Measuring the Effects of Employment Protection for the Disabled: Theory and Evidence from the Americans with Disabilities Act *

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Abstract

Despite the legislation of the American Disabilities Act (ADA) for the disabled in 1990, labor market outcomes of the disabled have been deteriorated for the past 20 years. We analytically prove that these facts are easy to reconcile with our economic theories where firms perceive this employment protection law as additional costs (e.g. mandated accommodation and expected legal disputes). The optimal job creation decision of the firm implies that the job finding rate of the disabled decreases in equilibrium after the ADA, as firms have more incentive not to hire the disabled and avoid the costs. A firm's hiring response to employment protection intensifies with the productivity difference across health groups and the share of the disabled in labor markets. We conduct two empirical analyses – cross-state analysis using state-level variation in pre-ADA employment protection laws and occupation-level analysis using differences in physical activity intensities of tasks – to verify the model's prediction. Consistent with our theory, the disabled in states with weaker labor protection experienced a significantly larger decline in labor force participation rate and an increase in exit rate from the employment to out-of-labor force.

JEL Codes: E6, J3
Keywords: Americans with Disabilities Act, Employment protection, Labor market frictions, Labor force participation, Job separation, Job creation

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1 Introduction

In 1990, the U.S. introduced the American Disability Act (ADA) to improve labor market outcomes of the disabled by preventing discrimination in hiring, firing, and wage compensation and by mandating firms to provide reasonable accommodation to their disabled employees. Nevertheless, labor market performance of the disabled is worse than their healthier counterparts. In 2013, the labor force participation rate of the disabled was 20.3%, while 68.9% of those without disabilities participated in the labor market. Moreover, the unemployment rate of people with disabilities was 13.2%, about twice that of those without disabilities (7.1%).[1]

In this paper, we compute the impact of the ADA for the disabled to analyze the effectiveness of these labor protection policies. We approach this question in two stages. First, we present a theoretical model to illustrate possible discrimination mechanisms triggered by the ADA. Second, we provide empirical analysis to measure the actual impact of the legislation.

Our model incorporates search friction in general equilibrium framework where both firms' job creation decisions and workers' labor supply responses are endogenously determined. The literature assessing the labor market performance of the disabled after the ADA has focused on the possible costs that firms face in hiring disabled employees.[2] The frameworks used in these analyses are that firms face fixed supply of labor of disabled and non-disabled workers. These approaches do not allow possible interactions from the changes in labor supply motives of the workers. This assumption may be implausible, in particular in recent periods, as the Social Security Disability Insurance (DI) program has rapidly expanded.[3]

In the competitive search equilibrium without government intervention, we find that that healthy workers (whose net productivity is higher) receive a higher wage and have a lower unemployment rate, compared to disabled workers. Under the ADA, however, disabled workers who face discrimination can file lawsuits, which can be costly to firms.[4] In effect, both the costs of firing and accommodation lower the net productivity of disabled employees, providing more incentives to discriminate against the disabled. On the other hand, the introduction of (not) hiring costs reduces jobs for the non-disabled. We prove that firms find it optimal to abide by the law so that healthy and unhealthy workers cross-subsidize each other in equilibrium only if there is significantly high

[1] Source: Bureau of Labor Statistics

[2] Acemoglu and Angrist (2001) and DeLeire (2000) are among them.

[3] French and Song (2014) and Maestas, Mullen and Strand (2013).

[4] Acemoglu and Angrist (2001) estimates the cost to range between \$24.50 to \$35 a week per employee (in 2001 dollars).

cost of hiring. Otherwise, firms find it optimal to violate the law by discriminating the disabled in hiring stage, and avoid expected costs from potential lawsuits.

Guided by our theory, we estimate the effect of the ADA using the Annual Social and Economic Supplement from the Current Population Survey (March CPS) from 1981 to 2014. We measure the disability statistics and their relationships with other labor market outcomes (e.g. labor force participation rate, job finding and job separation rates of the disabled) before and after the ADA. We are able to identify the role of the costs induced by the ADA because of variation in state-level employment protection laws before the ADA. Prior to the legislation of the ADA, 18 states already had implemented state-level labor protection laws for the disabled similar to the ADA.[5] Therefore, the legislation of the ADA was not an introduction of additional costs to firms in these states. We consider these states with pre-existing labor protection laws as a control group and compare them with the experiences of the disabled in 32 other states with weaker labor protection prior to the ADA. We also test our theory using heterogeneity in occupation groups within the states.

We find that between 1988 and 1992, the introduction of the ADA reduced the labor force participation rate of the disabled by 5% in states with weaker labor protection laws. Simultaneously, the job separation rate of the disabled employees increased by 2%. These facts are the evidence of significant hiring and firing costs firms expect under the ADA, jointly contributing a lower level of employment of the disabled after the introduction of the ADA. However, we observe that non-disabled workers experienced an increase in labor force participation by 2.5% and a decrease in job separation by 2.1% after the implementation of the ADA.

A part of the diverging trends of labor transitions between the disabled and non-disabled might be because firms adopt more comprehensive selection and separation processes after the legislation of the ADA. To verify this hypothesis, we measure the changes in labor transition probabilities before and after the ADA by the degree of physical intensity of occupations. If a job is physically demanding, then firms will find the cost of providing accommodation outweigh the benefit of providing it, and hence have more incentive to be selective in labor markets. Our results show that physically intensive occupations experienced a wider gap in labor market outcomes across health types after the introduction of the ADA, pointing to a negative impact of the ADA on labor demand.

Our results add to a large labor economics literature studying the effects of employment protection policies for the disabled. The majority of these studies find evidence that the introduction

[5]The share of working-age population in these states were 32%. In contrast, 68% of working age population were either residing under weaker or no labor protection laws.

of the ADA has a significant negative labor market outcomes of the disabled. Among them are DeLeire (2000) and Acemoglu and Angrist (2001) who find a significant decrease in employment of the disabled that ranges between 5 and 8 percentage points. Our empirical approach allows us to decompose the sources of these negative labor market outcomes in detail.

Our theoretic analysis builds on work by Acemoglu and Shimer (1999) and Menzio and Shi (2010*a*,*b*, 2011), who model the labor market with heterogeneous agents in directed search framework. While many have acknowledged the interactive effects of the firms and workers under the ADA, ours is the first to study the impact of the ADA in a general equilibrium model with search frictions. By adopting the directed search framework, we can analytically illustrate the effects of policy changes on transition probabilities. Similar to ours, Choi and Fernandez-Blanco (2014) adopted the directed search framework to study the role of unemployment insurance on labor market dynamics.

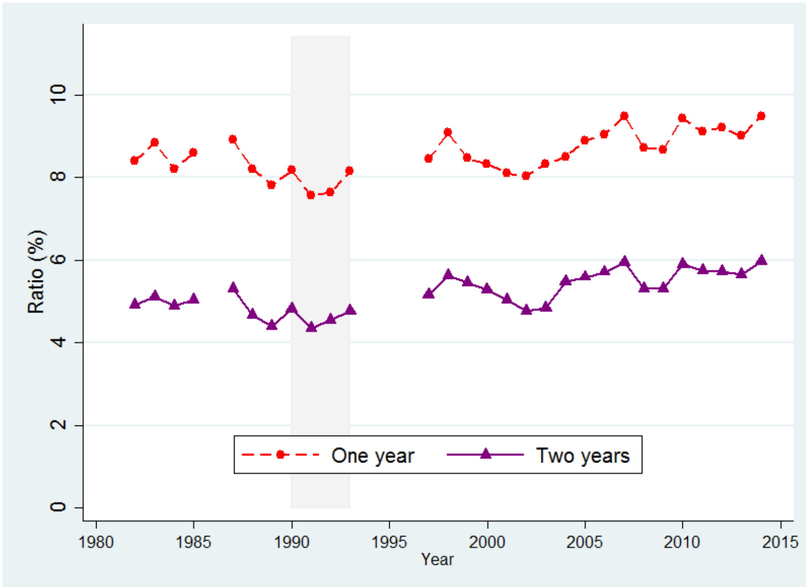
The remainder of the paper is organized as follows. In the next section, we document stylized facts summarizing labor market performance and job transition rates by health status. Then, we introduce our model and characterize the effects of the Americans with Disabilities Act in 4. Section 3 contains descriptions of our empirical analysis and its results. Section 5 concludes.

2 Stylized Facts

2.1 Aggregate Trends of Disability in the United States

In this section, we document stylized facts on the labor market performance of disabled workers compared to non-disabled workers. The main source of our analysis is the matched Annual Social and Economic Supplement from the Current Population Survey (March CPS) for the years 1981 through 2014. We measure disabilities using the work limitation variable (DIS-HP). Starting from 1981, the March CPS has been collecting information whether the individual has any form of heath problems causing work limitations. Despite its narrow definition of disabilities, Burkhauser and Houtenville (2006) found that the overall trend of disability in the March CPS is similar to other measures of disabilities found from the National Heath Interview Survey (NHIS).

Figure 1
Trends of Disability:
The Share of Working-age Population with Work Limitations

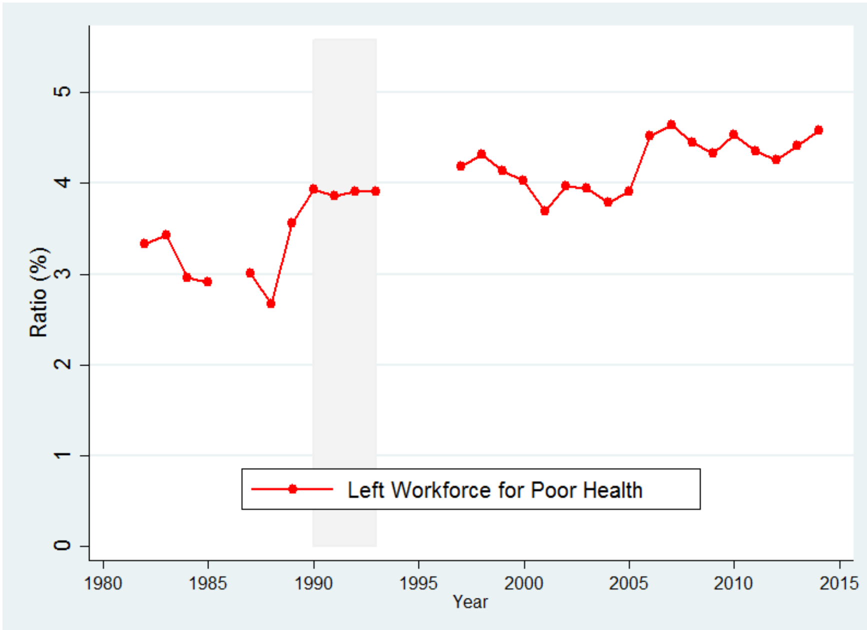


Note: Figure 1 illustrate the fractions of individuals between 21 to 64 with work limitations using the matched March CPS. The purple line with triangle markers denotes the population shares that reported work-limitations in two survey years in a row. The dashed line at the top depicts the fraction of individuals experienced at least one year of work limitation. The average is weighted each year using the March supplement weight.

Figure 1 illustrates the aggregate time trends of the disability among the working-age population. The red dashed line is the fraction of adults with work limitations for at least a year, and the solid line indicates the share of working-age population who reported the health problems in two consecutive surveys. We can verify that both measures of disabilities have been gradually increasing starting from 1990s.

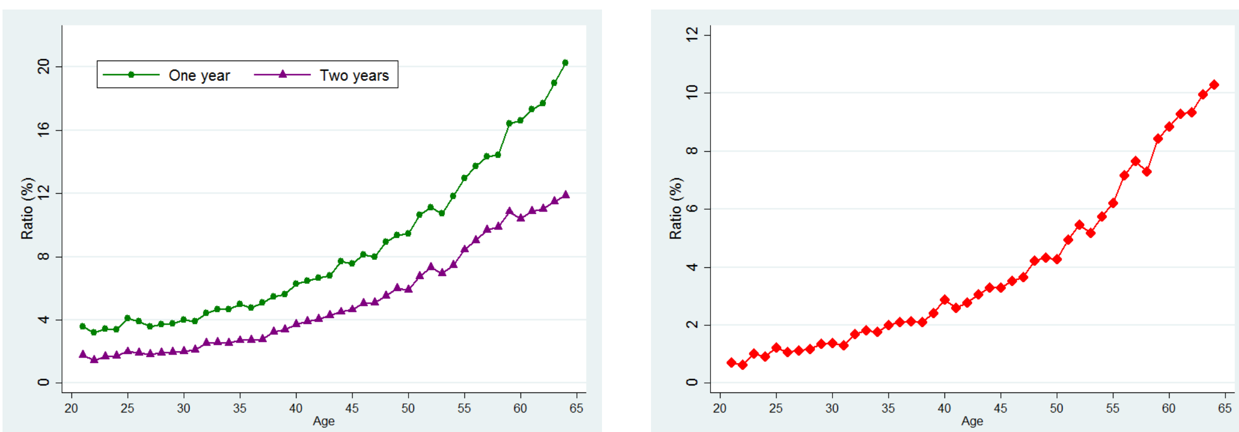
There is another variable available in the March CPS (DIS-CS) that is related to health status of individual. This variable directly asks whether the major factor of leaving his job (or retirement) was his poor health status. Unlike the previous question, however, this question also related to the labor market decision of the individual. That is, the statistics can driven by long-run trend of health of the population, but also get influenced by the macroeconomic status of the economy. Figure 2 summarizes the result. The fraction of individuals leaving the labor market for health related reason has been steadily growing from 3% in 1980s to 4.5% in 2010. One important remark of the trend from Figure 2 is that the fraction of individuals leaving the job citing their health as their main cause has increased by 1 percentage point in early 1990, even though the the ADA has made it easier for employers to keep their jobs when they experience physical or mental disabilities.

Figure 2
Trends of Disability:
The Share of Individuals Leaving the Workforce for Poor Health



Note: Table 2 computes the fraction of individuals in each year that positively responded that they left the labor force due to their poor health status. The working-age population is defined as age between 21 and 64. The average is weighted with the March supplement weight.

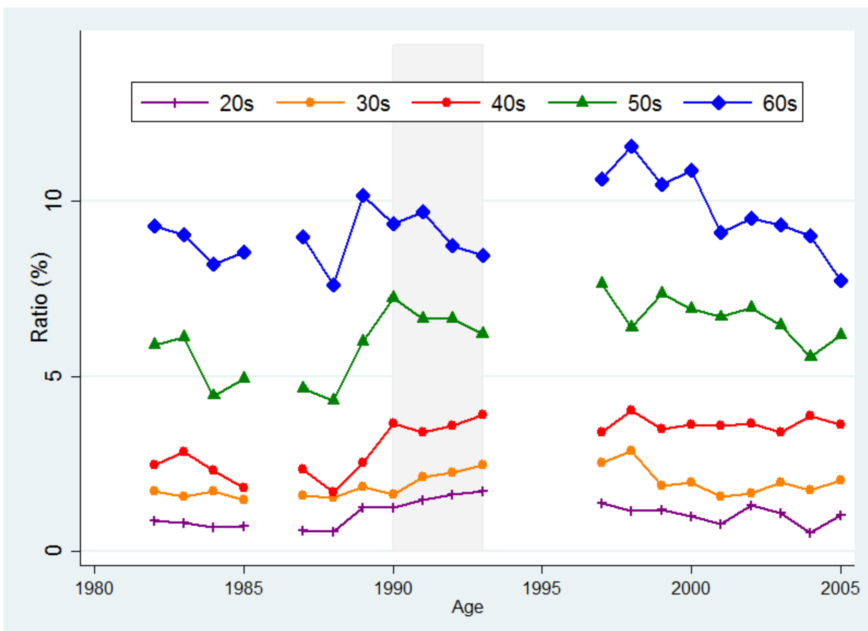
Figure 3
Life-cycle Patterns of Disabilities



Note: Figure 3 illustrate the average share of individuals with disability by age group. The first graph is the fraction of individuals in each age group that positively responded that they have health problems causing work limitations. The purple line with square markers denote the population shares that suffered work limitations two years in a row. The average is weighted with the March supplement weight. The right panel illustrates the fraction of individuals cited poor health as their main cause of exiting the labor market.

The growing share of disability in working age population may be driven by the aging population. As shown in Figure 3, higher fraction of older population experiences work-limitations and exit the labor markets. Taking into account the demographic changes of the US economy, one might expect that it may not be surprising to see the rising the trend of population share of disability and labor market outflow caused by health problems. To test the hypothesis that the aggregate trend in disability is the result of demographic compositional change, we compute the age-group specific statistics in labor market exit rate for health related reasons. Figure 4 summarizes the results. Overall, older population exit more frequently then the younger cohorts. However, in late 1980s and early 1990s there have been a rise in exit rate for every age group.

FIGURE 4
THE SHARE OF INDIVIDUALS LEAVING THE WORKFORCE CAUSED BY POOR HEALTH



Note: Figure 4 computes the fraction of individuals in each age group that positively responded that they left their jod due to their health status. We observe the rise in the exit rate from every age group. Each age group is defined with a 10-year interval starting from 21 years old except the last one (61-64). The average is weighted with the March supplement weight.

2.2 Transition Probabilities of Disabled Workers

Here, we restrict our empirical analysis on individuals who maintain the same level of health status for the two consecutive years. Estimation including observations with transitory health status variables generates similar results in transition probabilities. Details of the robustness analyses are reported in Appendix B.We first look at how the health status of individual affects his labor market status – Nonparticipation (N), Unemployment (U), and Employment (E) – from year t to year $t+1$ after controlling observable individual characteristics. We estimate the following probit model:

$$\mathbf{Pr}\left(s_{t+1}=j\right) \;=\; \Phi\left(\alpha_s+\beta_t+\mathbb{I}_{\{\text{disabled}\}}+X\beta+\epsilon_i\middle|\, s_t=i\right) \tag{1}$$

where the dependent variable is the probability that an individual changes his labor market status from i to j. Year dummies are included to control for macroeconomic conditions of the economy. We also include state dummies as well as state-specific time trend in our regression as each states may have its own economic trajectory. Table 2 reports the estimation results. For the all six probit regressions, we find that disability indicates a significantly negative impact on individual's labor market transition probabilities.

In Table 1 we report the predicted probabilities of labor market transition by health status based on the estimated coefficients by health status, assuming all the other characteristics are the same at the mean of the sample. Individuals with disability experience lower job finding rate (NE or UE) compared to their healthy counterparts when they are non-employed. They also demonstrate 1.4 times higher job separation rate in EU, and 4.5 times higher probability to exit the labor force from employment (EN). For those who are already out of the labor force, disabled individuals are less likely to return to the labor force in either form of being employed (NE) or of being unemployed (NU).

Table 1
Predicted Transition Probabilities

t	unemployment		employment		out-of-labor-force	
$t+1$	employment	out-of-labor-force	unemployment	out-of-labor-force	employment	unemployment
Disabled	0.230 [0.20,0.26]	0.539 [0.51,0.57]	0.039 [0.034,0.045]	0.271 [0.26,0.28]	0.028 [0.026,0.30]	0.010 [0.009,0.012]
Non-disabled	0.517 [0.51,0.52]	0.222 [0.22,0.23]	0.027 [0.027,0.028]	0.059 [0.059,0.06]	0.210 [0.208,0.213]	0.042 [0.041,0.044]

Note: Table 1 computes the predicted probabilities of labor market transitions based on the probit estimation results. All the other regressors are computed at the mean. Numbers in parentheses are 95% confidence interval.

TABLE 2
ROLE OF HEALTH IN TRANSITION PROBABILITIES

t	unemployment		employment		out-of-labor-force	
$t+1$	employment	out-of-labor-force	unemployment	out-of-labor-force	employment	unemployment
Disability	-0.805	0.923	0.204	0.995	-1.010	-0.549
	[-0.91,-0.70]	[0.82,1.02]	[0.13,0.27]	[0.95,1.04]	[-1.04,-0.97]	[-0.59,-0.49]
Female	-0.074	0.367	-0.065	0.37	-0.171	-0.319
	[-0.11,-0.04]	[0.33,0.40]	[-0.08,-0.05]	[0.36,0.38]	[-0.19,-0.15]	[-0.34,-0.28]
White	0.322	-0.146	-0.203	-0.104	0.080	-0.284
	[0.28,0.36]	[-0.19,-0.10]	[-0.23,-0.18]	[-0.12,-0.09]	[0.06,0.10]	[-0.32,-0.26]
College	0.236	-0.182	-0.230	-0.146	0.075	-0.175
	[0.19,0.29]	[-0.24,-0.12]	[-0.25,-0.21]	[-0.16,-0.13]	[0.05,0.10]	[-0.22,-0.13]
Age	0.049	-0.086	-0.028	-0.146	0.038	0.032
	[0.04,0.06]	[-0.09,-0.08]	[-0.03,-0.02]	[-0.15,-0.14]	[0.03,0.04]	[0.03,0.04]
Age^2	-0.0007	0.001	0.0002	0.0017	-0.0007	-0.0006
	[-0.0008,-0.0006]	[0.001,0.001]	[0.0001,0.0003]	[0.0017,0.0018]	[-0.0007,-0.0007]	[-0.0007,-0.0005]
adj-R^2	0.044	0.0743	0.0492	0.0891	0.1084	0.0895
# of obs.	35,494		628,618		200,919	

Note: Table 2 shows the probit regression coefficients based on the March CPS from year 1981 to 2014 using the March supplement weight. These estimations also include year fixed effects, state fixed effects, and state-specific linear time trends. Numbers in parentheses are 95% confidence interval based on robust standard errors.

2.3 Trends in Labor Market Transition Probabilities

This section looks at how the labor market transitions have evolved before and after the introduction of the ADA in 1990. We study the effects of the disability status by replacing the previous health dummy variable with a new set of health dummy variables interacting with 10-year interval time dummies, 1981-89, 1990-99, and 2000-09, respectively. Other independent variables remain the same as in equation (1).

$$\begin{aligned}&\mathbf{Pr}\left(s_{t+1}=j\right)\\ =\ &\Phi\left(\alpha_s+\beta_t+\mathbb{I}_{\{\text{disabled}\}}\left\{\gamma_1\mathbb{I}_{\{81\le t\le 89\}}+\gamma_2\mathbb{I}_{\{90\le t\le 99\}}+\gamma_3\mathbb{I}_{\{00\le t\le 09\}}\right\}+X\beta+\epsilon_i\middle|\, s_t=i\right) \quad (2)\end{aligned}$$

Tables 3 and 4 report the estimated coefficients for the health dummies as well as predicted probabilities based on the estimates. For those who are already employed, we do not see significant changes of the role of health on job separation rate (EU and EN) over time within the health groups. However, when we focus on the disabled who were out of the labor force or jobless in year t, we do see that poor health status is associated with relatively lower job finding rates (UE and NE) over time. The estimated coefficients of the disabled individuals in 1990s are approximately one standard deviation lower compared to coefficients 1980s. The gap in job finding rate increases by 2 percentage points among the unemployed and 6 percentage points among the individuals out of the labor force. The estimated coefficient for the labor market exit rate of the unemployed disabled (UN) also increases by one standard deviation after the introduction of the ADA.

TABLE 3
TRENDS IN TRANSITION PROBABILITY: COEFFICIENT ESTIMATES

t	unemployment		employment		out-of-labor-force	
$t+1$	employment	out-of-labor-force	unemployment	out-of-labor-force	employment	unemployment
Disability	-0.742	0.812	0.220	0.975	**-0.720**	-0.421
× [1981 − 89]	[-0.93,-0.55]	[0.63,0.99]	[0.10,0.34]	[0.90,1.05]	**[-0.78,-0.66]**	[-0.51,-0.33]
Disability	-0.811	0.947	0.218	1.011	**-0.966**	-0.472
× [1990 − 99]	[-1.02,-0.60]	[0.62,1.16]	[0.09,0.35]	[0.93,1.09]	**[-1.03,-0.90]**	[-0.57,-0.37]
Disability	-0.762	0.914	0.184	0.959	-1.092	-0.580
× [2000 − 09]	[-0.93,-0.59]	[0.76,1.07]	[0.06,0.31]	[0.89,1.03]	[-1.15,-1.04]	[-0.67,-0.49]
adj-R^2	0.0427	0.0719	0.0492	0.0879	0.1035	0.0903
# of obs.	35,494		628,618		200,919	

Note: Table 3 documents the probit regression coefficients based on the March CPS from year 1981 to 2014 using the March supplement weight. These estimations also include year fixed effects, state fixed effects, and state-specific linear time trends. Numbers in parentheses are 95% confidence interval based on robust standard errors.

Table 4
Predicted Transition Probabilities by Health Status

t		unemployment			unemployment	
$t+1$		employment			out-of-labor-force	
	Disabled	Nondisabled	Difference	Disabled	Nondisabled	Difference
1981-89	0.270 [0.22,0.32]	0.649 [0.63,0.67]	-0.379	0.478 [0.44,0.52]	0.137 [0.13,0.14]	0.341
1990-99	0.263 [0.21,0.32]	0.662 [0.65,0.68]	-0.399	0.530 [0.49,0.57]	0.149 [0.14,0.16]	0.381
2000-09	0.250 [0.21,0.29]	0.602 [0.21,0.31]	-0.352	0.580 [0.54,0.62]	0.200 [0.19,0.21]	0.380
t		out-of-labor-force			out-of-labor-force	
$t+1$		unemployment			unemployment	
	Disabled	Nondisabled	Difference	Disabled	Nondisabled	Difference
1981-89	0.038 [0.03,0.04]	0.297 [0.29,0.31]	-0.241	0.017 [0.01,0.02]	0.112 [0.10,0.13]	0.095
1990-99	0.040 [0.04,0.04]	0.338 [0.33,0.35]	-0.298	0.017 [0.01,0.02]	0.107 [0.09,0.12]	0.090
2000-09	0.028 [0.02,0.03]	0.333 [0.32,0.34]	-0.305	0.012 [0.01,0.01]	0.108 [0.09,0.12]	0.096

Note: Table 4 compares the predicted probabilities of labor market transitions between the individuals with work limitations (Disabled) and those are healthy (Nondisabled). Probabilities are computed at the average sample age of 41 years male. Numbers in parentheses are 95% confidence interval.

3 Empirical Analysis

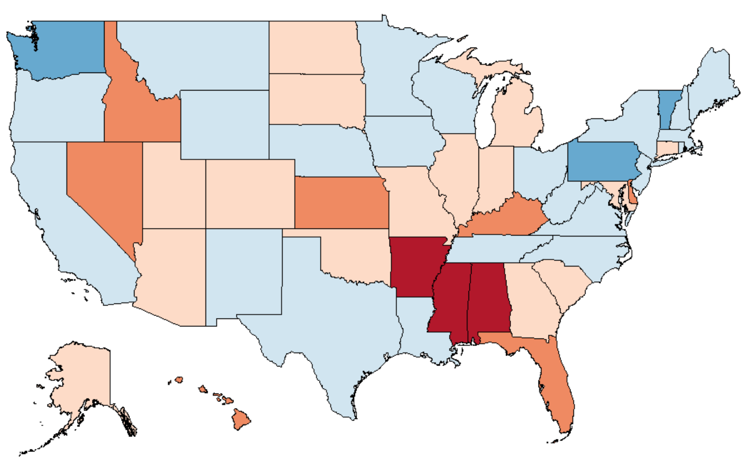
The federal ADA was signed in July 26, 1990 and became effective from July 26, 1992. The focus of our interests in empirical analysis is measuring the effects of the ADA on job flow variables of the disabled after the legislation of the ADA. We identify these effects by exploring cross-state variations in labor protection laws for the disabled workers before the implementation of the American Disability Act.

3.1 State-Level Labor Protection Laws before the ADA

We define the degree of state-level employment protection laws based on two criteria. First, following the classification of Jolls (2004), we group states into three different categories based on the similarity of between the ADA and pre-existing state-level employment laws against discrimination. The two key elements of the ADA are mandated reasonable accommodations and prohibition of disability-based discrimination. According to her definition, 18 states already had implemented state-level labor protection laws for the disabled similar to the ADA, 29 other states with limited labor protection prior to the ADA, and 3 states did not provid neither of accommodation nor prohibition of discriminiation the disabled in labor markets prior to the ADA.

The scope of these anti-discrimination policies is another important factor to consider when we evaluate the degree of employment protection. For instance, the employment protection laws of State of Idaho strictly prohibited discrimination prior to the ADA. However, the private sectors were not excluded from these laws and only public employers were covered by the laws. In this case, it is hard to conclude that the disabled residents in Idaho could claim these legal protections. To reflect the range of employment protection laws, we take Percy (1989) 's classification and ask whether both public and private employers were subject to covered. The detailed list of our classification results is summarized in 10 in Appendix A.[6]

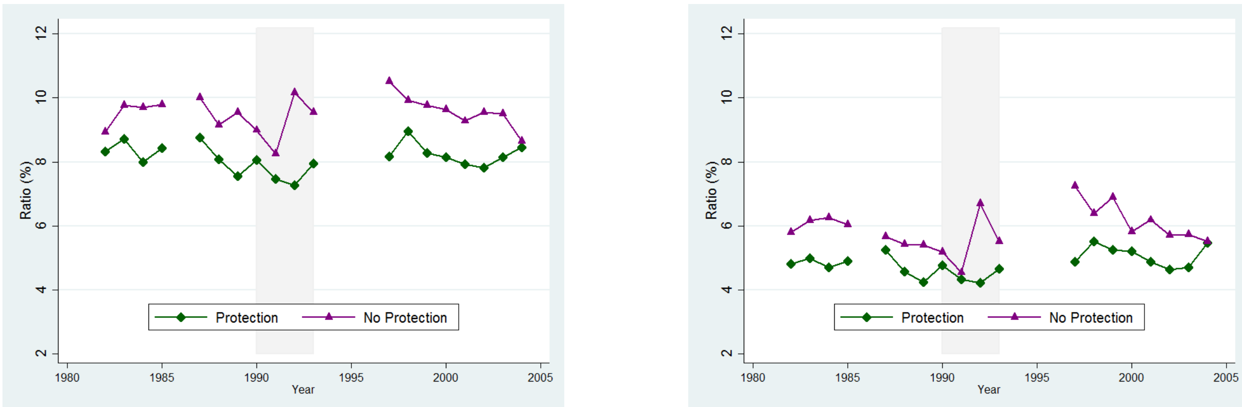
FIGURE 5
VARIATIONS IN STATE-LEVEL EMPLOYMENT PROTECTION PRIOR TO THE ADA



Note: Figure 5 illustrates the degree of employment protection laws across states prior to the legislation of the ADA in July 1990. Red color indicates weaker protection of employment. Blue colored states indicate the opposite.

[6] Percy (1989) also emphasized that states treating violation of disability laws subject to misdemeanor charges or civil penalties can be considered as imposing more restrictive discrimination laws. According to his definition, there were only 15 states treating disability-based discrimination as misdemeanor charges or civil penalties. Adding this additional criteria doesn't affect our empirical results.

Figure 6
Trends of Individuals with Work Limitations



Note: The left panel of Figure 6 illustrate the fraction of individuals in age between 21 and 65 who self-reported at least one year of work limitations. The purple line with triangle markers denotes the state-level average with no employment protections and and the green line with square markers is for the average of states with full employment protection. The right panel is the fraction of working age population reported work limitations in two consecutive years. Both averages are weighted with the March supplement weight. (Source: Authors' calcuations based on the matched March CPS from 1981 to 2014).

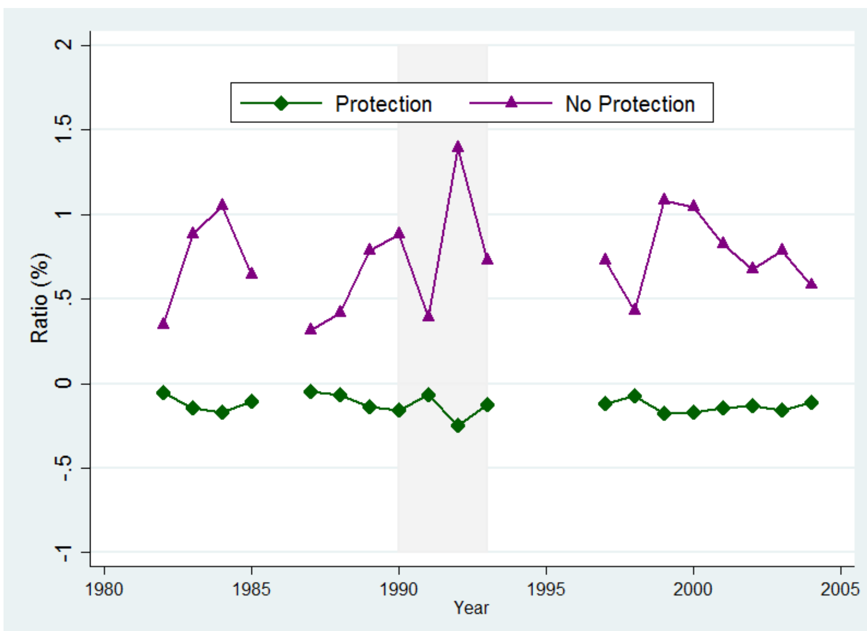
Figure 7
Trends in the Employment Rates of Individuals with Work-Limitations

Note: Figure 7 illustrates the fraction of employed individuals with work limitations. The purple line with triangle markers denotes the state-level average with no employment protections and and the green line with square markers is for the average of states with full employment protection. The right panel is the fraction of working age population reported work limitations in two consecutive years. Both averages are weighted with the March supplement weight. (Source: Authors' calcuations based on the matched March CPS from 1981 to 2014).

We define a state provided strong employment protection prior to the ADA if the the state provides at least limited provision to more than public employees. There are 39 states satisfying these criteria. Before we conduct our empirical analysis, we report time trends of labor market variables between these two groups. Figure 6 illustrates the fraction of working-age population suffering work limitations. Consistent with the aggregate trends, both groups have experienced the upward trajectory of growing share of the disabled population.

Figure 7 illustrates the fraction of employed individuals with work limitation in each state. We de-trended aggregate time trend components of the state-level employment rates. States with no employment protection records consistently lower employment rate of the disabled during the sample periods, ranging from 2 to 8 percentage points lower than the national average, and the difference in employment rate of the disabled becomes more noticeable in 1990s.

Figure 8
Trends in the Labor Market Exit Rates Caused by Poor Health



Note: Figure 8 illustrates the fraction of working-age population who cited poor health as the main cause of their job separation. The purple line with triangle markers denotes the state-level average with no employment protections and and the green line with square markers is for the average of states with full employment protection. The right panel is the fraction of working age population reported work limitations in two consecutive years. Both averages are weighted with the March supplement weight. (Source: Authors' calcuations based on the matched March CPS from 1981 to 2014).

Finally, we report the fraction of working-age individuals who left labor markets due to poor health. Figure 8 describes the fraction of working-age population either retired or left their jobs and cited their poor health as their major reason. Again, to ease the comparison between the states, we report the state-level average after subtracting the aggregate time trend. Consistent with the previous result in Figure 7, the disabled have worse labor market outcomes in states with no protection overall. Their labor market exit rates are higher than the national average by 0.5 to 1 percentage points. We also not from the figure that the difference in labor market exit rates rose during the late 1980s to early 1990s.

3.2 Empirical Model

Applying differences-in-differences, we control for time-varying factors and estimate the effect of the ADA on the transition probabilities of the disabled. The benchmark empirical model looks at how the annual transition probability of an individual from $l_t \in \{N, E\}$ to $l_{t+1} \in \{N, E\}$ evolves on state-level employment protection before and after the registration of the ADA. We define an individual is disabled if he experiences work-limitation due to his physical condition.

$$\begin{aligned} & \mathbf{Pr}\left(l_{t+1} = y \middle| l_t = x, X_{it}\right) \\ = \quad & \Phi\left[\lambda D_{\{\text{t}>1990\}} + \left(\lambda D_{\{\text{t}>1990\}} + \gamma\right) D_{\{\text{No Protection}=1\}} + t\beta_s + y_t + \alpha X_{it} + \epsilon_{it}\right] \end{aligned}$$

where ϵ represents a standard measurement error. We include individual-level characteristics such as age, education, gender, and industries (in case when we estimate transition flows coming out from E). We also include state-specific linear time trend. We also include year dummies y_t in our regression to capture the macroeconomic events of the economy. Table 5 summarizes the main empirical exercise that we test. By comparing the role of health status on the labor market transition probabilities before and after the the legislation of the ADA, we first measure the time effect.

TABLE 5
SUMMARY OF EMPIRICAL TESTS OF MODEL

	Pre-ADA	Post-ADA
Protection	λ	$\lambda + \delta$
No Protection	γ	$\gamma + \delta + \theta$

3.3 Estimation Results

TABLE 6
PREDICTED TRANSITION PROBABILITIES: E TO E

	Probit				Logit			
	Before	After	Δ	$\Delta\Delta$	Before	After	Δ	$\Delta\Delta$
Disabled in Protection	66.3 [64, 68]	70.6 [68, 73]	4.3		66.3 [64, 69]	70.7 [68, 73]	4.4	
Disabled in No-Protection	65.4 [64, 67]	62.2 [60, 65]	-3.2	-7.5	65.5 [64, 67]	62.3 [60, 65]	-3.2	-7.6
Test: $\theta = 0$	Prob $> \chi^2 = 0.0075$				Prob $> \chi^2 = 0.0089$			
Non-disabled in Protection	91.3 [91, 91]	91.4 [91, 91]			91.3 [91, 91]	91.4 [91, 91]		
Nondisabled in No-Protection	91.1 [91, 91]	91.1 [91, 91]			91.1 [91, 91]	91.1 [91, 91]		
Test: $\theta = 0$	Prob $> \chi^2 = 0.4035$				Prob$\chi^2 = 0.4336$			

Note: Table 6 reports the estimated empoloyment to employment transition of an individual based on probit and logit regression models after controlling individual characteristics and state-level characteristics using matched March CPS from 1981 to 2014 (except for 1984-1995 and 1995-1995). Numbers in brackets indicate 95% confidence intervals for the probabilitty estimates. The March supplement weights are used for both estminations. Numbers are written in percentage.

Table 7
Predicted Transition Probabilities: E to N

	Probit				Logit			
	Before	After	Δ	$\Delta\Delta$	Before	After	Δ	$\Delta\Delta$
Disabled in Protection	29.8 [27, 32]	24.9 [22, 28]	−4.9		29.8 [27, 32]	24.7 [22, 27]	−5.1	
Disabled in No-Protection	30.5 [29, 32]	32.2 [30, 35]	1.7	6.6	30.3 [29, 32]	32.1 [30, 34]	1.8	6.9
Test: $\theta = 0$	Prob $> \chi^2 = 0.0187$				Prob $> \chi^2 = 0.0244$			
Nondisabled in Protection	5.5 [5, 6]	5.5 [5, 6]	–		5.6 [5, 6]	5.6 [5, 6]	–	
Nondisabled in No-Protection	6 [6, 6]	6 [6, 6]	–	–	6 [6, 6]	6 [6, 6]	–	–
Test: $\theta = 0$	Prob $> \chi^2 = 0.7456$				Prob $> \chi^2 = 0.7028$			

Note: Table 7 reports the estimated empoloyment to employment transition of an individual based on probit and logit regression models after controlling individual characteristics and state-level characteristics using matched March CPS from 1981 to 2014 (except for 1984-1995 and 1995-1995). Numbers in brackets indicate 95% confidence intervals for the probabilitty estimates. The March supplement weights are used for both estminations. Numbers are written in percentage.

Figure 9
Estimation Results: Difference-in-Difference Estimators
Employment to Out-of-the-Labor-Force

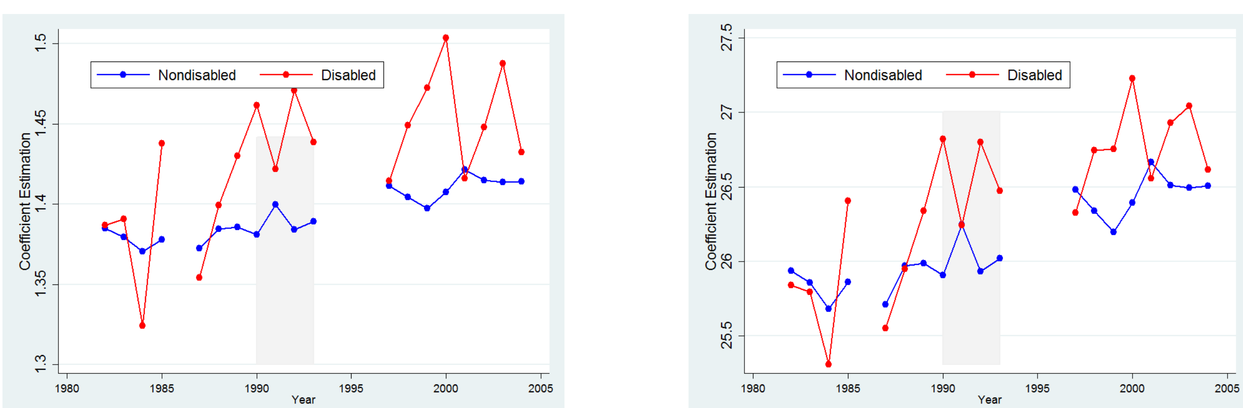


TABLE 8

PREDICTED TRANSITION PROBABILITIES: N TO E

	Probit				Logit			
	Before	After	Δ	$\Delta\Delta$	Before	After	Δ	$\Delta\Delta$
Disabled in Protection	4.3	5.3	1		4.2	5.2	1	
	[4, 5]	[4, 6]			[3, 5]	[4, 6]		
Disabled in No-Protection	3.9	3.6	−0.3	−1.3	3.9	3.5	−4	−5
	[3, 4]	[3, 4]			[3, 4]	[3, 4]		
Test: $\theta = 0$	Prob $> \chi^2 = 0.0698$				Prob $> \chi^2 = 0.0612$			
Non-disabled in Protection	17.2	21.2	4		17.3	21.3	4	
	[17, 18]	[20, 22]			[16, 18]	[20, 22]		
Nondisabled in No-Protection	18	20	2	−2	18.1	20	1.9	−2.1
	[18, 18]	[19, 21]			[18, 18]	[19, 21]		
Test: $\theta = 0$	Prob $> \chi^2 = 0.0004$				Prob $> \chi^2 = 0.00003$			

Note: Table 8 reports the estimated out-of-labor force to employment transition of an individual based on probit and logit regression models after controlling individual characteristics and state-level characteristics using matched March CPS from 1981 to 2014 (except for 1984-1995 and 1995-1995). Numbers in brackets indicate 95% confidence intervals for the probabilitty estimates. The March supplement weights are used for both estminations. Numbers are written in percentage.

FIGURE 10

ESTIMATION RESULTS: DIFFERENCE-IN-DIFFERENCE ESTIMATORS

OUT-OF-THE-LABOR-FORCE TO EMPLOYMENT

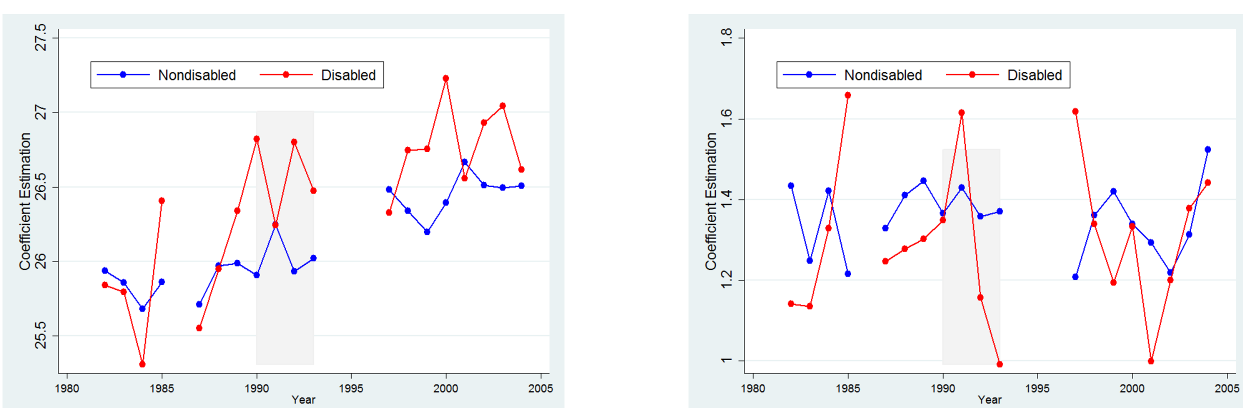


TABLE 9
PREDICTED TRANSITION PROBABILITIES: N TO N

	Probit				Logit			
	Before	After	Δ	$\Delta\Delta$	Before	After	Δ	$\Delta\Delta$
Disabled in Protection	93.9 [93, 95]	93.3 [92, 95]	−0.6		93.8 [93, .95]	93.5 [92, 95]	−0.3	
Disabled in No-Protection	94.5 [94, 95]	94.8 [94, 96]	0.3	0.9	0.946 [94, 95]	0.949 [0.94, 0.96]	0.3	0.6
Test: $\theta = 0$	Prob $> \chi^2 = 0.3696$				Prob $> \chi^2 = 0.4036$			
Non-disabled in Protection	78.6 [78, 79]	74.7 [0.74, 0.76]	−3.9		78.4 [78, 79]	74.6 [74, 76]	−3.8	
Nondisabled in No-Protection	77.9 [77, 78]	76.1 [75, 77]	1.8	57	77.7 [77, 78]	76 [75, 77]	−1.7	2.1
Test: $\theta = 0$	Prob $> \chi^2 = 0.0011$				Prob $> \chi^2 = 0.0007$			

Note: Table 9 reports the estimated transition probability from out-of-labor force to out-of-labor force based on probit and logit regression models after controlling individual characteristics and state-level characteristics using matched March CPS from 1981 to 2014 (except for 1984-1995 and 1995-1995). Numbers in brackets indicate 95% confidence intervals for the probabilitty estimates. The March supplement weights are used for both estminations. Numbers are written in percentage.

4 The Model

In Section 2 we showed that despite the legislation of the ADA, the performance of disabled individuals in the labor markets has worsened compared to 1980s. These trends are detectable both in job finding rates and labor force participation rates. In this section, we build a general equilibrium model of the labor market and provide a framework to analyze the effects of the government's employment protection policy.

4.1 Environments

The economy is populated by a unit measure of workers who are heterogeneous in their health status, $h \in \mathcal{H} \equiv [\underline{h}, \overline{h}]$. Health status h is fully observable. The measure of workers with health status h

is denoted by π_h, with $\sum_h \pi_h = 1$. The worker's health status determines his net productivity. A worker with high health h produces higher net output $y(h)$, and thus $y'(h) > 0$.[7]

In each period, a worker can be either employed (E), unemployed (U), or not in the labor force (N). Workers value consumption (x) and have a period utility function represented by $u_h(x)$, where $u_h : \mathbb{R}_+ \to \mathbb{R}$ is twice differentiable and strictly increasing. They discount the future at rate $\beta \in (0, 1)$. Workers who are not employed (both unemployed workers and those not in the labor force) collect b units of consumption goods, which represent the value of leisure. Unemployed workers search for a job, which incurs a fixed utility cost of c. Workers who are not employed can decide whether to participate in the labor market (U) or opt out of the labor force (N).

Each firm operates a constant returns to scale production technology, and turns one unit of type-h labor into $y(h)$ units of consumption. Workers and firms meet and produce output in frictional labor markets. There is a continuum of submarkets that differ in wage contracts $\boldsymbol{w} \equiv \{w(h)\}_{h\in\mathcal{H}}$. When a firm meets a type-h worker in a submarket, the firm offers an employment contract that pays $w(h)$ every period until the match is dissolved with an exogenous probability of δ.[8]

Search process in the labor market is directed. Once a worker decides to participate in the labor market, he chooses a submarket (characterized by wage contracts) to apply to. Similarly, firms choose a submarket $\boldsymbol{w}$ to enter and post vacancies. Firms pay a cost κ per vacancy. We denote the market tightness of a submarket with wage contract $\boldsymbol{w}$ as

$$\theta(\boldsymbol{w}) \equiv \frac{\int_{h\in\mathcal{H}} u_h(\boldsymbol{w})\, dh}{v(\boldsymbol{w})},$$

the ratio of total measure of unemployed workers $\left(\int_{h\in\mathcal{H}} u_h(\boldsymbol{w})\, dh\right)$ to vacancy $(v(\boldsymbol{w}))$. Within a submarket, the matches are determined by a constant returns to scale matching function $m(u, v) = u^\eta v^{1-\eta}$. Thus, the probability of filling a vacancy in a submarket is represented by

$$q(\theta(\boldsymbol{w})) \equiv \frac{m(u, v)}{v} = m\left(\frac{1}{\theta(\boldsymbol{w})}, 1\right)$$

[7]Even if there is no difference in productivity, the net output of workers can be different by health types, if unhealthy workers incur additional costs. Here, we are agnostic about where the difference comes from: healthy workers might have higher productivity than the unhealthy; or it might also be that both workers have the same productivity, but the disabled requires (costly) equipments (accommodations) to perform their tasks.

[8]We assume that firms and workers fully commit to this contract.

and the job finding rate of a worker, by

$$p\left(\theta\left(\boldsymbol{w}\right)\right)\equiv\frac{m(u,v)}{u}=\theta\left(\boldsymbol{w}\right)q\left(\theta\left(\boldsymbol{w}\right)\right).$$

In the next section, we formally define the competitive equilibrium of the model, in the absence of government intervention.

4.2 A Competitive Equilibrium without Employment Protection

Given the economic environment described in the previous section, we now present the problem of workers and firms, after which we present the definition and properties of the competitive equilibrium without government policy.

4.2.1 Problem of Workers

In this economy, workers can either be employed, unemployed, or out of the labor force. We start by describing the decision problem of an employed worker. Equation (3) presents the value of an employed worker if type h, with wage w:

$$W_h\left(w\right) = u_h\left(w\right)+\beta\left[\left(1-\delta\right)W_h\left(w\right)+\delta\max\left\{U_h,N_h\right\}\right]. \tag{3}$$

The employed type-h worker enjoys a flow utility of $u_h\left(w\right)$ until the match is dissolved, which happens at rate δ. When the match is destructed, the worker can either choose to be unemployed and search for a job, or exit the labor force, whose values are expressed as U_h and N_h, respectively. A non-employed worker makes a labor market participation decision by comparing the value of being unemployed U_h and the value of being out of the labor force N_h.

Unemployed workers value leisure $u_h\left(b\right)$ and pay a flow cost of c from searching. Since job search is directed, each unemployed worker chooses a submarket $\boldsymbol{w}$ to search for a job, that maximizes his expected utility. Workers face submarket-specific job finding probability, $p\left(\theta\left(\boldsymbol{w}\right)\right)$. If the worker does not find a job, he can make labor market participation decision again. Thus, their value functions can be written as:

$$U_h = u_h\left(b\right)-c+\beta\left[\max_{\boldsymbol{w}}p\left(\theta\left(\boldsymbol{w}\right)\right)W_h\left(w\left(h\right)\right)+\left(1-p\left(\theta\left(\boldsymbol{w}\right)\right)\right)\max\left\{U_h,N_h\right\}\right].$$

The non-participants also enjoy leisure that yield utility of $u_h\left(b\right)$ in the current period, and their value functions are expressed as:

$$N_h \quad = \quad u_h\left(b\right) + \beta \max\left\{U_h, N_h\right\}.$$

4.2.2 Problem of Firms

A firm which is matched with a type-h worker at wage w collects the residual after paying out wage w until the job is destructed exogenously at rate δ:

$$J_h(w) \quad = \quad y\left(h\right) - w + \beta\left(1-\delta\right) J_h\left(w\right),$$

where $y\left(h\right)$ is the net output of a type-h worker.

Since firms offer contracts of the form $\boldsymbol{w} = \left\{w\left(h\right)\right\}_{h\in\mathcal{H}}$, which potentially attracts multiple types of workers, the expected value of posting a vacancy in a submarket $\boldsymbol{w}$ is

$$V = -\kappa + \max_{\boldsymbol{w}} q(\theta(\boldsymbol{w})) \int_{h\in\mathcal{H}} \tilde{s}_h(\boldsymbol{w}) J_h(w) dh,$$

where $\tilde{s}_h(\boldsymbol{w}) \equiv \dfrac{s_h\left(\boldsymbol{w}\right)}{\displaystyle\int_{h\in\mathcal{H}} s_h\left(\boldsymbol{w}\right) dh}$ is the share of type-h workers in submarket $\boldsymbol{w}$. In equilibrium, there is free entry of firms and the expected return from creating a vacancy in each submarket should satisfy

$$\kappa \quad \geq \quad q(\theta(\boldsymbol{w})) \int_{h\in\mathcal{H}} \tilde{s}_h(\boldsymbol{w}) J_h(w\left(h\right)).$$

4.2.3 Competitive Equilibrium

Now we define the recursive equilibrium of this economy.

Definition 1. *A recursive equilibrium comprises of a set of value functions* $\left\{W_h\left(w\right), U_h, N_h\right\}_{h\in\mathcal{H}}$ *and associated policy functions of workers* $\left\{g_S^*\left(h\right), l^*\left(h\right)\in\{0,1\}\right\}$*; the firms' value functions* $\left\{J_h\left(w\right)\right\}_{h\in\mathcal{H}}$*, and their wage posting policy functions* $\left\{g_P^* = \left(w\left(h\right)\right)_{h\in\mathcal{H}}\right\}$*; and equilibrium outcomes* $\left\{e\left(h\right), \upsilon\left(h\right), n\left(h\right)\right\}_{h\in\mathcal{H}}$*, the measure of employed, unemployed, and non-participants for each health type h; and* $\left\{\theta\left(\boldsymbol{w}\right), \left(s_h\left(\boldsymbol{w}\right)\right)_{h\in\mathcal{H}}\right\}_{\boldsymbol{w}}$ *where* $\theta\left(\boldsymbol{w}\right)$ *is the market tightness for all submarkets and* $s_h\left(\boldsymbol{w}\right)$ *represents the share of type-h workers in each submarket* $\boldsymbol{w}$ *such that:*

1. *(Worker Optimization.) Given* $G \equiv \left\{\boldsymbol{w} | \theta\left(\boldsymbol{w}\right) > 0\right\}$ *(the set of active submarkets),* $l^*\left(h\right)$ *and*

$g_S^*(h)$ *solve the maximization problem of workers' labor search for* $\forall h \in \mathcal{H}$.

- $l^*(h) = 0$ *if and only if* $N_h > U_h$.
- *For* $\tilde{\boldsymbol{w}} \in G$, *there are* $s_h(\tilde{\boldsymbol{w}})$ *measure of workers who find* $g_S^*(h) = \tilde{\boldsymbol{w}}^*$,

$$\tilde{\boldsymbol{w}}^* \in \arg\max p(\theta(\boldsymbol{w}))(W_h(w_h) - U_h)$$

2. *(Firm Optimization.) Given the set of active submarkets* G *and the distribution of job searchers, firms maximize profit by choosing optimal vacancy posting policy,* g_P^*.
3. *(Free Entry of Firms.) Firms posting vacancy make zero-profit:* $\forall \boldsymbol{w} \in G$,

$$\kappa = q(\theta(\boldsymbol{w})) \int_{h \in \mathcal{H}} \tilde{s}_h(\boldsymbol{w}) J_h(w) dh.$$

4. *(Unemployed Workers in Submarkets.)* $\sum_{\boldsymbol{w}} s_h(\theta(\boldsymbol{w})) = \upsilon_h$, *for* $\forall h \in \mathcal{H}$.
5. *(Labor Market Clearing by Type.)* $\upsilon_h + n_h + e_h = \pi_h$, *for* $\forall h \in \mathcal{H}$

Given the definition of competitive equilibrium, we now characterize several properties of the equilibrium without government intervention.

4.2.4 Characterization of Competitive Equilibrium

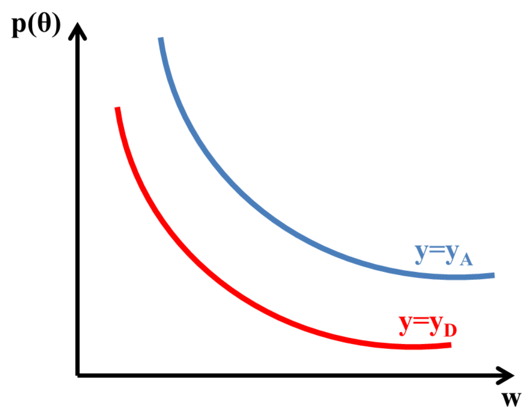
We show that each submarket only attracts one type of worker: that is, the market is endogenously segregated.

Proposition 2. *(Endogenous Segregation) If* $\boldsymbol{w} \in G \equiv \{\boldsymbol{w} | \theta(\boldsymbol{w}) > 0\}$, *then* $\tilde{s}_i(\boldsymbol{w}) \in \{0, 1\}$.

Proof. Suppose, in equilibrium, there exists an active submarket where two different types of workers, $h = A$ and $h = D$, enter. That is, with the posting wage $\boldsymbol{w} = (w_A, w_D)$, $s_A(\boldsymbol{w}) > 0$ and $s_D(\boldsymbol{w}) > 0$, so that $\tilde{s_h} \in (0, 1)$ for both $h = A, D$. If $y_A - w_A \geq y_D - w_D$, let $\tilde{\boldsymbol{w}} = (w_A, 0)$. Then, a firm offering $\tilde{\boldsymbol{w}}$ gets higher profit by offering the new contract (strictly higher profit with inequality). Thus, by zero-profit condition, the submarket with such a contract must have a higher market tightness. Then, the worker is strictly better off applying to the submarket with a contract $\tilde{\boldsymbol{w}}$. This is a contradiction to $s_A(\boldsymbol{w}) > 0$. If $y_A - w_A < y_D - w_D$, then a submarket with $\tilde{\boldsymbol{w}} = (0, w_D)$ selectively attracts type D workers. □

Now, we compare the equilibrium labor market outcomes of workers with different health status. For simplicity, we use two types of workers to characterize equilibrium, but all results hold for multiple types of workers. We denote healthy workers as A-type workers (non-disabled workers), and unhealthy workers as D-type workers (disabled workers).

FIGURE 11
WAGE AND JOB FINDING RATE IN COMPETITIVE EQUILIBRIUM



Market Tightness. From Proposition 2 we can rewrite $\theta(\boldsymbol{w})$ as $\theta_h(w)$ to denote the market tightness of the submarket with h-type workers with the wage of w. Therefore, the free-entry condition can be simplified

$$\begin{aligned}\kappa &\geq q\left(\theta_h\left(w\right)\right) J_h\left(w\right) \\ &= q\left(\theta_h\left(w\right)\right)\left[\frac{y_h - w}{1-\beta\left(1-\delta\right)}\right]\end{aligned}$$

as in the standard directed search model. For any active submarkets with $\theta_h\left(w\right) > 0$, we then have

$$\theta_h\left(w\right) = q^{-1}\left[\frac{\kappa\left\{1-\beta\left(1-\delta\right)\right\}}{y_h - w}\right].$$

It is straightforward to show that for a given wage rate w, the market tightness of A workers is higher than that of D workers, $\theta_A > \theta_D$, if $y_A > y_D$.

Equilibrium Wage and Job Finding Rate. In order to study the properties of the equilibrium wage and market tightness, we now consider the workers' problem, assuming for simplicity that the utility functions are identical: $u_A(\cdot) = u_D(\cdot)$.[9]

First, consider the case in which $l_h^* = 1$, i.e., $U_h > N_h$ for both types of workers. The unemployed workers choose a submarket in which to search for a job by solving

$$\max_{\theta_h(w)} p\left(\theta_h(w)\right)\left\{W_h(w) - U_h\right\},$$

whose associated first order condition reads

$$\frac{d}{dw}\left[p\left(\theta_h(w)\right)\left\{W_h(w) - U_h\right\}\right] = 0$$

for a worker type h. We can rewrite the first order condition as

$$\frac{\left(y_h - w_h^*\right) u_h'\left(w_h^*\right)}{1-\beta(1-\delta)} = \frac{1-\eta}{\eta}\frac{u_h\left(w_h^*\right) - u_h(b) + c}{1-\beta\left\{1-\delta-p\left(\theta_h\left(w_h^*\right)\right)\right\}}. \tag{4}$$

The left-hand-side (LHS) of the equation reflects the marginal benefit of searching in a submarket with higher wage, which is monotonically decreasing in w_h^*. On the other hand, the right-hand-side (RHS) represents the marginal cost of doing so, adjusted by the job finding rate, which is monotonically increasing in w_h^*. Thus, there exists a unique optimal wage w_h^* that maximizes the option value of labor search for each type h worker, which we graphically show in Figure 12. Using the optimal condition for the workers, we prove the following.

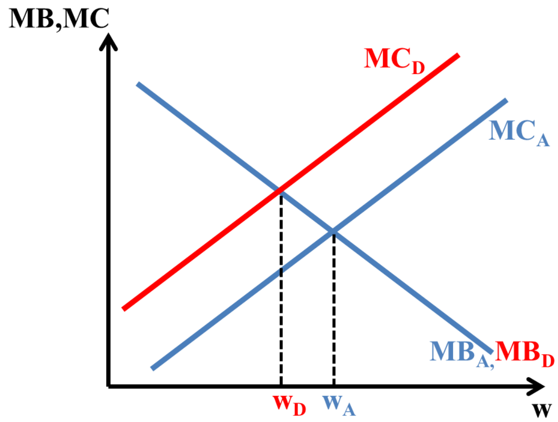
Proposition 3. *In a competitive equilibrium, more productive workers receive higher wage and their job finding rate is also higher than their less productive counterparts:*

$$0 \leq \frac{dw_h^*}{dy_h} \leq 1 \quad \textit{and} \quad \frac{d\theta_h^*}{dy_h} \geq 0.$$

Proof. Apply Implicit Function Theorem on the first order condition (4) above. □

[9] Finkelstein et al. (2013) shows that the marginal utility of consumption of the unhealthy is lower than that of the healthy. In this model, such assumption translates to $\sigma_D > \sigma_A$ if preferences are represented by a CRRA utility function, with risk aversion parameter of σ.

Figure 12
Wage and Job Finding Rate in Competitive Equilibrium



Since the equilibrium tightness is characterized by

$$\theta_h(w) \quad = \quad \left[\frac{y_h - w}{\kappa\{1-\beta(1-\delta)\}}\right]^{\frac{1}{\eta}}$$

the LHS of A workers is lower than that of D workers for all w, and $1-\beta\{1-\delta-p(\theta_D(w))\} < 1-\beta\{1-\delta-p(\theta_A(w))\}$. This implies that the equilibrium wages are higher for non-disabled workers: $w_A^* > w_D^*$.

As $y_A > y_D$, it is straightforward to show that the A-type workers also face higher job finding rate, and lower unemployment rate than the D-type workers.

Labor Market Participation. We have characterized the competitive equilibrium outcomes where both types of workers participate in the labor market. Now, we change our gears and study the worker's labor force participation decision. Type-h workers opt out of the labor market if and only if $N_h \geq U_h$, or

$$c \quad \geq \quad \beta \max_w p(\theta_h(w))[W_h(w) - N_h].$$

It is obvious that if non-disabled (A-type) workers do not participate in the labor market, then disabled workers also opt out as

$$p(\theta_A(w_A^*))[W_A(w_A^*) - N_A] > p(\theta_D(w_D^*))[W_D(w_D^*) - N_D].$$

This section summarized some of the key properties of the competitive equilibrium of the model. If the net output of disabled workers are strictly lower than that of non-disabled workers, wage and job finding rate of non-disabled workers are lower, and unemployment rate is higher than their non-disabled counterparts. Moreover, disabled workers are more likely to drop out of the labor force. In the next, we consider the effects of implementing government policies on disabled workers.

4.3 Analyzing the Effects of the Americans with Disabilities Act

Now, we introduce the Americans with Disabilities Act into our model and analyze the consequences of the employment protection policies. The ADA has three main clauses: no discrimination in hiring, no discrimination in firing, and providing reasonable accommodations to disabled employees. It is well-known that the ADA is costly to implement (see, for example, Acemoglu and Angrist (2001)): firms who face possible lawsuits from their employees buy Employment Practices Liability Insurance (EPLI), and they need to provide extra accommodations for employees (providing flexible hours, as well as equipments). We model each clause with associated costs and re-write the firm's problem to reflect the policy.

When a firm separates with its disabled employee, it can face a lawsuit whose expected cost is C_f. Similarly, a firm faces additional costs C_a as its disabled employee can demand reasonable accommodation under the ADA. Therefore, the expected value decreased to $\tilde{J}_D$ such that

$$\begin{aligned} \tilde{J}_D(w) &= (y_D - C_a) - w + \beta \left\{ (1-\delta) \tilde{J}_D(w) - \delta C_f \right\} \\ &= \tilde{y}_D - w + \beta (1-\delta) \tilde{J}_D(w) \end{aligned}$$

where $\tilde{y} = y_D - C_a - \beta\delta C_f$. Expected costs in employment and firing stages effectively lower the productivity of disabled employees from y_D to $\tilde{y}_D$.

Now, we turn into hiring stage and analyze the effects of government's another policy tool in the ADA, which is the hiring discrimination clause. Similar to the case in firing, we assume that firms face hiring cost C_h when it preferentially hires a non-disabled worker by offering a differential wage contracts. For simplicity, we focus on two cases: (i) a law-abiding equilibrium where firms treat both workers equally by posting equal wages regardless of health status and (ii) the equilibrium in which firms pay the penalty and post discriminatory wage contracts based on candidate's health status. In the following proposition, we characterize the first type of equilibrium.

Under the ADA with full compliance, both workers enter the same submarket where composition of workers are equivalent to population share:

$$\tilde{s_h}(w) = \frac{\pi_h}{\pi_A + \pi_D} = \pi_h, \quad \forall h \in \{A, D\}.$$

From the zero-profit condition,

$$q(\theta_p)\left[\pi\left\{\frac{y_A - w(\theta_p)}{1-\beta(1-\delta)}\right\} + (1-\pi)\left\{\frac{\tilde{y}_D - w(\theta_p)}{1-\beta(1-\delta)}\right\}\right] = \kappa,$$

where the index p denotes the pooling labor markets. Thus, the expected output and the associated market tightness are:

$$\theta_p(w) = \left[\frac{\bar{y} - w}{\kappa\{1-\beta(1-\delta)\}}\right]^{\frac{1}{\eta}},$$

where $\bar{y} = \pi y_A + (1-\pi)\tilde{y}_D$.

What would be the expected return from a deviation? When a firm posts a wage contract $(w, 0)$, it can exclusively hire healthy workers. Due to the ADA, however, the firm faces a potential lawsuit whose expected cost is C_h. Under the discrimination in hiring against the disabled, the zero-profit condition of posting a discriminatory wage contract would be

$$q(\theta_s)\left\{\frac{y_A - w(\theta_s)}{1-\beta(1-\delta)}\right\} = C_h + \kappa.$$

where θ_s indicates the market tightness in segregated labor markets by health types. Denoting $\tilde{y}_A \equiv y_A - C_h(1-\beta(1-\delta)) < y_A$, we can show that the introduction of the cost C_h reduces the net profit of hiring a *non-disabled* workers. Using the notation, the above free entry condition can be written as

$$q\left(\tilde{\theta}_s\right)\left\{\frac{\tilde{y}_A - w(\theta_s)}{1-\beta(1-\delta)}\right\} = \kappa,$$

and the market tightness (for a given wage rate),

$$\tilde{\theta}_s(w) = \left[\frac{\tilde{y}_A - w}{\kappa\{1-\beta(1-\delta)\}}\right]^{\frac{1}{\eta}}.$$

Finally, this separation will arise in equilibrium only when healthy workers prefer to participate the segregated submarkets compared to the pooling submarkets:

$$\max_{\{\theta_s\}} p(\theta_s)\{W_A(w(\theta_s)) - U_A\} \quad \geq \quad \max_{\{\theta_p\}} p(\theta_p)\{W_A(w(\theta_p)) - U_A\}.$$

With the assumption of linear utility function, this condition is equivalent to

$$\frac{y_A - w}{C_h + \kappa} \quad > \quad \frac{\pi y_A + (1-\pi)\tilde{y}_D - w}{\kappa}$$

from the zero-profit condition in the labor market. Intuitively, as long as the benefit from discrimination (selective hiring of healthy workers) outweigh the cost C_h, the ADA cannot be sustained. The benefit depends on two components – relative productivity difference across health types, and the population composition of health distribution. Rearranging terms, we get

$$\frac{\pi}{1-\pi} + \frac{\tilde{y}_D - w}{(1-\pi)(y_A - \tilde{y}_D)} \quad < \quad \frac{\kappa}{C_h}$$

where $\tilde{y} = y_D - C_a - \beta\delta C_f$. For given policy parameters, C_h, C_f and C_a, firms are more likely to post discriminatory wage contracts and pay penalties if there is larger difference in the net productivity across health status. On the other hand, as the proportion of healthy workers π increases, pooling markets can be supported in equilibrium.

5 Conclusion

In this paper, we analyze the effects of strengthening policies aimed towards disabled workers: disability insurance and the Americans with Disabilities Act. To motivate our analysis, we document stylized facts summarizing labor market outcomes of disabled workers, relative to non-disabled workers. Then, we build a directed search model with heterogeneous health status and three labor market states. Our model is suitable for understanding the response of both workers and firms to the changes in government policies. Disability insurance increases the outside option of disabled workers and drives up their outside option, which reduces firms' hiring incentives. On the other hand, the Americans with Disabilities Act lowers the firm's net profit from employing both non-disabled and disabled workers. As a result, in equilibrium, both types of workers suffer from lower wage and lower job finding probability. Our policy analysis (when both DI and the ADA are in place) is consistent with the aggregate trends we document, and imply that the government's effort to improve the welfare of disabled workers might have unintended consequences in equilibrium. However, we also theoretically show that the result might not always be so welfare-inferior. If the government manages to perfectly enforce the ADA (through prohibitively large penalties incurred to firms upon violating the law, for example), then the labor market is perfectly pooled: both types of workers receive the same wage rates and face the same job finding rate probabilities. Under such equilibrium, the welfare of disabled workers might improve (potentially, at the expense of non-disabled workers).

In the future, we aim to empirically test the predictions of our model and conduct quantitative analysis. The magnitude of the effects of the ADA depends heavily on productivity effects of health. We would like to exploit cross-industry differences in productivity of disabled and non-disabled workers to identify the magnitude of firm responses to the regulation (general equilibrium effect). Moreover, before the enactment of the ADA, states also had regulations of their own. We can use the cross-state variation in the ADA to identify the cost and impact of the law. Lastly, we would like to conduct a quantitative analysis to decompose the effects of the ADA and DI to understand the interaction between the two regulations, and analyze how to optimally coordinate the policies. We leave these interesting research agendas for the future.

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A Data Appendix

A.1 Construction of the Matched March CPS

This appendix describes the linking process of the panel data set we used for the empirical analysis in Section 3. The March supplement of the Current Population Survey (March CPS) is a cross-sectional data set that collects information based on housing unit, and not a standard panel data set that keep tracks of individuals over time. However, thanks to its rotation-based sample design in 16-month interval, researchers can map unique housing units (HH-IDNUM) in month 1 through 4 in year t from those in month 5 through 8 in year $t+1$. These matched housing unites, which account nearly 50% of the the entire sample of the March CPS, are potential candidates for our empirical analysis.[10]

In general, the residents in the housing unit can change during the matched sample periods. Following Madrian and Lefgren (2000), we use demographic information of the resident (A-LINENO) within the housing unit - sex, age, and educational attainment - to assure that we are tracking the same individuals over two consecutive years. This filtering process reduces the matched observations to to approximately 40%. Detailed information is summarized in Table **??**.

A.2 Construction of State-Level Employment Protection Variables

B Robustness Analysis

We focus on the transition of $\{E, N\}$ due to the limited number of observations of individuals with disability involved in unemployment status. Here are the tables of our estimation results. Although the estimated transition probabilities are not significant,

[10]March CPS datasets for this analysis are downloaded from the National Bureau of Economic Research: http://www.nber.org/cps/

Table 11
Predicted Transition Probabilities: U to E

	Probit				Logit			
	Before	After	**ΔPr**	**ΔΔPr**	Before	After	**ΔPr**	**ΔΔPr**
Disabled in Protection	0.238	0.300	0.062		0.238	0.301	0.063	
	[0.18, 0.29]	[0.22, 0.38]			[0.18, 0.29]	[0.22, 0.38]		
Disabled in Weaker Protection	0.256	0.234	−0.022	-0.084	0.258	0.234	−0.024	-0.087
	[0.22, 0.30]	[0.18, 0.29]			[0.22, 0.30]	[0.18, 0.29]		
Test: $\theta = 0$		Prob > $\chi^2 = 0.1457$				Prob > $\chi^2 = 0.1539$		
Non-disabled in Protection	0.494	0.531	0.037		0.494	0.531	0.037	
	[0.48, 0.51]	[0.51, 0.56]			[0.48, 0.51]	[0.51, 0.56]		
Non-disabled Weaker Protection	0.505	0.527	0.022	−0.015	0.505	0.527	0.022	−0.015
	[0.49, 0.52]	[0.51, 0.55]			[0.49, 0.52]	[0.51, 0.55]		
Test: $\theta = 0$		Prob > $\chi^2 = 0.4375$				Prob > $\chi^2 = 0.4418$		

Note: Figure 11 reports the estimated unemployment to employment transition of an individual based on probit and logit regression models after controlling individual characteristics and state-level characteristics using matched March CPS from 1981 to 2014 (except for 1984-1995 and 1995-1995). Numbers in brackets indicate 95% confidence intervals for the probabilitty estimates. The March supplement weights are used for both estminations.

Table 12

Predicted Transition Probabilities: E to U

	Probit				Logit			
	Before	After	**ΔPr**	**$\Delta\Delta$Pr**	Before	After	**ΔPr**	**$\Delta\Delta$Pr**
Disabled in Protection	0.039	0.046	0.007		0.039	0.046	0.007	
	[0.03, 0.05]	[0.03, 0.06]			[0.03, 0.05]	[0.03, 0.06]		
Disabled in Weaker Protection	0.043	0.056	0.014	0.007	0.042	0.056	0.014	0.007
	[0.034, 0.05]	[0.04, 0.07]			[0.034, 0.05]	[0.04, 0.07]		
Test: $\theta = 0$	Prob $> \chi^2 = 0.5297$				Prob $> \chi^2 = 0.5736$			
Non-disabled in Protection	0.031	0.029	-0.002		0.031	0.029	-0.002	
	[0.03, 0.03]	[0.03, 0.03]			[0.03, 0.03]	[0.03, 0.03]		
Non-disabled Weaker Protection	0.029	0.031	0.002	0.004	0.029	0.031	0.002	0.004
	[0.03, 0.03]	[0.03, 0.03]			[0.03, 0.03]	[0.03, 0.03]		
Test: $\theta = 0$	Prob $> \chi^2 = 0.0480$				Prob $> \chi^2 = 0.0613$			

Note: Figure 12 reports the estimated empoloyment to employment transition of an individual based on probit and logit regression models after controlling individual characteristics and state-level characteristics using matched March CPS from 1981 to 2014 (except for 1984-1995 and 1995-1995). Numbers in brackets indicate 95% confidence intervals for the probabilitty estimates. The March supplement weights are used for both estminations.

Table 10
The Degree of State-Level Employment Protection Prior to the ADA

I. ADA-like state laws pre-eixted.		
Full Protection	Weak Protection	No Protection
Arizona, Colorado, Delaware, Idaho, Iowa, Louisiana, Massachusetts, Minnesota, New Mexico, North Carolina, Oregon, Pennsylvania, Rhode Island, Vermont, Virginia, Washington, Wisconsin, Wyoming	Alaska, California, Connecticut, Florida, Georgia, Hawaii, Illinois, Indiana, Kansas, Kentucky, Maine, Maryland, Michigan, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New York, North Dakota, Ohio, Oklahoma, South Carolina, South Dakota, Tennessee, Texas, Utah, West Virginia	Alabama, Arkansas, Mississippi

II. Both public and private employers covered by the laws		
Full Protection	Weak Protection	No Protection
California, Connecticut, Georgia, Illinois, Indiana, Iowa, Louisiana, Maine, Maryland, Massachusetts, Michigan, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, Wyoming	Alaska, Arizona, Colorado, Florida, Hawaii, Kansas, Kentucky, Minnesota, Nevada,	Alabama, Arkansas, Delaware Idaho, Mississippi,

III. Discrimination is misdemeanore charges or civil penalties
Full Protection
Alaska, California, Maine, Minnesota, Montana, Nebraska, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Tennessee, Texas, Vermont, Washington, West Virginia