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DEATH AND TAXES: THE IMPACT OF GOVERNMENT POLICY ON HEALTH

Anca Cotet
Clemson University, acotet@clemson.edu

DEATH AND TAXES: THE IMPACT OF GOVERNMENT POLICY ON HEALTH

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Anca Maria Cotet
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Robert D. Tollison, Committee Chair
Angela K. Dills
Cotton M. Lindsay
Michael T. Maloney
John T. Warner

ABSTRACT

This dissertation investigates the impact of various government policies on health. First, I study the effect of labor income taxes on health. Labor income taxes are predicted to affect health through their impact on the value of time, which is at the same time an important input but also the output of health production. Using variation in labor income tax rates among US states, I find that both higher taxes and more progressive taxes keeping tax liability constant lead to a decline in health.

Second, I challenge the common wisdom that non-economic damage caps on malpractice awards have a positive effect on medical care delivery. My hypothesis is that caps may damage the quality assurance offered by physicians through their willingness to pay the full cost of their medical mistakes. If that is the case, the demand for medical services will decrease, and the net effect on the quantity of medical services delivered is ambiguous. I find evidence that the amount of medical services delivered to the population drops: caps lead to a reduction of the number surgeries performed, the number of individuals treated inpatient or outpatient in community hospitals, and to an increase in the average length of hospitalization.

And third, I explore the issue of licensure requirements in health. I test the hypothesis that current requirements are too strict using state variation in the regulation of telemedicine practices. Telemedicine is predicted to offset the impact of licensing by lowering the quality of the marginal medical services delivered and easing access to medical care, but any regulation that prevents telemedicine practices restores the state of the world originally envisaged by the regulator. My results indicate that states that adopted regulation preventing telemedicine experience an increase in mortality. The interpretation is that current regulation preventing telemedicine has unwanted effects and, thus, I conclude that since telemedicine, which partially offsets the impact of licensing, improves health, current licensing requirements are too strict.

DEDICATION

To my family.

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DEATH AND TAXES:

THE IMPACT OF PROGRESSIVE TAXATION ON HEALTH

Abstract

More progressive taxes, holding tax liability constant, generate disincentives for health investment by decreasing benefits for additional working time and, thus, decreasing returns to health. On the other hand, progressive taxation may induce individuals to invest more in health for the purpose of extending their working life, because lifetime maximization could imply less work per period but more working years. I identify the effect of progressivity through differences in labor income tax rates among states. I find that the former effect dominates, more progressive taxes are negatively correlated with health, and argue that neither selection effects nor reverse causality can explain this result.

JEL Classifications: I12, I18, H24, D91

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Introduction

Understanding the factors that determine individuals' investment in their health is important in crafting effective health policies. In this paper I investigate the relationship between fiscal policy and health investment and conclude that both the average labor income tax rate and the progressivity of labor income tax have a significant impact on health.

Grossman's [1972] health investment model postulates that an increase in wages encourages investment in health by raising the reward for this investment, thus, suggesting that taxes negatively impact health. However, the issue of progressive taxation has not been explored in the context of health yet. I argue that since one important return to health investment is more time to earn wages, a higher marginal tax rate on labor income reduces the incentives to invest in health. At the same time, however, a more progressive tax system generates incentives to inter-temporally substitute toward a longer working life [Ippolito, 1985], thus encouraging health investment. Tax progressivity also alters the input mix used in health production by lowering the cost of the time input, introducing inefficiency in health production.

Empirically, I identify the effect of a tax system from differences in the tax rates on labor income in the state of residence. In each of the three different surveys used, the National Longitudinal Survey of Youth 1979 (NLSY79), the Current Population Survey (CPS) 2002, and the Behavioral Risk Factor Surveillance System dataset (BRFSS) 2002, I measure the impact of increased progressivity through changes in the ratio between the maximum tax rate and the average tax rate on labor income in the state of residence, while keeping constant the average tax rate. I find a negative impact on health from both the average level and the progressivity of the labor income tax rates in the state of residence. Specifically, my estimates obtained from NLSY79 indicate that a 1 percentage point increase in the average rate of taxation is associated with a cumulative decline in health of 0.28 standard deviations by the age 40, and a 1 percentage point increase in the maximum rate of taxation, keeping the average tax rate constant, thus increasing progressivity, is associated with a cumulative decrease in health of approximately 0.36 standard deviations by age 40. I argue that neither selection effects nor reverse causality can explain these effects.

These findings contribute not only to our understanding of the incentives that determine health investment, but also of the mechanics of the tax structure impact on economic performance. Progressivity affects growth through its influence on labor incentives, on investment in education and thus labor productivity and perhaps health production efficiency, and on health investment incentives.

The remainder of the paper is organized as follows: Section 1.2 discuses the issue of health production; Section 1.3 develops a model of income taxation and health; Section 1.4 describes the empirical strategy; Section 1.5 presents and discusses the findings, and Section 1.6 concludes.

Health Production

Grossman [1972] was the first to develop a model of health capital and demand for health that motivated subsequent empirical work in health economics. This study identifies some of the factors that can influence health such as education, the cost of medical care, health depreciation rate (if it changes over time), and the price of time. Empirically he finds that an increase in the hourly wage rate improves health, but it should be recognized that hourly wage rate could be a function of health under the hypothesis that health increases productivity or changes the number of hours worked.

Several of the factors identified by Grossman were subsequently studied in an attempt to explain health outcomes and offer policy recommendations. Lakdawalla and Phillipson [2002], for instance, suggest that the technological innovations that lowered the price of food by shifting food production from the household to the market may be an explanatory factor for the increase in the intake of calories and obesity - based health problems. Others look at technological innovations like fast food for an explanation. Since fast food does not require a long preparation time it has a low cost per calorie consumed, leading to increased caloric intake and obesity [Cutler, Glaeser, and Shapiro, 2003].

The pervasiveness of fast food as well as the amount of time spent exercising, another health determinant, can be explained by the economic theory of time allocation. Becker [1965] proposes that the higher the reward for work, the higher the incentive to spend more time working and to consume less time-intensive commodities. In this case, people will prefer to eat out instead of preparing food at home; will prefer types of food they do not have to wait for, i.e. fast food; and in general will avoid time-intensive activities such as exercise. Readily available statistics (OECD Productivity Database) indicate that Americans tend to work longer hours than most of their counterparts in other countries and, thus, according to the theory of time allocation should tend to use fast-food more often. This tendency implies a higher incidence of diseases, situation supported by Banks et al. [2006] study. They provide evidence that a higher proportion of the United States population age 55-64 reports having various health problems than the similar segment of the population in England (Table A3).

This theory also offers an explanation for the increase in medical expenditures observed in the United States. As the value of time increases, people try to substitute their own time with medical care in producing health. The implication is that we should observe a higher incidence of disease due to less home prevention in the United States, but perhaps a higher rate of cure due to more medical care. Thus the relevant measure of health is not the incidence of disease, but rather the number of unimpaired, productive days during lifetime. It is not obvious that the impact of increased value of time on health as expressed by life expectancy or number of productive days should be negative. This hypothesis is consistent with the observed relatively small difference in life expectancy between the countries postulated to have significant differences in disease incidence (Life expectancy at birth in 2005 is 77.7 years for U.S. and 78.4 years for UK; Source: Census Bureau, International Database). The hypothesis of a higher incidence of diseases when the reward for work increases is also consistent with observed counter-cyclical variations in health [Ruhm, 2000]. He finds that smoking and obesity increase while physical activity and healthy diet habits reduce during booms.

If the explanation for higher incidence of disease is that individuals change the input mix used for health production, it is no longer obvious that spending more time enhancing health will necessarily improve health, as expressed by life expectancy or number of unimpaired days, or promote growth. People already are making rational decisions, maximizing their lifetime income. Forcing them to use more of their own time in health production rather than medical care, which is less time intensive but requires higher financial expenditures, is a constraint that cannot lead to higher income. Even though health improvements that reduce medical spending provide significant scope for growth [Murphy and Topel, 2005] it is not obvious that these should come from allocating more time to health production. The loss of a lower lifetime income may offset any gains from decreased health expenditures.

Consequently, if increased reward for work leads to a higher incidence of diseases and higher medical expenditures, a plausible implication is that the United States is only the first country to experience this trend because it has the highest labor productivity. In the future as countries develop, the same trend will be observed elsewhere[1]. Once it is acknowledged that this trend is the rational implication of a desirable increase in labor productivity and, thus, in the reward for work, it should also be acknowledged that the solution for health problems may not lie in making people spend more of their own time in health production. Rather it may be found in either the increase in the reward for health coming from

[1] International Obesity Task Force, EU Platform on Diet, Physical Activity and Health, March 15, 2005: "A marked trend towards increasing levels of adult overweight and obesity can be found throughout Europe, although there are variations in prevalence." available at http://www.publico.clix.pt/docs/pesoemedida/EU_Platform_Diet_PA_Health_2005.pdf

an increase in the retirement age, or in the decrease in the cost of health production through medical innovations that reduce the price of medical care.

This postulated significant effect of the value of time on health behavior represents the motivation for this study. The way to test the effect of changes in the value of time on health is to look at the effect of exogenous factors that change the value of time. Differences among state tax systems provide a plausible exogenous variation among the value of time of otherwise identical individuals. Specifically, this paper explores the effect of the progressivity of the system of taxation on health in a time allocation setting. Progressive taxation, which affects health choices by changing the relative gain from investment, is most relevant in health context because it is one of the policy tools that generate an inter-temporal distortion.

In regard to the issue of taxation, the relevant question is the effect of increasing progressivity while keeping the average tax rate or the tax revenue constant. Sandmo [1983] addressed this problem with respect to labor supply. For the representative consumer, progressive taxation reduces labor supply compared with a flat tax that brings the same revenues. Overall, through increased progression, the average tax rate falls for low income people but rises for high income individuals, indicating that there is a negative income effect for part of the population, a positive income effect for the other, and a negative substitution effect for everybody. The overall effect on the total labor supply is a function of the relative sizes of these effects. Empirical studies like the one conducted by

Atkinson and Stiglitz [1980] suggest that these effects offset one another in the case of aggregate labor supply.

Ippolito [1985] argues that higher progression creates incentives for inter-temporal substitution. Workers may prefer to work less before the usual retirement age but continue working after retirement age, an effect found to be statistically significant in the empirical analysis conducted on Social Security Newly Entitled Beneficiaries Survey data. Another effect of progressivity is identified by Gentry and Hubbard [2002], who argue that an increase in the degree of progression will decrease job search as it decreases the rewards from the search. Their estimates from the Panel Study of Income Dynamics support this theory.

Similar to Ippolito's [1985] paper, I argue that increased progressivity could induce individuals to invest more in health for the purpose of extending their active life because lifetime maximization, when the duration of life can be chosen through health investment, may be associated with fewer labor hours per period but more working periods. In other words since health investment extends the duration of life, it can also provide a way of avoiding high marginal tax rates by smoothing taxes over a longer period of time. However, there is an opposite effect: if progressivity discourages work and decreases utility, it also generates disincentives for health investment. In addition, it leads to inefficient health production by distorting the input mix because it changes the price of the time input. Consequently, I expect that the degree of tax progressivity has a significant impact on health investment in addition to the effect of tax level identified by Grossman [1972].

This paper uses individual level data to investigate the impact of progressive taxation on health by first developing a health-investment type of model and then testing empirically the effects of tax system progressivity on the flow of health. I identify the effect of tax progressivity through differences in labor income taxes among states. The empirical results indicate that controlling for the level of the tax more progressive income taxes are associated with declining health.

The Theoretical Model

The investment model of health proposes that individuals use their time as well as medical care to produce a stock of health, which, in turn, determines the duration of life. This paper investigates the impact of progressive taxation on health in the setting of an health investment model.

Let the individual's utility be increasing at a decreasing rate in consumption (*c*) and leisure (*l*):

$$U_t = \alpha_1 \log(c_t) + \alpha_2 \log(l_t) \text{, where } \alpha_1, \alpha_2, (\alpha_1 + \alpha_2) < 1 \tag{1}$$

Investments in health determine the amount of time available to be divided among health production, market production, and leisure. Health is produced using time

(x) and medical care (m). The Cobb-Douglas in logs production function of health is defined as:

$$Q_t = A + \beta_1 \log(x_t) + \beta_2 \log(m_t) \tag{2}$$

where Q_t denotes output, m_t is medical care, $\beta_1 + \beta_2 < 1$, and A is a parameter dependent on human capital (S).

Total human capital is considered exogenous in the sense that the accumulation period has already ended. Health depreciates at a rate (δ), which increases with time, so the dynamics of the health stock (D_t) are described by:

$$\dot{D}_t = A + \beta_1 \log(x_t) + \beta_2 \log(m_t) - \delta D_t \tag{3}$$

The cost of investment is measured by the time spent producing health that could have been used for other purposes (x_t) and by the cost of medical care. In this model the gain from investing in health comes from a longer life, allowing for more periods in which the individual can earn wages or enjoy leisure. The period is counted as a standard measure of healthy time; thus, the total time available each period is normalized to 1, and the number of periods available is a function of the stock of health. Therefore, the time spent working each period is ($1-x_t-l_t$), and the pre-tax total income (I_t) each period is calculated as earned wage, which is a function of human capital (S), multiplied by the amount of time spent working.

$$I_t = (1 - x_t - l_t)w \quad (4)$$

The amount of money available for utility enhancing consumption is determined by the income earned, and by the amount of tax liability and of medical expenditures.

$$c_t = w(1 - x_t - l_t) - T(w(1 - x_t - l_t)) - p_m m_t \quad (5)$$

where $T(w(1\text{-}x_t\text{-}l_t))$ is the tax function and p_m is the price of medical care.

This model suggests a trade-off between using time for market production versus health production, similar to the one that occurs in any specialization decision in which gains from trade provide incentives toward production specialization. However, in reality the specialization decision with respect to health versus market production bears some particularities.

First, specialization can occur only if trade takes place: when people choose to specialize in producing a specific product or service, there is an underlying assumption that the goods and services they no longer produce can be acquired on the market. Health cannot be bought, nor is it obvious that health can be produced using the only input that can be bought, medical care. Even if it could be, the quality of medical services is hard to evaluate without having specific knowledge. Obtaining specific knowledge requires a time investment, bringing us back to the point that all persons are in charge of producing their own health and that health production technology is always going to involve time use.

The second particularity refers to the way health production is affected by taxes. Wages earned in different occupations are taxed similarly under the income tax. On the other hand, the output of health production is not taxed directly: taxation affects only the product, healthy time, used for market production. In the case of market production, the worker receives the value of his output in the form of wages that are immediately taxed. In the case of health production, the increase in the stock of health is not taxed in the period of occurrence but will be taxed when the healthy time produced is used for work. It can be said that taxes corresponding to the health output produced this period are paid in the future with the extended active life. Because of this delay between obtaining the output and the moment when taxes are due, taxation generates an inter-temporal substitution effect that represents an incentive to produce health. This effect should moderate the direct effect of the decreased incentives to invest in health associated with the decrease in wages by taxation noted by Grossman [1972].

A more interesting case is that of progressive taxation. Progressive taxation exacerbates the issue just described because the marginal tax increases with wages and, thus, with time spent working each period. As a result, for the representative individual, a progressive tax decreases the incentives to invest in health compared with a proportional tax bringing the same revenue. But since health production can be used to shift resources between periods, lifetime maximization could be associated with earning a smaller wage per period but working more periods, i.e. living longer. This second effect acts as an incentive to invest in health. Thus, the overall effect of increased progressivity is a function of the relative magnitude of these two effects.

Under progressive taxation the amount of tax increases with income at an increasing rate, such that the marginal rate of taxation is always higher than the average rate of taxation. Accordingly, $T(w(1-x_t-l_t))$, the tax liability in this model, indicates that the amount of tax is a function of income. For the rest of this paper, $\pi = dT/d(w(1-x_t-l_t))$ will denote the marginal rate of taxation and $\tau = T/(w(1-x_t-l_t))$ the average rate of taxation.

The dynamics of this model are described by the current value Hamiltonian (*Hc*) below. The length of lifetime is chosen by the individual through the choice of stock of health. When the stock of health drops below *Dmin*, the individual dies.

$$\begin{aligned} Hc = \alpha_1 \log(w(1-x_t-l_t) - T(w(1-x_t-l_t)) - p_m m_t) + \alpha_2 \log(l_t) + \\ + \lambda_t (A + \beta_1 \log(x_t) + \beta_2 \log(m_t) - \delta D_t) \end{aligned} \tag{6}$$

The system of equations representing the first order conditions necessary for the maximization is presented below.

FOC:

$$\frac{\alpha_1 w(1-\pi)}{w(1-x_t-l_t)(1-\tau)-p_m m_t}=\frac{\lambda_t\beta_1}{x_t} \tag{7}$$

$$\frac{\alpha_1 w(1-\pi)}{w(1-x_t-l_t)(1-\tau)-p_m m_t}=\frac{\alpha_2}{l_t} \tag{8}$$

$$\frac{\alpha_1 p_m}{w(1-x_t-l_t)(1-\tau)-p_m m_t}=\frac{\lambda_t\beta_2}{m_t} \tag{9}$$

$$\dot{D}_t = A+\beta_1\log(x_t)+\beta_2\log(m_t)-\delta D_t \tag{10}$$

$$\dot{\lambda}_t = (\delta+\rho)\lambda_t \tag{11}$$

$$D_{1^{st}\ period} = D_o \tag{12}$$

$$\lambda_{1^{st}\ period} = \lambda_0(D_o) \tag{13}$$

In this problem, ρ is the discount rate, and λ_t is the Lagrange multiplier representing the shadow value of health. The above system of equations completely characterizes the time path of the stock and the shadow value of health.

This system implies that the amount of time spent investing in health is:

$$x_t=\frac{\lambda_t\beta_1\frac{(1-\tau)}{(1-\pi)}}{(\alpha_1+\lambda_t\beta_2)+(\alpha_2+\lambda_t\beta_1)\frac{(1-\tau)}{(1-\pi)}} \tag{14}$$

As a result, the fraction above can be interpreted as the share of the total time available each period being used for health production. In the case of a proportional income tax, the marginal rate of taxation is equal to the average rate of taxation: $\pi = \tau$; thus, the fraction of healthy time spent for health production becomes: $\frac{\lambda_t \beta_1}{(\alpha_1 + \alpha_2) + \lambda_t (\beta_1 + \beta_2)}$. But the higher the difference between the marginal rate of taxation and the average rate, i.e., the more progressive the tax system, the higher will be the share of healthy time spent on health.

On the other hand, the more progressive the tax system, the lower the amount of medical care purchased:

$$m_t = w \frac{1}{p_m} \frac{\lambda_t \beta_2 (1-\tau)}{(\alpha_1 + \lambda_t \beta_2) + (\alpha_2 + \lambda_t \beta_1) \frac{(1-\tau)}{(1-\pi)}} \tag{15}$$

This relationship also indicates that the amount of medical care decreases with an increase in the level of the tax rate.

Given the results above, total investment in health is given by:

$$INV_t = G_t + \beta_2 \log(1-\tau) + \beta_1 \log \frac{(1-\tau)}{(1-\pi)} - (\beta_1 + \beta_2) \log[(\alpha_1 + \lambda_t \beta_2) + (\alpha_2 + \lambda_t \beta_1) \frac{(1-\tau)}{(1-\pi)}]$$

where $G_t = A + \beta_1 \log(\lambda_t \beta_1) + \beta_2 \log(\lambda_t \beta_2 w / p_m)$

Therefore, the model predicts that higher tax levels decrease health investment, but does not offer a clear prediction of the impact of progressivity:

$$\frac{dINV_t}{d\frac{(1-\tau)}{(1-\pi)}} = \frac{\beta_1(\alpha_1 + \lambda_t\beta_2) - \beta_2(\alpha_2 + \lambda_t\beta_1)\frac{(1-\tau)}{(1-\pi)}}{\frac{(1-\tau)}{(1-\pi)}[(\alpha_1 + \lambda_t\beta_2) + (\alpha_2 + \lambda_t\beta_1)\frac{(1-\tau)}{(1-\pi)}]} \quad (16)$$

The sign of this expression, given by the sign of the numerator, is uncertain. The actual direction of change of health investment, and thus of health, is ultimately an empirical question. The investment determines the stock of health; thus, controlling for the original level of health, the effect of taxation on health stock is completely determined by its effect on health investment.

An implication of this model is that the share of healthy time spent for investment tends toward a constant as the shadow value of health increases. Since the shadow value of health increases with age, $\lambda_t = \lambda o + exp((\delta+\rho)t)$, the share of time invested in health also increases with age, leveling off at a constant. The same happens with medical care spending. However, since the depreciation rate of health also increases with time, at some point the stock of health drops below a minimum value, and the individual dies. At high values of the shadow value of health, it is more likely that the effect of progressivity on health investment is negative.

Empirical Strategy

The theoretical model suggests that the stock of health is determined by:

$$D_t=D_t\ (D_0, \pi, \tau, X, \Omega),$$

where D_0 is the initial stock of health; X is a vector of controls among which is the price of medical care, Ω is a vector of parameters specific to each individual: α_1, α_2, β_1, β_2, ρ, δ, A, and S education. Thus health is a function not only of the tax level but also of the tax progressivity.

Measuring Progressivity

As the theoretical model suggests, the impact of a progressive system of taxation is captured by the ratio of the marginal tax rate and the average tax rate while controlling for the average tax level in the state of residence. We observe the wage earned by the individual; thus, the average and marginal rate of tax can be calculated for each person, but these measures are endogenous as they are functions of the time spent working, which is endogenous in the model. Also, hourly wage, sometimes used to construct measures of the marginal tax faced by each person, is endogenous if wage is a function of the number of daily hours of work. A solution to this problem would be to use an exogenous measure of the tax level and the degree of progressivity of the tax system constraining individuals. Such a measure is the state level ratio of the marginal tax rate for a maximum level of income and the average tax rate. This ratio measures the growth of the tax rate with income. For instance, between two states having the same maximum rate of taxation, the state with a higher average rate has a less progressive system because it means that low income people are taxed at a higher rate in this state compared with the other. In other words, for states having the same maximum rate but a higher average rate, the marginal tax rate increases at a slower rate with income. Similarly, between two states with the same average tax rate, the one with a higher maximum tax rate has a more progressive system as it means that low income individuals are taxed at a lower rate, i.e. the tax rate increases faster with income.

The caveat of measuring progressivity by this ratio is that it assumes a smooth tax schedule, ignoring the possible kinks generated by constant marginal tax rates within the brackets. Using this ratio it would be impossible to measure accurately the effects of an income tax reform on health just as it can not be done for labor supply [Hausman, 1981]. Moreover, all the issues generated by a negative income tax [Burtless and Hausman, 1978] or by any kind of tax system generating non-convexities in the after-tax income schedule are also relevant for health choices. As previous surveys [Hausman, 1985; Pencavel, 1986] indicate, using piecewise linear constraints delivers different results in the case of labor supply and, thus, has the same effect in the case of health. Nevertheless, the ratio between the marginal and the average tax rate at an exogenous level of income alone is sufficient for investigating the main point of the paper, the existence of a significant effect of the tax progressivity on health, and offers the advantage of simplicity. Given that studies incorporating piecewise-linear constraints indicate larger labor supply responses, my approach will at most underestimate the negative effect of progressivity on health.

Empirical Specification

The empirical analysis uses individual level data to test the effect of tax progressivity on health. Considering only taxes would not account for the entire picture of the effect of government on health choices. It may be the case that people with health problems move where the health care system is better. If the quality of health care is correlated with state expenditures for hospitals, then where taxes are higher and the state spends more on health care, there are also more people with health problems. To account for this possibility, the regression analysis controls for the level of health and hospital expenditures in the state of residence.

Another issue arises from the fact that health production uses two inputs: time and medical care, so there may be substitution in production. The empirical analysis acknowledges that changes in the price of medical care influences health outcomes by controlling for the differences in the median hourly wages of the medical personnel in the state of residence.

Given these considerations, testing the effect of progressive taxation uses the following model specification.

Model 1: OLS on NLSY79 and BRFSS data/ Ordered probit on CPS

$$Health_i = a_0 + a_1(Tax\ progressivity)_i + a_2(Tax\ level)_i + a_3(Price\ of\ medical\ care)_i + a_4(State\ health\ expenditures)_i + a_5(I)_i + a_6(R) + e_i$$

where *I* is a vector individual characteristics variables and *R* is a vector of state demographics.

A source of concern with the estimates obtained from this specification is that individuals self-select themselves with respect to their state of residence. For instance, people who are more efficient at producing wages may prefer to live in states with less progressive systems of taxation. If health also increases labor productivity, then healthier people may choose to locate in states with less progressive income taxes, introducing a bias toward a more negative estimator of the effect of progressivity on health. On the other hand, people who value health more and prefer to spend a lot of time exercising instead of working may choose a state with more progressive taxes in order to benefit from the lower tax rates applied to the lowest income brackets. In this case health is positively correlated with progressivity and the coefficients obtained would be biased toward a more positive estimate. The instrumental variable technique is used to correct for this possibility, the proposed instruments being the property crime rate in the state, the ratio of Democrats to Republicans in the state House, and the same ratio in the Senate, severance tax revenues per capita and the state population.

A high crime rate is the result insufficient law enforcement, indicative of poor police financing. This suggests that the property crime rate is correlated with state expenditures, which are financed by higher taxes and, thus, is also correlated with the tax level. The property crime rate in a state is exogenous as it is not correlated with health production efficiency, so it has the potential of being a good instrument for the tax level. If political beliefs influence the way people vote for taxes, the ratio of Democrats to Republicans is a good indicator of both tax levels and progressivity too. Moreover, since it is not obvious that political preferences are in any way correlated with health, the ratios of Democrats to Republicans in the state House or Senate are good instruments for the tax system. Severance tax revenues are postulated to be correlated with labor income taxes because they represent a good substitute for labor income taxes. Since their base of taxation, natural resources, is fixed severance taxes are very hard to avoid, making severance taxes a good alternative for labor income taxes. As a result they should be strongly negatively correlated with labor income tax rates while at the same time not correlated with health. Hansen and Kessler [2001] argue that state population is an important determinant in the emergence of tax heavens because under sorting smaller states have a more homogenous population lowering political conflict and creating the conditions for the creations of “tax heavens”. Thus the tax system should be strongly correlated with the state population. At the same time there is no reason to believe that state population affects an individual’s health. The only way this would be true is if population would be strongly correlated with population density, but the coefficient of correlation between population and population density is 0.049.

I also acknowledge that there may be selection into states based on state health expenditures and instrument for this variable. The proposed instrument is state government employment- full time equivalent as a share of population. Since a significant share of government employment is occupied in health related fields, higher government employment is expected to be strongly positively correlated with state health and hospital expenditures. With these instruments, the following model specification is estimated.

Model 2: 2SLS model

First stage:

$$Tax\ progressivity_i = b_0 + b_1(Property\ crime\ rate)_i + b_2(Dem/Rep\ ratio\ House)_i + b_3(Dem/Rep\ ratio\ Senate)_i + b_4(Severance\ Tax)_i + b_5(Government\ Employment)_i + b_6(Population)_i + b_7(E)_i + u_i$$

$$Tax\ level_i = c_0 + c_1(Property\ crime\ rate)_i + c_2(Dem/Rep\ ratio\ House)_i + c_3(Dem/Rep\ ratio\ Senate)_i + c_4(Severance\ Tax)_i + c_5(Government\ Employment)_i + c_6(Population)_i + c_7(E)_i + u_i$$

$$State\ health\ expenditures_i = d_0 + d_1(Property\ crime\ rate)_i + d_2(Dem/Rep\ ratio\ House)_i + d_3(Dem/Rep\ ratio\ Senate)_i + d_4(Severance\ Tax)_i + d_5(Government\ Employment)_i + d_6(Population)_i + d_7(E)_i + u_i$$

(where *E* is the vector of exogenous variables from the health regression)

Second stage:

$$Health_i = a_0 + a_1(Tax\ progressivity)_i + a_2(Tax\ level)_i + a_3(Price\ of\ medical\ care)_i + a_4(State\ health\ expenditures)_i + a_5(I)_i + +a_6(R)_i + e_i$$

Data and Estimation Results

The empirical analysis uses a measure of health from the National Longitudinal Survey of Youths 1979 (NLSY79), the physical score determined based on the SF12 survey (higher score means healthier) administered to individuals turning 40 in 1998, 2000, and 2002 for a cross-section analysis. The SF-12 survey, the 12 question survey (Appendix) designed by John Ware of the New England Medical Center Hospital, was meant to give a health assessment not conditioned by the individual propensity to use medical services. This survey is considered reliable when samples are sufficiently large and the objective is to monitor overall physical and mental health outcomes. As the objective of this paper is exactly to measure the overall level of health, these scores provide a good measure for this purpose. But it should be recognized that this physical score suffers from measurement error as it is based on survey data [Baker, Stabile and Deri, 2001]. I acknowledge this potential problem and check the robustness of the results on two additional datasets that provide other measures of health. First, the Behavioral Risk Factor Surveillance System dataset (BRFSS) provides a measure of the number of days of poor physical health in the month prior to the interview, and second, the Current Population Survey (CPS) has a measure of self-reported health ranking from excellent to poor.

In all datasets I use the 2002 state level marginal tax rate at a maximum level of income and the average tax rate on labor income calculated by Daniel Feenberg using the TAXSIM model (Table 1.1) for constructing the tax variables. The maximum tax rate represents "the maximum tax rate for an additional $1000 of income on an initial $500,000 of wage income (split evenly between husband and wife) given that the taxpayer is assumed to be married and filing jointly. This rate allows for a mortgage interest deduction of $50,000 and the calculated state income tax as personal deductions" [Feenberg and Coutts, 1993]. The average marginal income tax rate was calculated using a nationally representative sample of individuals, isolating the effect of the tax system from the impact of the state characteristics.

Table 1.1 Tax Rates on Labor Income by State

STATE	Maximum Tax Rate[1] Wages 2002	Average Tax Rate[1, 2] Wages 2002	Tax Progressivity[3]
Alabama	41.64	27.52	151.308
Alaska	39.76	24.43	162.751
Arizona	42.78	27.29	156.761
Arkansas	44.18	28.64	154.260
California	45.81	29.85	153.467
Colorado	42.69	28.07	152.084
Connecticut	42.52	28.41	149.666
Delaware	43.52	28.00	155.429
Florida	39.76	24.43	162.751
Georgia	43.34	29.04	149.242
Hawaii	44.7	30.26	147.720
Idaho	44.6	30.21	147.633
Illinois	41.6	26.8	155.224
Indiana	41.85	27.12	154.314
Iowa	44.9	29.27	153.399
Kansas	43.75	29.22	149.726
Kentucky	43.55	28.40	153.345
Louisiana	42.02	27.09	155.113
Maine	45.13	30.54	147.773
Maryland	42.72	27.96	152.790
Massachusetts	43.01	28.59	150.437
Michigan	42.28	27.68	152.746
Minnesota	44.72	29.9	149.565
Mississippi	42.78	27.98	152.895
Missouri	43.38	28.29	153.340
Montana	44.22	28.79	153.595
Nebraska	44.39	29.27	151.657
Nevada	39.76	24.43	162.751
New Hampshire	39.76	24.43	162.751
New Jersey	43.67	27.43	159.205
New Mexico	44.55	29.39	151.582
New York	43.96	29.68	148.113
North Carolina	44.98	30.15	149.187
North Dakota	43.08	27.15	158.674
Ohio	44.36	28.64	154.888
Oklahoma	43.26	29.40	147.143
Oregon	45.34	31.22	145.227
Pennsylvania	41.48	26.59	155.999
Rhode Island	45.45	28.86	157.484
South Carolina	44.11	29.66	148.719

Continued on the next page

Table 1.1 Tax Rates on Labor Income by State (Continued)

STATE	Maximum Tax Rate[1] Wages 2002	Average Tax Rate[1, 2] Wages 2002	Tax Progressivity[3]
South Dakota	39.76	24.43	162.751
Tennessee	39.76	24.43	162.751
Texas	39.76	24.43	162.751
Utah	43.31	29.21	148.271
Vermont	44.98	29.1	154.570
Virginia	43.34	28.79	150.538
Washington	39.76	24.43	162.751
West Virginia	43.75	28.9	151.384
Wisconsin	43.9	29.75	147.563
Wyoming	39.76	24.43	162.751

[1] Tax rate = Federal tax rate + State tax rate
[2] The average marginal income tax rate was calculated using a nationally representative sample of individuals.
[3] Tax Progressivity=100*Maximum Tax Rate/Average Tax Rate
Source: Feenberg, Daniel Richard, and Elizabeth Coutts, "An Introduction to the TAXSIM Model", Journal of Policy Analysis and Management; 12(1), Winter 1993 : 189-194

Such measures taken from a single year are valid only under the assumption that the structure of the tax system in a state relative to all other states is constant over time such that measures of the average rate of taxation and of progressivity from the chosen year are representative for the state system of taxation. This appears to be the case given that the correlation between average or maximum tax rate in any consecutive years between 1987 and 2002 ranges from 96.94% to 99.99%, with an average over these years of 99.19% for the maximum tax level and of 99.99% for the average tax level. These numbers indicate that the relative tax systems are stable over this period.

The regression analysis on all datasets controls for the cost of medical care measured by the median wage by state for individuals included in the "Healthcare practitioners and technical occupation" group as defined by The Bureau of Labor Statistics, for state health and hospital expenditures, for education, and for such other individual characteristics as: gender, race, age, marital status, and urban residence. In addition, the NLSY79 regression controls for ability as measured by ASVAB test scores, and for parents' health and family structure as a measure of the initial stock of health. If the parents experienced health problems, the probability is that the children inherited some of these genes, meaning that their initial stock of health is lower. Family structure measured by a variable indicating if the individual lived with both parents until he was 18 years old controls for health accumulation in childhood. Children living with both parents have access to more resources and potentially more parental care and, thus, have better health outcomes [Case and Paxon, 2001].[2] Summary Statistics for all variables are available in Appendix, Table A1.

Given the availability of these measures of initial stock of health and of ability as well as the availability of detailed data regarding past states of

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[2] In some unreported regressions I also control for having health insurance or not, family size, and spouse wage income as a measure for non-labor income. The estimates on the tax variables are not sensitive to the inclusion of these variables. The choice of not including them in the specifications reported is explained by the desire for parsimony in the case of family size and health insurance coverage, neither being significant in regressions. The exclusion of spouse wage as a measure of non-labor income is due to concerns raised by the decrease in sample size and by the correlation between spouses wage levels. This correlation would mean that the spouse wage picks up some of the variation in the time worked by the respondent which is endogenous and, thus, should not be included in the regression.

residence, I choose the NLSY79 dataset for the main analysis. In the main analysis using the NLSY79 data, the questions serving as the basis for computing the dependent variable were asked in 1998-2002 when the individuals turned 40 years old. Given the age of the individuals in the sample, probability is that the current state of residence is the relevant one for testing. But I also check the results by restricting the sample to individuals who did not move between 1987 when they were 24-30 years old and 2002.

For easier interpretation, the analysis performed on NLSY79 dataset uses the standardized physical score as dependent variable. The OLS empirical results, reported in Table 1.2, Column 1 support the idea that the more progressive the income tax, controlling for the tax level, the lower the amount of health chosen by the representative individual. The higher the tax level, the poorer the health score is. The results obtained using the sample restricted to individuals who did not move between 1987 and 2002 (Table 1.2, Column 2) fully support the previous results, but are of a larger magnitude, suggesting that perhaps there is self-selection into the states of residence.

Other variables show the expected sign: the higher the level of education, the healthier people are, and the higher the ASVAB test scores the higher the physical health score. Married people are healthier, but this is only a simple correlation; it could be the case that healthier people have a better chance of getting married. Women seem to be less healthy than males, seemingly contradicting the observation that females have a longer life expectancy. This result could reflect the fact that these scores are computed on the basis of a survey and was recorded by previous literature [Strauss, Gertler, Rahman, and Fox, 1993]. Maybe women are more aware of their health or perhaps women systematically overestimate and/or men underestimate their health. Parental health is a very important predictor of children's health. If the parents had health problems, their children are less healthy, indicating that parental health is a good proxy for the initial stock of health. In addition, individuals who lived with both of their parents until age 18 are healthier as expected since they had access to more resources.

A source of concern is that other types of taxes may be correlated at the same time with labor income taxes and with health. In Column 3 of Table 1.2, I control for general sales and gross receipts tax (percent) and I find that sales taxes do not affect the estimates. In conclusion, the exclusion of this variable does not raise problems with the estimation.

A possible source of bias in my estimates is that state demographics may be correlated with various characteristics of the tax system. Two such possible sources of confound in our estimates are state age structure and income structure. Age structure may determine the type of health care services offered in a state, influencing the access to and the price of medical care, and, thus, affecting individuals' health. If age structure is correlated with the level and/or progressivity of the income tax, then we might be observing a spurious correlation between tax level and/or progressivity and health. In addition, if some states have a higher proportion of high-income individuals there may be the case these states provide a larger selection of medical services, thus influencing health. If state income structure is positively correlated with health, and if high-income individuals vote for less progressive taxes, our estimates would be biased. In order to correct the potential bias arising from omitted demographic correlates of the tax variables I augment the specification by including in Column 4 of Table 1.2 the proportion of population between 50 an 65 and the proportion of population 65 years and older, and in Column 5 Table 1.2 both state income and age structure. In all these specifications the estimators are negative and significant with only small variations in the order of magnitude.

Table 1.2 The Effect of Labor Income Taxation on Health, NLSY79

	All sample	Restricted sample [a]			
	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
	[t]	[t]	[t]	[t]	[t]
Tax Progressivity	-0.019	-0.030	-0.029	-0.028	-0.036
	[-2.13]	[-2.47]	[-2.73]	[-2.76]	[-2.54]
Tax Level	-0.063	-0.082	-0.082	-0.078	-0.104
	[-2.94]	[-2.71]	[-2.86]	[-3.03]	[-3.07]
Sales Tax			-0.001		
			[-0.05]		
Medical Care Cost	0.009	0.014	0.014	0.017	0.010
	[0.96]	[1.42]	[1.3]	[1.8]	[0.54]
State Health and	0.000	0.000	0.000	0.000	0.000
Hospital Expenditures	[0.6]	[0.38]	[0.38]	[0.23]	[0.45]
Education	0.036	0.040	0.040	0.040	0.041
	[3.55]	[3.89]	[3.86]	[3.88]	[3.85]
ASVAB	0.003	0.002	0.002	0.002	0.002
	[3.61]	[2.45]	[2.45]	[2.38]	[2.41]
Female	-0.131	-0.113	-0.113	-0.114	-0.112
	[-4.19]	[-3.07]	[-3.07]	[-3.12]	[-3.1]
Black	0.086	-0.004	-0.004	0.002	0.007
	[1.65]	[-0.06]	[-0.07]	[0.03]	[0.1]
Hispanic	0.037	0.053	0.054	0.070	0.082
	[0.58]	[0.67]	[0.66]	[0.79]	[0.89]
If Married	0.127	0.112	0.113	0.111	0.112
	[2.96]	[2.21]	[2.21]	[2.17]	[2.16]
Father Health	-0.207	-0.190	-0.190	-0.189	-0.197
Problem	[-7.41]	[-4.77]	[-4.79]	[-4.72]	[-4.87]
Mother Health	-0.207	-0.211	-0.211	-0.212	-0.210
Problem	[-4.87]	[-4.88]	[-4.91]	[-4.91]	[-4.84]
Both Parents until 18	0.137	0.162	0.162	0.160	0.160
	[4.01]	[3.89]	[3.9]	[3.83]	[3.86]
Urban	0.022	0.045	0.045	0.048	0.048
	[0.54]	[0.97]	[0.97]	[1.03]	[1.03]
Interview Year Dummies	yes	yes	yes	yes	yes
State Age Structure	no	no	no	yes	yes
State Salaries Structure	no	no	no	no	yes
No. Obs.	4304	2802	2802	2802	2802
No. Clusters	50	47	47	47	47
R Squared	0.080	0.082	0.082	0.083	0.084

Health is measured by standardized SF12 physical score. Robust standard errors are corrected for clustering by state. All calculations are weighted. [a] Restricted sample refers to individuals who did not move between 1987 and 2002.

In the light of our assumption of stable relative state tax systems, I test the sensitivity of the estimates to changes in the date of the tax information. Table 1.3 reports the results when using tax data from the years following the Tax Reform Act of 1993. The estimators are not significantly different from the results obtained using the 2002 tax data. For the years preceding the 1993 tax reform, the results are of the same sign and significance but somewhat different in magnitude, suggesting some non-linearity.[3]

Table 1.3 Sensitivity Test of the Tax Impact Estimators to the Source of the Tax Information, NLSY79
[t statistic in brackets], (t statistic Ho: $a_i = a_i^{2002}$ in parentheses)

Tax Data Source	2002	2000	1998	1996	1994
Tax Progressivity	-0.036	-0.044	-0.039	-0.028	-0.031
	[-2.54]	[-2.84]	[-2.64]	[-2.96]	[-3.5]
		(-0.52)	(-0.19)	(0.79)	(0.52)
Tax Level	-0.104	-0.110	-0.104	-0.091	-0.098
	[-3.07]	[-3.42]	[-3.26]	[-3.37]	[-3.88]
		(-0.19)	(-0.01)	(0.50)	(0.23)

Health is measured by standardized SF12 physical score. Although the coefficients for covariates are not reported, all regressions control for Medical Care Cost, State Health and Hospital Expenditures, Education, ASVAB, Female, Black, Hispanic, If Married, Father Health Problem, Mother Health Problem, Both Parents until 18, Urban, Interview Year Dummies, State Age Structure; and State Salaries Structure. Robust standard errors are corrected for clustering by state. All calculations are weighted. The sample is restricted sample to individuals who did not move between 1987 and 2002.

[3] Log-linear specification does not change the results, nor does it seem to improve the fit.

Another potential source of concern is that progressive taxation may encourage specialization within household [Hunt, DeLorme, and Hill, 1981]. Progressive taxation may distort time allocation decisions because marginal tax rates vary with family structure [Feldstein and Feenberg, 1996], and, in fact, the labor force participation of secondary earners which have higher labor supply elasticity [Killingsworth, 1983; Killingsworth and Heckman, 1986] has been shown to be sensitive to taxes [Triest, 1990]. In a couple one of the spouses may prefer to concentrate on household production, which could involve more health specific knowledge, thus influencing the health of at least one if not both of the spouses. The inclusion of interaction terms (Table 1.4) indicates no differential effect on married people or on women. While some studies indicate different effects of tax provisions on men and women in a couple [Eissa and Hoynes, 2004], separate regressions for men and women (not reported) do not indicate any differential effect on marriage either. This result suggests that the estimated effect of progressivity on health is not driven by the influence of tax progressivity on the specialization within the household.

Table 1.4. The Effect of Labor Income Taxation on Health Differentiated for Married Individuals and for Women, NLSY79

	Restricted sample [a]	
	Coeff. [t]	Coeff. [t]
Tax Progressivity	-0.037	-0.039
	[-2.18]	[-2.91]
Tax Level	-0.104	-0.103
	[-3.07]	[-3.02]
(Tax Progressivity)*(If Married)	0.003	
	[0.25]	
(Tax Progressivity)*(Female)		0.007
		[0.96]

Health is measured by standardized SF12 physical score. Although the coefficients for covariates are not reported, both regressions control for Medical Care Cost, State Health and Hospital Expenditures, Education, ASVAB, Female, Black, Hispanic, If Married, Father Health Problem, Mother Health Problem, Both Parents until 18, Urban, Interview Year Dummies, State Age Structure; and State Salaries Structure. Robust standard errors are corrected for clustering by state. All calculations are weighted. [a] Restricted sample refers to individuals who did not move between 1987 and 2002.

As already mentioned, an alternative explanation for our results is that there is self-selection with respect to the state of residence. In Table 1.5, I correct for endogenous sorting into states of residence by instrumenting the tax variables and state health expenditures variable with the property crime rate in the state, the ratio of Democrats to Republicans in the state House, and the same ratio in the Senate, severance taxes per capita, full-time equivalent government employment, and the state population. The negative relation between both the level and the progressivity of the tax and the health index remains strong and statistically significant in this specification but the Hausman exogeneity tests can only reject the hypothesis that the questioned variables are exogenous at 8% significance level. The estimators obtained from the 2SLS estimation are larger than the estimators obtained from our main specifications Possible explanations for the increase in the magnitude of the estimates are that some underlying characteristics of states generate both more progressive tax systems and better health systems delivering healthier outcomes, or that people who value health more and prefer to spend more time for health investment instead of working choose states with more progressive taxes in order to benefit from the lower tax rates applied for the lower income brackets.

The F statistics in the first stage regressions, as reported in Table 1.5, indicate that the proposed instruments are strongly correlated with the suspected variables. Overidentification tests (Table 1.5) indicate that all variables used to instrument the tax measures do not belong in the main equation and, thus, are legitimate in their use as instruments.

Table 1.5 The Effect of Labor Income Taxation on Health: 2SLS Estimation on NLSY79

	All sample	Restricted sample [a]
Instrumented Variables	Coeff.	Coeff.
	[t]	[t]
Tax Progressivity [b]	-0.098	-0.102
	[-2.67]	[-3.03]
Tax Level [b]	-0.294	-0.278
	[-2.65]	[-2.72]
State Health and	0.000	0.000
Hospital Expenditures[b]	[0.1]	[-0.07]
No. Obs.	4298	2800
No. Clusters	49	46
R squared	0.072	0.075
First stage F for Tax Progressivity	139.04	108.66
First stage F for Tax level	147.87	112.48
First stage F for Expenditures	195.74	136.06
Test for Overidentifying Restrictions [c]	0.860	6.440

Health is measured by standardized SF12 physical score. Although the coefficients for covariates are not reported, both regressions control for Medical Care Cost, State Health and Hospital Expenditures, Education, ASVAB, Female, Black, Hispanic, If Married, Father Health Problem, Mother Health Problem, Both Parents until 18, Urban, Interview Year Dummies, State Age Structure, and State Salaries Structure.
[a] Restricted sample refers to individuals who did not move between 1987 and 2002. [b] Tax variables are instrumented using variables Property Crime, Dem./Rep. Ratio House, Dem./Rep. Ratio Senate, Severance Tax, Population, and Gov. Employment. Robust standard errors are corrected for clustering by state. All calculations are weighted. [c] 95% critical value is 7.81

The Magnitude of the Effect

The coefficient on our measure of progressivity indicates that, keeping the average tax level constant, a 1 percentage point increase in the maximum rate of taxation, thus increasing progressivity, is associated with a cumulative decrease in health of approximately 0.36 standard deviations by the age of 40 (Table 1.6). But an exact interpretation of the magnitude of the effect is not possible as it is impossible to say exactly what this change means in terms of life expectancy.

Nevertheless, the magnitude of the progressivity coefficient relative to the coefficient on the tax level provides an indication of the importance of the impact of progressivity on health choices (Table 1.6). The estimates suggest that progressivity may have a more important effect on health choices than the tax level. A 1 percentage point increase in the average rate of taxation is associated with a cumulative decline in health of 0.28 standard deviations by the age 40, while a 1 percentage point increase in the maximum rate of taxation, keeping the average tax rate constant, thus increasing progressivity, is associated with a cumulative decrease in health of approximately 0.36 standard deviations by 40 years of age.

Table 1.6 The Predicted Effect of Labor Income Taxes on Health: Interpretation

	All sample	Restricted sample
	Standard Deviations Change in SF12 Physical Score	
1 percentage point increase in maximum tax rate holding average tax rate constant	-0.351	-0.363
1 percentage point increase in the average tax rate holding tax progressivity constant	-0.294	-0.278

[a] Restricted sample refers to individuals who did not move between 1987 and 2002. Both regressions control for Medical Care Cost, State Health and Hospital Expenditures, ASVAB, Female, Black, Hispanic, If Married, Father Health Problem, Mother Health Problem, Both Parents until 18, Urban, Interview Year Dummies, State Age Structure, and State Salaries Structure.

Robustness Check

I check the robustness of our results on two additional datasets, the Current Population Survey (CPS) 2002, and the Behavioral Risk Factor Surveillance System dataset (BRFSS) 2002. The sample retained for estimation includes individuals 40 to 65 years old, such that there is a reasonable probability that they resided in the observed state for a significant period. While these two datasets do not offer the same opportunities to control for various factors that may bias our results as NLSY79, they do provide different measures of health. When using BRFSS, the dependent variable is expressed as the number of days of good physical health in the month prior to the interview, and in CPS the dependent variable is a self-reported health measure taking 5 values with a higher value representing better health.

Given that 66% of the individuals in BRFFS reported having good physical health for the entire month, the sample retained for estimation (Table 1.7, Column 1) includes only individuals who had some health issues at least one day out of the 30 possible. The estimates obtained using this sample support our previous results. The model specification used on the CPS data (Table 1.7, Column 2) is an Ordered Probit, and again, the results are consistent with our previous results.

Table 1.7 Robustness Check

	BRFFS	CPS All sample	CPS Restricted sample [c]
	OLS	Ordered Probit	Ordered Probit
Dependent variable	Number Days Good Physical Health/Month [a]	Health Status [b]	Health Status [b]
	Coeff.	Coeff.	Coeff.
	[t]	[z]	[z]
Tax Progressivity	-0.150	-0.013	-0.006
	[-1.73]	[-2.22]	[-0.38]
Tax Level	-0.433	-0.031	-0.005
	[-1.8]	[-2.14]	[-0.13]
Medical Care Cost	0.249	0.028	0.043
	[1.9]	[4.87]	[3.61]
State Health and	-0.002	0.000	0.000
Hospital Expenditures	[-0.7]	[-3.12]	[0.45]
High-School	4.020	0.419	0.308
	[9.5]	[17.06]	[5.14]
Some College	4.687	0.555	0.386
	[11.32]	[19.78]	[6.43]
College Degree (or >	8.251	0.864	0.556
for BRFFS dataset)	[18.26]	[28.09]	[7.13]
> College		0.971	0.780
		[27.95]	[4.78]
Female	-0.311	-0.014	0.043
	[-1.87]	[-2.04]	[1.03]
Black	0.060	-0.261	-0.203
	[0.14]	[-12.62]	[-2.82]
Hispanic	0.243	-0.110	-0.017
	[0.42]	[-6.12]	[-0.17]
Age	-0.172	-0.025	-0.002
	[-12.93]	[-33.37]	[-0.78]
If Married	1.705	0.253	0.113
	[2.86]	[16.4]	[2.23]
Metropolitan		0.053	-0.012
		[6.18]	[-0.55]
Intercept	52.665		
	[3.06]		
No. Obs.	15124	65042	3466
(Pseudo) R squared	0.088	0.049	0.021

[a] Sample of individuals who experienced less than 30 days of good health in the previous month. [b] Health status takes values from 1 to 5, where higher value translates to better health. [c] Restricted sample refers to individuals who quit job or retired for health reasons.
Robust standard errors are corrected for clustering by state. All calculations are weighted.
Sample: individuals 40 to 65 years old

In addition, CPS provides us with a way to construct a falsification test. I estimate the same model specification on a sample of individuals that quit their job or retired for health reasons. If they are prevented from working, their health investment should not be affected by income tax progressivity. The results obtained from this restricted sample (Table 1.7, Column 3) suggest that this is in fact the case: the estimates are much smaller and not statistically significant.

Introducing interaction terms of progressivity variable with age group dummies: a 40 to 65 age group and a over 65 group in regressions on a CPS sample of individuals over 25 years old suggest a smaller but still negative impact of progressivity for younger people (Table 1.8). The larger negative estimated effect of progressivity for older individuals has two sources. One is the difference in the per period investment in health determined by changes in the shadow value of health over time indicated by the theoretical model, and the second is the cumulative effect over the years coming from each period investment.

Table 1.8: The Impact of Progressivity on Health by Age Groups, CPS

CPS

Dependent variable: Health Status [a]

	Tax Progressivity	Tax Progressivity interacted with Dummy for 39<age<66	Tax Progressivity interacted with Dummy for age>65
Coeff.	-0.010	-0.005	-0.007
[z]	[-1.74]	[-1.99]	[-1.77]

[a] Health status takes values from 1 to 5, where higher value translates to better health. Although the coefficients for covariates are not reported, the regression controls for Tax Level, Dummies for age groups 40-65 and over 65, Medical Care Cost, State Health and Hospital Expenditures, High-School, Some College, College Degree, >College, Age, Female, Black, Hispanic, If Married, and Metropolitan. Robust standard errors are corrected for clustering by state. All calculations are weighted.
Sample: individuals older that 25 (129799 observations)

However, the results from BRFSS and CPS are not reliable for measuring the magnitude of the effect because these regressions do not control for the initial stock of health. As an offset, it may be the case that the impact of the initial stock of health is picked up by other variables included in the regression. As initial stock of health determines the life expectancy, it also influences investment in education because life expectancy limits the returns to human capital investment [Case, Lubotsky, and Paxson, 2002]. Thus, if the initial stock of health is positively correlated with education, then the estimated coefficients of education will pick up some of the influence of the initial stock of health.

Conclusions

This paper proposes that progressive taxation distorts health choices. Using plausibly exogenous variation in state labor income tax structure, I find that individuals who live in states with less progressive labor income taxes tend to report healthier outcomes. While this analysis can provide only a rough approximation of its importance, income tax progressivity appears to have a significant effect on people's health choices even when compared with the estimated effect of the tax level. A 1 percentage point increase in the average rate of taxation is associated with a cumulative decline in health of 0.28 standard deviations by the age 40, while a 1 percentage point increase in the maximum rate of taxation, keeping the average tax rate constant, thus increasing progressivity, is associated with a cumulative decrease in health of approximately 0.36 standard deviations by the age of 40.

More important than the identification of this influence are the implications of this result. One issue is that the distortions generated by progressive taxation are not limited to labor choices. Part of the observed health and health expenditures differences among people may be explained by the tax structure. Another aspect is that the estimated negative effect of progressivity is probably exacerbated by low employment opportunities after retirement age limiting the possibility of smoothing taxes over time. Increased labor opportunities for individuals past the legal retirement age promote health by increasing the reward for health investment.

Under a progressive tax system, the marginal tax on income increases not only with hours of work but also with hourly wage, so tax progressivity also affects the incentives to invest in education. Since education has been proven to be strongly correlated with health, future research should concentrate on identifying the impact of progressivity on health mediated through education. This aspect is also very important in terms of growth because overall, progressivity affects growth through several channels: it affects labor incentives, labor productivity through education, incentives to invest in health, and perhaps the efficiency of health production through the education channel.

THE EFFECT OF NON-ECONOMIC DAMAGES CAP ON THE DELIVERY OF MEDICAL SERVICES

Abstract

The impact of non-economic damage caps on physicians supply was investigated by several studies; however, its potential effect on the demand for medical care has not been considered so far. While the reforms decrease operational costs for physicians, they could also affect the quality assurance offered by physicians through the willingness to bear the full cost of their medical mistakes. Therefore, the net effect on the quantity of medical services delivered is ambiguous. I find that the adoption of a non-economic damages cap leads to a reduction of the number of individuals treated either inpatient or outpatient in community hospitals, a reduction in the number of surgeries performed in community's hospitals, and increases the average length of stay in hospital.

JEL Classifications: I11, I12, I18, K13, K32, D00

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Introduction

Health regulation has always been controversial because of the trade-off between quantity and quality associated with most types of medical regulation. For instance, the widely pervasive physician licensing decreases the number of physicians but increases the average quality of medical care. The quality guarantee provided by licensing should increase the demand for medical services, but given that decrease in the number of physicians, the net effect on health is not obviously positive and may in fact be negative [Kleiner and Kudrle, 2000]. As a result, policy makers passed a series of regulations meant to encourage entry in medical field. This paper investigates the effect of non-economic damages caps which are meant to attract more physicians but may reduce physicians' incentives to provide an efficient level of care quality because of the reduced cost of medical mistakes. If patients expect this reduction in the quality of care, the demand for medical services decreases, potentially offsetting the positive impact of increased supply on the quantity of medical services delivered.

The justification behind non-economic damages caps, which seems to offset previous health regulation: physicians' licensing, lies in the observed increase of the price of medical care. This increase in price can potentially be explained by the increase in premium of malpractice insurance for physicians, attributed by some to increasing compensation amounts awarded in the malpractice cases. As a result, many states passed or at least debated legislation to introduce caps on malpractice damages. Moreover, President George W. Bush proposed a nationwide $250,000 cap in medical malpractice cases, but the proposal did not pass the Senate. Much of the existing legislation concentrates on non-economic damages caps rather than total damages caps, the justification being that it is hard for the juries to asses the value of non-economic losses. Thus, the awarded compensations for such damages should be bounded in order to offer the juries guidance in evaluating non-economic losses.

The legislation imposing non-economic damages caps was crafted having in mind the effect on the supply of physicians. The cap reduces damages awarded, and thus should decrease malpractice insurance premium. This decrease in the cost of practicing medicine will induce physicians to relocate, to delay retirement, and in a longer term will lead to entry in the medical field. The increase in the supply of physicians in places that adopted the cap would decrease the price of medical care and improve access, thereby increasing the number of people that benefit of medical care. This shift in the supply of physicians has been studied as will be shown in the following pages, but no one so far inquired on a second effect: a potential decrease in demand for medical services.

The novelty of this paper is that it addresses the issue of a decrease in demand for medical care brought about by the break in the bonding between physicians and patients. Patients find it very hard to assess the quality of medical services before buying them and may be reluctant to buy a product of an uncertain quality. To increase the demand for their services, physicians could offer some quality guarantees. It may be the case that the willingness of physicians to bear the full cost of their mistakes effectively acts as a way of bonding between the physician and the patient, thus increasing patients' confidence that the physician will deliver the service of expected quality. Absent this quality assurance, the demand for medical services will decrease and the quantity of medical care delivered will drop below the efficient level.

If there is a change in the demand, the observed effect in the number of suppliers is not enough to ensure an increase in the number of medical services delivered. This paper uses state level data between 1995 and 2004 to investigate the impact of non-economic damage caps on the medical care services delivered by community hospitals. I find that states that regulate the amount of non-economic damages experience a drop in the number of patients admitted in hospitals, number of outpatient visits and number of surgeries performed, and potentially an increase in the average length of hospitalization in community hospitals.

The rest of the paper is laid out as follows. In section 2.2, I present the theoretical framework that explains the effect of non-economic damages caps on the quantity of medical care services delivered; in section 2.3, I present the empirical strategy used to investigate the questioned effect; in section 2.4, I present the empirical results, and in section 2.5 the conclusions.

The Effect of Medical Malpractice Reforms

The Impact on the Number of Physicians

If non-economic damage caps are binding and reduce awarded damages, the prediction is that malpractice insurance premiums decrease, triggering a drop in the cost of practicing medicine and leading to entry in the medical field. As the supply of physicians increases, everything else held constant the price of medical care decreases, access to medical services improves, resulting in a larger number of people that benefit of medical care.

Hence the increase in the supply of physicians depends on whether insurance companies will pass some of the gains from reduced damage payments on their customers, the physicians. The opponents of caps, lawyers in particular, claim that there is no evidence that caps will have any influence on insurance rates. Baicker and Chandra [2004] find that increases in malpractice payments do not result in an increase in premiums, supporting lawyers' hypothesis. On the other hand, other studies indicate that may not be the case. Sloan, Mergenhagen, and Bovbjerg [1989] using closed claims data from National Association of Insurance Commissioners (NAIC) find that non-economic damage caps reduced insurer payouts. Zuckerman, Bovbjerg, and Sloan [1990] results from per-physician premium data from the Health Care Financing Administration survey of insurers indicate that caps decreased the average indemnity per claim. More recently Thorpe [2004] used state specific NAIC data from 1985-2001 to conclude that premiums are lower in states that regulated the amount of non-economic damages. Over a similar period of time, 1994-2003, Danzon et. al. [2004] find significant reductions in premium increases in states that adopted caps on awards for non-economic damages at or below $500,000. Also Viscusi and Born [2005] study reports that in 1984-1991 insurers from states with caps on non-economic damages had 17% lower losses and 6% lower earned premiums.

All these studies suggest that caps lead to lower losses for the insurance companies and that part of this gain is passed to their customers, the physicians, in the form of lower premium rates. Moreover, there is evidence that non-monetary costs are also reduced. Analyzing data from the American Medical Association

Socioeconomic Monitoring System ("AMA SMS") survey, Kessler and McClellan [1997] find that general reforms also reduce the probability that a physician will be sued and Browne and Puelz [1999] suggest that non-economic damages caps lead to a significant reduction in the number of court cases filed.

The available data point toward a reduction in the costs born by physicians in the states that introduced the reform. If that is the case, there should be entry in this field. Several studies suggest that this is indeed the case. Klick and Stratmann [2005] find that there are more doctors in states that have a cap.[4] Encinosa and Hellinger [2005] analyze 1985-2000 data and conclude that caps increase the supply of doctors. Kessler, Sage, and Becker [2005] study also provides support toward an increase in physicians supply caused by tort reforms.

<u>The Impact on the Demand for Medical Services</u>

The market for medical care services is characterized by asymmetric information. Physicians know more about their abilities than patients and the quality of the product cannot be assessed ex-ante by the patients. Patients may be reluctant to buy a product of an uncertain quality, resulting in an inefficiently low quantity of medical care consumed.

The solution for the asymmetric information problem is equal information, and sometimes the government can intervene to alleviate the problem. Governments in all states introduced licensing requirements like minimum

[4] Their estimates are strongly significant, but they obtain an unexpected result when analyzing the effect of the amount of the cap. The $500,000 cap leads to a significant change in the number of doctors, while a tighter restriction, a $250,000 cap has no significant effect.

knowledge in the field as proved by tests (United States Medical Licensing Examination, USMLE). Minimum proved expertise should be able to offer some information about medical care quality and remove any possibility of a "market for lemons" [Ackerlof, 1970] in medical care. But this measure does not yet lead to an efficient way of assessing true quality; there remains enough variation between physicians having at least the minimum level of competence.

Absent perfect information, the demand for medical care reflects patients' expectation about the quality of the service and is lower than the efficient level. Thus there are still unexhausted gains from eliminating asymmetric information. If patients could assess quality, they would be willing to pay more for better quality, providing incentives for physicians to supply it. Patients gain from improved access to higher quality services, and physicians are rewarded for increased effort. Whether the patients should try to obtain the information or the physicians should try to convey the information is a question that hinges on the relative costs. Some data like the number of physicians and dentists, 74,148[5], serving the 35,086,061[6] patients admitted in US's community hospitals in 2004 suggest that it is efficient for the physicians to undertake this task.

Part of the problem is solved by reputation: as some physicians prove that they deliver high quality service, the demand for their services will increase. But building this reputation requires that the doctor has the incentives to commit to provide the high quality product in the first place. If for instance the insurance

[5] AHA Hospitals Statistics, 2006

[6] AHA Hospitals Statistics, 2006

premiums do not adjust for past experience, as it is in fact the case [Sloan, 1990], these incentives will be diminished.

Another way to convey the information to the consumers is to provide a credible guarantee that the service provided has the promised quality [Grossman, 1980]. This guarantee has value only if the seller can be constrained to honor his promise in case of failure to deliver. In this case, sellers that do not provide the guarantee will find themselves facing a lower demand for their services. I propose that caps on non-economic damages act as a signal that physicians are not willing to and will choose not to bear the costs of their failure of providing a certain level of quality. Even if the physician continues to buy insurance and even if the premiums do not decrease with the regulation, damage caps effectively signal that the quality guarantee may not be honored. In this case demand for medical services or at least for a part of medical services will decrease. This decrease depends on how responsive is the demand to this signal and on patients' expectations.

Predicted Effect of Caps on Medical Care Delivered

Non-economic damage caps lower operation costs for doctors leading to entry in the medical field. The prediction is that more physicians lead to lower transportation costs and lower price of medical services, which, everything else held constant, induces an increase in the quantity of care delivered.

The reform may also affect the quality guarantee offered by the physicians' willingness to bear the full cost of potential mistakes, thus decreasing the demand for medical services. As a consequence the overall effect of the caps on the equilibrium quantity of medical services actually delivered is ambiguous. If the effect is positive then the reform at least partially attained its purpose, but if the effect is negative we may want to reconsider the method used so far to improve medical care delivery.

Changes in the amount of medical care delivered have effects on the health of the population. As economic theory points out, the demand for medical care is a result of the demand for health. Individuals use medical care and their own time to produce health [Grossman, 1972]. As regulation affects the amount of medical care, it may also change health outcomes in the same direction. But Kessler and McClellan [1996] find no significant effect on mortality or medical complications even though malpractice reforms reduce hospital expenditures. The cost difference, they say, may be explained by defensive medicine. Potential losses from malpractice liability, argue the authors, create incentives for physicians to practice "defensive medicine," by ordering additional procedures than they would otherwise in order to reduce involvement in litigations. Klick and Stratmann [2005] on the other hand indicate that caps on non-economic damages reduce black infant mortality rate. The difference between the white and black infant mortality rate is explained by disproportionate improvement in access to medical care for the two categories. As the number of physicians grows, they locate in regions lacking a provider at that point in time. Their result is consistent with an expected low elasticity of demand for prenatal care with respect to changes in quality guarantee. On the other hand, Currie and Macleod [2006] argue that physicians may be more likely to perform unnecessary procedures when they are less fearful of liability, leading to maternal complications. They find some empirical support for their theory: non-economic damage caps increase the number of C-sections and the number of complications of labor. Nevertheless and alternative explanation for their result is that caps reduce people's trust in physicians. The perceived reduced benefit from medical assistance may lead to less preventive visits to the doctor, and to worsening outcomes, requiring more procedures. In general the lack of definitive evidence with respect to health outcomes is consistent with the existence of a time lag necessary to observe the effects and of defensive medicine practices.

Data and Empirical Strategy

This study uses state level data between 1995 and 2004 to investigate the effect of non-economic damages caps on the quantity of medical services delivered by community hospitals. I measure the quantity of medical services delivered by the percent of state population treated either inpatient or outpatient in community hospitals, the percent of state population having surgeries, and the average length of stay in community hospitals.

During this period fourteen states changed their existing law (reported in Table 2.1) either by introducing or by removing the cap, opening the opportunity of using this panel data to perform a difference-in-difference analysis that uses the state reforms of the non-economic cap regulation as exogenous shocks. This method identifies the effect of changes in laws on the various measures of medical care delivered for every state.

Table 2.1: Summary of Legislation on Non-Economic Damages Caps: 1995-2004

States with Caps for the Entire Period	AK, CA, CO, HI, ID, KS, LA, MD, MA, MI, MO, MT, ND, VA, WV
States without Caps for the Entire Period	AL, AZ, AR, CT, DE, GA, IA, KY, ME, MN, NH, NJ, NY, NC, OK, PA, RI, SC, TN, VT, WA, WY
States that Introduced Caps in this Period	FL (2003), IN(1998), MS(2002), NV(2002), NM(1996), OH(2003), OK(2004), SD(1997), TX(2003), UT(1996), WI(1997)
States that Repealed Caps during this Period	IL (1997), OH(1999), OR(1999)

Source: American Tort Reform Association (http://www.atra.org/issues/index.php?issue=7340); McCullough, Campbell, Lane, "Summary of Medical Malpractice Law," (http://www.mcandl.com/states.html)

I measure the impact of the law by introducing a dummy variable indicating the state has a cap on non-economic damages in a given year regardless of the value of the cap. This study also controls for a variety of factors that may explain why some states deliver more medical services. Among these factors are demographic characteristics like the percent of population 65 years old or older, percent blacks, percent population that graduated high-school, personal income per capita, and percent individuals not covered by medical insurance. An older population may imply a higher demand for medical care. The variables reflecting the racial structure of the population control for possible systematic differences in demands from different segments of the population. A better educated population could make a difference in a number of ways: it could mean a higher demand for medical care; it could mean more prevention, thus a shorter average stay in hospitals; it could also mean faster or more significant reactions to changes in legislation.

Further, state health and hospital expenditures influence the demand for health. Because the state provides coverage to certain low-income or disadvantaged population groups, the demand for medical care increases. It may be also the case that individuals with frail health prefer to locate in states that already spend more on health, because a high demand for these services makes it more likely for the state to provide a larger range of health services and to have more health facilities, and thus to have lower costs of access to care. If health infrastructure is correlated not only with state health expenditures but also with non-economic damages caps because there are more doctors to lobby for the caps, the obtained estimator for the regulation will be biased. To control for this possibility a measure of state health and hospital expenditures is also included in regressions.

Table 2.2 Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Source
Non-Economic Damages Cap	500	0.430	0.496	American Tort Reform Association [1]; McCullough, Campbell, Lane, "Summary of Medical Malpractice Law" [2]
Outcomes of Interests				
Patients Admitted (per 100 pers.)	500	11.604	2.040	AHA Hospital Statistics 2000-2006
Total Outpatient Visits (per 100 pers.)	500	189.241	52.145	AHA Hospital Statistics 2000-2006
Outpatient Visits other than Emergency (per 100 pers.)	500	152.139	49.600	AHA Hospital Statistics 2000-2006
Outpatient Visits Emergency (per 100 pers.)	500	37.102	7.778	AHA Hospital Statistics 2000-2006
Surgeries Performed (per 100 pers.)	500	9.510	2.023	AHA Hospital Statistics 2000-2006
Average Length of Stay	500	6.243	1.438	AHA Hospital Statistics 2000-2006
Month Prenatal Care Began: 1st-3rd month	198	81.873	4.657	Center of Disease Control and Prevention
Month Prenatal Care Began: 4th-6th month	198	12.556	2.876	Center of Disease Control and Prevention
Month Prenatal Care Began: 7th-9th month	198	2.567	0.964	Center of Disease Control and Prevention
No Prenatal Care	198	0.923	0.574	Center of Disease Control and Prevention
Control Variables				
State Health and Hospital Exp. (per capita, share of income)	500	4.646	7.706	Census: State Government Finances
>=65 years old (per 100 pers.)	500	12.611	1.898	Statistical Abstract of the United States
High-School (per 100 pers.)	500	84.640	4.338	U.S. Census Bureau, Current Population Survey
Bachelor (per 100 pers.)	500	24.651	4.666	U.S. Census Bureau, Current Population Survey
Percent Black	500	10.176	9.520	U.S. Census Bureau, Population Division
Percent Hispanic	500	7.421	8.748	U.S. Census Bureau, Population Division
Percent Uninsured	500	10.385	12.117	U.S. Census Bureau, Current Population Survey, (1988 to 2005 Annual Social and Economic Supplements)
Personal Income per Capita (CPI adjusted) (in thousands)	500	11.464	7.766	Regional Economic Information System, Bureau of Economic Analysis, U.S. Department of Commerce

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Table 2.2 Descriptive Statistics (continues)

Variable	Obs.	Mean	Std. Dev.	Source
Population (in thousands)	500	554.614	607.439	U.S. Census Bureau, Population Division
Immigrants (per 1000 pers.)	500	198.058	160.956	Yearbook of Immigration Statistics
Sales Tax Receipts (per capita, income share)	500	10.045	16.592	U.S. Census Bureau, State Government Tax Collections
Fatalities from Vehicle Accidents (per 100000 pers.)	500	17.091	6.044	Fatality Analysis Reporting System
Union (per 100 employees)	500	12.623	5.741	Hirsh et. al, 2005
Percent Non-metropolitan	497	31.270	21.881	Current Population Survey
Instruments				
Lawyers (per 100 pers.)	346	0.148	0.046	Bureau of Labor Statistics
Catholics (per 100 pers.)	350	18.511	12.642	The Official Catholic Directory ‘98-‘04

[1] http://www.atra.org/issues/index.php?issue=7340; [2] http://www.mcandl.com/states.html

Economic theory predicts that non-economic damage caps lead to an increase in the number of physicians in the states that adopted a cap. Changes in the number of doctors definitely affect the amount of care delivered, but since from a policy point of view the relevant question is whether, everything considered, a non-economic damage cap is able to improve the delivery of medical care in population, I do not include the number of physicians and the number of hospitals in the state in the regressions because these variable would be endogenous in this setting. Consequently, I estimate the net effect of this regulation a measure for the effectiveness of non-economic damage caps.

In addition state and fixed effects are included. All regressions are estimated using population weights. The model specification is:

$$Qms_{it} = \alpha + \beta_1 * Cap_{it} + \beta_2 * X_{it} + \gamma_i + \lambda_t + \varepsilon_{it},$$

Here *Qms* is the quantity of medical services; *Cap* is a dummy equal to 1 if there is a non-economic damages cap in effect in a state in a particular year and β_1 is the coefficient of interest; *i* represents the state; *t* is time; *X* is a vector of covariates; γ_i and λ_t represent state and year fixed effects; β_2 is the matrix of coefficients on the covariates; β_3 is the coefficient on the time trend, which is included in some specifications.

Direct estimation of the impact of the law on the quantity of medical care is not appropriate if the law was passed because of a presumed inefficient level of medical care delivered to the population. Faced with the discontent caused by poor access to medical care, the government introduces regulation predicted to reduce the cost of medical services. If that is the case, all measures of the quantity of medical care are negatively correlated with the passage of the law. Or it may be the case that physicians lobbied for measures decreasing their operating costs, in which case the quantity of care could be positively correlated with the passage of the law, because in states with higher demand for medical care, physicians would have more resources for lobbying and would be more likely to attain their objective. To control for this hypothesis we instrument the existence of the non-economic damages cap in a state with the percent of lawyers in the state population and with the percent Catholics in population.

The intuition behind using the number of lawyers as an instrument is that lawyers are one of the parties that have interests in this type of legislation. As Olson [1965] noted, groups that have some advantage in organizing for collective action are more successful in influencing the legislative process. Lawyers not only are relatively easy to organize but also have significant individual stakes in increasing the quantity of litigation and the size of the damages awarded. Non-economic damages caps reduce the incentives to sue physicians for malpractice because the benefits from suing decrease under the law, creating strong incentives for lawyers to openly take position against tort reform[7]. More lawyers could be indicative for higher lobbying power, in which case I expect a lower probability of passing a law in states with more lawyers. The negative correlation between lawyers and regulation should be especially strong given that states that have more lawyers are expected to have more lawyer-legislators supporting the same interests. As McCormick and Tollison [1981] explain, lawyers find it more

[7] A couple of examples are given by: Wisconsin Academy of Trial Lawyers: "Caps Reward Bad Doctors and Punish Injured Consumers" in "10 Reasons Noneconomic Damage Caps Are Unfair" at <http://www.watl.org/10%20reasons%20caps.pdf#search=%22non-economic%20damage%20cap%22>; The Ohio Academy for Trial Lawyers: "Malpractice insurance rates aren't driving doctors out of Ohio, as the number of doctors in Ohio has remained steady. Insurance companies are making record profits. States with more stringent legal reforms have no better business climate or malpractice rates for doctors than those that don't. " <http://www.oatlaw.org/OH/index.cfm?event=showPage&pg=InsuranceReformFacts>

advantageous to get involved in the political process than other professions; making this profession the best represented profession in the legislature. This advantage is explained by the fact that when these legislators-lawyers return to their practice after service in the legislature they are capable of capturing the gains from the legislation they supported. Thus the more lawyers-legislators, the lower the probability that the state adopts non-economic damages caps. This predicted strong correlation between the number of lawyers and regulation indicates that the number of lawyers meets the first condition for a good instrument. In addition, given that I control for the level of per capita income in a state, the number of lawyers is not expected to be correlated with the quantity of medical care delivered, thus meeting the second necessary condition for a good instrument.

Catholics are another group that took position in the issue of tort reforms. Catholic groups and leaders, concerned about illegitimate malpractice claims, expressed support for tort reforms in general and non-economic damages caps in particular[8]. Given their openly expressed support, I expect that the part of

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[8] Some examples of Catholic leaders and organizations that expressed their support for tort reform include: West-Virginia Catholic Conference: "We call for policies that: […]Maintain tort reform legislation passed in 2003 to maintain a degree of protection to physicians, hospitals, care givers, charities and other health care providers" at <http://www.dwc.org/chancery/wvcc/health.shtml>; Sister Jomary Trstensky about medical care system in Wisconsin: " Unless a cap is reinstated on non-economic damages, Wisconsin will experience what Illinois has endured…access to care will suffer." at <http://www.wha.org/newsCenter/pdf/ nr10-27-05sb393.pdf>; "Pennsylvania Catholic Conference

population that follows their leadership also support such legislation and thus the larger the share of Catholics in population the higher the probability that the state adopted non-economic damages caps. In addition it is not obvious that religious beliefs should have any impact on the quantity of medical services demanded, making the proportion of Catholics in population a good instrument for caps.

The model specification used is a treatment effects model as described by Maddala [1983, pp. 117-122]:

$$Qms_{it} = \alpha + \beta_1\, Cap_{it} + \beta_2\, X_{it} + \gamma_i + \lambda_t + \varepsilon_{it},$$

$$Cap_{it} = \delta + \theta * W_{it} + u_{it}$$

where W is a vector of exogenous instruments: percent lawyers and percent Catholics in the state population; δ is vectors of coefficients on intercept, and θ is the matrix of coefficients on instruments.

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supports the following legislation […] HB 139 Limits non-economic damages in medical liability cases to $250,000," where HB= House Bill. <http://www.pacatholic.org/newsletter/Spring%202004%20Viewpoint.pdf#search=%22%20Catholic%20Health%20%20on%20non-economic%20damages%22> ; Washington State Catholic Conference is a member of the Liability Reform Coalition that lists among its goals "to limit the expansion of tort liability," <http://www.walrc.org/about/members.html>

Results

Panel data analysis, reported in Table 2.3, indicates that caps on non-economic damages have a negative effect on the number of patients admitted in community hospitals, the number of outpatient visits, and on the number of surgeries performed, but are associated with a longer average length of hospitalization. These results are consistent with the hypothesis that, when a cap is in place, people perceive medical care as riskier and prolong their period of search for the right physician. But a longer period of search comes at the cost of potential health worsening. If people delay seeing a doctor, the probability that a disease is detected in early stages decreases, making necessary a longer period of hospitalization.

The covariates have the expected signs. States with a higher percentage of individuals over 65 years old have a higher demand for medical services. Income per capita is negatively correlated with the number of patients treated in community hospitals consistent with the already observed regularity that income is positively correlated with health. While we should expect that higher income is associated with higher demand for preventive services, the same would not hold for the type of services provided by hospitals if income is positively correlated with health. Education, as measured by the percent of population that graduated high-school is negatively correlated with the average length of hospitalization, reflecting the fact that better educated individuals tend to enjoy better health and, thus, need less time to recover. My estimates also indicate in that states with a higher percentage of African-Americans more individuals are being treated outpatient, and the average length of hospitalization is shorter. Having a higher proportion of uninsured population is positively correlated with a higher incidence of surgeries performed, an indication that a higher part of the population relies exclusively on emergency care.

Table 2.3: The Effect of Non-Economic Damages Cap on the Delivery of Medical Care [t statistic in brackets]

	Patients Admitted	Total Outpatient Visits	Surgeries Performed	Average Length of Stay
Non-Economic Damage Cap	-0.192	-4.570	-0.138	0.092
	[-3.34]	[-2.49]	[-1.48]	[2.78]
State Health and Hospital Exp.	0.010	-0.215	-0.010	-0.002
	[1.4]	[-0.79]	[-0.91]	[-0.43]
Percent 65+	-0.127	18.152	0.411	-0.006
	[-1.4]	[6.37]	[3.23]	[-0.12]
Income	-0.074	-0.142	-0.007	-0.013
	[-4.64]	[-0.21]	[-0.32]	[-0.75]
High-School	-0.006	1.140	0.024	-0.023
	[-0.39]	[1.95]	[1.08]	[-2.21]
Percent Black	0.069	9.123	0.041	-0.222
	[0.96]	[3.01]	[0.38]	[-3.54]
Percent Uninsured	0.001	-0.031	0.001	0.000
	[1.65]	[-1.65]	[2.73]	[1.19]
State FE	yes	yes	yes	yes
Year FE	yes	yes	yes	yes
No. obs.	500	500	500	500
Sample	1995-2004	1995-2004	1995-2004	1995-2004
R squared	0.977	0.949	0.928	0.958

Regressions weighted by population. Standard errors computed using White-Huber estimator.

A sensitivity check of the results is performed and some of the results reported in Table 2.4. The baseline results are compared first with the results obtained after excluding Ohio, the state that first repealed the cap and than adopted it again during the period analyzed. In the third row of results I exclude the state with the lowest amount of medical care delivered from each specification: Alaska in the case of percent patients admitted and surgeries performed in community hospitals, Nevada in the case of percent outpatient visits, and New Mexico in the case of the average length of stay. Then the highest amount of care delivered state is excluded: District of Columbia in the case of percent patients admitted and surgeries performed in community hospitals, Vermont in the case of percent outpatient visits, and Montana in the case of the average length of stay. In all cases, the results are comparable with the results obtained from the baseline specification. Even when controlling for geographically correlated factors by augmenting the baseline specification with region-year interactions, the results are remain comparable but somewhat smaller with the exception of the surgeries performed specification. This last result is an indication that there are some unobserved factors, not controlled for in the baseline specification, whose influence is picked-up by the region-year interactions.

Table 2.4 Sensitivity Check of Non-Economic Damages Cap Coefficient to Alternative Specifications [t statistic in brackets]

	Patients Admitted	Total Outpatient Visits	Surgeries Performed	Average Length of Stay
Baseline	-0.192	-4.570	-0.138	0.092
	[-3.34]	[-2.49]	[-1.48]	[2.78]
Omit Ohio	-0.185	-6.267	-0.138	0.111
	[-2.92]	[-3.39]	[-1.4]	[3.12]
Omit High Demand State	-0.192	-4.504	-0.138	0.093
	[-3.34]	[-2.43]	[-1.48]	[2.82]
Omit Low Demand State(s)	-0.194	-4.403	-0.140	0.092
	[-3.36]	[-2.36]	[-1.49]	[2.71]
Region-Year Interactions	-0.175	-3.685	-0.231	0.061
	[-3.2]	[-1.72]	[-2.14]	[1.6]
Sample	1995-2004	1995-2004	1995-2004	1995-2004

Although the coefficients for covariates are not reported, all regressions control for State Health and Percent 65+, Income, High-school, Percent Black, Percent Uninsured, and State and Time FE. Regressions weighted by population. Standard errors computed using White-Huber estimator.

Another concern is raised by the possibility that the non-economic damages caps have effects across the border. While it is relatively costly for physicians to move from one state to another due to different licensing requirements, a large enough drop in the cost of practice could induce some of the physicians to move their practice from a state without a cap to a state that as adopted the cap. I explore this possibility by introducing a dummy variable indicating whether the state is bordering at least one other state that adopted the cap. The results reported in Table 2.5 indicate that this is not a problem for the sample investigated, and that at least in a relatively short term of 10 years most of the increase in the number of physicians recorded by previous literature as being associated with the introduction of the cap does not come from movement across the border but rather from delayed retirement.

Table 2.5 The Impact of Non-Economic Damage Caps Adopted by Bordering States [t statistic in brackets]

	Patients Admitted	Total Outpatient Visits	Surgeries Performed	Average Length of Stay
Non-Economic Damage Cap	-0.206 [-3.6]	-4.615 [-2.54]	-0.147 [-1.56]	0.091 [2.77]
Border States Cap	-0.175 [-1.93]	-0.563 [-0.15]	-0.108 [-0.88]	-0.013 [-0.17]
Sample	1995-2004	1995-2004	1995-2004	1995-2004

Although the coefficients for covariates are not reported, all regressions control for State Health and Percent 65+, Income, High-school, Percent Black, Percent Uninsured, and State and Time FE. Regressions weighted by population. Standard errors computed using White-Huber estimator.

The results reported in Table 2.5 also suggest that, at least for the 10 years period investigated, there is no bias in my baseline estimated due to physicians' mobility across border. But the estimates may still be underestimating the total effect of the regulation if there are cumulative effects from having the cap in place for several years. In Table 2.6, I control for the number of years passed since the cap was introduced, and find that there is no cumulative effect on the patients treated or surgeries performed but there is a significant cumulative effect on average length of hospitalization. This result is consistent with the hypothesis advanced previously of an increase in the search time coming at the later cost of health deterioration.

Table 2.6 The Instantaneous and the Cumulative Impact of Non-Economic Damages Cap [t statistic in brackets]

	Patients Admitted	Total Outpatient Visits	Surgeries Performed	Average Length of Stay
Non-Economic Damage	-0.218	-4.590	-0.098	0.029
Cap - Instantaneous Effect	[-3.28]	[-1.89]	[-0.92]	[0.72]
Non-Economic Damage	0.011	0.009	-0.017	0.026
Cap - Cumulative Effect	[1.22]	[0.02]	[-0.97]	[2.78]
Sample	1995-2004	1995-2004	1995-2004	1995-2004

Although the coefficients for covariates are not reported, all regressions control for State Health and Percent 65+, Income, High-school, Percent Black, Percent Uninsured, and State and Time FE. Regressions weighted by population. Standard errors computed using White-Huber estimator.

As I mentioned, some of these measures of medical care delivery are probably related. For instance, if people go more often to the doctor and the marginal individual is healthier, the average length of hospitalization drops. The same relation holds between the number of surgeries performed and the average length of stay. Consequently, I estimate the patients admitted and the average length of stay equations simultaneously using Zellner's seemingly unrelated regressions approach. Then I do the same thing for surgeries performed and the average length of stay. The results are reported in Table 2.7.

Table 2.7 The Effect of Non-Economic Damages Cap on the Delivery of Medical Care: Zellner's Seemingly Unrelated Regression

	Coefficient on Non-Economic Damages Cap	
	Patients Admitted	Average Length of Stay
Coeff	-0.191	0.085
[t statistic]	[-3.6]	[2.08]
Test of Independent Equations		
Chi square	4.480	
[P value]	[0.034]	
	Coefficient on Non-Economic Damages Cap	
	Surgeries Performed	**Average Length of Stay**
Coeff	-0.141	0.086
[t statistic]	[-1.46]	[2.13]
Test of Independent Equations		
Chi square	11.582	
[P value]	[0.001]	

Although the coefficients for covariates are not reported, all regressions control for State Health and Percent 65+, Income, High-school, Percent Black, Percent Uninsured, and State and Time FE. In addition, I control for Percent Hispanics in the "Patients Admitted" regression, for Sales Tax Receipts in the "Average Length of Stay" regression, and for Percent Immigrants in the "Surgeries Performed" regression. Regressions weighted by population. Small-sample adjustments are used for computing the covariance matrix of the residuals.

I control for Percent Hispanics in the "Patients Admitted" regression, for Sales Tax Receipts in the "Average Length of Stay" regression, and for Percent Immigrants in the "Surgeries Performed" regression. Given the sample size, I make small-sample adjustments for computing the covariance matrix of the residuals. While the coefficients on the caps become even more significant in the equations for patients admitted and for surgeries performed, the t statistic on the estimated effect of caps on the length of hospitalization drops somewhat. This result indicates that at least part of the observed positive effect on the average length of hospitalization is caused by the observed drop in the number of patients admitted in community hospitals and in the number of surgeries.

Replicating the analysis reported in Table 2.3 using logs of the dependent variables indicates that states that choose to introduce a cap experience a decrease of 1.5% in the percent of population admitted in community hospital, of 1.7 % in the percent outpatient visits, of 1.3% in the percent surgeries performed in population, and a 1.7% increase in the average length of stay, the equivalent of 0.09 days. One explanation for this difference is that the cap is not equally binding for across types of medical services. Another plausible explanation is that people are more likely to increase their search period when it is less costly in terms of health worsening, for preventive or exploratory services for instance. This last theory implies that caps should have the smallest negative effect on types of medical care that are hard / expensive to delay acquiring. I test this prediction by splitting the total number of outpatient visits between emergency outpatient visits and all other outpatient visits and estimate the effect of caps on these variables simultaneously. I control for fatalities from vehicle accidents in the emergency outpatient visits regression, and for percent of population living in non-metropolitan area in the all other outpatient visits regression because people living far from a hospital are less likely to choose outpatient treatment than those living close if transportation cost are high. Table 2.8 results from the Zellner's seemingly unrelated regressions estimation indicates that indeed, non-economic damage caps have a strongly significant and relatively large effect on outpatient visits other than emergency, but no significant effect on emergency visits, providing support for the above argument.

Table 2.8 The Effect of Non-Economic Damages Cap on Emergency Care

	Coefficient on Non-Economic Damage Cap	
	[1] Outpatient Visits other than Emergency	[2] Outpatient Visits Emergency
Coeff	-5.470	0.358
[t statistic]	[-2.43]	[1.35]
Test of Independent Equations		
Chi square	14.379	
[P value]	[0.000]	
Ho: Coeff [1] =Coeff [2]		
F	6.870	
[P value]	[0.01]	

Although the coefficients for covariates are not reported, all regressions control for State Health and Percent 65+, Income, High-school, Percent Black, Percent Uninsured, and State and Time FE. In addition, I control for Fatalities from Vehicle Accidents in the "Outpatient Visits Emergency" regression and for Percent Non-metropolitan in the "Outpatient Visits other than Emergency" regression. Regressions weighted by population. Small-sample adjustments are used for computing the covariance matrix of the residuals. Sample size: 497 observations.

The alternative explanation for our estimates would be that the law was passed in states with low level of medical care delivered to the population. We test this hypothesis by instrumenting the existence of regulation in a state with the percent of lawyers in the state population and with the percent catholic in population. Both instruments are strongly correlated with the non-economic damages cap regulation, as seen in Table 2.9. A Wald test for independence indicates that treatment regression is the appropriate estimation method in the case of surgeries performed. The test cannot reject the hypothesis that there is no bias in the direct estimations of the impact of non-economic damages cap on patients admitted, outpatient visits and average length of stay in community hospitals.

Table 2.9 The Effect of Non-Economic Damages Cap - Treatment Effects Model
[t statistic in brackets]

	Patients Admitted	Total Outpatient Visits	Surgeries Performed	Average Length of Stay
Non-Economic Damage Cap	-0.384	-12.276	-1.151	0.096
	[-1.1]	[-2.19]	[-6.06]	[1.99]
First stage				
Lawyers	-6.896			
	[-2.79]			
Catholics	0.021			
	[2.04]			
No. Obs.	346			
Chi square	7.82			
Test of Independence	0.25	1.86	16.75	2.93
[P value]	[0.618]	[0.172]	[0]	[0.087]

Although the coefficients for covariates are not reported, all regressions control for State Health and Percent 65+, Income, High-school, Percent Black, Percent Uninsured, and State and Time FE. Regressions weighted by population. Standard errors computed using White-Huber estimator.

The estimated coefficient on the reform dummy from the treatment effects estimation increases in magnitude while keeping the significance and the same sign indicated by the fixed effects estimation. These results suggest that the legislation was passed in states where more surgeries were performed and perhaps as a result more lawsuits were filed. The cap is not as binding for other specializations and that is why the law is exogenous in the other regressions. But this is also an indication that the impact of the regulation varies across types of medical services because the cap is only binding for certain specializations. Due to the specific of their specialization, the surgeons and the obstetrician are expected to experience the largest decrease in the cost of their malpractice insurance once the cap is introduced. Previous results indicate that while surgeries are one of the fields with the largest expected increase in supply, the net effect of non-economic damages caps is nevertheless still negative. But it is worth looking at the amount of obstetric services too, as the second field where the increase in supply may be able to offset the postulated decrease in demand, such that the cap actually achieves its purpose.

Using data from the Center of Disease Control and Prevention between 2000 and 2003, I investigate the influence of non-economic damages cap on the amount of prenatal care services delivered as measured by the percent of expecting mothers starting to receive prenatal care in the first, second, third trimester, or receiving no prenatal care. Since these measures are related I estimate all 4 equations simultaneously using Zellner's seemingly unrelated regressions approach. In addition to the previous controls, I include the percent of people holding a bachelors degree in the first equation because more educated women are more likely to present themselves to the doctor early; the rate of unionization in the state in the second equation because unions may be able to negotiate better terms on the insurance contracts and increase the likelihood that women are covered, thus increasing the demand for prenatal care; sales tax receipts per capita as a share of income per capita as a measure of redistribution in the third equation; and the percent new immigrants in the last regression because new immigrants are the one the are most likely not to ask for any prenatal care. The results reported in Table 2.10 indicate that even though these are preventive visits, thus more likely perceived as cheap in terms of health worsening and more likely to experience a significant drop in demand, the introduction of a non-economic damages cap leads to an increase in the proportion of mothers that start receiving care in their first trimester and to a reduction in the proportion of mothers that receive no care. The result is consistent with a shift in supply large enough to offset any drop in demand caused by a longer search period.

Table 2.10 The Impact of Non-Economic Damages Cap on Prenatal Care

Dependent Variable	Coefficient on Non-Economic Damage Cap			
	Month Prenatal Care Began			
	1st-3rd month	4th-6th month	7th-9th month	No Prenatal Care
Coeff	0.944	-0.237	-0.020	-0.285
[t statistic]	[3.15]	[-1.18]	[-0.26]	[-4.77]
Test of Independent Equations				
Chi square	130.327			
[P value]	[0]			

Although the coefficients for covariates are not reported, all regressions control for State Health and Percent 65+, Income, High-school, Percent Black, Percent Uninsured, and State and Time FE. Regressions weighted by population. Standard errors computed using White-Huber estimator.
Sample 2000-2003.
Sample size: 198 observations

If caps lead to a decrease in demand, the result obtained in the case of prenatal care services would not be true for most other preventive visits, because the cap would not be binding for many other physicians' specialties and the supply would not increase. I test this hypothesis using the Behavioral Risk Factor Surveillance System (BRFSS) data from 1996 to 2002. This dataset provides a measure of the amount of preventive medical services consumed by a person as described by how long has it been since the individual last visited a doctor for a routine checkup. This variable takes a value of 1 if the last check-up visit took place within the past year, a value of 2 if within the past 2 years, a value of 5 if within the past 5 years, and a value of 4 if the last visit took place 5 or more years before the interview. As a result I estimate an ordered probit with state and time fixed effects that controls for age, gender, race, marital status, number of children, education, income, health status, whether the individual has any type of health insurance, and whether the state of residence has adopted a cap on non-economic damages. The health status variable controls for an increased demand for care derived from a poorer general health even in absence of a health shock, and the health plan variable accounts for the moral hazard generated by the existence of the insurance. Summary statistics for these variables are reported below in Table 2.11.

Table 2.11 Summary Statistics – BRFSS Sample

Variable	Mean	Std. Dev.	Min	Max
Non-Economic Damages Cap	0.431	0.495	0	1
Routine Check-up	1.519	0.940	1	4
Age	46.039	16.684	18	99
Female	0.581	0.493	0	1
Black	0.087	0.282	0	1
Hispanic	0.060	0.238	0	1
Married	0.572	0.495	0	1
No. Children	0.766	1.155	0	21
High-School	0.892	0.311	0	1
College	0.291	0.454	0	1
Income between 35K and 75K	0.355	0.479	0	1
Income above 75K	0.137	0.344	0	1
General Health	2.361	1.067	1	5
Health Plan	0.880	0.325	0	1

No. observations: 653587

Because the error terms could be correlated for individuals living in the same state I correct for clustering by state. The results from this estimation, as reported in Table 2.12 indicate a positive correlation between the existence of a non-economic damages cap and our measure of the consumption of preventive care services. Since the dependent variable takes larger values the longer the period that passed since the last preventive visit, the estimates obtained are a sign that people living in states that adopted the cap tend to delay going to the doctor for preventive visits, providing support for the theory of a longer search period caused by the introduction of the cap.

Table 2.12 The Impact of Non-Economic Damages Cap on the Frequency of Routine Health Check-ups [t statistic in brackets]

	Routine Check-up
Non-Economic Damage Cap	0.055
	[2.32]
No. Obs.	653587
Sample	1996-2004
Pseudo R2	0.0547

Although not reported, this regression controls for Age, Female, Black, Hispanic, Married, Number of Children, High-school, College, Income between 35k and 75K, Income above 75k, General Health, Health Plan, State and Time FE. Weighted regression. Robust standard errors clustered by state. Sample 1996-2002. Sample size: 653587 observations

Conclusions

The novelty of this paper is that it addresses the issue of a decrease in demand for medical care brought about by the break in the bonding between physicians and patients through the malpractice damages payments. The effective result is that the predicted increase of the number of medical services providers, doctors, does not automatically imply an increase in the quantity of medical care actually delivered. This paper recognizes this difference and investigates the effect of non-economic damages cap on several measures of the quantity of medical services delivered. I find evidence that the number of patients admitted in community hospitals, the number outpatient visits, and the number of surgeries performed in community hospitals is smaller in states that have non-economic damages caps, while the average duration of hospitalization is somewhat longer. The interpretation is that the breakage of the quality assurance device affected peoples' willingness to rely on a service that is now of uncertain quality. They give up or perhaps delay buying some medical services, resulting in a longer average duration of hospitalization.

This paper recognizes that it may be the case that the observed correlation between the reform and various measures of the quantity of medical care is a by-product of the conditions that favored the reform. After correcting for this problem the results regarding the quantity of care still hold.

Non-economic damages caps affect various medical specialties differently; specifically, my results indicate that non-economic damages caps are associated with a larger proportion of women receiving early prenatal care. It is not the object of this paper to investigate the differences in the prevailing effect of reform on medical care delivered for various physicians' specializations, but such analysis could indicate where the cap is most helpful or damaging. Nevertheless, the message of this paper nevertheless is that a cover-all solution is not necessarily appropriate: while such regulation may be obtaining good results for certain specialties, it may also be producing damage for others. A targeted solution may be more appropriate.

QUALITY VERSUS QUANTITY IN MEDICAL CARE: WHAT TELEMEDICINE TELLS US ABOUT MEDICAL LICENSING

Abstract

In order to preserve the level of medical care quality guaranteed by licensing, some states took measures to prevent physician-patient telemedicine, a more accessible but also a lower expected quality service than face-to-face consultations, by adopting regulation that requires physicians to perform a physical examination before prescribing drugs. This paper uses variation in this type of regulation to investigate whether licensing requirements are too strict. The results indicate that the states that adopted the regulation experienced an increase in mortality. Because the introduction of an easily accessible but lower quality service improves outcomes, I conclude that overall licensing requirements are too strict.

JEL Classifications: I18, I12, K00

Keywords: telemedicine, regulation, medical licensing

Introduction

It is widely acknowledged that the market for health care provision is characterized by asymmetric information. The providers, physicians, have more information about the quality of the product than do their customers. Because there is no possibility to check ex-ante the quality of the products, patients may be reluctant to buy the product, resulting in an inefficiently low quantity of medical care consumed.

As a result, it has become commonplace for the governments to offer a quality guarantee in health provision by requiring doctors to prove a minimum level of competence. Such regulation is expected to increase the expected quality of medical services and, thus, the demand for care, but to also decrease the supply of doctors. The ultimate effect on health is ambiguous and depends on the stringency of the requirements [Kleiner and Kurdle, 2000] because the stringency of requirements decides the number of practicing physicians and, thus, the ease of access to care.

More recently the internet era opened the opportunity of improving access to medical advice through electronic means using what it is called telemedicine. Telemedicine comprises physician-patient or physician-physician communication using telephones, videophones, fax machines, computers, or any other device that enables the transmission of information between parties located at a distance from each other. These technologies create the potential for medical care delivery to people located in remote area for whom access to specialized care would otherwise be prohibitively costly due to transportation costs.

Nevertheless, telemedicine remains controversial. Telemedicine supporters emphasize the advantage of improved access and of increased competition leading to more choice for patients at significantly lower costs of contacting a doctor. Its adversaries point out that there is no realistic way of monitoring the quality of such services, leading, they argue, to worse health outcomes. Practically, telemedicine practices are predicted to partially reverse the effects of licensing. Licensing prompts an increase in the average quality of care delivered, but decreases the number of physicians, thereby, raising the costs of contacting a physician. On the other hand, physician-patient telemedicine practices ease access, but are predicted to be associated with lower quality because physicians can not collect as much information about patients in tele-encounters as they would in face-to-face encounters. It is not obvious that the same argument can be made about physician-physician tele-encounters because this service implies that a physician meets the patient face-to-face even though it is not the one that establishes the diagnostic. There is a possibility that the physician that actually meets the patient cannot interpret the information collected from the physical examination as well as the specialist that was contacted for the diagnosis, but the risk of missing relevant information is significantly lower than in the physician-patient encounters. Overall, the result is that if the licensing requirements were too strict therefore having a net negative effect on health, telemedicine would provide an improvement in health, but if the licensing requirements were adequate, telemedicine would worsen health.

Concerns about the quality of care provided through electronic meetings caused many states to act toward providing a legal setting for telemedicine practice. In all cases, the stumbling blocks for doctors trying to practice telemedicine are the same as for doctors with cross-state practice: licensing requirements for each state and the lack of reimbursement. In addition telemedicine practitioners face a more pressing problem with no real loophole: the existence of regulation requiring an actual physical examination before any prescriptions may be issued (Table 3.1). The justification behind this regulation is that telemedicine-practicing physicians do not have as much information when establishing a diagnosis as the physicians that physically encounter their patients, increasing the probability of a medical mistake. This hands-on policy prevents any practice from physicians that are not physically present in the same room with the patients, effectively ruling out any form of physician-patient telemedicine. On the other hand, in many states the legislators seem to recognize that the lower quality argument does not necessarily hold for physician-physician tele-meetings and allow for drug prescriptions to be made by physicians located at a distance if the whole process is mediated by another physician that meets the patient face-to-face.

Table 3.1 Summary of State Policies Precluding Physicians to Prescribe Drugs to Individuals They Have Not Personally Examined

State	Required by Law	Required by Regulation/Policy	Year
Alabama		Ala. Admin. Code r. 540-X-9-11ER	2000
Alaska		AK Administrative Code	2000
Arizona	Ariz. Rev. Stat. § 32-1831 (D.O. Only)		2000
California	Cal. Bus. & Prof. Code §§ 4067, 2242.1		2000
Colorado		Board Policy	2000
District of Columbia		Board Statement	1998
Florida		Board Rule	2003
Georgia		Board Rule	2002
Indiana		Board Rule	2003
Kentucky	KRS 311.597(1)(e)		2002
Louisiana		Board Policy	2000
Maine		Board Policy	2002
Maryland		Board Statement	2005
Massachusetts		Board Policy	2001
Mississippi		Board Policy	2000
Missouri	334.100.2(4)(h)		2001
Nebraska		Board Policy	2001
Nevada	Nevada Revised Statutes 453.3643		2001
New Mexico		Board Rule	2001
New York		Board Statement	2003
North Carolina		Board Statement	1999
Ohio	Ohio Rev. Code Ann. § 4731-11-09		1999
Oklahoma		Board Policy	2001
Oregon		Board Rule	2000
South Carolina		Board Rule	2001
Tennessee		Board Statement	2000
Texas		Board Rule	2003
Virginia	Code 54.1-3303 and 54.1-3434.1		2000
Washington		Board Policy	2002

Source: Federation of State Medical Boards; Office for the Advancement of Telehealth; States Legislatures

This paper uses state level variation in the regulations requiring physicians to perform a physical examination before prescribing drugs to test the hypothesis that licensing requirements are too strict. Since telemedicine is predicted to partially reverse the effects of licensing regulation, states that passed the physical requirement regulation, thus preventing physician-patient telemedicine, provide not only a way to test the effect of telemedicine on health but also a way to test whether licensing requirements are too strict and whether lower quality but larger quantity of medical care would improve outcomes. If licensing requirements were too strict and telemedicine improves outcomes, any regulation that prevents telemedicine will affect health negatively. Therefore, by looking at the effect of a regulation that prevents physician-patient telemedicine we can infer whether the licensing requirements were too strict in the first place.

Section 3.2 describes the link between regulation in the medical field, quality and quantity of medical care delivered, and outcomes; Section 3.3 introduces the theoretical model; Section 3.4 describes the empirical results; and Section 3.5 concludes.

The Link Between the Regulation of Medical Care Quality and Health Outcomes

The health care market is characterized by asymmetric information: the seller has more information about the quality of the service than the buyer, potentially leading to quality deterioration [Akerlof, 1970]. This characteristic of the market, as Arrow [1963] notes, makes necessary the development of trust relations between physicians and patients and highlights the social value of a reliable source of information about the quality of the service. The result is the creation of social institutions that theoretically provide reliable information, reducing the uncertainty regarding quality and increasing demand for medical services. An example of such an endeavor is professional licensing of physicians.

As a practical matter, physicians can obtain licenses that allow them to practice medicine if they are able to pass some competency tests. Therefore, licensing guarantees that physicians have a minimum level of competence determined by the strictness of the tests. As a byproduct, there are fewer doctors and, thus, less competition. So at any point in time in the medical field as in many other fields the question remains: was licensing in the public interest or was it driven by the desire to create monopolies? The answer is not an obvious one way or the other but rather, as Moore [1961] finds after surveying licensing regulations, often licensing is not strictly in the public interest and extends also into the realm of competition restrictions. If the tests are designed by professional groups, then we should expect that in the process of maximizing net gains the group will choose standards higher than optimal [Leland, 1979]. But that licensing may support both consumer interest and may also restrict competition is consistent with the idea that regulators that respond to pressures from different interest groups do not grant perfect cartels with their regulations [Peltzman, 1976]. In fact, there is evidence to support that medical licensing tends to create a monopoly [Friedman and Kuznet, 1945; Kessel, 1958] but also that licensing is consumer-demand driven [Leffler, 1978]. Therefore, even if we accept that licensing is socially desirable, we should still question whether licensing requirements are too strict. Standards that are too high not only increase the monetary price of medical care but also make access to care difficult.

All else held constant, there is a way to ease access to medical care: the practice of medicine at distance through what we now call telemedicine. While such practices existed even in the 1960's and 1970's, telemedicine really took off in the 1990's when the improvements in technology made telemedicine more useful and reliable [Emery, 1998]. The notion of telemedicine today covers both physician-patient and physician-physician communications using telephones, videophones, fax machines, computers, or any other devices that enables the transmission of information between parties located at distance.

While physician-physician communication is generally viewed in a positive light because patients benefit from both face-to-face consultations but also from specialized advice that otherwise would be inaccessible to them, physician-patient telemedicine remains controversial. The controversy stems from the fact that even if telemedicine consultations have a lower transportation cost and lower time cost both in time spent in transportation [Smith et al., 2003] and in time spent in the consultation [Guilfoyle et al., 2003] and significantly improve access to medical care [Martinez et al., 2004], they also provide less information to the physician, creating potential for mistakes. Comparisons of telemedicine with face-to-face consultations, of which I will mention just a few for brevity, indicate that this may indeed be the case. Smith et al. [2006] finds that of 58 ear, nose and throat assessments, in 81% of the cases the diagnosis was the same in the case of tele-consultations and face-to-face consultation. In the case of trauma the percent of incorrect tele-diagnoses was even smaller: only approximately 2% or less of the original tele-diagnoses was considered incorrect after face-to-face review [Tachakra et al., 02/2000; Tachakra et al., 12/2000]. There is also evidence of a higher incidence of mistakes in teledermatology compared to face-to-face encounters [Loane M.A. et al, 1998; Chao et al., 2003; Oztas et al., 2004; Oakley A. M. M. et al., 2006] even when a general practitioner was present with the patient in the videoconference room [Nordal E.J et al., 2001], but no real evidence of this sort for genetic services [Stalker H.J. et al., 2006]. More information about the outcomes of such comparisons are easily available in reviews of the literature [Currell R. et al., 2000; Miller E. A., 2001; Hersh W. et al, 2002; Hersh W.R. et al, 2006], which indicate, just as the small sample that I mentioned above, that telemedicine offers services of close but somewhat lower quality than face-to-face consultation, and that the relative quality varies with the type of health problem targeted. Therefore, by introducing the option of a service of lower quality but cheaper, physician-patient telemedicine partially offsets the impact of licensing requirements. If as a result of interest groups pressure the regulator adopted requirements that were too strict, telemedicine would have a positive effect on health; otherwise its impact would be negative and the society would be better off without it.

Under the assumption that current licensing requirements are justified, the quality of physician-patient telecare services is too low and that is why several states took steps to prevent such activities by requiring physicians to meet their patients in person before prescribing drugs (Table 3.1). The effect of this requirement again depends on how strict licensing requirements were in the first place. If the standard was justified or too low, then physician-patient telemedicine would only worsen the situation, so the introduction of a physical examination requirement would improve health outcomes. On the other hand, if the standard was too high, as predicted by theory when the standard is set by professional groups, like in case of medicine, then telemedicine probably improves outcomes, and the physical examination requirement would have a negative effect. The caveat is that the effect would also depend on the relative quality of telemedicine and traditional medical services, but since the literature indicates only a small difference in quality this should not be a major concern for the purpose of this analysis.

The Effect of Physical Examination Requirement on Health

Consumers in need of treatment frequently demanded physician consultations involving physical examinations even before they became mandatory by law. Such consultations entail some costs above the price of the actual consultation: the transportation cost and the opportunity cost of time spent traveling. The alternatives to meeting a physician would be either obtaining a physician's advice through telephone, e-mail, fax, Internet and/or other electronic means, or self-treatment. However, if the physical examination is required the only alternative is self-treatment. Once it is understood that the presence of regulation does not imply that every person with health problems will actually meet with a doctor and that there is a real possibility some will give up physician consultations altogether, the implications of such regulation for consumer health are less clear than might be imagined.

The ambiguity arises from the effect of the law on various groups of the population. The marginal effect of this hands-on policy is to raise the cost of access to medical advice for some individuals. Among the individuals that would have used telemedicine services, under the regulation some will choose to meet a physician in person and some will give up obtaining professional advice because it would be too expensive. Those that switch from electronically obtained advice to advice based on face-to face encounters obtain a higher quality service, thus, experiencing an improvement in health. However, those that exchange electronically obtained professional advice for self-treatment suffer a decline in health because they have a higher probability of making a mistake than a physician.

Let the individual's utility be increasing at a decreasing rate in consumption and health:

$U_i = C^{\alpha} H^{\beta}$, where $\alpha + \beta < 1$, C represents consumption, and H health.

Health depends on the type of medical care acquired. The treatment based on face-to-face encounters with physicians is the highest quality service, providing the most significant improvement in health, but it is also the most expensive. Self-treatment is the cheapest option but also the lowest in quality, bringing the lowest expected improvement in health. The third option is the electronically obtained advice, cheaper than physical consultations but more expensive than self-treatment. When physical examination is required, this third option is not available.

$$H = \begin{cases} Q_1 \text{ if physical consultation} \\ Q_2 \text{ if tele-consultation} \\ Q_3 \text{ if self-treatment} \end{cases}$$

where Q_1 costs P_1, Q_2 costs P_2, and Q_3 costs P_3, with $P_1>P_2>P_3$.

The individual maximizes utility subject to discrete choices of health and to an income constraint:

$L = C^{\alpha}H^{\beta} + \lambda(Y - C - P_j)$, where j=1,2,3, the price of consumption goods is normalized to 1, and Y represents total income.

The implication is that individuals choose the type of medical care to use function of the level of their income:

1) face-to-face consultation if

$$Y \geq \frac{P_1Q_1^{\beta/\alpha} - P_2Q_2^{\beta/\alpha}}{Q_1^{\beta/\alpha} - Q_2^{\beta/\alpha}} \;\&\; Y \geq \frac{P_1Q_1^{\beta/\alpha} - P_3Q_3^{\beta/\alpha}}{Q_1^{\beta/\alpha} - Q_3^{\beta/\alpha}} \quad (17)$$

2) tele-consultation if

$$\frac{P_2Q_2^{\beta/\alpha} - P_3Q_3^{\beta/\alpha}}{Q_2^{\beta/\alpha} - Q_3^{\beta/\alpha}} \leq Y < \frac{P_1Q_1^{\beta/\alpha} - P_2Q_2^{\beta/\alpha}}{Q_1^{\beta/\alpha} - Q_2^{\beta/\alpha}} \quad (18)$$

3) self-treatment if

$$Y < \frac{P_2 Q_2^{\beta\alpha} - P_3 Q_3^{\beta/\alpha}}{Q_2^{\beta/\alpha} - Q_3^{\beta/\alpha}} \; \& \; Y < \frac{P_1 Q_1^{\beta/\alpha} - P_3 Q_3^{\beta/\alpha}}{Q_1^{\beta/\alpha} - Q_3^{\beta/\alpha}} \tag{19}$$

The choice of telemedicine is only relevant under the condition that: $\frac{P_2 Q_2^{\beta/\alpha} - P_3 Q_3^{\beta/\alpha}}{Q_2^{\beta/\alpha} - Q_3^{\beta/\alpha}} < \frac{P_1 Q_1^{\beta/\alpha} - P_3 Q_3^{\beta/\alpha}}{Q_1^{\beta/\alpha} - Q_3^{\beta/\alpha}} < \frac{P_1 Q_1^{\beta/\alpha} - P_2 Q_2^{\beta/\alpha}}{Q_1^{\beta/\alpha} - Q_2^{\beta/\alpha}}$, otherwise, nobody ever chooses this type of service. Because I investigate the impact of a regulation that came into being due to the exertion of this choice, I continue the analysis under this constraint.

Given the existence of the physical examination requirement, tele-consultations are not available; therefore, utility maximization involves the following choice:

1) face-to-face consultation if $Y \geq \frac{P_1 Q_1^{\beta/\alpha} - P_3 Q_3^{\beta/\alpha}}{Q_1^{\beta/\alpha} - Q_3^{\beta/\alpha}}$ (20)

2) self-treatment if $Y < \frac{P_1 Q_1^{\beta/\alpha} - P_3 Q_3^{\beta/\alpha}}{Q_1^{\beta/\alpha} - Q_3^{\beta/\alpha}}$ (21)

Consequently, with a physical examination requirement, all individuals in the $\left(\frac{P_2 Q_2^{\beta/\alpha} - P_3 Q_3^{\beta/\alpha}}{Q_2^{\beta/\alpha} - Q_3^{\beta/\alpha}} ; \frac{P_1 Q_1^{\beta/\alpha} - P_3 Q_3^{\beta/\alpha}}{Q_1^{\beta/\alpha} - Q_3^{\beta/\alpha}} \right)$ range of income switch from tele-consultations to self-treatment and, thus, experience a decline in health. On the other hand, all individuals in the $\left(\frac{P_1Q_1^{\beta/\alpha} - P_3Q_3^{\beta/\alpha}}{Q_1^{\beta/\alpha} - Q_3^{\beta/\alpha}}; \frac{P_1Q_1^{\beta/\alpha} - P_2Q_2^{\beta/\alpha}}{Q_1^{\beta/\alpha} - Q_2^{\beta/\alpha}}\right)$ range of income switch from tele-consultations to face-to-face consultations and, thus, experience an improvement in health.

Therefore, the net effect of the regulation is function of the relative quality and relative prices of various types of care, and of the income distribution of population. Specifically, the regulation will lead to an improvement in health if:

$$\int_{\frac{P_1Q_1^{\beta/\alpha} - P_3Q_3^{\beta/\alpha}}{Q_1^{\beta/\alpha} - Q_3^{\beta/\alpha}}}^{\frac{P_1Q_1^{\beta/\alpha} - P_2Q_2^{\beta/\alpha}}{Q_1^{\beta/\alpha} - Q_2^{\beta/\alpha}}} f(I)dI > \int_{\frac{P_2Q_2^{\beta/\alpha} - P_3Q_3^{\beta/\alpha}}{Q_2^{\beta/\alpha} - Q_3^{\beta/\alpha}}}^{\frac{P_1Q_1^{\beta/\alpha} - P_3Q_3^{\beta/\alpha}}{Q_1^{\beta/\alpha} - Q_3^{\beta/\alpha}}} f(I)dI \qquad (22)$$

where *f(I)* is the density of the income distribution of the population.

Because the proportion of people that seek medical advice based on face-to-face encounters with physicians is determined by the price and quality of this service, which are set through licensing requirements, ultimately the net impact of a physical examination requirement will provide information on the effectiveness of the current level of licensing requirements.

<u>Empirical Analysis of the Effectiveness of Licensing Requirements</u>

This paper uses a panel data analysis over the period 1995-2003 to investigate the impact of regulations requiring physicians to perform a physical examination prior to prescribing drugs on state level mortality rates. The source of state level mortality data from different causes is the Center for Disease Control and Prevention (CDC) but because some data is listed as unreliable due to very small mortality rates (example: diseases of the skin and subcutaneous tissue, diseases of the eye and adnexa, diseases of the ear and mastoid process, etc.), I only retain the following categories: mortality from medical care adverse effects, from diseases of the digestive system, respiratory system, circulatory system, musculoskeletal system and connective tissue, and mortality from endocrine, nutritional and metabolic diseases and immunity disorders. It should be noted that in 1999 the Tenth Revision of the International Classification of Diseases (ICD-10) replaced the previously used ICD-9 to code the underlying cause-of-death. As a result, the category that includes mortality from endocrine, nutritional and metabolic diseases and immunity disorders was split into two groups: mortality from endocrine, nutritional and metabolic diseases was listed separately and mortality from immunity disorders was included in the same category as diseases of the blood-forming organs. Consequently, for the period 1999-2003 I added the mortality rate from endocrine, nutritional and metabolic diseases and mortality rate from immunity disorders to obtain a category comparable to the one listed for previous years (more information about the conversion of the ICD9 to ICD10 is available at: http://www.tdrdata.com/ipd/ipd_icdcodetools.aspx?SessionGUID=).

The panel dataset is used for a fixed-effects analysis including several control variables:

$Mortality\ rate_{st} = \beta_1\ (P.E.R.)_{st} + \beta_1\ X_{st} + \gamma_s + \lambda_t + \varepsilon_{st}$, where *s* indexes states and *t* time.

The dependent variable is the mortality rate per 100,000 individuals, not adjusted by age. On the right-hand side, *P.E.R.* stands for Physical Examination Regulation, and it is a dummy variable indicating whether in a particular state and year there was any regulation requiring physicians to perform physical examinations on their patients before prescribing drugs, regardless on whether it was required by law or only by the Medical Board. *X* is a vector of state-level controls including: percent uninsured, income per-capita, percent high-school graduates, percent 65 years old or older, percent black, health and hospital expenditures per capita, hospitals per 100 square-miles, and percent investor-owned hospitals, γ_s and λ_t represent state and year fixed effects, and ε_{st} is the error term.

When controlling for economic conditions through income per-capita variable, percent uninsured offers a measure of the intensity of the demand for medical care. The percent high-school graduates variable is included because of the strong correlation between education and health. Percent 65 years old or older controls for differences in mortality rates coming from differences in the age structure of the state population. State health and hospital expenditures may influence life expectancy in just the same way as a higher number of hospitals would: namely, by easing access to medical care. I use the number of hospitals per square-mile because it gives a better estimate of the transportation costs associated with the consumption of medical services. Percent investor-owned hospitals is included because organizational structure may influence efficiency and as a result health outcomes too.

Table 3.2 Summary Statistics

Variable	Mean	Std. Dev.	Source
P.E.R.	0.184	0.388	
Mortality: Medical Care Adverse Effects (per 100,000)	1.062	0.414	CDC
Mortality: Diseases of the Digestive System (per 100,000)	30.454	4.249	CDC
Mortality: Diseases of the Respiratory System (per 100,000)	85.066	15.054	CDC
Mortality: Diseases of the Circulatory System (per 100,000)	334.324	67.149	CDC
Mortality: Diseases of the Musculoskeletal System and Connective Tissue(per 100,000)	4.685	1.291	CDC
Mortality: Endocrine, Nutritional and Metabolic Diseases and Immunity Disorders (per 100,000)	35.434	7.384	CDC
Uninsured	14.116	4.002	Census
Income (per capita, in thousands, deflated using CPI)	15.786	2.384	BEA
Percent of Population with an Adjusted Gross Income between $50,000 and $100,000 [1]	19.236	2.604	IRS
Percent of Population with an Adjusted Gross Income above $100,000 [1]	6.588	2.355	IRS
High-School	84.437	4.364	Census
Bachelor	24.412	4.599	Census
College Enrollment	5.541	0.845	NCES

Continues on next page

Table 3.2 Summary Statistics (continued)

Variable	Mean	Std. Dev.	Source
>65	12.618	1.916	Census
Black	10.160	9.513	Census
State Health and Hospital Exp. (per capita, deflated using CPI)	148.896	55.871	Census
Hospitals/100 sq. miles	0.265	0.251	AHA
Investor Owned Hospitals (percent of total)	12.439	12.012	AHA
Urban Hospitals (percent of total)	0.486	0.250	AHA
Population (in thousands)	5511.042	6029.454	Census
>50% Non-Metropolitan	0.244	0.430	CPS
Farm Acreage (mil. acres)	0.423	0.264	Statistical Abstract of the US
Public Libraries [1]	0.306	0.342	NCES
Internet [1]	91.755	11.591	NCES

State level data from 1995-2003: 450 observations. CDC: Center for Disease Control and Prevention; IRS: Internal Revenues Service, United States Department of Treasury BEA: Bureau of Economic Analysis; AHA Hospital Statistics 2000, 2005; NCES: National Center for Education Statistics

[1] Sample data: 1997-2002

The results from the empirical analysis performed on this data are presented below in Table 3.3. All regressions are weighted least squares, the weights being state population. Standard errors are computed using the White-Huber estimator.

Table 3.3 The Impact of Physical Examination Requirement (P.E.R.) on Mortality from Different Causes [t statistic in brackets]

	Medical Care Adverse Effects	Diseases of the Digestive System	Diseases of the Respiratory System	Diseases of the Circulatory System	Diseases of the Musculoskeletal System and Connective Tissue	Endocrine, Nutritional, Metabolic Diseases and Immunity Disorders
P.E.R.	-0.102	0.343	0.051	0.995	0.144	0.656
	[-2.61]	[1.98]	[0.05]	[0.83]	[2.04]	[2.5]
Uninsured	-0.032	-0.019	0.061	-0.101	0.034	-0.017
	[-3.5]	[-0.47]	[0.42]	[-0.32]	[2.26]	[-0.29]
Income	-0.104	-0.397	-1.498	1.974	0.004	-0.366
	[-2.85]	[-2.5]	[-2.23]	[1.61]	[0.07]	[-1.54]
High-School	0.002	-0.006	0.372	-0.940	-0.012	0.084
	[0.21]	[-0.14]	[2.36]	[-2.86]	[-0.66]	[1.32]
>65	-0.105	1.316	4.099	14.893	0.360	1.292
	[-1.59]	[5.99]	[3.84]	[6.7]	[3.59]	[3.92]
Black	-0.128	0.426	1.737	-3.447	0.379	-0.462
	[-2.2]	[2.02]	[1.98]	[-1.76]	[4.68]	[-1.37]
State Health and Hospital Expenditures	-0.001 [-1.5]	-0.009 [-2.5]	-0.021 [-1.84]	0.092 [3.56]	0.000 [0.09]	-0.006 [-1.05]
Hospitals/ 100 sq. miles	-0.216 [-0.39]	8.879 [2.5]	10.540 [0.92]	15.725 [0.97]	0.179 [0.19]	14.174 [3.67]
Investor Owned Hospitals	-0.006 [-0.88]	0.076 [2.65]	0.062 [0.69]	0.239 [1.26]	-0.014 [-1.34]	-0.160 [-3.97]
Year effects	yes	yes	yes	yes	yes	yes
State FE	yes	yes	yes	yes	yes	yes
No. Obs.	450	450	450	450	450	450
R squared	0.799	0.946	0.941	0.991	0.906	0.970

Regressions weighted by population. Standard errors computed using White-Huber estimator.

The physical examination requirement regulation has a negative and significant effect on mortality from medical care adverse effects, consistent with the previous literature indicating that physicians have a higher probability of making a mistake if they use only communication at a distance for diagnosis. Therefore, this result provides support for the view that the physician-patient type of telemedicine may be of somewhat lower quality. On the other hand, this regulation is positively correlated with the mortality from all other listed causes, and the coefficients are significant in the case of the mortality rate from diseases of the digestive system, mortality from diseases of the musculoskeletal system and connective tissue, and mortality from endocrine, nutritional and metabolic diseases and immunity disorders.

These estimates provide support for the idea that physician-patient telemedicine has a positive impact on the health of at least a part of the population. The order of magnitude as well as the significance of the coefficients varies with the cause of mortality. The regulation has a relatively large effect on mortality from endocrine, nutritional, metabolic diseases and immunity disorders but only a small effect on the mortality from diseases of the musculoskeletal system and connective tissue.

The rest of the coefficients also seem plausible. Income per capita, when significant, is negatively correlated with mortality, as expected if health is a normal good, and a larger percent of elderly is positively correlated with mortality. There is a positive association between a larger percent of black population and mortality for most causes, but there is a negative association with the mortality rate from medical care adverse effects. The probable explanation is that minorities tend to have poorer access to medical care and, thus, there are fewer opportunities for mistakes. This does not imply that minorities experience better health, but rather that the reported cause of death for them would likely not be medical care adverse effects but the underlying health problem that would have required medical care. The coefficients on the state health and hospital expenditures variable vary with the cause of death and, thus, do not readily admit a straight-forward interpretation. A possible explanation for these results is that these regressions only control for the total amount spent without regard for where the money goes or the efficiency of spending. The number of hospitals per square-mile is positively correlated with mortality from all causes except medical care adverse effects. The negative correlation with medical mistakes is probably the result of increased competition, because easy access to more physicians implies low costs of switching from one physician to another, creating incentives for hospitals to monitor quality more closely. The positive correlation with all other types of mortality can be caused by selection. Since hospitals are more likely to locate in areas with high demand for medical care, and lower health may generate higher demand for medical care, we would observe more hospitals located in high mortality areas. The same explanations work for the coefficients on the percent investor-owned hospitals, especially since we would expect that profit-maximizing investors would choose to locate their facilities in regions with higher demand for medical services.

A sensitivity check of the results is performed and some of the results reported in Table 3.4. The baseline results are compared first with the results obtained after excluding Alaska, the state with lowest mortality rate. Then the highest mortality state is excluded: New Mexico in the case of mortality from medical care adverse effects, Wyoming in the case of mortality from diseases of the digestive system, West Virginia in the case of mortality from diseases of the respiratory system, of the circulatory system, and from endocrine, nutritional and metabolic diseases and immunity disorders, and Montana in the case of mortality from diseases of the musculoskeletal system and connective tissue. In all cases, the results are comparable with the results obtained from the baseline specification. When controlling for geographically correlated factors by augmenting the baseline specification with region-year interactions, the results are in general comparable but understandably weaker given the drop in the number of degrees of freedom. There is also a surprising result regarding the impact of regulation on mortality from diseases of the circulatory system: the coefficient is negative and significant.[9]

Because some diseases reinforce other health problems or perhaps external factors create conditions for the onset of several types of diseases, there may be correlation between different types of mortality. Zellner's seemingly unrelated estimation reported in the 5th line of estimates controls exactly for such a problem and indicates even stronger results. And finally, the last line estimators control for possible contemporaneous correlation of disturbances across panels and for first-order autocorrelation AR(1) within panels and the results still hold.

[9] This result is driven by the South region and it disappears in the IV estimation.

Table 3.4 Sensitivity Check of Physical Examination Requirement Coefficient to Alternative Specifications [t statistic in brackets]

	Medical Care Adverse Effects	Diseases of the Digestive System	Diseases of the Respiratory System	Diseases of the Circulatory System	Diseases of the Musculoskeletal System and Connective Tissue	Endocrine, Nutritional, Metabolic Diseases and Immunity Disorders
Baseline[1]	-0.102	0.343	0.051	0.995	0.144	0.656
	[-2.61]	[1.98]	[0.05]	[0.83]	[2.04]	[2.5]
Exclude Lowest Mortality State [1]	-0.103	0.353	0.050	0.922	0.147	0.654
	[-2.63]	[2.04]	[0.05]	[0.76]	[2.09]	[2.48]
Exclude Highest Mortality State[1]	-0.105	0.348	0.077	0.879	0.146	0.738
	[-2.7]	[2.01]	[0.08]	[0.73]	[2.07]	[2.82]
Include Region-Year Interactions[1]	-0.078	0.311	0.321	-2.673	0.142	0.661
	[-1.79]	[1.59]	[0.55]	[-2.42]	[1.96]	[2.46]
Simultaneous Estimation[2]	-0.099	0.369	0.272	1.047	0.139	0.618
	[-2.67]	[2.23]	[0.44]	[0.91]	[2.1]	[2.52]
Control for Serial Correlation (AR1)[3]	-0.102	0.303	0.213	0.228	0.138	0.617
	[-2.75]	[1.82]	[0.22]	[0.17]	[1.99]	[2.27]

[1] These regressions control for Uninsured, Income, High-school, 65+, Black, State Health and Hospital Expenditures, Hospitals/sq. mile, Investor Owned Hospitals, State FE, and Year FE.
[2] All previous covariates are included. In addition the first equations controls for Urban Hospitals, the second equations for Bachelors, the third for High-School and College Enrollment, the fourth for High-School and South Region - Year interactions, the fifth for High-School and Farm Acreage, and the sixth for High-school and Population Density.
[3] Prais-Winsten regressions, correlated panels corrected standard errors.

Besides identifying this effect, it should be acknowledged that the impact of changes in the character and structure of medical care today sometimes has have lag effects. As a result, we might observe a larger effect of the regulation as time passes. I estimate the impact of the number of years the regulation was in place on mortality and report the results in Table 3.5. The results are plausible:

there is a significant instantaneous effect of regulation on mortality from medical care adverse effects but no cumulative effect since the impact of medical mistakes is often felt immediately. On the other hand, for all other types of mortality the cumulative effect is strongly significant, because changes in the ease of access to medical care will have not only instantaneous effects but also delayed effects. Therefore, one should be cautious in drawing conclusions about the magnitude of the effects because, at this point in time, we may not be observing the full impact of the regulation for all types of mortality causes.

Table 3.5 The Cumulative Effect of Physical Examination Requirement on Mortality [t statistic in brackets]

	Medical Care Adverse Effects	Diseases of the Digestive System	Diseases of the Respiratory System	Diseases of the Circulatory System	Diseases of the Musculoskeletal System and Connective Tissue	Endocrine, Nutritional, Metabolic Diseases and Immunity Disorders
P.E.R.	-0.119	0.041	-0.629	-2.309	0.019	0.154
	[-2.12]	[0.19]	[-0.77]	[-1.61]	[0.2]	[0.45]
P.E.R. Cumulative Effect	0.011	0.185	0.416	2.023	0.076	0.308
	[0.5]	[2.2]	[1.35]	[3.15]	[2.06]	[2.16]

Regressions weighted by population. Standard errors computed using White-Huber estimator. All previous covariates are included.

The postulated positive effect of a physical examination requirement on health is explained by the reduced access to medical care for a certain part of population. In practice, this usually refers to people located in rural areas who incur high transportation costs in order to get to a physician’s office for a physical consultation. Therefore, the prediction is that this policy is going to have larger negative effect on health in states that are predominantly rural. In order to test this prediction, I identify the states that are predominantly rural and test whether the regulation has a different impact on these states compared with predominantly urban states. For this purpose, I use CPS data on the percentage of people living in non-metropolitan areas. If more than 50% of the population is living in non-metropolitan areas, I expect to observe the regulation having a larger positive impact on mortality. The results reported in Table 3.6 provide some evidence that this is indeed the case. The physical examination requirement has a larger impact on mortality from diseases of the respiratory system and on mortality from endocrine, nutritional and metabolic diseases and immunity disorders in states where the majority of population lives in non-metropolitan areas.

The implication is that telemedicine managed to penetrate areas disadvantaged from the point of view of access to medical care, bringing real relief for at least some types of health problems. It is unclear whether the result does not hold across medical fields because some types of telemedicine services did not manage penetrate rural areas yet or because the measure used for the number of people located in rural areas is too noisy, but it would be interesting to know whether and why would people located in rural areas buy some types of telecare but not others.

Table 3.6 The Impact of Physical Examination Requirement on Mortality in Predominantly Rural States [t statistic in brackets]

	Medical Care Adverse Effects	Diseases of the Digestive System	Diseases of the Respiratory System	Diseases of the Circulatory System	Diseases of the Musculoskeletal System and Connective Tissue	Endocrine, Nutritional, Metabolic Diseases and Immunity Disorders
P.E.R.	-0.109 [-2.74]	0.359 [2.04]	-0.129 [-0.13]	1.154 [0.93]	0.146 [2.04]	0.579 [2.17]
(P.E.R.) * (>50% Non-Metro)	0.134 [1.36]	-0.231 [-0.35]	3.523 [2.22]	-3.526 [-1.13]	-0.015 [-0.07]	1.663 [3.38]
>50% Non-Metro	0.142 [1.36]	-1.261 [-2.17]	-0.263 [-0.13]	6.568 [0.73]	-0.377 [-1.5]	-2.407 [-1.09]

All previous covariates are included. Regressions weighted by population. Standard errors computed using White-Huber estimator.

Previous literature [Emery, 1998] indicates that investor-owned hospitals are less likely to adopt telemedicine technology. It could be that this is considered a risky investment since it had not been thoroughly tested, but the more likely explanation is that these hospitals postpone investing in telemedicine related technology until the states decide definitively the legal setting in which telemedicine practitioners can act. If that is the case, then perhaps physicians located in those states would be less likely to engage in physician-patient type of telemedicine practices. The prediction is that regulation would be less binding in states that have predominantly investor-owned hospitals because there would be less telemedicine practiced in these states in the first place. Table 3.7 reports the results from the empirical test of this prediction. I find that the physical examination requirement has a smaller impact on mortality from diseases of the musculoskeletal system and connective tissue and on mortality from endocrine, nutritional and metabolic diseases and immunity disorders in states where a larger proportion of the hospitals are investor-owned, validating the previous prediction.

One should note that if something hinders the development of telemedicine, the predicted effect of regulation on health would not necessarily be biased downward. An estimate would be biased downward under the hypothesis that the practice of telemedicine on a larger scale would bring additional benefits. Since telemedicine is not very pervasive, the sample of data used in this papers only registers marginal changes, but if the quality of the marginal service drops with increased delivery at some point the quality could be too low and telemedicine would negatively affect health. Of course, this argument only holds when there is no technological progress that could increase the quality of electronic information and improve the quality of telecare services, but it highlights the necessity of caution in extrapolating these results out of sample.

Table 3.7 The Impact of Physical Examination Requirement on Mortality Function of the Organizational Structure of Hospitals [t statistic in brackets]

	Medical Care Adverse Effects	Diseases of the Digestive System	Diseases of the Respiratory System	Diseases of the Circulatory System	Diseases of the Musculoskeletal System and Connective Tissue	Endocrine, Nutritional, Metabolic Diseases and Immunity Disorders
P.E.R.	-0.099	0.688	0.102	-1.090	0.507	1.228
	[-1.93]	[1.94]	[0.12]	[-0.57]	[3.82]	[3.75]
P.E.R.* Investor Owned Hospitals	0.000	-0.019	-0.003	0.113	-0.020	-0.144
	[-0.07]	[-1.24]	[-0.07]	[1.14]	[-3.65]	[-3.35]
Investor Owned Hospitals	-0.006	0.086	0.064	0.179	-0.004	-0.031
	[-0.87]	[3.02]	[0.65]	[0.92]	[-0.36]	[-2.07]

All previous covariates are included. Regressions weighted by population. Standard errors computed using White-Huber estimator.

A source of concern with the previous estimates would be that perhaps the adoption of such regulation is endogenous. The policy makers may decide to require physicians to perform physical examinations before prescribing drugs because the previously recorded rate of mortality indicated that the quality of medical care in these states was too low. Such decisions would make the existence of regulation to be positively correlated with the rate of mortality.

In order to identify the effect of regulation on mortality, a variable is required that would change incentives to adopt the regulation but would not affect mortality directly. The variables used here are the number of public libraries per capita relative to the percent tax returns filed for incomes from salaries and wages between $50,000 and $100,000 [10], and the percent of public libraries that offer internet services.

There are two main categories that are affected by the regulation: one is physicians because the regulation reduces competition and the other is formed by people who want to buy telemedicine services because face-to-face consultations are too expensive and who will be made better off by telemedicine whether this would improve their health or not because it would increase their overall utility. Since it is postulated that regulators do not offer perfect cartels [Pelzman, 1976], the probability that the regulator will support one party or the other depends on the state of the world at the time the regulation is introduced. Since according to the theoretical model telemedicine has the largest impact on people with relatively low incomes per household but perhaps not the poorest, I chose a measure of redistribution toward this category of population: those that are really rich do not need the services provided by public libraries, while those that are really poor are less likely to use them due to the expected characteristics of their occupation. More public libraries relative to this segment of population translate into more redistribution toward them: the regulator may be less sensitive to the demand of this part of the population and be more likely to adopt regulation that would prevent telemedicine. A similar argument stands behind the choice of the second instrument: the percent of public libraries that have internet. Physician-patient

[10] The source of data on number of individuals earning between 50,000 and 100,000: Internal Revenue Service, United States Department of the Treasury at http://www.irs.gov/taxstats/indtaxstats/article/0,,id=98123,00.html

telemedicine implies that the patient has access to the contact information of physicians located at distance; it also implies that patients should be able to transmit verbal and/or written information or even images to the physician. The percent of public libraries that offer internet services represents a proxy for the rate of adoption of technology in the state. If the rate of adoption is higher, then there are more people that could benefit from telemedicine and the policy maker would be less likely to adopt the regulation.

It could be argued that the number of public libraries per capita relative to the percent tax returns filed for incomes from salaries and wages between 50,000 and 100,000 USD is correlated with the degree of inequality in the state, which in turn may be correlated with mortality. So I introduce measures of inequality in the regressions: specifically, I introduce the proportion of tax returns filed for incomes from salaries and wages between $50,000 and $100,000 and the proportion filed for incomes from salaries and wages above $100,000. Once I solve this problem, it is reasonable to expect that the number of public libraries per capita relative to the percent tax returns filed for incomes from salaries and wages between $50,000 and $100,000 is not correlated with mortality. Also if the rate of adoption of technology is to be a valid instrument, it should not be correlated with mortality. The most obvious correlation arises from the fact that it is likely that states having a better educated population also adopt technology faster. It may also be the case that a higher population density generates spillovers that would increase the rate of technology adoption. Since population density could influence mortality from at least some causes, respiratory diseases for instance, I augment the baseline specification to include population density. Having controlled for income inequality, the level of education of people residing in the states, and population density, it is reasonable to argue that the percent of public libraries offering internet services is otherwise uncorrelated with mortality.

Due to data availability issues regarding the instruments used, the sample drops to 300 observations representing data between 1997 and 2002. Table 3.8 shows first the results obtained from the baseline specification augmented with the population density variable on this smaller sample and then the results from the IV estimation. The results from the baseline specification are comparable with the results obtained on the larger dataset but somewhat weaker, to be expected since the sample size drops by 33%. The IV estimates are larger than the baseline ones but, with two exceptions, Hausman tests do not indicate endogeneity problems. The two exceptions refer to the results obtained in the case of mortality from diseases of the circulatory system and in the case of mortality from endocrine, nutritional and metabolic diseases and immunity disorders. In both cases the coefficient on the regulation remains positive and becomes larger.

Since the number of instruments exceeds the number of the endogenous regressors, it is possible to perform a test of the exogeneity of the extra instruments. This is a chi square test computed as $N^* R^2$, where N is the number of observations and R^2 is the unadjusted R^2 from a regression of IV residuals on all exogenous variables plus all the instruments. The critical value for this test is 3.84, so I conclude that the two variables used as instruments are exogenous and, thus, valid as instruments for the physical examination requirement variable.

The overall pattern of coefficients in tables 3.4, 3.5, and 3.8 indicates that states that require physicians to perform a physical examination before prescribing drugs experience a drop in the mortality from medical care adverse effects, consistent with the hypothesized lower quality of physician-patient telemedicine services. On the other hand, states that adopted the regulation display higher mortality rates from diseases of the digestive system, circulatory system, musculoskeletal system and connective tissue, and mortality from endocrine, nutritional and metabolic diseases and immunity disorders. The interpretation is that the population in these states would have been healthier if the practice of physician-patient telemedicine would have been allowed. The meaning of this result is that licensing requirements for physicians in these specialties are too strict and the population would be healthier if there were more physicians even if the marginal physician would be of lower quality.

Table 3.8 The Impact of Physical Examination Requirement on Mortality: IV

	Coefficient on the Physical Examination Requirement Variable [t]					
	Medical Care Adverse Effects	Diseases of the Digestive System	Diseases of the Respiratory System	Diseases of the Circulatory System	Diseases of the Musculoskeletal System and Connective Tissue	Endocrine, Nutritional, Metabolic Diseases and Immunity Disorders
Baseline +	-0.082	0.269	0.733	0.512	0.167	0.466
(300 obs.)	[-1.53]	[1.38]	[0.52]	[0.42]	[1.98]	[1.34]
IV	-0.120	-0.115	-1.592	11.587	0.082	2.454
	[-1.01]	[-0.23]	[-0.76]	[3.16]	[0.37]	[2.89]
First Stage						
Public Libraries	3.585					
[t]	[3.46]					
Internet	-0.013					
[t]	[-3.36]					
No. Obs.	300					
F	8.99					
R squared	0.7219					
WU t Test of Exogeneity	0.31	0.85	0.98	-3.48	0.4	-2.49
X^2 Test of Overidentifying Restrictions	0.36	3	0.78	0.48	1.86	0.21

These regressions control for Uninsured, Income, High-school, 65+, Black, State Health and Hospital Expenditures, Hospitals/sq. mile, Investor Owned Hospitals, Population Density, Income Distribution, State FE, and Year FE. Regressions weighted by population. Standard errors computed using White-Huber estimator.

A policy maker may not be interested only in knowing what are the specialties for which the licensing requirement are too strict but also in the overall effect of the current level of licensing requirements. The results reported in Table 3.9 indicate that the regulation leads to an increase in total mortality, meaning that, overall, the licensing requirements are too strict. Therefore, telemedicine can bring real gains even if the current state of technology does not enable physicians to collect as much information through tele-encounters as they would in face-to face consultations.

Table 3.9 The Impact of Physical Examination Requirement on Total Mortality Rate

	Coefficient on the Physical Examination Requirement Variable [t]
Baseline + (300 obs.)	4.577 [2.12]
IV	16.580 [2.9]
Wu t Test of Exogeneity	[-2.22]
X^2 Test of Overidentyfying Restrictions	0

These regressions control for Uninsured, Income, High-school, 65+, Black, State Health and Hospital Expenditures, Hospitals/sq. mile, Investor Owned Hospitals, Population Density, Income Distribution, State FE, and Year FE.. Regressions weighted by population. Standard errors computed using White-Huber estimator.

Conclusions

Using variation in the regulation of procedures required before drugs may be prescribed by physicians, this paper develops a way to test whether licensing requirements in the medical field are too strict. In an attempt to preserve the quality guarantee offered by the current level of licensing requirements, several states introduced regulation that prevents physician-patient telemedicine practices, which are expected to be of lower quality because physicians cannot collect all relevant information during tele-encounters. Such regulation requires physicians to perform a physical examination before prescribing drugs, thus, eliminating physician-patient telemedicine. This type of regulation generates the same quality-quantity trade-off that licensing does. Even if it manages to increase the quality of the marginal service delivered, it would decrease the amount by making access to medical services more difficult in the same way licensing requirements does.

If the licensing requirements were too strict, having a net negative effect on health, telemedicine, by improving access at the cost of lower quality, would provide an improvement in health. On the other hand, if the licensing requirements were adequate, telemedicine would worsen health. The caveat is that the effect would depend on the relative qualities of telemedicine and traditional medical care, but since the literature indicates only small differences in the quality of the two types of service, this is not a concern in this case because this means we are looking at the margin. It follows that if licensing requirements were too strict and telemedicine improves outcomes, any regulation that prevents telemedicine would worsen outcomes and reciprocally. Therefore, by looking at the effect of a regulation that prevents physician-patient telemedicine, we can infer whether the licensing requirements were too strict in the first place or quite the opposite.

This paper finds that overall the level of licensing requirements is too strict. I find evidence that support the idea that telecare is a lower quality service with higher incidence of medical mistakes but at the same time brings real improvements in health especially in predominantly rural states.

CONCLUSIONS

Government policies adopted at the request of various segments of the population have side-effects that may prove detrimental to other segments of population, sometimes offsetting their intended positive impact. This body of work concentrates on identifying the impact on health of three different government policies: labor income taxes, non economic damages caps, and the regulation that requires physicians to perform a physical examination before prescribing drugs.

I find that both higher and more progressive labor income taxes lead to a decline in health, that non-economic damages caps lead to a decrease in the amount of many types of medical services delivered, and that hindering telemedicine by requiring physicians to perform a physical examination before they are allowed to prescribe drugs leads to worse health outcomes.

APPENDIX

SF12 questionaire

The SF-12 (short-form 12-question questionnaire) measures self-reported mental and physical health. The questionnaire was administered to respondents who had turned 40 since their last interview in 1998, 2000, and 2002. Based on these 12 questions, 2 summary scores were created (by the Center for Human Resources Research, CHRR), the physical and the mental score. This research uses only the physical score.

SF12 questionaire

1) ASSESSMENT OF RESPONDENT'S GENERAL HEALTH: In general, would you say your health is ....

2) DOES RESPONDENT'S HEALTH LIMIT MODERATE ACTIVITIES? The following items are activities you might do during a typical day. Does your health limit you in these activities?... Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling or playing golf?

3) DOES RESPONDENT'S HEALTH LIMIT CLIMBING STAIRS?.... Climbing several flights of stairs?

4) HAS RESPONDENT ACCOMPLISHED LESS THAN WOULD LIKE IN PAST 4 WEEKS? During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health? ..... Accomplished less than you would like?

5) HEALTH LIMIT KIND OF WORK OR OTHER ACTIVITIES? .... Were limited in the kind of work or other activities?

6) HAVE EMOTIONAL PROBLEMS CAUSED RESPONDENT TO ACCOMPLISH LESS IN PAST 4 WEEKS? During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)? (Please answer YES or NO for each question.).... Accomplished less than you would like?

7) HAVE EMOTIONAL PROBLEMS MADE RESPONDENT LESS CAREFUL IN PAST 4 WEEKS? .... Didn't do work or other activities as carefully as usual?

8) PAIN INTERFERED WITH NORMAL WORK IN PAST 4 WEEKS? During the past 4 weeks, how much did pain interfere with your normal work (including both work outside of the home and housework)?

9) HOW OFTEN RESPONDENT FELT CALM AND PEACEFUL IN PAST 4 WEEKS The next questions are about how you feel and how things have been with you during the past 4 weeks. for each question, please give the one answer that comes closest to the way you have been feeling. How often during the past 4 weeks........ have you felt calm and peaceful?

10) HOW OFTEN RESPONDENT HAD A LOT OF ENERGY IN PAST 4 WEEKS .... Did you have a lot of energy?

11) HOW OFTEN RESPONDENT FELT DOWN-HEARTED AND BLUE IN PAST 4 WEEKS .... Have you felt down-hearted and blue?

12) RS PHYSICAL/EMOTIONAL PROBLEMS INTERFER WITH SOCIAL ACIVITIES IN PAST 4 WEEKS During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?

Table A1. Descriptive Statistics NLSY79[1]

Variable	Description	Mean	Std. Dev.	Source
Physical Score	SF12 physical score (standardized)	0.010	0.988	NLSY79
Medical Care Cost	Median hourly wage of Healthcare practitioners and technical occupations	21.170	2.436	BLS
State Health and Hospital Expenditures		303.291	105.470	Census
Sales Tax	percent	5.287	1.327	B.o.S
Education	Years of education at interview	13.570	2.485	NLSY79
ASVAB	Overall Armed Forces Vocational Aptitude Test score (AFQT score) (percentile)	51.273	28.792	NLSY79
Female	dummy=1 if female	0.502	0.500	NLSY79
Black	dummy=1 if Black or African-American	0.131	0.337	NLSY79
Hispanic	dummy=1 if Hispanic	0.059	0.236	NLSY79
If Married	dummy=1 if married	0.653	0.476	NLSY79
Father Health Problem	dummy=1 if father had health problems	0.491	0.500	NLSY79
Mother Health Problem	dummy=1 if mother had health problems	0.436	0.496	NLSY79
Both Parents until 18	dummy=1 if lived with both parents till 18	0.714	0.452	NLSY79
Urban	dummy=1 if lives in urban area	0.665	0.472	NLSY79
Interview 1998	dummy=1 if interviewed in 1998	0.257	0.437	NLSY79
Interview 2000	dummy=1 if interviewed in 2000	0.386	0.487	NLSY79
State Age Structure	% of population between 50 and 65	0.159	0.009	Census
	% of population over 65 (2002)	0.125	0.018	Census
State Salaries	% of population with salary income of			
Structure	20000-30000	0.146	0.013	IRS
	30000-50000	0.197	0.009	IRS
	50000-75000	0.146	0.014	IRS
	75000-100000	0.077	0.012	IRS
	100000-200000	0.068	0.020	IRS
	>200000	0.019	0.007	IRS
Property Crime	Property Crime per 100,000 population	3589.004	774.777	Census
Severance Tax		13.855	62.870	Census
Gov. Employment	Full-time equivalent Gov. Empl. per capita	0.015	0.004	Census
Population	in thousands	11200	8870	Census
Dem./Rep Ratio House		1.190	0.824	B.o.S.
Dem./Rep Ratio Senate		1.097	0.794	B.o.S.

NLSY79: National Longitudinal Survey of Youth 1979; Census: www.census.org or from The Statistical Abstract of the United States 2003; IRS: Internal Revenue Service, United States Department of Treasury; B.o.S.: The Book of the States, Lexington KY., Council of State Governments, 2002; [1] Weighted statistics; Number of observations: 4304

Table A2. Descriptive Statistics: CPS and BRFFS[1]

	CPS[2]		BRFFS[3]	
Variable	Mean	Std. Dev.	Mean	Std. Dev.
Health Status	3.612	1.118		
Number days good physical health/month			19.545	10.707
Medical Care Cost	21.360	2.539	22.324	2.583
State Health and Hospital Expenditures	306.419	105.207	336.965	93.397
High-School	0.327	0.469	0.273	0.446
Some College	0.263	0.440	0.292	0.455
College Degree (or more for BRFFS)	0.175	0.380	0.294	0.456
> College	0.107	0.309		
Female	0.514	0.500	0.569	0.495
Black	0.109	0.312	0.093	0.291
Hispanic	0.110	0.313	0.148	0.355
Age	50.633	7.165	50.555	7.200
If Married	0.693	0.461	0.680	0.466
Metropolitan	2.529	0.964		

[1] Weighted statistics
[2] Number of observations: 65042
[3] Number of observations: 15124

Table A3. Self-reported Health in England and the United States, Ages 55-64

	England	USA
Unweighted sample size	3681	4386
Diabetes	6.1	12.5***
Hypertension	33.8	42.4***
All heart disease	9.6	15.1***
Myocardial infarction	4	5.4***
Stroke	2.3	3.8***
Lung disease	6.3	8.1***
Cancer	5.5	9.5***

English data are from the first wave of English Longitudinal Survey of Aging, and US data are from the 2002 wave of the Health and Retirement Survey. All data are weighted. *** significant at 1%, ** significant at 5% significance level.
Source: Oldfield, Zoe, and James P. Smith, "Disease and Disadvantage in the United States and England," *Journal of American Medical Association*, 295(17), May 3, 2006: 2037-2045.

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