Employment and Disability Insurance

Ben Johnson

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Part I

Introduction

When an individual becomes disabled, he faces a decision whether to continue working or to apply for disability benefits through Social Security Disability Insurance (SSDI). The individual must consider tradeoffs between continuing to work and applying for SSDI benefits. If the individual continues to work, he might make his disability worse. If he applies for disability benefits, he must quit his job, forgoing his wages and losing his accumulated tenure with his employer. He also faces the uncertainty of whether his SSDI application will be approved. This paper models the disabled individual's decision-making process.

1 Social Security Disability Insurance

Social Security Disability Insurance (SSDI) is a benefit for people who are unable to work for at least a year as a result of a disability. In order to be eligible for SSDI, the disabled individual must have worked and paid Social Security taxes in the past. The disabled individual also must be unable to work in the same capacity as before the onset of the disability. If the individual is working and earning more than $1,000 per month, he cannot

be considered disabled. In addition, the Social Security Administration must determine that the individual cannot find a new job whose requirements would be possible to perform with the disability. There is a five-month waiting period from the time of application for SSDI benefits until the benefits begin to be paid. The waiting period allows time for some disabilities to be cured, or for the individual to show signs of improvement.

Once an individual begins receiving SSDI benefits, he will continue getting benefits for the duration of the disability, as long as he continues to meet all eligibility requirements. The Social Security Administration reviews eligibility periodically, depending on the severity of the individual's disability. If the disability is expected to improve, the review occurs within six to 18 months of the initial approval to receive SSDI benefits. If improvement is possible, the review occurs after three years. If improvement is not expected, the review takes place after seven years.

2 Review of Literature

Previous researchers have explored the SSDI application process. Benitez-Silva et al. (1999) consider the application process as a dynamic game. They find allowing for appeals in the process greatly increases the probability that an application will be ultimately accepted. Their findings suggest that modeling the uncertainty in the process is important. The results of Benitez-Silva et al. (1999) show that having a health problem that prevents the individual from working is the most significant predictor of success in the SSDI application.

Benitez-Silva, Buchinsky and Rust (2005) investigate classification errors in SSDI applications. They find that 20% of individuals who are awarded SSDI benefits are not actually disabled, while 60% of individuals who are denied benefits are actually disabled. Benitez-Silva et al. (2004) find that, on average, individual evaluations of disabilities are the same as Social Security Administration evaluations of disabilities. This result indicates that it is not necessary to model individuals who incorrectly report their disability in order to increase

their chances of being approved to receive SSDI benefits.

Kreider (1999) finds that the mandatory five-month waiting period is a strong disincentive for applications. Burkhauser, Butler and Gumus (2004) study the timing of the SSDI application. They find that employer accommodation has a significant effect on the timing of the application.

Part II

Model

See Table 3 for a description of each variable in the model.

3 Timing

Each person begins with an initial state vector S_0. Each period is one month. The disability state d_t is realized first. Subsequently, employers present individuals with their wage offers w_t. At this point, individuals will make their employment decisions e_t, m_t, and j_t. After employment decisions are made, the unemployed individuals choose a_t, whether to apply for SSDI benefits. Next individuals receive their income from wages, unemployment benefits, or SSDI benefits. Finally, the individual makes his consumption decision c_t.

4 Per-period Alternatives

Each period, the individual makes several decisions. See Table 1 and Figure 1 for a summary of the individual's decisions. The individual first chooses an employment alternative e:

$$e = 0 : \text{Unemployed}$$

$$e = 80 : \text{Employed part-time}$$

$$e = 160 : \text{Employed full-time.}$$

This analysis assumes that all three alternatives are available to each individual in every period. The values of e represent the number of hours a person with each employment status could expect to work in a month, assuming four 20-hour weeks for part-time employees and four 40-hour weeks for full-time employees.

If the individual chooses $e \in \{80, 160\}$, he has chosen to work and can choose his employer m and occupation j:

$$m = 0 : \text{Begin working for a new employer}$$

$$m = 1 : \text{Continue working for the same employer}$$

$$j = 0 : \text{Occupation with low requirement for physical exertion}$$

$$j = 1 : \text{Occupation with high requirement for physical exertion.}$$

Note the implicit assumption that there is a job available for all individuals who want to work. This assumption may not be true in reality, but the model is made more simple by assuming it is unnecessary to model labor demand. Occupations are split into two groups based on how much physical exertion is required. The occupation's physical requirements have implications for how well a disabled person can perform the job and the progression of a disability.

If the individual chooses $e = 0$, then he is eligible to receive unemployment benefits. After six periods of unemployment, unemployment benefits have run out. The six-period limit on eligibility reflects the 26-weeks of state unemployment benefits that workers in the United States are eligible to receive when they lose their job.

If the individual chooses $e = 0$, he can choose a, whether or not to pursue Social Security

Table 1: Per-Period Alternatives for the Individual

Variable	Description
e_t	Employment
m_t	Employer
j_t	Occupation
a_t	Pursuing SSDI

Disability Insurance this period:

$$a = 0 : \text{Do not pursue SSDI}$$

$$a = 1 : \text{Pursue SSDI (note : } a_t = 1 \text{ implies } e_t = 0).$$

Individuals who choose $a = 1$ must also choose $e = 0$ that period. Pursuing SSDI means the individual is not working and is not engaging in any activity that would disqualify him from receiving SSDI benefits. An individual may, on the other hand, choose not to work and not to pursue SSDI.

If the individual chooses $a = 1$, he will receive a decision g from the government after five months

$$g = 0 : \text{Government denies the application for SSDI benefits}$$

$$g = 1 : \text{Government approves the application for SSDI benefits.}$$

Assume the government will make a decision on each application after a five-month wait. Five months is the average time for a decision found by Benitez-Silva et al. (1999). This assumption makes modeling the mandatory five-month waiting period until individuals can receive benefits unnecessary. In reality, if the government denies the SSDI application, the individual has the option to appeal. The appeal takes two months on average. This model, however, does not take into account appeals and assumes that denied individuals must reapply and endure the entire five-month wait again.

Figure 1: Individual's Decision Tree

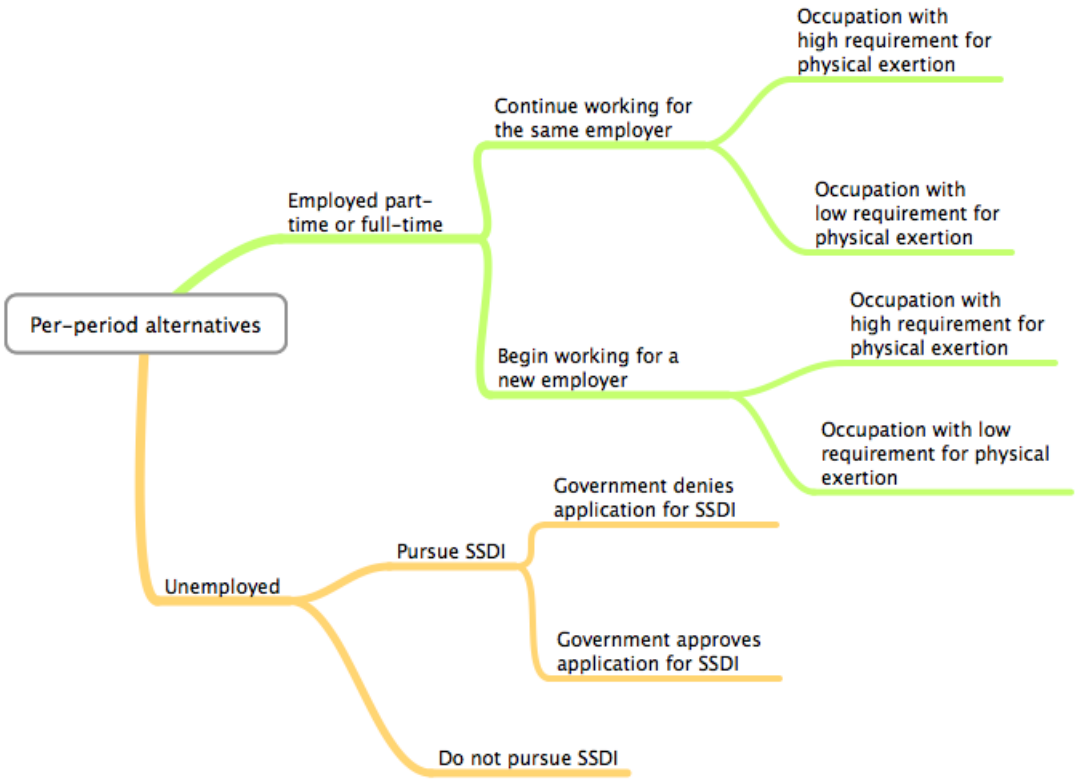

Table 2: State Variables and Descriptions

Variable	Description
d_t	Disability in t
t_t	Tenure with current employer up to t
o_t^0	Experience in occupation with low requirement for physical exertion up to t
o_t^1	Experience in occupation with high requirement for physical exertion up to t
n_t	Duration of unemployment up to t
k_t	Whether the individual is collecting unemployment benefits in t
i_t	Time since application for SSDI (number of consecutive periods that $a = 1$) in t
b_t	Whether the individual is receiving SSDI benefits in t

5 State Variables and Laws of Motion

The decisions made during period t depend on the history up to period t of the individual's disability, tenure with his current employer, experience in each of the two occupation types, the duration of time he has been unemployed, his eligibility for unemployment benefits, time since his application for SSDI benefits, and whether he is receiving SSDI benefits. The state in which an individual is observed at the beginning of period t is described by a vector $\mathbf{S}_t = (d_t, t_t, o_t^0, o_t^1, n_t, k_t, i_t, b_t)$. See Table 2 for descriptions of each state variable.

The following laws of motion describe how each state variable changes based upon the decisions the individual makes each period. The disability state variable is stochastic. The severity of an individual's disability in period t depends on the severity of the disability in period $t-1$, the individual's occupation in $t-1$, and the individual's experience in the physically demanding occupation accrued through period $t-1$. In addition, there is a stochastic error term. The law of motion for the individual's disability is

$$d_t = d_{t-1} + f(j_{t-1}, o_{t-1}^1) + \mu_t,$$

where μ_t is a stochastic error term. An increase in d represents a worsening of the disability. Working in the more physically demanding occupation will worsen the progression of the disability more than working in the less physically demanding occupation. In addition, having worked in the physically demanding occupation in the past also worsens the progression

of the disability. Intuitively, an individual with a bad back who has worked in construction for many years will have more wear and tear on his back than a similar person who worked a desk job for many year.

The law of motion for tenure accrued with the current employer up to period t is

$$t_t = \begin{cases} t_{t-1} + m_{t-1} & \text{if } e_{t-1} \in \{80, 160\} \text{ and } m_{t-1} = 1 \\ 0 & \text{otherwise} \end{cases}.$$

The individual's tenure with his current employer increases by one if he decides to continue working with his current employer for another period. If he chooses to find a new employer, his tenure is zero.

The law of motion for an individual's experience up to t in an occupation with high physical exertion is

$$o_t^0 = \begin{cases} o_{t-1}^0 + j_{t-1} & \text{if } e_{t-1} \in \{80, 160\} \text{ and } j_{t-1} = 1 \\ o_{t-1}^0 & \text{otherwise} \end{cases}.$$

Similarly, the law of motion for an individual's experience up to t in an occupation with low physical exertion is

$$o_t^1 = \begin{cases} o_{t-1}^1 + (1 - j_{t-1}) & \text{if } e_{t-1} \in \{80, 160\} \text{ and } j_{t-1} = 0 \\ o_{t-1}^1 & \text{otherwise} \end{cases}.$$

The law of motion for duration of unemployment up to t is

$$n_t = \begin{cases} n_{t-1} + (1 - e_{t-1}) & \text{if } e_{t-1} = 0 \\ 0 & \text{otherwise} \end{cases}.$$

The duration of unemployment is important for determining eligibility for unemployment

benefits. The law of motion for whether an individual is collecting unemployment benefits in t is

$$k_t = \begin{cases} 1 & \text{if } e_t = 0 \text{ and } n_{t-1} \leq 6 \\ 0 & \text{otherwise} \end{cases}.$$

The model assumes that all individuals who are eligible to collect unemployment benefits actually collect the benefits.

The law of motion for the number of periods since the individual applied for SSDI benefits is

$$i_t = \begin{cases} i_{t-1} + a_{t-1} & \text{if } a_{t-1} = 1 \\ 0 & \text{otherwise} \end{cases}.$$

The law of motion for whether the individual is receiving SSDI benefits in period t is

$$b_t = \begin{cases} 1 & \text{if } g_t = 1 \text{ or } b_{t-1} = 1, \text{ and } a_t = 1 \\ 0 & \text{otherwise} \end{cases}.$$

The individual begins receiving SSDI benefits immediately after approval by the government. Once an individual is approved for SSDI benefits, he continues receiving benefits until he begins working or becomes otherwise ineligible ($a = 0$). The model disregards the possibility of an audit by the Social Security Administration.

6 Utility Function and Budget Constraint

The deterministic portion of the individual's utility function depends on consumption c_t, the severity of the disability d_t, leisure time l_t, and job fit $d_t j_t$. A random taste component, ϵ_t, also affects utility additively. The per-period utility function is

$$u\left(c_t, d_t, l_t, d_t j_t\right),$$

where $d_t j_t$ represents job fit. The job fit component represents the increasing level of disutility individuals with more severe disabilities get from working in physically demanding jobs. The marginal utility of consumption and leisure time is positive. The marginal utility of d_t is negative.

The per-period budget constraint is

$$p_t c_t = e_t \times w_t(t_t, o_t^{j_t}, d_t, j_t) + b_t s_t + k_t v_t.$$

Each period, the individual may receive labor income equal to the product of hours worked and the wage rate, disability benefits, or unemployment benefits. There may be a short overlap between the time the individual begins receiving disability benefits and the end of unemployment benefits where he receives both benefits. The individual spends his income on consumption. There is no saving in the model. The wage rate in t depends on tenure with the current employer up to t, experience up to t in the occupation the individual has chosen in t, the disability in t, and the occupation in t. Wage rate is expected to be increasing in tenure and experience and decreasing in disability severity. It is difficult to predict how occupation will affect the wage. In order for an individual to choose to work in the physically demanding occupation there should be a wage premium to compensate for increased rate of progression for the disability. On the other hand, many high-paying jobs have low requirements for physical exertion. Perhaps there is an interaction between education and occupation in which physically demanding jobs pay better at low levels of education. Such an interaction is not modeled here.

The time constraint is

$$T_t = e_t + l_t + z(d_t, a_t),$$

where z represents time lost as a result of the disability and time spent applying for SSDI benefits or complying with requirements of the SSDI program. z represents a cost of applying for SSDI benefits or maintaining eligibility in period t. If z were not included, all unemployed

individuals would apply for SSDI benefits.

7 Optimization problem

The individual chooses e, m, j, and a to maximize discounted lifetime expected utility conditional on disability state and SSDI eligibility:

$$V^{d,b}_{e,m,j,a}(\mathbf{S}_t, \epsilon_t) = U^{d}_{e,m,j,a} + \epsilon_t^{e,m,j,a} + \beta \sum_{d'}^{D} P(d_{t+1} = d' | d_t = d) \left[\gamma_t V^{d',1}(\mathbf{S}_{t+1}) + (1 - \gamma_t) V^{d',0}(\mathbf{S}_{t+1}) \right],$$

where

$$\gamma_t = P(g_t = 1) = \begin{cases} 0 & e_t \neq 0 \text{ or } i_t < 5 \text{ or } a_t = 0 \\ g(d_t, n_t, a_t) & \text{otherwise} \end{cases}$$

and

$$V^{d',b'}(\mathbf{S}_{t+1}) = E_t \left[\max_{e',m',j',a'} V^{d',b'}_{e',m',j',a'}(\mathbf{S}_{t+1}, \epsilon_{t+1}) \right].$$

The probability that the government approves the SSDI application in period t is 0 if the individual worked in t, has not waited for five periods since applying for SSDI, or did maintain eligibility in t. Otherwise the probability of an approval is a function of disability, duration of unemployment, and eligibility status. There are three sources of uncertainty in the optimization problem: the progression of the disability, the approval or denial of the SSDI application, and the wage offer.

8 Shortcomings of the model

The model has a few shortcomings. For simplicity, the model does not consider the individual's decision to appeal against a denial of his SSDI application. Benitez-Silva et al. (1999) suggest that the decision to appeal is an important part of the application process. Also,

the model does not allow for saving, instead providing unemployed individuals with unemployment benefits. Adding saving and debt would let the researcher draw conclusions about whether individuals with more savings are more willing to take a chance on an SSDI application. In addition, the model does not take employer characteristics into account. Some employers might be more accommodating of disabilities, which could result in a smaller wage penalty for the disabled individual. Employer characteristics might explain why individuals are willing to lose their tenure to switch employers. Finally, the model disregards the possibility of an audit by the Social Security Administration. In this model, once the individual is approved to receive SSDI benefits, he continues receiving them until he begins working again or chooses $a_t = 0$, regardless of whether his disability has improved. In reality, the Social Security Administration could audit the individual and take away his benefits if his disability has improved sufficiently.

Part III

Implications of the Model

The model suggests that individuals would work because they can earn more money from working than from unemployment benefits. There is also uncertainty associated with becoming unemployed and filling out an SSDI application. In addition, the individual can build up tenure with an employer if he chooses to continue working. An individual would choose to be unemployed if his disability is sufficiently bad that it will depress his wage to a low enough level, if he wishes to apply for SSDI benefits, or if he places a high value on leisure time.

The model suggests individuals will continue working with the same employer in order to build up tenure. The model does not suggest any reason why an individual would change employers. To add incentive to switch employers, firm-specific characteristics like disabil-

ity accommodations or firm generosity (where a firm rewards experience or tenure more generously) could be added to the model.

Employees would change occupations from the more physical job to the less physical job in order to slow the progression of his disability and to improve job fit, a component of the utility function. An employee might switch from the less physical job to the more physical job if it pays better. Employees would decide to stay in their current occupation so they can accumulate experience, which leads to higher wages.

The individual will apply for SSDI benefits if he believes he has a high chance of being accepted to receive SSDI benefits. He incurs costs for applying for SSDI of lost income from not working for five periods while he waits for a decision on his application and lost time for filling out the application and complying with the rules of SSDI.

Part IV

Appendix

Table 3: Variables and Functions

Letter	Description
a	Pursue SSDI benefits
b	Receive SSDI benefits
c	Consumption
d	Disability
e	Work time
$f(j, o^1)$	Progression of disability
g	Government's decision on SSDI application
i	Time since application for SSDI benefits
j	Occupation
k	Collect SSDI benefits
l	Leisure time
n	Duration of unemployment
o	Experience in occupation
p	Price of consumption good
$\mathbf{S}$	State vector
s	Value of SSDI benefits
t	Tenure at current employer
T	Total time available
$u\left(c, d, l, dj\right)$	Utility function
v	Value of unemployment benefits
$w(t, o^j, d, j)$	Wage function
z	Lost time function

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