

**Effects of Disability-Based Underwriting Prohibitions
on the Labor Market**

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Abstract

In the United States, about two thirds of the non-elderly population obtains health insurance coverage through an employer, either of one's own or a family member's. State governments have enacted regulations that prohibit the use of a variety of underwriting criteria, ostensibly to make insurance more affordable to those who would have otherwise been denied coverage or charged higher rates. Browne and Frees (2004) examine how underwriting restrictions affect the insurance market. This study tests whether the regulations that restrict the use of disability status as criterion for the purposes of underwriting on the small group insurance market have different impacts on the employment of the disabled and the able-bodied people.

Research generally supports the theory that employment based health insurance impacts the labor market because the coverage provided by employers constitutes a portion of employment costs. The literature suggests group insurance regulations tend to affect the labor market through eligibility for group coverage and premium rates. The underwriting restrictions may have different effects on the premium rates of different groups, and hence impose different effects on the labor market outcomes of these groups. Using the Current Population Survey and state statutes this paper examines whether the underwriting restrictions are associated with changes in (1) employment status, (2) firm size, and (3) wages of two separate groups of people, namely, the disabled, and the able-bodied.

The findings suggest, in states and years when disability is prohibited as an underwriting criterion, able-bodied workers are more likely to be hired by small firms, and they are paid more than those in states without such restrictions.

1. Introduction

Since the mid-1980s, the percentage of the U.S. population without health insurance has increased. For many individuals, the high cost of health insurance is a major obstacle to obtaining coverage. In an effort to lower the hurdle for portions of the population facing high premium, including females, older individuals and those suffering from disabilities, state governments have enacted insurance regulations to restrict the underwriting practices of insurance companies. For example, some states prohibit the use of gender, age, or disability status as criteria for the purposes of risk classification and pricing of health insurance sold in both the individual and group markets. The ostensible purpose of these regulations is to decrease the cost of health insurance for higher risk individuals.

Have these underwriting prohibitions made health insurance more affordable and accessible? Browne and Frees (2004) study the impact of underwriting regulations on the health insurance market for small businesses. They find that prohibitions on the use of disability status in underwriting are associated with reductions in the likelihood that able-bodied individuals will obtain group insurance, and with increases in the likelihood that the disabled will obtain group health insurance coverage. They report that underwriting prohibitions on the use of age and gender have similar effects.

An important question raised, but not answered, by their study is whether employers respond to health insurance underwriting regulations with changes in their hiring practices. In particular, do employers discriminate in the labor market when they are prohibited from engaging in risk selection and differential pricing in the group insurance market? If so, health insurance underwriting prohibitions may be associated with changes in the labor market outcomes of individuals whose insurance statuses would be impacted by the regulations. Few studies have been conducted to test the possible effects of underwriting prohibitions on the labor market. This research is intended to contribute to this area by identifying any changes in employment status and wage of certain demographic groups following the enactment of the prohibitions.

Kapur (2003, 2004) and Kaestner and Simon (2002) study the impact of the small group health insurance reforms on the hiring practices of small firms. The small group health insurance reforms, which include the restrictions on underwriting, refer to a collection of insurance regulations enacted by states to improve the accessibility and affordability of health insurance to small businesses. Using medical expenditure data, Kapur (2004) finds that before the reforms, small firms offering health insurance were less likely to employ workers with families of potential higher medical costs than large insured firms. Insured small firms, after the enactment of reforms, are less likely to employ workers with certain conditions. Kapur (2003) uses Current Population Survey (CPS) data to examine whether small group reforms increase the likelihood for high risk workers to be hired by small firms. She concludes that the effect of the reforms on small firm hiring and job mobility of costly subgroups is often statistically insignificant. Kaestner and Simon (2002) also use CPS data to examine the impacts of these reforms on employment, hours worked and wages of small firm employees, but again, find insignificant effects.

The present research departs from previous ones in several aspects. First, this research focuses on the labor market effect of a specific underwriting restriction, instead of the whole package of the small group reforms. By focusing on disability-based underwriting restriction, it is possible to isolate and capture disability effects. Second, the specific underwriting restriction is designed to remove obstacles for disabled people to obtain health insurance. This paper examines whether the underwriting prohibition is associated with changes in the employment status of the disabled who are more favorably underwritten and the able-bodied who are less favorably underwritten as a result of the prohibition; specifically, whether small employers are more likely to hire the disabled or the able-bodied than they would have if the underwriting restriction based on impairment was not present. Third, small firms in this research are defined as those that hire fewer than 10 workers, as opposed to 25 used by Kaestner and Simon (2002). Ten is chosen as the cutoff point because it is the smallest firm size specified in the CPS March survey, one of the major data sources of this study, and because medical underwriting by group health insurers is more common and more stringent when the firm size becomes smaller.

Underwriting is the insurers' effort to distinguish among different risk types and to assign premium rates that reflect differences in risk levels among insurance applicants. It is common in the individual health insurance market, and the bulk of insurers offering coverage in the small group market used to medically underwrite such business before the passage of restrictive regulations on underwriting. The health insurance industry generally marketed experience rated policies to all firms, regardless of firm size. With experience rating, a firm hiring more workers with higher anticipated costs, such as older and disabled workers, faces more expensive premium of health insurance. The process adopted by insurance companies to set experience rated premiums differs substantially between large and small employers. For large firms, the expected cost is largely based on medical claims of the firm in the previous period. The previous medical claims of a large firm are granted a higher "credibility" because the large number of claims from a large firm allows the random variations in claims to be diversified internally. Hence the claims provide a reasonably good approximation of the distribution of future risk of the firm.

However the situation is different for small firms. Random variations in medical expenses of a small firm are unlikely to be diversified internally because of the small number of insureds. This is consistent with findings by Cutler (1994b) that small firms are subject to a higher degree of premium variability than larger firms. Therefore, claims of small firms do not allow for a good estimation of the risk profile. Hence, as noted by Zeller, McLaughlin and Frick (1992), small firms tended to be individually underwritten before the underwriting prohibition reforms. Individual underwriting in the small group market implies that individual employees of a small firm are required to provide a statement of health and evidence of insurability about themselves and their dependents when the firm seeks coverage on the market. Cutler (1994b) reports that two-thirds of firms with fewer than 10 employees were required to fill medical questionnaires before purchase of health insurance, while half of firms of all sizes were required to do so. Zeller et al. (1992) report that all small group policies in their survey required a health questionnaire. The practice of underwriting each individual within a small group was most common for firms under the size of 25 and resulted in high premium for high risks, which, in turn,

affects the offer rate of group coverage by employers and the take-up rate by employees. The Department of Commerce reported offer rates and coverage rates of employees in “Employment-Based Health Insurance: 1997” issued in 2002. Among all people who worked for employers with 500 or more employees in 1997, 91.6 percent had health insurance offers from their current employers, and more than two-thirds were actually covered by employment-based health insurance plan with their current employers. Both offer rate and coverage rate decreased with decreasing business size. Among workers who were hired by employers with fewer than 25 employees, only 52.1 percent had health insurance offers, and only 33.8 percent had health insurance coverage through their current employers in 1997.

The literature has examined several issues that relate to small business and health insurance. Cutler (1994b) finds that small firms with young workers, high turnover or low wages tend to have the highest premium variability. Monheit and Vistnes (1994) find that the risk selection practices of insurers partition the small group market so that only persons who are favorable health risks obtain employment related insurance. They find that the employees and dependents with coverage from small firm policies are in better health than those with non-group policies (when firm coverage was not available) or those who had no coverage. The effect of underwriting practices on small firm employment is noted by Kapur (2004), who finds that when underwriting was permitted insured small firms were less likely to employ workers with families that had conditions leading to higher premiums than insured large firms.

State governments have taken steps to respond to the health insurance concerns of small businesses. As underwriting is identified by many to be the cause the high premiums charged to older, female and disabled individuals, regulations were enacted to restrict, even prohibit, some types of underwriting practices. See Browne and Frees (2004) for the description of underwriting prohibitions enacted by states over late 1980s and 1990s. The focus of this study is the regulation that prohibits the use of impairment as underwriting criterion in group health insurance.

Using CPS data for the period of 1988-1995 and multinomial logistic models Browne and Frees

(2004) find that underwriting restrictions affect both small group and individual health insurance markets. Their findings indicate that both high risks' and low risks' insurance consumption decisions are influenced by state underwriting regulations, albeit in opposite directions. They suggest that those individuals who are more favorably underwritten as a result of underwriting restrictions are more likely to obtain group insurance or government insurance than they would in the absence of underwriting restrictions. Further, they find that those less favorably underwritten as a result of the underwriting prohibitions are more likely to obtain non-group insurance or go uninsured.

The purpose of this study is to examine whether disability-based underwriting restriction affects the employment status and wages of both the disabled and the able-bodied individuals, in other words, individuals who are more favorably or less favorably underwritten as a result of the prohibition. Specifically of interest are the relationships between the presence of the prohibition and (1) the employment status of individuals of two groups, (2) the choice of firm size by workers, and (3) wages of small firm employees. The results of such an analysis can improve our understanding of the relationship between group health insurance and labor market outcomes, and identify new factors that may explain changes in the labor market outcomes of certain groups of individuals.

In Section 2, relevant theoretical and empirical research studying the effects of group health insurance regulations on the labor market is reviewed, followed by development of questions of research interest. Section 3 presents models and methodology, describes the data set employed, and provides details of the variables to be included in the analysis. Empirical analysis is evaluated and presented in section 4. Section 5 provides a summary of the study and briefly discusses the study's limitations and implications for further research in this area.

2 Underwriting Restrictions and the Labor Market

Rosen (1986) uses a simplified example to illustrate how an employer and employee reach their decisions about health insurance. Rosen suggests that workers will only work at firms offering insurance

coverage if their valuation of coverage is no less than the wage loss that occurs in exchange for the coverage. Firms will only offer health insurance if the firm's cost for providing coverage per worker is less than or equal to the savings in wage. Summers (1989) illustrates the effects of a law that mandates employers provide health insurance to their workers. An increase in the costs of providing health insurance will reduce workers' wages but have an ambiguous effect on employment, which depends on workers' valuation of the coverage. Gruber and Krueger (1991) study the employment effects of workers' compensation insurance. Their results suggest that a substantial portion of the cost to employers of providing workers' compensation benefits is shifted to employees in the form of lower wages. This shifting is not complete. Employers bear at least some additional cost because of mandated work-injury insurance. As a consequence, the authors find that increases in workers' compensation costs are associated with reduced employment growth.

Rising medical care costs impose different effects on firms of different size due to the underwriting process, through the effect on premiums charged. Experience rating of small firms is particularly detailed; in the extreme, if a particular worker is found to be very costly, he may be "underwritten out" of the policy, or the entire group may be rejected (Congressional Research Service, 1988). As a result of experience rating, there is tremendous dispersion in the cost of health insurance across firms. Cutler (1994a) finds that, for employer-provided individual insurance plans, the premium at the 90th percentile of the premium distribution is 2.5 times as large as the premium at the 10th percentile. Only a small share of this substantial variation can be explained by plan features, suggesting that most is due to experience rating. This tremendous variation in premium imposes greater effects on the employment behavior of small firms, which either decline to offer health insurance to their workers, or shift a larger amount of employer costs to wages of workers.

The literature suggests that underwriting affects the labor market. Monheit and Vistnes (1994) suggest that the risk selection practices of insurers in the small group market allow only persons with better health conditions to obtain employer-sponsored insurance. Specifically, they find that employees

and dependents with coverage from small firm policies are in favorable health risks relative to those with nongroup policies (when firm coverage was not available) or those who had no insurance. While their findings may suggest that employment was distorted because of health insurance, it may be possible that better health conditions were a result of, not the cause for, group health coverage. Olson (1993) finds that individuals in poor health are far less likely to have health insurance in industries with a high proportion of small firms compared to industries that have a high proportion of large firms.

In addition to effects on employment, the impacts of health insurance costs on wages and hours worked have also been examined. Although some work (Jensen and Morrisey, 2001; Simon, 2001) fails to find significant estimates of the expected relationship between wages and health insurance, others obtain expected results. Cutler and Madrian (1998) suggest that when health insurance costs rose, firms were more likely to increase hours worked by existing employees rather than employing more workers. Other research (Olson, 2002; Scott, Berger, and Garen, 1995) provides evidence that wages and the hiring possibility of certain groups are sensitive to health insurance costs. As suppliers of labor, workers have different levels of preference for health insurance, which in turn plays a role in employment decisions. Monheit and Vistnes (1999) show that workers with low preferences for health coverage opt to work for firms that do not offer health insurance.

Kapur (2004) suggests that unrestricted underwriting prior to the passage of the underwriting restrictions affected the chance that individuals with higher medical costs would be able to obtain health insurance through work. Among workers who were covered by an employer's plan, premiums charged by insurers varied with the health condition of the workers. Insurers charge more for those they classify as high risks than those they classify as low risks. This additional cost would be borne by either the employer, the employee, or shared, depending on the employment relationship. In short, high risk workers either were not insured, or obtained insurance at a higher cost when underwriting was permitted.

Kapur (2003, 2004) and Kaestner and Simon (2002) study the impact of the small group health

insurance reforms on small firms' hiring practices. Using the 1987 National Medical Expenditure Survey and the 1996 Medical Expenditure Panel Survey, Kapur (2004) compares small firm employment before and after the passage of the small group reforms and finds that before the reforms, small firms offering health insurance were less likely than large firms to employ workers whose families had high expected medical expenses. Insured small firms, after the enactment of reforms, were found to be less likely to employ workers with "denial conditions"¹.

Kapur (2003) uses CPS data to examine whether the small group reforms passed in the insurance market increased the likelihood that high risk workers would be hired by small firms. This expectation is based on the assumption that employer costs for providing health insurance to high risk workers would decrease as a result of the reforms. She concludes that the effect of the reforms on small firm hiring and job mobility of costly subgroups is often statistically insignificant. Kaestner and Simon (2002) also use CPS data to examine the impacts of these reforms on small firm insurance coverage and employment. Their results suggest that small group insurance reforms have resulted in higher premiums in the market on average, but have not had any significant effects on labor market outcomes.

Although health insurance is primarily regulated at the state level, federal laws may affect the operation of insurance markets. The Americans with Disabilities Act (ADA) is a comprehensive civil rights bill that intends to eliminate many of the barriers faced by people with disabilities by guaranteeing access to public and private employment, state and local government services, places of public accommodation, and telecommunication services. The ADA prohibits employment discrimination against individuals with disabilities but does not prohibit the practice of underwriting or charging higher premiums for individuals with disability. DeLeire (2000) analyzes the effects of ADA on the employment and wages of disabled men using data from the Survey of Income and Program Participation. The results show that, on average, over the post-ADA period, employment of men with disabilities was 7.2

¹ Kapur (2004) classifies medical conditions into three categories: conditions leading to denial of coverage;

percentage points lower than before the act was passed while wages of disabled men did not change with the passage of the ADA. The findings suggest that firms employ fewer disabled individuals to avoid the costs associated with disability-friendly accommodations required by the ADA. The ADA, as a federal law, influences each state, while the current study focuses on the discrepancies across the states, the ADA is not supposed to affect the empirical results of the study.

Small firms are more likely to be impacted by underwriting restrictions. Large firms have advantages over small ones regarding health insurance. With more capital available and internally diversifiable claim risks, large firms are more likely to self-insure their health insurance plan. Self-insured plans are exempt from most state regulations. As a result, state prohibitions on underwriting are less likely to affect the practices of large firms regarding their health plans. Another advantage related to large firm size is that the variability in claim amount declines compared to small firms. Even when large firms purchase group health insurance from an insurer, the enormous economies of scale makes the premium charged to large firms relatively low compared to small firms on a per employee basis.

As described in section 1, a goal of underwriting prohibitions was to make health insurance more accessible and affordable to employers and employees, especially those of small businesses. Regarding to the focus of this study, restricting the use of impairment in underwriting is anticipated to reduce the premium rates for disabled workers, and raise that for able-bodied workers. Marquis and Long (2002) and Buchmueller and Jensen (1997) both examine premium data before and after the broader small group reforms. Marquis and Long (2002) suggest that the reforms do not appear to have had a substantial effect either on the level or on the variability of premiums adjusted for plan benefits in the small group market. The overall premium an employer faces depends on the industry of the business, and the demographic structure of the business' workforce.

Insurers responded to reforms by increasing their requirements for employer contributions and

conditions leading to higher premium; and, conditions leading to exclusion restrictions.

employee participation, that is, by requiring that employers contribute a higher portion of the premium and that a higher percentage of eligible employees enroll, as reported by Hall (1999). It is not clear whether more small employers may be offering health insurance to their employees after than prior to the market reforms, but the evaluations of offered coverage by low risk and high risk groups of workers are not likely to be the same if the coverage is offered at non-differential cost. Low risk and high risk groups may accordingly make different decisions as to whether to work at all and for what firm to work.

If the underwriting prohibition laws result in a reduction in insurance premium for high risks, there is an incentive for high risks to increase their participation in the labor force to take advantage of the lower cost insurance. To the extent the prohibitions result in lower costs for employers, employment of high risks by firms becomes more advantageous, other things equal. The prohibitions create an incentive for small employers to employ more high risk workers relative to low risks. In addition, younger and healthier workers now face an increase in premium if they want to be covered by the group plan because the underwriting restrictions greatly restrict the ability of insurers to offer discounts to the healthiest subscribers. Low risk workers may feel upset because they will have to pay the same amount for health insurance as high risk workers do, if they want to be covered by the group plan. The discrepancy in valuation of coverage, together with the increased cost-sharing requirements, may result in healthier workers opting out of coverage if they value the coverage below the cost. If they do want the group coverage but are upset by the higher premium, they may even quit small firms and turn to large firms, whose health insurance plans are not likely to be affected by the prohibition laws. If this is the case, low risk workers will migrate to large employers.

Another possibility is that small firms hire more low risk workers. Employers may be not willing to replace low risk workers with high risks because of productivity and growth concerns. In order to retain low risk workers who prefer the group coverage at low cost, small firms may hire fewer high risk workers to keep a low risk workforce. Several characteristics of small businesses make this option

possible, as pointed out by Kapur (2003). The organizational structure of small firms is unlike that of larger firms. In small firms, decision-making is more likely to be concentrated, possibly by a single entrepreneur. Hence it is relatively easy for the owner of the business to screen out an individual with high expected medical costs. In addition, information required for employment screening is readily available to small businesses as most small firms are required to provide information on the family health status of potential employees to their health insurance companies (U.S. Congress, 1988). Even the Americans with Disabilities Act (ADA) does not prohibit the practice of underwriting or charging higher premiums for individuals with family health conditions. If this trend prevails, one expects to observe that high risk workers lose jobs with small firms to low risk workers.

As the literature suggests, employers tend to shift costs of providing health insurance to workers in the form of lower wages. With the underwriting prohibitions in effect, in which direction do workers' wages move to reflect the impact of the laws? If low risk workers drop the group coverage, we would expect wages of low risks to increase. On the other hand, premium rates of group insurance for high risk workers now decline thanks to the underwriting restrictions, wages of high risk workers at small firms are not as likely to increase.

Reported in the Appendix A is the analysis of the effects of underwriting prohibitions on the labor market, with inconclusive results. The empirical analysis is reported in the sections 3 to 5.

3 Models and Methodology

The restrictions on underwriting analyzed in this research are those that limit the use of disability status for the purposes of underwriting in the small group insurance market. Labor economics associated with employment based group health insurance suggests competing potential effects of the restrictions on the labor market. CPS data is used to examine whether the specific underwriting restrictions have

impacted three labor market outcomes, namely, employment status, firm size of employer, and wages of disabled and able-bodied workers.

Employment Status

Employment status is classified into three types, being either employed full time, part time, or being unemployed. While the three types of employment status seem to be ordered outcomes, the criterion for ordered outcomes, the Proportion Odds Assumption is violated, so they are treated as unordered categories.

This question is examined by estimating a multinomial logistic model of the form:

$$y_{s,t,i} = X'_{s,t,i} \beta + \varepsilon_{s,t,i} \quad (1)$$

where $y_{s,t,i}$ is a categorical variable with three categories as discussed above. It is defined for time periods $t = 1, \dots, 9$, $s = 1, \dots, 50$ (corresponding to each of the 50 states) and $i = 1, \dots, n_{st}$, where n_{st} is the number of individuals in state s during time period t . Specifically,

$$y_{s,t,i} = \begin{cases} 1 & \text{if } \textit{unemployed} \\ 2 & \text{if } \textit{part-time} \\ 3 & \text{if } \textit{full-time} \end{cases} \quad (2)$$

Multinomial logistic is employed for two reasons. Like other discrete choice models, the multinomial logistic model provides “random utility” interpretations. Under this interpretation, one assumes that the utility of each choice can be represented as a linear function of explanatory variables plus an error term, say $X'_{s,t,i} \beta_c + \varepsilon_{s,t,i,c}$. We do not observe the actual utility, but the employment status of an individual.

Specifically, a multinomial logistic model estimates choice probabilities

$$\text{Prob}(y_{s,t,i} = c) = p_{s,t,i,c} = \frac{\exp(X'_{s,t,i} \beta_c)}{\sum_{k=1}^3 \exp(X'_{s,t,i} \beta_k)} \quad (3)$$

where $X'_{s,t,i} \beta_k = \beta_{0k} + \beta_{1k}x_{s,t,i,1} + \dots + \beta_{mk}x_{s,t,i,m}$. $X_{s,t,i} = (1, x_{s,t,i,1}, \dots, x_{s,t,i,m})'$ represents the vector of explanatory variables whose values may depend on the individual characteristics, state of residence and time of observation. Further, β_k is the corresponding vector of parameters to be estimated whose values may depend on choice made. The intercept parameters, β_{0k} , vary by state and choice; they control for state-specific factors that are not explicitly measured.

An interpretation of coefficients for multinomial logistic model is helpful for understanding the parameter estimates and odds ratios. Suppose the vector of explanatory variable is $X_{ist} = (x_{ist,1}, \dots, x_{ist,j}, \dots, x_{ist,K})'$. Assume that the j th variable, $x_{ist,j}$, is either 0 or 1. With the vector of choice variables as $\beta_c = (\beta_{ic}, \dots, \beta_{jc}, \dots, \beta_{Kc})'$, the j th coefficient can be expressed as $\beta_{jc} = (x_{ist,1}, \dots, 1, \dots, x_{ist,K})\beta_c - (x_{ist,1}, \dots, 0, \dots, x_{ist,K})\beta_c$. Straightforward calculation then shows that

$$\beta_{jc} - \beta_{jd} = \ln \left(\frac{\Pr(y_{ist} = c | x_{ist,j} = 1) / \Pr(y_{ist} = d | x_{ist,j} = 1)}{\Pr(y_{ist} = c | x_{ist,j} = 0) / \Pr(y_{ist} = d | x_{ist,j} = 0)} \right), \text{ for } c, d = 1, 2, 3.$$

The right-hand side of the equation can be interpreted as the logarithmic ratio of the odds when $x_{ist,j}$ equals to 1 compared to 0. Here, the odds are the relative probabilities of comparing choice c to choice d .

The maximum likelihood method is applied to estimate the multinomial model. The programming is done using the IML procedure in the statistical analysis package SAS. The model identification strategy is to assess the importance of control variables first, including state and time effects. Then legal variables are included to examine their effects. Because of the concern that observations from the same year and state may not be independent, a method proposed by Moulton (1990) and specified by Browne and Frees

(2004) is adopted to calculate the robust standard errors, so that the assessment of the significance of the regression coefficients is more reasonable. Specifically, from equation (3) the log-likelihood for the (s,t,i)

observation is $L_{s,t,i} = \sum_{c=1}^3 \log p_{sti,c}$ and the total log-likelihood is $L = \sum_{s,t,i} L_{s,t,i}$. Define

$S_{s,t,i}(\beta) = \frac{\partial}{\partial \beta} L_{s,t,i}(\beta)$ to be the score function with respect to the regression coefficients β . The

maximum likelihood estimator of β is the solution \mathbf{b} of the equation $\sum_{s,t,i} S_{s,t,i}(\mathbf{b}) = 0$. Denote this

solution as \mathbf{b}_{MLE} . The usual asymptotic variance is computed using the matrix of second derivatives,

$H(\beta) = \frac{\partial}{\partial \beta'} \sum_{s,t,i} S_{s,t,i}(\beta)$. That is, the asymptotic variance of \mathbf{b}_{MLE} is estimated by $H(\mathbf{b}_{MLE})^{-1}$. For

robust alternatives, the Taylor-series expansion is derived from

$$0 = \sum_{s,t,i} S_{s,t,i}(\mathbf{b}_{MLE}) \approx \sum_{s,t,i} S_{s,t,i}(\beta) + (\mathbf{b}_{MLE} - \beta)H(\beta).$$

Thus, the asymptotic variance of \mathbf{b}_{MLE} becomes $H(\beta)^{-1}Var\left(\sum_{s,t,i} S_{s,t,i}(\beta)\right)H(\beta)^{-1}$. Since the

assumption of independence among observations within a state-year cell is not well-based,

$Var\left(\sum_{s,t,i} S_{s,t,i}(\beta)\right)$ is estimated by $n_{st}^{-1} \sum_j \sum_i S_{s,t,i}(\mathbf{b}_{MLE})S_{s,t,j}(\mathbf{b}_{MLE})'$, as proposed by Browne and Frees

(2004), where n_{st} is the number of observations in state s at year t . Therefore, the ‘‘group robust’’

standard errors of \mathbf{b}_{MLE} is approximated as

$$(H(\beta))^{-1} \left(\sum_{s,t} n_{st}^{-1} \sum_j \sum_i S_{s,t,i}(\mathbf{b}_{MLE})S_{s,t,j}(\mathbf{b}_{MLE})' \right) (H(\beta))^{-1}. \quad (4)$$

Firm Size of Full-time Workers

The next question is whether the specific underwriting restrictions are associated with the size of firms at which able-bodied and disabled workers are employed. The test is limited to full-time workers because part-time workers typically are not eligible for employment-based group insurance coverage.

Similar to employment status, firm size is classified into three categories: small, medium, and large. Small firms are defined to be those that hire fewer than 10 workers. Medium firms hire at least 10, but at most 24 workers. All other firms are considered large in this study. This question is examined using a multinomial logistic model similar to equation (1). The only differences are that (1) the dependent variable now becomes the firm size and (2) the data set now consists of people who are full-time employees.

Wages of Small Firm Workers

Lastly, the effects of the restrictions on wages of small firm workers are tested. Specifically, wages of small firm workers are examined to identify any discrepancy between those who live in states and years with the prohibition and their counterparts who are not subject to such a law. The equation analyzed is:

$$\text{Annual wage} = f(\text{demographic, industry and occupation, state and year; restriction}) \quad (5)$$

Logarithmic wage is the fitted response in the model to deal with the long tail problem of wage distribution. It is generally believed that wages of workers in the same state-year cell are correlated to that of each other, instead of being independent; a general linear mixed model is employed to handle the situation. In this setting, the effects of variables *state* and *year* are considered random while those of the other explanatory variables are fixed. Declaring state and year as random effects sets up a common correlation among all individuals who live in the same state in the same year. As an alternative a model with fixed state and year effects is run and results reported in Appendix B.

Table 1 summarizes the models used to test all three questions of interest, including the fitted response and data set used for each model.

Table 1 Summary of Models

Test	Employment	Firm size	Wage
Model	Multinomial Logistic	Multinomial Logistic	Mixed GLM
Fitted Response	$Pr(\text{unemployed})/Pr(\text{full-time})$ $Pr(\text{part-time})/Pr(\text{full-time})$	$Pr(\text{large})/Pr(\text{small})$ $Pr(\text{medium})/Pr(\text{small})$	Log(wage)
Sample Data	Unmarried, single-person households	Full-time employed	Workers of small firms
Observations	82,083	59,824	12,913
Years	1991-1996	1991-1996	1991-1996

Sources of Data

The study makes use of data from three sources: state statutes that provide information on state underwriting restrictions, the Current Population Survey (CPS) conducted by the Bureau of Labor Statistics (BLS), and state-wide economic data compiled by the Bureau of Economic Analysis (BEA). Information on underwriting restrictions is reported in state statutes. There is significant variation in the restrictions enacted by the different states. Further, the years of enactment of similar statutes vary by state. The primary focus of this study is underwriting restrictions related to disability status. Underwriting prohibitions can result from either regulation or legislation. As in Browne and Frees (2004), a state is considered to prohibit the particular form of underwriting if (i) the state has enacted laws or regulations specifically forbidding the use of impairment for classification purposes and pricing purposes for all lines of health insurance or (ii) the state has enacted a community rating law that prohibits differential pricing and risk categorization based on the criteria. Prohibitions that were enacted as part of small group reform laws are also accounted for. That is, some states prohibit the use of impairment as underwriting criteria only in the small group market. Table 2 provides additional information and reports the underwriting restrictions in effect in the different states during the period of analysis.

The Current Population Survey (CPS) is a monthly survey of about 50,000 households conducted

by the Bureau of the Census for the Bureau of Labor Statistics. The sample is scientifically selected to represent the civilian non-institutional population. Respondents are interviewed to obtain information about the employment status of each member of the household 15 years of age and older. However, published data focus on those ages 16 and over. The sample provides estimates for the nation as a whole and serves as part of model-based estimates for individual states and other geographic areas (<http://www.bls.census.gov/cps/overmain.htm>).

The CPS reports information on employment status in the March Supplemental Survey. The sample of the study covers the period 1991 through 1996, due to the limitation of data availability of state statutes.² The CPS March Survey also provides information about demographic characteristics of individuals interviewed. The analysis is limited to unmarried single-person households. The age range of observations in the sample is confined to 16-64. Medicare benefits begin at age 65 for the majority, so for most people aged 65 and older health insurance is not closely related to employment status.

Table 2. Small Group Disability-Based Underwriting Regulations

State	Year of Effect
Florida	1994-*
Kentucky	1995-
Maine	1993-
Maryland	1994-
Massachusetts	1992-
Minnesota	1995-
New Hampshire	1995-
New Jersey	1992-
New York	1993-
South Carolina	1995-
Vermont	1992-
Washington	1993-

²I use the same data set of state statutes as Browne and Frees (2004), courtesy of the authors. The data set contains information about underwriting prohibitions up to 1996.

Note: * indicates that the disability restriction is effect since 1994. States not in the table do not have the underwriting restrictions of interest.

Variable Descriptions

Dependent variables in the three models have been defined in the previous section. Descriptive statistics of major variables, both dependent and explanatory, are presented at the end of this section. The previous literature (Kapur, 2003 and 2004; Kaestner and Simon, 2002) sheds light on factors that are assumed to be associated with employment status and wage.

The legal variables depicting underwriting restrictions are the major interest in the study. Legal variable is defined to indicate whether a state has an effective law to prohibit the use of impairment for the purpose of underwriting in a year. If a state does have such a law, the value of variable *law_disa* is equal to one, otherwise *law_disa* zero. Interaction term *law*disa*, the product of law variable *law_disa* and disability status indicator *disable*, is also included to capture the interaction effects. The independent variables employed include legal variables, demographic and work-related variables of an individual, and state-level economic conditions. A list of all variables, dependent and independent, employed in this study is presented in Tables 3.

Table 3 Definitions of Variables

Dependent Variable	
EMPLOYSTATUS	Categorical variable indicating the employment status of an individual; = 1 if unemployed, 2 if employed part-timely, 3 if employed full-timely.
FIRMSIZE	Categorical variable for individuals who are employed; indicating the number of workers of the employer; = 1 if hired by a small firm, 2 a medium-size firm, 3 a large firm.
WAGE	Continuous variable for individuals who are employed, in thousands of dollars.
Independent Variable	
<i>Demographic characteristics</i>	
AGE	Measure of an individual's age. Equals to actual age divided by 10. Squared age and cubic age are also included.

FEMALE	Dummy variable, = 1 if an individual is female, and 0 otherwise.
EDUCN	Education level of an individual, measured by years of education completed.
RACE_BLACK	Dummy variable, = 1 if an individual's race is black, and 0 otherwise.
RACE_WHITE	Dummy variable, = 1 if an individual's race is white, and 0 otherwise.
INC_NW	An individual's income from sources other than wage.
DISABLE	Dummy variable, = 1 if an individual is physically impaired and 0 otherwise.
FULLTIME	Dummy variable, = 1 if a worker is hired on full-time job, and 0 if part-time.
JOBSWITCH	Dummy variable, = 1 if a worker changes job during a year, and 0 if otherwise.
WEEKS	Continuous variable, measure of work time in a year, valued by integers between 1 and 52.
HOURS	Continuous variable. The average number of hours a worker works per week.
<i>Macroeconomic characteristics</i>	
PCINCOME	Per capita income of the state where an individual resides, measured in thousands of dollars
PCEMPLOY	Per capita jobs. It is the ratio of number of jobs available in a state to that state's population.
BEFRATIO	Is the ratio of average benefit of unemployment insurance to average wage of the state where an individual resides.
<i>Legal Variable</i>	
LAW_DISA	An indicator variable. It equals to 1 if the individual lives in a state during a year where an underwriting law restricting discrimination based on physical impairment is in effect and 0 otherwise.
<i>Interaction Variables</i>	
DISA*LAW	An indicator variable. It equals to LAW_DISA times DISABLE.

Descriptive Statistics

First, descriptive comparisons between the study's major data set of single-person households and the data set of the more general population extracted from CPS database are provided in Tables 4 and 5. Among the 546,087 observations of the general population, 7.4 percent are disabled, and 20.5 percent are

unemployed. On the other hand, of 82,083 observations from single-person households, 10.9 percent and 14.6 percent are disabled and unemployed, respectively. The discrepancy between the two data sets warrants caution when applying the empirical results of this study to the general population.

Table 4 Comparison of Indicator Variables of Two Data Sets, in percent

Data Set	Observations	Indicator Variables						
		Race_b	Race_w	Disable	Female	Unemploy	Part-time	Full-time
All9196	546,087	9.7	85.0	7.4	52.0	20.5	16.4	63.1
Single9196	82,083	10.3	84.9	10.9	46.2	14.6	12.6	72.9

Note: All9196 contains all observations for the period of 1991 through 1996, with the age of the individual between 16 and 64. Single9196, a subset of all9196, consists of single-person households, providing that person is unmarried.

Table 5 Comparison of Continuous Variables of Two Data Sets

Variable	Data: All9196, 546,087 observations.				Data: Single9196, 82,083 observations.			
	Mean	Std Dev.	Min.	Max.	Mean	Std Dev.	Min.	Max.
Age	37.68	12.99	16.00	64.00	37.25	12.82	16.00	64.00
Educn	12.73	2.43	0.50	16.00	13.11	2.31	0.50	16.00
Wage	\$18,069	23,336	-9,999	576,372	\$19,374	21,208	-9,999	576,372
Inc_nw	\$3,254	8,744	-19,998	331,772	\$4,255	10,177	-10,099	331,772
PCEmploy	3.473	0.433	2.681	7.470	3.534	0.593	2.681	7.470
PCIncome	\$21,774	3,249	13,702	32,786	\$22,013	3,266	13,702	32,786
Befratio	0.360	0.050	0.251	0.528	0.360	0.050	0.251	0.528

Note: The means of state level variables are calculated using the number of observations in each state as the weight.

Next descriptions of each of the three data sets associated with the three tests are provided. Tables 6 through 8 are devoted to the descriptions of all unmarried, single-person households. The descriptive statistics of full-time employees are provided in Tables 9 and 10. Tables 11 and 12 present descriptions of the data set consisting of small firm workers.

From Table 5 we see that in our major data set *single9196*, an average person is 37.25 years old and has received 13.11 years of education. Table 6 provides description of indicator variables. Forty-six percent of our observations are female, and 10.9 percent are disabled.

Table 6. Average of Indicator Control Variables, in percent.

Data: 1991-1996, Unmarried Single-person Household, 89,203 Observations			
FEMALE	RACE_BLACK	RACE_WHITE	DISABLE
46.2	10.3	84.9	10.9

Table 7 provides a detailed description of dependent variables in the models used to test the effects on employment status. Of the 82,083 individuals observed, 67,766 live in states and years when disability based restrictions are not in effect, and the odds of being full-time employed to being unemployed is 5.127. For the remaining 14,317 individuals under the influence of the restriction, the value of the odds is 4.547. The odds ratio between this two groups is 0.887, indicating that when disability is prohibited as an underwriting criterion, people are less likely to be full-time employed.

Table 7. Percentage of Dependent Variable by Law Variable

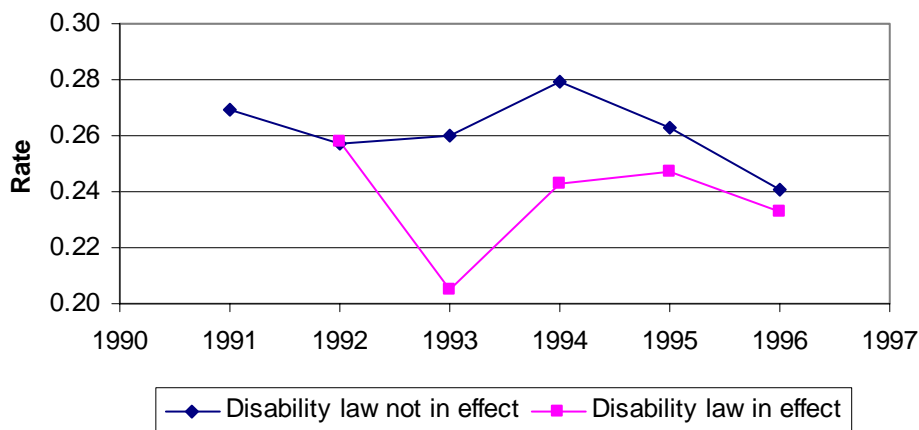
Data: 1991-1996, Unmarried Single-person Households, 82,083 observations.							
Law	Law In Effect	Number	Unemployed	Part-time	Full-time	Odds-Comparing Full-time to Unemployed	Odds Ratio
Disability	No	67,766	14.2	13.0	72.8	5.127	0.887
	Yes	14,317	16.1	10.7	73.2	4.547	

Table 8. Employment Status of the Sample, by disability restriction, for selected groups.

Data: 1991-1996, Unmarried Single-Person Households, 82,083 observations.						
Selected Subgroups	Disability Restriction in Effect	Number	Percent Unemployed	Percent Full-time	Odds-comparing Full-time to Unemployed	Odds Ratio
Able-bodied	No	60,329	8.6	78.6	9.140	0.840
Able-bodied	Yes	12,783	10.3	79.1	7.680	
Disabled	No	7,437	59.9	26.2	0.437	0.844
Disabled	Yes	1,534	64.0	23.6	0.369	
Disabled Female	No	3,722	62.3	23.5	0.377	0.805
Disabled Female	Yes	786	66.2	20.1	0.304	
Disabled Male	No	3,715	57.6	28.9	0.502	0.883
Disabled Male	Yes	748	61.6	27.3	0.443	
Age<50	No	53,848	9.9	76.8	7.758	0.852
Age<50	Yes	11,179	11.7	77.3	6.607	
Age>=50	No	13,918	31.1	57.3	1.842	1.011
Age>=50	Yes	3,138	31.5	58.7	1.863	

Further, the potential effects of disability law on employment status of selected subgroups are described in Table 8. Again, for most subgroups, the presence of disability law is related to lower odds of being full-time employed relative to unemployed. Figure 1 presents an intuitive illustration that the disability law is associated with lower rate of being full-time employed among the disabled.

Figure I.3.1
Rate of full-time employed among the disabled



Tables 9 and 10 provide firm size descriptions of the 59,824 full-time employees. When disability law is not in effect, 17.2 percent full-time workers are employed by small firms and 73.1 percent are employees of large organizations. A full-time worker is 3.25 times more likely to be hired by a large firm than by a small one. The odds increase slightly when the disability law is in effect. For the other two laws, the odds ratios greater than unity indicate that these two laws are related to increases in the likelihood of full-time workers migrating to large firms. Table 10 presents more descriptions of the relationship between the disability law and firm size of selected subgroups. Entries in this table suggest that disability restriction is related to the choice of firm size of different groups in different ways. For example, when disability restriction is in effect, workers below age 50 are less likely to work for large firms, while older workers are more likely to be hired by large firms.

Table 9. Firm Size of Full-time Employees, by Law Variable, in percent

Data: 1991-1996, Full-time employed, 59,824 observations.							
Law	Law In Effect	Number	Small	Medium	Large	Odds-Comparing large to small	Odds Ratio
Disability	No	49,346	17.2	9.7	73.1	4.250	1.001
	Yes	10,478	17.2	9.6	73.2	4.256	

Table 10. Firm Size of Full-Time Employees, by disability restriction, for selected groups.

Data: 1991-1996, Full-time employed, 59,824 observations.						
Selected Subgroups	Disability Restriction in Effect	Number	Percent Small	Percent Large	Odds-comparing large to small	Odds Ratio
Able-bodied	No	47,398	16.9	73.4	4.343	0.994
Able-bodied	Yes	10,116	17.0	73.4	4.318	
Disabled	No	1,948	22.8	67.9	2.978	1.108
Disabled	Yes	362	21.0	69.3	3.300	
Disabled Female	No	875	16.7	76.2	4.563	1.068
Disabled Female	Yes	158	15.2	74.1	4.875	
Disabled Male	No	1,073	27.9	61.1	2.190	1.176
Disabled Male	Yes	204	25.5	65.7	2.576	
Age<50	No	41,370	16.7	73.4	4.395	0.978
Age<50	Yes	8,637	17.0	73.1	4.300	
Age>=50	No	7,976	19.8	71.8	3.626	1.148
Age>=50	Yes	1,841	17.8	74.1	4.163	

The descriptive statistics of the data set consisting of small firm employees are provided in tables 11 through 13. From Table 11 we see that wages of small firm workers are related to all continuous variables describing individual characteristics and two of the three state level variables. Table 12 reports the average of logarithmic wage by level of explanatory variables. Entries indicate that all indicator variables are associated with wage differentials. For instance, males on average earn 36.9% more than females ($\exp(9.312-8.998)=1.369$), and disabled workers earn 65.4% less than able-bodied workers ($\exp(8.211-9.273) = 0.346$). Finally Table 13 gives the means of continuous variables of small firm workers.

Table 11. Correlation Coefficients

Data: 1991-1996, small firm employees, 12,913 observations.								
	WAGE	AGE	EDUCN	NON-WAGE	WEEKS	HOURS	PER CAPITA INCOME	PER CAPITA EMPLOY
AGE	0.053							
EDUCN	0.197	0.015*						
NONWAGE	-0.035	0.155	0.158					
WEEKS	0.486	0.039	0.119	-0.067				
HOURS	0.397	-0.051	0.088	-0.074	0.337			
PCINCOME	0.137	-0.001*	0.043	0.048	0.042	0.022		
PCEMPLOY	0.014*	-0.014*	0.068	0.037	-0.002*	0.016*	0.356	
BEFRATIO	-0.039	0.005	0.056	0.008*	-0.013*	0.006*	-0.275	0.041

Note: All coefficients are significant at 5% level except those denoted by asterisk. Wage, non-wage, weeks, hours, and per capita income are measured in logarithmic dollars.

Table 12. Average of logarithmic wage by level of explanatory variable

Data: 1991-1996, small firm employees, 12,913 observations.						
Level of explanatory variable	Explanatory variable					
	FEMALE	RACE_B	RACE_W	DISABLE	JOBSWITCH	FULLTIME
0	9.312	9.211	8.980	9.273	9.389	8.191
1	8.998	8.984	9.223	8.211	8.609	9.481

Table 13. Mean of Continuous Variables

Data: 1991-1996, small firm employees, 12,913 observations.							
Wage	Age	Educn	Hours	Weeks	PCEmploy	PCIncome	Befratio
\$18,862	37.69	13.01	40.22	44.44	3.528	\$21,873	0.359

4 Empirical Results

This section reports inference using models described earlier. Results suggest that prohibition on the use of disability status in underwriting is associated with significant changes in the labor market outcomes. Estimation for each model is discussed in turn.

4.1. Test Results about Employment Status

The analysis strategy is to first examine the influence of control variables on dependent variables

using multinomial logistic model, and then include the legal variable to test its effects.

Model with Control Variables Only (Base Model)

**Table 14. Effects on Employment Status:
Multinomial Logistic Regression with only Control Variables
(Year and State effects are included, although coefficients are not reported.)**

Data: 1991-1996, Unmarried Single-person households, 82,083 observations						
Variable	Unemployed versus Full-Time			Part-Time versus Full-Time		
	Estimate	Odds Ratio	p-value	Estimate	Odds Ratio	p-value
INTER	12.1689		<0.0001	9.1214		<0.0001
AGE	-5.8876	0.0028	<0.0001	-5.6011	0.0037	<0.0001
AGE SQUARED	1.0917	2.9793	<0.0001	1.0488	2.8542	<0.0001
AGE CUBED	-0.0544	0.9471	<0.0001	-0.0583	0.9434	<0.0001
FEMALE	0.4498	1.5680	<0.0001	0.4900	1.6323	<0.0001
RACE_W	-1.1331	0.3220	<0.0001	-0.3339	0.7161	<0.0001
RACE_B	-0.3702	0.6906	<0.0001	-0.2471	0.7811	0.0004
DISABLE	2.9300	18.7276	<0.0001	1.4375	4.2102	<0.0001
INC_NW	0.0330	1.0336	<0.0001	0.0212	1.0214	<0.0001
EDUCN	-0.1961	0.8219	<0.0001	-0.0677	0.9345	<0.0001
PCINCOME	-0.7365	0.4788	0.0017	-0.7392	0.4775	0.0047
PCEMPLOY	0.0102	1.0103	0.8166	0.0219	1.0221	0.5820
BEFTRATIO	-0.3758	0.6867	0.7479	1.7485	5.7460	0.1483
-2 Log Likelihood = 100,814.53						

Table 14 displays the multinomial logistic regression results for the employment status equation using control variables only, including parameter estimates, corresponding odds ratios and p-values for the choice model including control variables only. For the convenience of analysis, all β s associated with full-time employed status, i.e., $y_{ist} = 3$, are set to 0. Thus, Table 14 reports the difference in the regression coefficients and corresponding odds ratios. For instance, the coefficient of variable *female*, 0.4498 means that with everything else being equal, the odds ratio for a female to be unemployed relative to full-time employed is $e^{0.4452} = 1.5680$ times the ratio for a male. Similarly, from the entry at the same row of variable *female* and the sixth column of Table 14, the ratio for a female to be part-time employed relative to full-time employed is $e^{0.4900} = 1.6323$ times the ratio for a male. In addition, the p-values on the fourth and seventh columns corresponding to variable *female* indicate that explanatory

variable *female* is statistically significant in explaining the employment status of an individual. In short, females are more likely to be unemployed and employed part-time than males. This result is consistent with previous studies by Neumark (1998) and Royalty (1998). Also consistent with previous studies are estimate results of variables *education*, *disable*, and *age*. Variables *age_squared* and *age_cubed* are included, in addition to *age*, to obtain a more complete understanding of the effect of an individual's age on the choice of employment. For a person aged 16 and older, the likelihood of working increases as the individual matures and obtains more education. But the likelihood of being employed does not always increase as a person grows older. The simple and most usual case is to retire at a certain age. A quadratic curve between the likelihood of employment and age possibly better describes the relationship. The variable *inc_nw* measuring all annual incomes other than salary and wage is significant in the model. The two positive coefficients in the second and fifth columns indicate that if an individual has more non-wage income, she has less incentive to work full-time.

The three state level variables tell different stories. The negative coefficients of *PCINCOME* suggest that if an individual lives in a state with higher per capita income, she is less likely to be unemployed or work part-time. The estimate results of *PCEMPLOY* are surprisingly insignificant. When the number of full-time and part-time jobs in a state is higher, it is hypothesized that residents of that state are less likely to be unemployed. It is also worth noticing that the proxy of the generosity level of a state's unemployment insurance, variable *BEFTRATIO*, is not significant in explaining the choice model for employment status.

Model Including Legal Variables

To test its differential effects on the different subgroups affected by the specific prohibition, the legal variable is interacted with the subgroups addressed by the regulations. To assess the improvement in fit of the models that include the legal variables over the base model, the value of $-2\log(\text{likelihood})$ is calculated and reported in Table 15. The difference between -2 log likelihood statistics of the base model and the model including the legal interaction variables follows a chi-square distribution under the null

hypothesis of no difference between the models. Here, the number of degrees of freedom of the chi-square distribution equals the difference in the number of parameters from the base model. Also reported is the *p*-value associated with the specific type of restriction, which measures the significance of the inclusion of the legal interaction terms in the choice model.

Table 15. Effects on Employment Status: Comparison of Multinomial Logistic Regressions

Data: 1991 ~ 1996, Unmarried single-person households, 82,083 observations.				
Model	-2 Log Likelihood	Difference in -2 Log Likelihood from the base model	Difference in the number of parameters from the base model	p-value
Base	100,814.53	N/A	N/A	N/A
Include Disable*Law and Able*Law	100,805.51	9.02	4	0.0606

Table 16. Effects on Employment Status: Estimated Logarithmic Odds Ratios. Multinomial Logit Models for Disability-Based Underwriting Restrictions.

Data: 1991-1996, Unmarried Single-person households.						
Interaction Terms	Unemployed versus Full-Time			Part-Time versus Full-Time		
	Estimate	Odds Ratio	p-value	Estimate	Odds Ratio	p-value
Disable*law	0.0410	1.0419	0.6368	0.0518	1.0532	0.6117
Able*law	0.0823	1.0858	0.0920	-0.1063	0.8992	0.0235

Effects of Disability Based Prohibition Law

The introduction of disability based underwriting restrictions is marginally statistically significant. However Table 16 suggests that variable *able_law* is significant. Estimation indicates that when disability based underwriting restriction is in effect, able-bodied individuals are 10% less likely to work part-time relative to full-time. The employment of disabled people seems not to be affected. Although the law may have lowered the premium rate for the disabled when the insurance is purchased through a small employer, the effects are not strong enough to have an observable influence on the hiring behavior of

small employers. It is also possible that disabled individuals have limited access to jobs. Among 8,971 disabled individuals in the sample, 60.6% are unemployed, and only 25.7% have full-time jobs, of which 55.2% are covered by group insurance, 8.7% and 5.9% by individual or government plan, respectively, and 30.2% do not have any insurance.

4.2. Test Results about Firm Size

Next analysis is conducted to examine whether the underwriting prohibition law is related to firm size of full-time workers whose health insurance costs is likely to be affected by the laws, namely, able-bodied and disabled workers.

Model with Control Variables Only (Base Model)

Table 17 displays the multinomial logistic regression results for the firm size equation where control variables only are included. Firms are classified into three categories: small, medium and large, based on the number of employees a firm hires. The range of number of employees for the three categories are 1~9, 10~24 and 25 and more. Recall that when underwriting is permitted in the small group health insurance market, the practice of underwriting is more stringent the smaller the size of the firm. We also distinguish firms with 10~24 employees to examine whether this group experiences different impacts than firms with fewer than 10 employees. Multinomial logistic models are employed with the results reported below. The alternative ordered discrete choice models produce similar results.

From Table 17, we see that all individual characteristics in the model are significant in explaining firm size choice by individuals. For instance, the results show that females are more likely to be hired by medium and large firms than males. Specifically, a female is 31% more likely to work for a medium sized firm than a small firm. Another observation of Table 17 is that the disabled are more likely to work for small firms. The statistically significant coefficient, -0.2390, indicates that a disabled individual is 21% less likely to be employed by a large firm than a small one, compared to an able-bodied worker. The

effect of age on firm size is similar to its effect on employment status. When age increases, an individual is more likely to be hired by larger firms, but the increase rate of the possibility decreases with age, reflected by the negative value of the coefficient for variable *age_squared*. Results also show that a white person is more likely to work for small firm, while a black one has the reverse likelihood. In addition, education level plays a role in determining firm size of a person's choice. The more education a person receives, the more likely this person is employed by a large firm than a small one. The macro economic variables do not have significant influences on individuals' choice of firm size, though they may on choice of employment status.

**Table 17. Effects on Firm Size of Full-time Employed:
Multinomial Logistic Regression with only Control Variables.
(Year and State effects are included, although coefficients are not reported.)**

Data: 1991-1996, Full-time employed, 59,824 observations						
Variable	Large versus Small			Medium versus Small		
	Estimate	Odds Ratio	p-value	Estimate	Odds Ratio	p-value
INTER	-2.6949	0.0675	0.0358	-3.3372	0.0355	0.0756
AGE	0.7029	2.0196	0.0440	0.0257	1.0260	0.9576
AGE SQUARED	-0.2058	0.8140	0.0201	-0.0848	0.9187	0.5017
AGE CUBED	0.0168	1.0169	0.0191	0.0092	1.0092	0.3789
FEMALE	0.5287	1.6967	<0.0001	0.2702	1.3102	<0.0001
RACE_W	-0.1466	0.8636	0.0177	-0.0035	0.9965	0.9690
RACE_B	0.4456	1.5614	<0.0001	0.0592	1.0610	0.5884
DISABLE	-0.2390	0.7874	<0.0001	-0.2253	0.7983	0.0077
INC_NW	-0.0053	0.9947	<0.0001	-0.0032	0.9968	0.0705
EDUCN	0.1007	1.1059	<0.0001	-0.0082	0.9918	0.2179
PCINCOME	0.2160	1.2411	0.3730	0.0117	1.0118	0.9753
PCEMPLOY	0.0024	1.0024	0.9559	0.0791	1.0823	0.1528
BEFRATIO	1.7860	5.9655	0.0987	1.9542	7.0583	0.2787
-2 Log Likelihood = 88,369.56						

Model with Legal Variables

Table 18 reports the comparison of the model with the specific type of underwriting restriction, and the base model. The disability based underwriting restriction marginally influences full-time workers' choice of firm size, indicated by the test statistic of 7.98.

**Table 18. Effects on Firm Size of Full-time Employed:
Comparison of Multinomial Logistic Regressions**

Data: 1991-1996, Full-time employed, 59,824 observations				
Model	-2 Log Likelihood	Difference in -2 Log Likelihood from the base model	Difference in the number of parameters from the base model	p-value
Base	88,369.56			
Include Law*Disable and Law*Able	88,361.58	7.98	4	0.0923

**Table 19. Effects on Firm Size of Full-time Employed: Estimated Logarithmic Odds Ratios.
Multinomial Logit Models for The Underwriting Restriction**

Data: 1991-1996, Full-time employed, 59,824 observations.						
Variable	Large versus Small			Medium versus Small		
	Estimate	Odds Ratio	p-value	Estimate	Odds Ratio	p-value
Interaction Terms						
Disable*law	0.0267	1.0271	0.8432	-0.0607	0.9411	0.7766
Able*law	-0.0957	0.9087	0.0363	-0.2109	0.8099	0.0053

The coefficients and related *p*-values of legal interaction terms are reported in Table 19. Entries indicate that when the law is in effect, able-bodied workers are more likely to work for small firms than medium and large firms. To be specific, an able-bodied worker is 23.5% ($1/\exp(-0.2109) = 1.235$) more likely to work for a small firm than a medium one, when physical impairment is not allowed as a criterion for the purpose of underwriting in group health insurance. This coefficient estimation is significant with *p*-value less than 1%. For an able-bodied worker, the odds ratio of working for a large firm relative to a small one decreases by 9.13% when a law is in effect to prevent the use of disability status in underwriting process. When combined with the findings of Browne and Frees (2004), the findings suggest that smallest firms hire more able-bodied workers but drop group health insurance in states where physical impairment based underwriting restriction is in force.

4.3 Test Results about Wages

The study then proceeds to test whether the underwriting restriction is associated with changes in wages of small firm employees. Control variables include variables describing job characteristics, in

addition to characteristics of individuals and state economic conditions employed when testing the other two hypotheses. The observations used to test the wage effects are individuals who are employed by small firms, either part-time or full-time. Since the variable annual wage tends to have long-tailed distribution, logarithmic annual wage plays the role of the fitted response in the estimation equation. Accordingly, independent variables originally measured by dollar value like non-wage income and per capita income are transformed to logarithmic values. In addition, both logarithmic values of weeks worked per year and that of hours worked per week are used to replace the actual values so that together with logarithmic annual wage, one can easily calculate logarithmic weekly wage. Table 20 reports all the estimation results of the underwriting restriction. Also a column is inserted to reflect the percentage change in dollar value of annual wage associated with a change in the explanatory variable.

Table 20 Effects on Wages of Small-firm Workers
Effects of industry and occupation are included, although coefficients are not reported.

Data: 1991-1996 small firm workers, 12,913 observations.

Variable	Estimate	% Change in \$	p-value
Race_w	0.0060	0.60%	0.9132
Race_b	-0.0758	-7.3	0.2720
Age	0.7382	109.2	0.0089
Age2	-0.1203	-11.3	0.0978
Age3	0.0054	0.54	0.3589
Female	-0.1798	-16.5	<0.0001
Disable	-0.2746	-24.0	<0.0001
Educn	0.0449	4.6	<0.0001
Group	0.3546	42.6	<0.0001
Fulltime	0.1878	20.7	<0.0001
Jobswitch	-0.1802	16.5	<0.0001
Lognowage	-0.2271	-20.3	<0.0001
Logwks	0.8850	2.0 ^{N1}	<0.0001
Loghrs	0.5826	1.4 ^{N2}	<0.0001
LgPCIncome	0.4758	2.1 ^{N3}	<0.0001
PCEmploy	-0.0593	-5.8 ^{N4}	0.0394
Befratio	-0.8146	-7.8 ^{N5}	0.0129
Disable*law	0.1823	20.0	0.1267
Able*law	0.0832	8.7	0.0335

Note: The superscript ^N indicates the change is calculated for an average worker. Specifically, ^{N1} and ^{N2} are calculated if the average worker works one more week, or one more hour per week, respectively. ^{N3} through ^{N5} indicate the percentage changes in dollar value of the average worker's annual wage when the per capita income of the worker's state increases by \$1,000, per capita employment by unity, and the benefit ratio by 0.1, respectively.

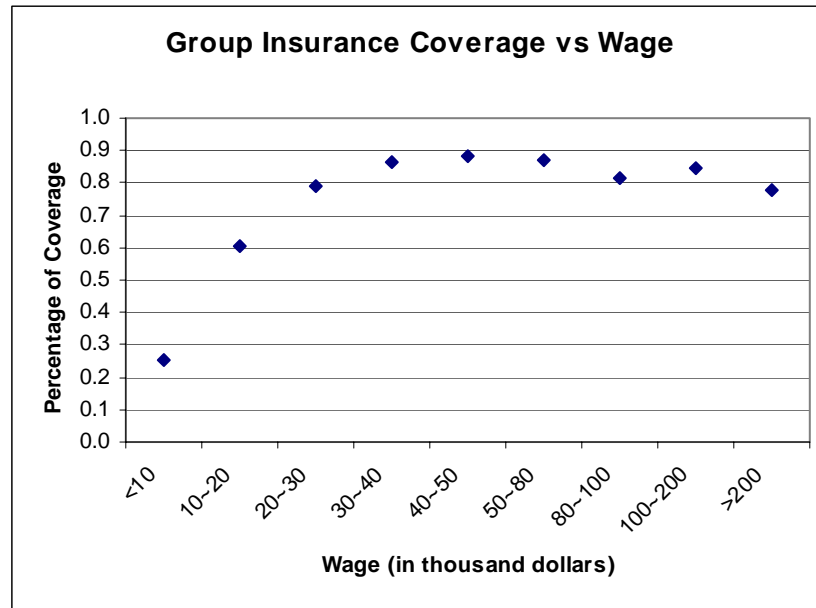
Analysis of Control Variables

The results show that race of a worker does not have any influence on how much he/she earns in this market. This is reflected by the large p-values of variables *race_w* and *race_b*. However, all other individual characteristics have statistically significant power in explaining the wage of a small firm worker. Age is significantly related to a worker's wage level. Wage increases with age, but the rate of wage increase decreases, reflected by the positive sign of variable *age* and negative sign of *age_squared*. Taken together, the estimation equation including age based legal variable estimates that, a 50-year old worker earns 109.2% more than a 40-year old, when everything else is equal. With respect to gender, females earn about 16.5% less than males. Compared to able-bodied worker, the wage of a disabled worker is about 24.0% less. As conceived by common sense, education a person receives is positively related to her wage, with a 4.6% increase in wage per additional year of education received. Full-time workers generally earn about 20.7% more than part-times. If an individual changes her job during a year, then her wage income of that year is 16.5% less than that of workers who stay on their jobs. A possible explanation may be that people who change jobs take some time off between two jobs. CPS data shows that on average, people work 48 weeks per year if they stay on their jobs, while individuals who switch jobs work about seven weeks less. Not surprisingly, number of weeks worked per year and number of hours worked per week are positively related to annual wage.

What should be pointed out is that the status of group health insurance, measured by variable *group*, is positively related to wage, apparently opposite to the argument that employers shift their costs of providing group health insurance to workers in the form of lower wage. Figure 2 suggests another story. The percentage of group insurance coverage is related to wage level. Among the group of individuals whose annual wage is below \$10,000, only 25.6% are covered by group insurance provided by employers. This percentage jumps to 60.8% for the group with annual salary income of \$10,000-\$20,000. Among all other working populations, about 80% participate in the employment based health insurance. In other

words, wage may be a better indicator of group coverage than group coverage is of wage.

Figure 2. Group Insurance Coverage versus Wage



Analysis of Legal Variables

In addition to estimation results of control variables, Table 20 also reports that of legal interaction variables. Estimations show that able-bodied workers earn 8.7% more when a law is effective to restrict the use of impairment status for the purpose of underwriting in group insurance. This effect on wage is statistically significant. This result, combined with the findings by Browne and Frees (2004), suggests that when disability based restriction on underwriting is in effect, able-bodied workers of small firms choose to opt out the group health insurance, in exchange for a higher take-home pay. The 8.7% increase in wage translates into \$1,875 increase in dollar value for a worker who earns mean wage in the sub-sample of full-time small firm workers. This estimation is in line with findings of Levitt et al (1999), who estimate that the average cost of health benefits each worker for employers with three to 199 employees was \$2,268 in 1999. But caution needs to be exercised about this estimation since the model

with fixed state and year effects fails to identify significant estimation of the underwriting restriction.

These findings are not the same as that of Kapur (2002) and Kaestner and Simon (2002). They both examine the labor market effects of a broader set of legislations governing the small group insurance market, and do not find significant results. It is probable that some reforms may cancel out others in terms of the effects on the labor market. The present study focuses on three types of restriction on underwriting, and tests their effects on the labor market of small firms. This strategy may have helped to capture the effects of interest through concentration.

5 Conclusion

In the United States, about two thirds of the non-elderly population obtains health insurance coverage through an employer. State governments have enacted regulations that prohibit the use of a variety of underwriting criteria, ostensibly to make insurance more affordable to those who would have otherwise been denied coverage or charged higher rates. This study tests whether or not the regulations that restrict the use of disability status as criterion for the purposes of underwriting on the small group insurance market affect the labor market outcomes.

Research generally supports the theory that employment based health insurance impacts the labor market because the coverage provided by employers constitutes a portion of employment costs, which influence employment decisions of both workers and employers. The underwriting restrictions may have different effects on the premium rate of different groups, and hence impose different effects on the labor market outcomes of these groups.

The study makes use of CPS data from 1991 through 1996 and data from the Bureau of Economic Analysis Observations include households that have only one unmarried person with that person being aged 16-64. The analysis is limited to single person households to avoid problems associated with the analysis of health insurance consumption by multi-member households.

There are three parts of the analysis. First, the relationship between the disability-based underwriting restriction and changes in the employment status of disabled and able-bodied people is examined. Next the hypothesis that the restriction is associated with workers' choice of the size of the employer's business is tested. On the one hand, the disabled, who are more favorably underwritten as a result of the underwriting restriction, may pursue jobs with small firms to take advantage of the lowered insurance premium. In this case, rates of insurance consumption among these groups would be observed to increase. On the other hand, small firms may discontinue providing health insurance as a result of the underwriting restriction to retain able-bodied workers. This would result in reduced rates of insurance consumption. The first two tests are conducted by fitting multinomial logistic models. Finally a general linear model is employed to detect the possible effects of the underwriting restriction on wages of small firm workers.

When disability based restriction is in place, the able-bodied are more likely to work full-time than part-time. The restriction is statistically significant in the models fitting the choice of firm size by workers and the wages of small firm employees. The findings suggest that when disability based restriction on underwriting is in effect, able-bodied workers are more likely to work for small firms. Further, empirical results suggest wages paid to able-bodied workers are higher when the underwriting restriction is in place. Taken together, the findings suggest that small firms respond to the restrictions by discontinuing offering health insurance as an employee benefit and increasing wage compensation. A small firm worker, who earns average wage, is estimated to receive a \$1,875 increase in pay when a state law prohibits disability based underwriting. This increase in wage is about 83% of the average per worker cost of health insurance for employers with three to 199 workers. However this finding is not robust as discussed in section 4.

As predicted by labor economic theory, the results indicate that disability-based underwriting prohibitions in the group health insurance market are associated with individuals' employment decisions and wage levels. Evidence from unmarried single-person households suggests that prohibition on the use

of disability status in underwriting is associated with significant changes in the labor market outcomes. The results have implications on public policies focused on health insurance market. This side-effect warrants a cost-benefit analysis on a broader scale when a regulation is in the process of drafting and debating.

In the current study, only single-person households are included in the sample. Future work should address whether the findings are generalizable to the broader population. While the study sheds light on the decision making that results from the underwriting restrictions, the estimates of the magnitude of the effects need to be tempered prior to their being the basis for public policy, as the sample does not represent the United States labor market as a whole. With that said, the study does have important implications of these laws on the employment decisions made in the labor market.

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Appendix A

In the following model we assume there are only two types of workers in the labor market, high risks and low risks. Employers have to offer health insurance to all the employees. We modify Gruber's (1992) model to describe the effects of underwriting restrictions on the labor market.

A.1 Derivation of Formulas

Suppose the two types of workers in the labor market are type A, for high risks and type B, for low risks. Let α and β denote the group A's and B's evaluation of the marginal dollar spent by the employer for providing health insurance to the employees, and refer to them as evaluation coefficients hereinafter. Discussions in section 2 indicate that α and β are not likely to be the same when underwriting restrictions are in place.

Labor demand and supply for both groups are modeled by equation set (A.1):

$$\begin{aligned} L^s_A &= f_A(W_A + \alpha C), & L^s_B &= f_B(W_B + \beta C) \\ L^d_A &= g_A(W_A + C, W_B + C), & L^d_B &= g_B(W_B + C, W_A + C) \end{aligned} \quad (\text{A.1})$$

Own- and cross-elasticities of labor demand and supply for each sub-market are given by (A.2):

$$\begin{aligned} \eta^s_A &= f'_A \cdot \frac{W_A}{f_A} & \eta^s_B &= f'_B \cdot \frac{W_B}{f_B} \\ \eta^d_A &= g_{A1} \cdot \frac{W_A}{g_A} & \eta^d_B &= g_{B1} \cdot \frac{W_B}{g_B} \\ \eta^d_{AB} &= g_{A2} \cdot \frac{W_B}{g_A} & \eta^d_{BA} &= g_{B2} \cdot \frac{W_A}{g_B} \end{aligned} \quad (\text{A.2})$$

where g_{A1} and g_{A2} are the partial derivatives of function g_A with respect to the first and second argument, respectively, f'_A denotes the derivative of function f_A . When there is no ambiguity the arguments of functions are dropped for simplicity. For example, the demand elasticity for group A labor actually is

$$\eta_A^d = \frac{W_A}{g_A(W_A + C, W_B + C)} \cdot g_{A1}(W_A + C, W_B + C) = g_{A1} \cdot \frac{W_A}{g_A}$$

Equating demand and supply for each group, and taking total differentiation to each equation, one gets

$$f_A' \cdot (dW_A + \alpha \cdot dC) = g_{A1} \cdot (dW_A + dC) + g_{A2} \cdot (dW_B + dC) \quad (\text{A.3})$$

$$f_B' \cdot (dW_B + \beta \cdot dC) = g_{B1} \cdot (dW_B + dC) + g_{B2} \cdot (dW_A + dC) \quad (\text{A.4})$$

Solving equations (A.3) and (A.4) for dW_A/dC and dW_B/dC yields

$$\begin{aligned} \frac{dW_A}{dC} &= - \frac{f_B' g_{A1} - g_{A1} g_{B1} + g_{A2} g_{B2} - \alpha(f_A' f_B' - f_A' g_{B1}) + (1 - \beta) f_B' g_{A2}}{f_B' g_{A1} - g_{A1} g_{B1} + g_{A2} g_{B2} - (f_A' f_B' - f_A' g_{B1})} \\ &= - \frac{\alpha \eta_A^s \eta_B^s - \alpha \eta_A^s \eta_B^d - \eta_A^d \eta_B^s + \eta_A^d \eta_B^d - \eta_{AB}^d \eta_{BA}^d - (1 - \beta) \eta_B^s \eta_{AB}^d \cdot \frac{W_A}{W_B}}{\eta_A^s \eta_B^s - \eta_A^s \eta_B^d - \eta_A^d \eta_B^s + \eta_A^d \eta_B^d - \eta_{AB}^d \eta_{BA}^d} \\ &= - \frac{(\alpha \eta_A^s - \eta_A^d)(\eta_B^s - \eta_B^d) - \eta_{AB}^d \eta_{BA}^d - (1 - \beta) \eta_B^s \eta_{AB}^d \cdot \frac{W_A}{W_B}}{(\eta_A^s - \eta_A^d)(\eta_B^s - \eta_B^d) - \eta_{AB}^d \eta_{BA}^d}, \end{aligned} \quad (\text{A.5})$$

and

$$\begin{aligned} \frac{dW_B}{dC} &= - \frac{f_A' g_{B1} - g_{A1} g_{B1} + g_{A2} g_{B2} - \beta(f_A' f_B' - f_B' g_{A1}) + (1 - \alpha) f_A' g_{B2}}{f_A' g_{B1} - g_{A1} g_{B1} + g_{A2} g_{B2} - (f_A' f_B' - f_B' g_{A1})} \\ &= - \frac{\beta(\eta_A^s \eta_B^s - \eta_A^d \eta_B^s) - \eta_A^s \eta_B^d + \eta_A^d \eta_B^d - \eta_{AB}^d \eta_{BA}^d - (1 - \alpha) \eta_A^s \eta_{BA}^d \cdot \frac{W_B}{W_A}}{\eta_A^s \eta_B^s - \eta_A^d \eta_B^s - \eta_A^s \eta_B^d + \eta_A^d \eta_B^d - \eta_{AB}^d \eta_{BA}^d}. \end{aligned} \quad (\text{A.6})$$

To assess the influence of underwriting restrictions on job opportunity, we take total differentiation to the demand equation of group A, and denote the labor demand at equilibrium by L_A^m . It follows then

$$\frac{dL_A^m}{dC} = g_{A1} \cdot \left(\frac{dW_A}{dC} + 1 \right) + g_{A2} \cdot \left(\frac{dW_B}{dC} + 1 \right)$$

$$\begin{aligned}
&= \frac{f_A'}{I} \{ (1-\alpha)(f_B' g_{A1} - g_{A1} g_{B1} + g_{A2} g_{B2}) + (1-\beta) f_B' g_{A2} \} \\
&= \frac{L_A^m}{W_A} \eta_A^s \frac{(1-\alpha)(\eta_A^d \eta_B^s - \eta_A^d \eta_B^d + \eta_{AB}^d \eta_{BA}^d) + (1-\beta) \eta_B^s \eta_{AB}^d \cdot \frac{W_A}{W_B}}{\eta_A^s \eta_B^s - \eta_A^s \eta_B^d - \eta_A^d \eta_B^s + \eta_A^d \eta_B^d - \eta_{AB}^d \eta_{BA}^d} \quad (\text{A.7})
\end{aligned}$$

where $I = f_A' f_B' - f_A' g_{B1} - f_B' g_{A1} + g_{A1} g_{B1} - g_{A2} g_{B2}$

$$= \frac{f_A' f_B'}{W_A W_B} (\eta_A^s \eta_B^s - \eta_A^d \eta_B^s - \eta_A^s \eta_B^d + \eta_A^d \eta_B^d - \eta_{AB}^d \eta_{BA}^d). \quad (\text{A.8})$$

Similarly one gets

$$\begin{aligned}
\frac{dL_B^m}{dC} &= g_{B1} \cdot \left(\frac{dW_B}{dC} + 1 \right) + g_{B2} \cdot \left(\frac{dW_A}{dC} + 1 \right) \\
&= \frac{f_B'}{I} \{ (1-\beta)(f_A' g_{B1} - g_{A1} g_{B1} + g_{A2} g_{B2}) + (1-\alpha) f_A' g_{B2} \} \\
&= \frac{L_B^m}{W_B} \eta_B^s \frac{(1-\beta)(\eta_A^s \eta_B^d - \eta_A^d \eta_B^d + \eta_{AB}^d \eta_{BA}^d) + (1-\alpha) \eta_A^s \eta_{BA}^d \cdot \frac{W_B}{W_A}}{\eta_A^s \eta_B^s - \eta_A^s \eta_B^d - \eta_A^d \eta_B^s + \eta_A^d \eta_B^d - \eta_{AB}^d \eta_{BA}^d} \quad (\text{A.9})
\end{aligned}$$

A.2 Analysis of Formulas

The analysis is based on four assumptions: (1) workers supply larger quantities of labor in response to a higher wage, so that the labor supply curve is positively sloped for both groups; (2) employers demand smaller quantities of labor of a higher wage, so that the labor demand curve is negatively sloped for both groups; (3) workers from each group are substitutes for those from the other group; and (4) the own elasticity of demand for each group is greater than the cross-elasticity of demand.

By formulas, these assumptions require that

$$(1) \quad \eta_A^s > 0, \quad \eta_B^s > 0;$$

$$(2) \quad \eta_A^d < 0, \eta_B^d < 0;$$

$$(3) \quad \eta_{AB}^d > 0, \eta_{BA}^d > 0; \text{ and}$$

$$(4) \quad |\eta_A^d| > |\eta_{AB}^d|, |\eta_B^d| > |\eta_{BA}^d|.$$

Equations (A.5) through (A.9) indicate that the labor market responses to the underwriting restrictions are pretty complicated, even in this simplified model. Demand and supply elasticities, relative wage levels of groups A and B workers, and the values of evaluation coefficients all contribute to the effect of underwriting prohibitions on the labor market. We focus on the situation when $\alpha \geq \beta$ to demonstrate the different effects of underwriting prohibitions on the two groups. Some special cases are noticed here as illustrations.

Case 1. $\alpha = 1$ and $\beta \leq 1$:

Equation (A.5) and (A.6) now are simplified as

$$\frac{dW_A}{dC} = -1 + \frac{(1 - \beta)\eta_B^s \eta_{AB}^d \cdot \frac{W_A}{W_B}}{(\eta_A^s - \eta_A^d)(\eta_B^s - \eta_B^d) - \eta_{AB}^d \eta_{BA}^d} \quad (\text{A.5})'$$

and

$$\frac{dW_B}{dC} = -\frac{\beta(\eta_A^s \eta_B^s - \eta_A^d \eta_B^s) - \eta_A^s \eta_B^d + \eta_A^d \eta_B^d - \eta_{AB}^d \eta_{BA}^d}{\eta_A^s \eta_B^s - \eta_A^d \eta_B^s - \eta_A^s \eta_B^d + \eta_A^d \eta_B^d - \eta_{AB}^d \eta_{BA}^d}. \quad (\text{A.6})'$$

When $\alpha = 1$ and $\beta < 1$, dW_A / dC is greater than -1, and less than zero when the second term on the right-hand side of (A.5)' is small enough. This is different from the result of Gruber (1992) where dW_A / dC equals to -1. Gruber (1992) finds that when benefits is provided to and fully valued by group A only, the employer costs for the benefits are fully shifted to wages of group A workers. Now benefits are provided to two groups, employer costs for providing group A health insurance are shifted not only to wages of group A, but also to wages of group B workers, as indicated by the negative value of dW_B / dC . Even when β is zero, dW_B / dC is still negative. This implies that the wages of Group B workers will

be cut to “reimburse” the employer even if group B workers do not value the insurance coverage at all. This is exactly the same consequence of a tax imposed on all workers.

With the increase in the value of β , the absolute value of the negative dW_B/dC increases. When $\alpha = 1, \beta = 1$, both dW_A/dC and dW_B/dC are equal to -1, indicating that the full evaluation of employer spending on health insurance will result in full shifting of employer costs to workers’ wages. Each group bears its own portion of the employer costs. In this case the two groups are no difference as we concern. The result is the same as those hinted by Summers (1989) and shown by Gruber (1992).

Now examine equations (A.7)’ and (A.9)’ to assess the effects of underwriting restrictions on employment.

$$\frac{dL_A^m}{dC} = \frac{L_A^m}{W_A} \eta_A^s \frac{(1-\beta)\eta_B^s \eta_{AB}^d \cdot \frac{W_A}{W_B}}{\eta_A^s \eta_B^s - \eta_A^s \eta_B^d - \eta_A^d \eta_B^s + \eta_A^d \eta_B^d - \eta_{AB}^d \eta_{BA}^d} \quad (\text{A.7})'$$

$$\frac{dL_B^m}{dC} = \frac{L_B^m}{W_B} \eta_B^s \frac{(1-\beta)(\eta_A^s \eta_B^d - \eta_A^d \eta_B^d + \eta_{AB}^d \eta_{BA}^d)}{\eta_A^s \eta_B^s - \eta_A^s \eta_B^d - \eta_A^d \eta_B^s + \eta_A^d \eta_B^d - \eta_{AB}^d \eta_{BA}^d} \quad (\text{A.9})'$$

Assumptions (1) ~ (4) assert that dL_A^m/dC is positive or zero whereas dL_B^m/dC is negative or zero. Both derivatives are equal to zero when both β and α equal to 1. A negative dL_B^m/dC suggests that workers who do not value the benefit at its cost might lose jobs because of the insurance coverage. Else being equal, group A workers provide the employer more margin for wage reduction relative to group B workers, so the employer may hire more group A workers to replace group B workers.

Case 2. Both α and β are less than 1:

Equations (A.5) ~ (A.6) can be simplified when the two groups have the same wages. In this case dW_A/dC and dW_B/dC can be shown always negative regardless of the values of α and β . Take,

for example, equation (A.6), the denominator is always positive based on our assumptions so we concentrate on the numerator and notice that both α and β are between 0 and 1:

$$\begin{aligned} & \beta(\eta_A^s \eta_B^s - \eta_A^d \eta_B^s) - \eta_A^s \eta_B^d + \eta_A^d \eta_B^d - \eta_{AB}^d \eta_{BA}^d - (1 - \alpha) \eta_A^s \eta_{BA}^d \\ & \geq -\eta_A^s \eta_B^d + \eta_A^d \eta_B^d - \eta_{AB}^d \eta_{BA}^d - \eta_A^s \eta_{BA}^d = -\eta_A^s (\eta_B^d + \eta_{BA}^d) + (\eta_A^d \eta_B^d - \eta_{AB}^d \eta_{BA}^d). \end{aligned}$$

The last expression is larger than zero. The fact that dW_A/dC and dW_B/dC are both negative indicates that both groups sacrifice their wages for the health insurance coverage, the employer shifts part, if not all, of the employer costs to workers' wages.

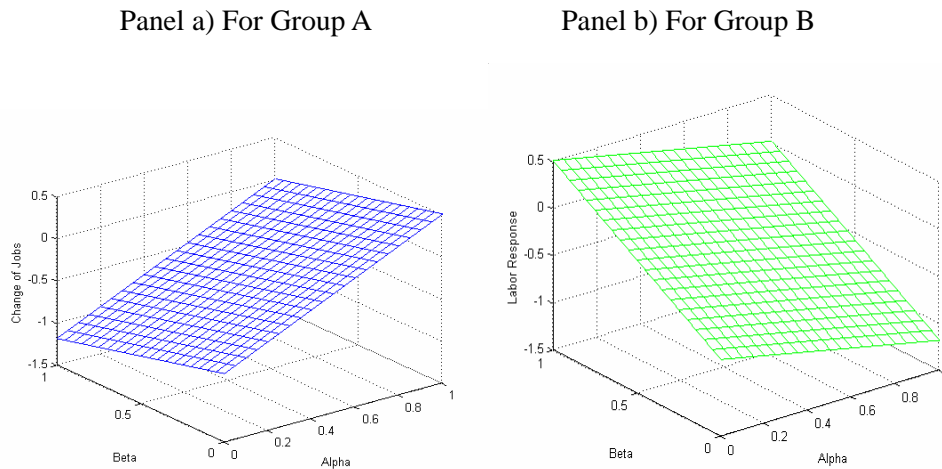
The effects of underwriting restrictions jobs are more complicated, even if the two groups earn the same salary. Both dL_A^m/dC and dL_B^m/dC vary from negative to positive values when α and β change their values. To illustrate, panels a) and b) of Figure A.1 display the curves of dL_A^m/dC and dL_B^m/dC as functions of the evaluation coefficients α and β for a given set of elasticities. Specifically, let $W_A = W_B$, $\eta_A^s = \eta_B^s = 1\%$, $\eta_A^d = \eta_B^d = -0.8\%$, and $\eta_{AB}^d = \eta_{BA}^d = 0.5\%$, then by equations (A.7) and (A.9) we have

$$\begin{aligned} \frac{dL_A^m}{dC} \propto Z_1 &= -1.19(1 - \alpha) + 0.5(1 - \beta), \\ \frac{dL_B^m}{dC} \propto Z_2 &= -1.19(1 - \beta) + 0.5(1 - \alpha). \end{aligned}$$

Panels a) and b) of Figure A.1 are the graphs of functions Z_1 and Z_2 , respectively. The most important information conveyed by Figure A.1 is that the values of dL_A^m/dC and dL_B^m/dC can be both positive and negative depending on the values of α and β .

To summarize, when both groups of workers, low risk and high risk, participate in the health insurance plan offered by the employer, wages of both groups will be reduced to “pay back” the entire or portion of the employer costs for providing the health plan. The job opportunities for the two groups, however, do not necessarily move in the same direction when underwriting restrictions differentiate the two groups’ evaluation of the coverage. The extents of wage reduction and the impact on job opportunities for each group are functions of demand and supply elasticities of labor, relative wage levels, and evaluation coefficients of the two groups. It might occur that both groups lose jobs, or one group loses jobs while the other wins.

Figure A.1 Relationship between Jobs and Evaluation Coefficients



Note: The vertical axis in each panel is the change in jobs taken by that group of workers. Two horizontal axes in both panels are evaluation coefficients of insurance coverage by two groups of workers.

Appendix B

When testing the effects of underwriting restrictions on wages of small firm workers, a model with random state and year effects is employed and results are reported in Section 4. The data is also fitted with a fixed state and year effects model with the results reported below.

Table B. Effects of the Underwriting Prohibition on Wages of Small-firm Workers
Effects of state, year, industry and occupation are included, although coefficients not reported

Data: 1991-1996 small firm workers, 12,913 observations.

Variable	Estimate	% Change in \$	p-value
Race_w	0.0286	2.9%	0.6071
Race_b	-0.0591	-5.7	0.3997
Age	1.0539	186.9	0.0003
Age_sqrd	-0.2007	-18.2	0.0072
Age_cube	0.0119	1.2	0.0517
Female	-0.1740	-16.0	<0.0001
Disable	-0.2767	-24.2	<0.0001
Educn	0.0452	4.6	<0.0001
Group	0.3405	40.6	<0.0001
Fulltime	0.1804	19.8	<0.0001
Jobswitch	-0.1795	-16.4	<0.0001
Lognowage	-0.1585	-14.7	0.0003
Logwks	0.8881	2.0 ^{N1}	<0.0001
Loghrs	0.5947	1.5 ^{N2}	<0.0001
LgPCincome	0.4126	1.9 ^{N3}	0.0008
PCEmploy	0.0040	0.4 ^{N4}	0.9872
Befratio	-1.8191	-1.8 ^{N5}	0.1061
Disable*law	0.0994	10.5	0.4213
Able*law	-0.0001	-0.001	0.9997

Note: The superscript ^N indicates the change is calculated for an average worker. Specifically, ^{N1} and ^{N2} are calculated if the average worker works one more week, or one more hour per week, respectively. ^{N3} through ^{N5} indicate the percentage changes in dollar value of the average worker's annual wage when the per capita income of the worker's state increases by \$1,000, per capita employment by unity, and the benefit ratio by 0.1, respectively.