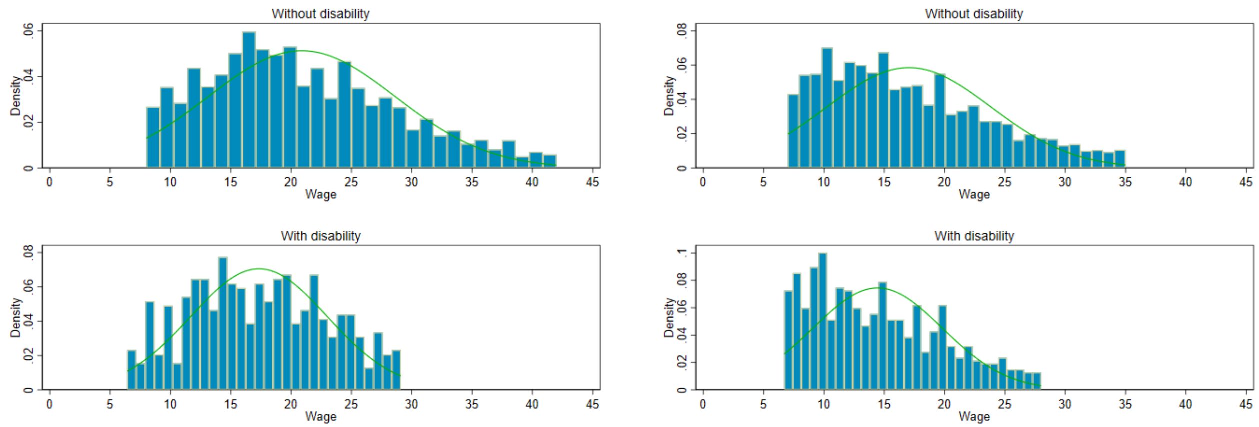

Table 4: Maximum likelihood estimates

		Men	Women
Productivity	μ_A	3.411***	3.156***
		(0.007)	(0.008)
	μ_D	3.622***	3.506***
		(0.024)	(0.043)
	σ_A	0.515***	0.558***
		(0.005)	(0.005)
	σ_D	0.182***	0.220***
		(0.013)	(0.017)
Discrimination	d	18.684**	19.187***
		(0.928)	(1.220)
	π	0.575***	0.682***
		(0.044)	(0.046)
Job offer rate	λ_A	0.159***	0.115***
		(0.011)	(0.010)
	λ_D	0.065***	0.116***
		(0.017)	(0.016)
Job destruction rate	δ_A	0.002***	0.002***
		(0.0001)	(0.0001)
	δ_D	0.003***	0.003***
		(0.0006)	(0.0005)
Home value shock	η_A	0.032***	0.014***
		(0.001)	(0.000)
	η_D	0.008***	0.009***
		(0.001)	(0.000)
	rU_A	8.161	7.282
	rU_D	7.824	8.688
	γ_A	0.300	0.201
	γ_D	0.072	0.061
Observations		12,841	15,322

Notes: Standards errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Data: SLID longitudinal data; For both estimations, we jointly estimate productivity difference and prejudice parameters.

Table 5: Counterfactual policies experiments

Panel A: Men

	Data	Benchmark	Without discrimination	Subsidy 20% min. wage: With discrimination	Subsidy 20% min. wage: Without discrimination	Subsidy 85% min. wage: With discrimination	Subsidy 85% min. wage: Without discrimination
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Minimum wage							
$\mathbb{E}(w_i^* \mid i \in A)$	8.00	8.00	7.98	8.01	8.01	8.07	8.9
$\mathbb{E}(w_i^* \mid i \in D)$	6.25	6.25	10.41	6.76	10.94	8.47	12.71
Earnings							
$\mathbb{E}(w_i \mid w_i \geqslant w_i^*, i \in A)$	21.16	21.27	21.36	21.37	21.38	21.41	21.42
$\mathbb{E}(w_i \mid w_i \geqslant w_i^*, i \in D)$	16.83	19.38	24.23	17.07	24.49	17.90	25.37
Unemployment (u_i), non-participation ($1-l_i$) and employment (e_i) rates							
$u_i \mid i \in A$	0.038	0.023	0.023	0.023	0.023	0.023	0.023
$u_i \mid i \in D$	0.038	0.048	0.054	0.049	0.055	0.051	0.056
$e_i \mid i \in A$	0.909	0.923	0.922	0.921	0.920	0.918	0.917
$e_i \mid i \in D$	0.404	0.394	0.528	0.410	0.540	0.460	0.580
$1-l_i \mid i \in A$	0.054	0.054	0.055	0.056	0.056	0.058	0.059
$1-l_i \mid i \in D$	0.587	0.558	0.417	0.541	0.404	0.488	0.363
Lump-sum tax	-	-	-	0.059	0.081	0.285	0.368

Panel B: Women

	Data	Benchmark	Without discrimination	Subsidy 20% min. wage: With discrimination	Subsidy 20% min. wage: Without discrimination	Subsidy 85% min. wage: With discrimination	Subsidy 85% min. wage: Without discrimination
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Minimum wage							
$\mathbb{E}(w_i^* \mid i \in A)$	7.00	7.00	6.99	7.02	7.03	7.11	7.14
$\mathbb{E}(w_i^* \mid i \in D)$	6.57	6.57	13.49	7.24	14.20	9.47	16.53
Earnings							
$\mathbb{E}(w_i \mid w_i \geqslant w_i^*, i \in A)$	17.21	17.12	17.38	17.39	17.40	17.45	17.47
$\mathbb{E}(w_i \mid w_i \geqslant w_i^*, i \in D)$	14.32	16.24	23.80	14.58	24.16	15.50	25.33
Unemployment (u_i), non-participation ($1-l_i$) and employment rates (e_i)							
$u_i \mid i \in A$	0.035	0.033	0.033	0.033	0.033	0.033	0.034
$u_i \mid i \in D$	0.033	0.031	0.034	0.031	0.034	0.032	0.034
$e_i \mid i \in A$	0.766	0.768	0.766	0.765	0.764	0.759	0.757
$e_i \mid i \in D$	0.380	0.382	0.567	0.399	0.581	0.458	0.623
$1-l_i \mid i \in A$	0.199	0.199	0.201	0.202	0.202	0.207	0.209
$1-l_i \mid i \in D$	0.587	0.587	0.400	0.569	0.385	0.509	0.342
Lump-sum tax	-	-	-	0.059	0.081	0.286	0.368

Notes: Data: SLID. 1999-2011. 25-55 years old.

Online Appendix

A Model

A.1 The value function

The present value of a non-participating individual is equal to his instantaneous utility of leisure and home production z plus the continuation value of either staying non-participant or entering the labour market and become unemployed. We can write

$$rV_i^{NP}(z) = b_i^{NP} + z + \eta_{i,1}(V_i^U - V_i^{NP}(z)) \tag{18}$$

with $\eta_{i,1} = \eta_i \int^{z^{NP}} Q_i(z)dz = \eta_i \mathbb{P}(z' \leqslant z_i^{NP})$.

The value of unemployment for a worker i is given by the unemployment insurance and the continuation value of either stay unemployed, or meet a firm (either prejudiced or unprejudiced) or leave the labour market. This value as defined as

$$\begin{aligned} rV_i^U &= b_i^U + \eta_i \int_{z*} (V_i^{NP}(z) - V_i^U) dQ_i(z) \\ &+ \lambda_i \left[\pi \int_{x_P^*} (V_i^E(x_P) - V_i^U) dG_i(x) + (1-\pi) \int_{x_N^*} (V_i^E(x_P) - V_i^U) dG_i(x) \right] \end{aligned} \tag{19}$$

The value of an employment that pays instantaneous wage w is

$$rV_i^E(w) = w + \delta(V_i^U - V_i^E) + \eta_i \int_{z_i^*} (V_i^{NP}(z) - V_i^E(w)) dQ_i(z) \tag{20}$$

A.2 Computing γ

Recall that we have specified $Q_i(z) = 1 - exp(-\gamma z_i)$. Using $l_i = Q_i(z_i^{NP*})$, the share of individuals who participate in the labour market, we have $\gamma z_i^{NP*} = -ln(1 - l_i)$

In equilibrium $z_i^{NP*} = rV_i^U$. We assume that $b^{NP} = 0$

$$\begin{aligned}
\int_{z_i^{NP*}} (V_i^{NP}(z) - V_i^U) dQ_i(z)) &= \int_{z_i^{NP*}} \frac{z - rV_i^U}{r + \eta_{i,1}} q_i(z) dz \\
&= \int_{z_i^{NP*}} \frac{-rV_i^U}{r + \eta_{i,1}} q_i(z) dz + \frac{z_i}{r + \eta_{i,1}} q_i(z) dz \\
&= \frac{-rV_i^U}{r + \eta_{i,1}} \exp\left(-\gamma_i z_i^{NP*}\right) + \frac{1 + \gamma_i z_i^{NP*}}{\gamma_i (r + \eta_{i,1})} \exp\left(-\gamma_i z_i^{NP*}\right) \\
&= \frac{-z_i^{NP*}}{r + \eta_{i,1}} \exp\left(-\gamma_i z_i^{NP*}\right) + \frac{1 + \gamma_i z_i^{NP*}}{\gamma_i (r + \eta_{i,1})} \exp\left(-\gamma_i z_i^{NP*}\right) \\
&= \frac{1}{\gamma_i (r + \eta_{i,1})} \exp\left(-\gamma_i z_i^{NP*}\right) \qquad (21)
\end{aligned}$$

Using wage equilibrium equation

$$\begin{aligned}
w_i^* &= rV_i^U - \eta_i \int_{z_i^{NP*}} (V_i^{NP}(z) - V_i^U) dQ_i(z)) \\
&= z_i^{NP*} - \eta_i \frac{exp(-\gamma_i z_i^{NP*})}{\gamma_i (r + \eta_{i,1})} \\
&= \frac{\gamma_i z_i^{NP*} (r + \eta_{i,1}) - \eta_i \exp\left(-\gamma_i z_i^{NP*}\right)}{\gamma_i (r + \eta_{i,1})} \qquad (22)
\end{aligned}$$

Inverting w^* and γ in the last equation, we can finally get the value of γ using the following equation

$$\gamma_i = \frac{\gamma_i z_i^{NP*} (r + \eta_{i,1}) - \eta_i \exp\left(-\gamma_i z_i^{NP*}\right)}{w_i^* (r + \eta_{i,1})} \qquad (23)$$

and replacing $\gamma_i z_i^{NP*}$ by $-\ln(1 - l_i)$ that is the non-participation share in the data and replacing w^* by the observed minimum wage in the data.

A.3 Equilibrium derivation

Let e_i, u_i and $1 - l_i$ denote the respective proportion of employed, unemployed and non-participant individuals of type i. We have $e_i + u_i = l_i$. At equilibrium, the inflow into unemployment equals the outflow from unemployment

$$\delta(l_i - u_i) + \eta_i Q_i(z_i^{NP*})(1 - l_i) = \eta_i (1 - Q_i(z_i^{NP*})) u_i + \lambda_i^U [(1 - \pi)(1 - G_i(x_{i,N}^*)) + \pi(1 - G_i(x_{i,P}^*))] u_i \qquad (24)$$

Then, it follows that

$$u_i = Q_i(z_i^{NP*}) \frac{\eta_i(1 - Q_i(z_i^{NP*}) + \delta_i}{\eta_i(1 - Q_i(z_i^{NP*}) + \delta_i + \lambda_i^U[(1-\pi)(1 - G_i(x_{i,N}^*)) + \pi(1 - G_i(x_{i,P}^*))}$$

At equilibrium, we haven the following value of unemployment, the equilibrium unemployment share and the participation share.

$$\begin{aligned}
rV_i^U &= b_i^U + \eta_i \int_{z_i^{*NP}} (V_i^{NP}(z) - V_i^U) dQ_i(z) && (25)\\
&+ \frac{\alpha\lambda_i^U}{r + \delta_i + \eta_{i,2}} \left[\pi \int_{x_{iP}^*} \left(x - d\mathbb{1}_{\{i=D,j=P\}} + \eta_i \int_{z_i^{*NP}} (V^{NP}(z) - V_i^U) dQ_i(z) - rV_i^U \right) dG_i(x) \right.\\
&+ \left. (1-\pi) \int_{x_{iN}^*} \left(x + \eta_i \int_{z_i^{*NP}} (V^{NP}(z) - V_i^U) dQ_i(z) - rV_i^U \right) dG_i(x) \right]\\
u_i &= Q_i(z_i^{NP*}) \times \frac{\delta_i + \eta_i(1 - Q_i(z_i^{NP*}))}{\delta_i + \eta_i(1 - Q_i(z_i^{NP*})) + \lambda_i((1-\pi)(1 - G_i(x_{i,N}^*) + \pi(1 - G_i(x_{i,P}^*))} && (26)\\
l_i &= Q_i(z_i^{NP*}) && (27)
\end{aligned}$$

B Estimation

B.1 The density of observed wages

For deriving this contribution we begin with the unconditional cumulative distribution function of earnings given by

$$\begin{aligned}
F_e(w) &= \mathbb{P}\left[w_{ij}(x) \leqslant w \right] \quad i = A, D, j = N, P\\
&= \mathbb{P}\left[(1-\alpha)(rV_i^U - \eta_i \int_{z^*} (V^{NP}(z) - V_i^U) dQ(z)) + \alpha(x - d\mathbb{1}_{\{i=D,j=P\}}) \leqslant w \right]\\
&= G_i \left[\frac{w - (1-\alpha)(rV_i^U - \eta_i \int_{z^*} (V^{NP}(z) - V_i^U) dQ(z)) + \alpha d\mathbb{1}_{\{i=D,j=P\}})}{\alpha} \right]
\end{aligned}$$

The corresponding density is

$$f_e(w) = \frac{1}{\alpha} g_i \left[\frac{w - (1-\alpha)(rV_i^U - \eta_i \int_{z^*} (V^{NP}(z) - V_i^U) dQ(z)) + \alpha d\mathbb{1}_{\{i=D,j=P\}})}{\alpha} \right]$$

$$f_e(w | w > w_i^*) = \left[\frac{\frac{1-\pi}{\alpha} g_i \left(\frac{w - (1-\alpha) x_{i,N}^*}{\alpha} \right)}{1 - G_i(x_{i,N}^*)} + \frac{\frac{\pi}{\alpha} g_i \left(\frac{w + \alpha d\mathbb{1}_{\{i=D,j=P\}} - (1-\alpha) x_{i,P}^*}{\alpha} \right)}{1 - G_i(x_{i,P}^*)} \right]$$

B.2 Derivation of the Likelihood contribution

To derive the likelihood of the model, we model the probability to observe each individual in a certain labour market status for a certain period of time and to observe a transition toward another labour market status. We will model the probability to observe 8 different situations that depend on the three possible initial labour market status (employment, unemployment and non-participant), and the three possible next labour market status (same as initial if the spell is right censored and we cannot observe the whole duration of the labour market spell, or one of the two other labour market status). As we forbid transitions from non-participation to employment, we have only 8 different possible situations instead of 9. We denote t the observed duration of the first employment spell whether it is censored or not.

For an individual who is initially employed, we denote $\mathcal{L}1$, $\mathcal{L}12$ and $\mathcal{L}13$ her respective contributions to the likelihood whether her employment spell is right censored, whether she becomes unemployed after a period of time t or whether she becomes non-participant after a period of time t. These contributions are written :

$$\mathcal{L}_1 = (l-u) \times f(w) \times exp(-(\delta+\eta_2)t)$$
$$\mathcal{L}_{12} = (l-u) \times f(w) \times (\delta+\eta_2)exp(-(\delta+\eta_2)t) \times \delta$$
$$\mathcal{L}_{13} = (l-u) \times f(w) \times (\delta+\eta_2)exp(-(\delta+\eta_2)t) \times \eta_2$$

Next, we calculate the contribution to the likelihood for an individual who is unemployed at the date of the first interview. We denote $\mathcal{L}2$, $\mathcal{L}21$ and $\mathcal{L}23$ her respective contributions to the likelihood whether her unemployment spell is right censored, whether she becomes employed after a period of time t at wage w or whether she becomes non-participant after a period of time t. These contributions are written :

$$\mathcal{L}_2 = u \times exp(-(h+\eta_2)t)$$
$$\mathcal{L}_{21} = u \times (h+\eta_2)exp(-(h+\eta_2)t) \times h \times f(w)$$
$$\mathcal{L}_{23} = u \times (h+\eta_2)exp(-(h+\eta_2)t) \times \eta_2$$

Finally, we write the contribution to the likelihood for an individual who is a non-participant at the date of the first interview. In this scenario the only possible transition is to exit toward unemployment. We denote $\mathcal{L}3$ and $\mathcal{L}32$ her respective contributions to the likelihood whether her non-participation spell is right censored, or if she enters unemployment after a period of time t.

$$\mathcal{L}_3 = (1 - Q(z^{*NP})) \times exp(-\eta_1 t)$$
$$\mathcal{L}_{32} = (1 - Q(z^{*NP})) \times \eta_1 exp(-\eta_1 t) \times \eta_1$$

The likelihood of the observed sample is the product of all the individual contribution to the likelihood.