Journal of Business & Economic Statistics, April 1995, Vol. 13, No. 2

The Labor-Market Effects of Introducing National Health Insurance: Evidence From Canada

Jonathan Gruber
Department of Economics, Massachusetts Institute of Technology, Cambridge, MA 02138, and
National Bureau of Economic Research, Cambridge, MA 02138

Maria Hanratty
Department of Economics, Princeton University, Princeton, NJ 08544, and
National Bureau of Economic Research, Cambridge, MA 02138

Although national health insurance (NHI) plans in the United States are often opposed on the basis of their potential disemployment effects, there is no existing evidence on the effects of NHI on employment. We provide such evidence by examining the employment consequences of NHI in Canada, using the fact that NHI was introduced on a staggered basis across Canadian provinces. We examine monthly data on employment, wages, and hours across 8 industries and 10 provinces over the 1961–1975 period. We find that employment rose after the introduction of NHI; wages increased as well, and average hours were unchanged. In addition, we find lower rates of employment and wage growth after introduction of NHI in provinces that financed NHI with general revenues rather than lump-sum premiums and lower rates of wage growth in provinces with high initial levels of private insurance coverage.

KEY WORDS: Employer-provided insurance; Health-care reform; Job mobility.

Health-insurance reform in the United States appears inevitable. The rapid growth of medical costs, which have tripled as a share of gross national product since 1950 (Newhouse 1992), and the large fraction of the population without insurance has caused policy makers to consider substantial changes to our health-care system. One option that has received considerable support is national health insurance (NHI), which offers publicly financed health insurance to all citizens. Such a system is in place in Canada, and it has been widely commended as one that provides universal health-insurance coverage while spending only 75% as much, per capita, as the United States on health care (U.S. General Accounting Office 1991). A major objection to this approach, however, is that it would increase government taxation, with resultant deadweight loss and reduced economic activity. Indeed, the specter of large-scale disemployment has been a major impediment to the serious consideration of this program at a policy level.

Despite concern over the disemployment effects of NHI, we currently have little empirical evidence on the effects of NHI on employment. Most analyses of the impact of NHI consider only the effects of increasing taxes to finance the program (Browning and Johnson 1980); not surprisingly, such analyses produce estimates of sizable disemployment effects. The introduction of NHI differs from the introduction of a new tax in at least two ways, however. First, NHI replaces a primarily employer-provided benefit with a publicly provided one, which can have additional effects on both the composition and the level of employment. Recent research has highlighted key differences between pure tax policies and policies that interact with the provision of employee benefits; see Summers (1989) for a general discussion and Gruber and Krueger (1991), Gruber (1994), Viscusi and Moore (1987), or Moore and Viscusi (1990) for empirical results. Second, increased health-insurance coverage may have important implications for the functioning of the labor market because it may affect job mobility or the health of the work force.

We therefore propose an alternative to studies that rely on preexisting evidence on tax incidence to impute the effects of NHI on the labor market—an examination of the transition to NHI in Canada. This approach has two distinct advantages. First, because Canada is similar to the United States in both demographic and economic structure, its experience may be representative of what might happen if the United States moved to a public insurance program. Second, the Canadian provinces implemented NHI at different points in time; NHI was first introduced in Saskatchewan in 1962, then in the remainder of the provinces in the 1968–1971 period. Thus we can identify its effect by comparing provinces that have implemented NHI with those that have not implemented NHI at a point in time. In this way, the Canadian experience serves as a "natural experiment" from which lessons for the United States can be drawn.

To estimate the impact of NHI, we use monthly data on employment, wages, and hours of work for the years 1961–1975 for 8 industries in 10 Canadian provinces. We first

model these labor-market variables as a function of whether NHI was in place in a given province/industry/month/year. We then explore a variety of dynamic specifications and allow the impact of NHI to vary across provinces and industries.

Contrary to expectations, we find that NHI did *not* cause a significant fall in employment in Canada. In fact, implementation of NHI was associated with a rise in both employment and the nominal wage rate. This conclusion is robust to a variety of specifications that control for the potential endogeneity of the timing of implementation of NHI. Our evidence further suggests that the increase in employment reflects "permanent" increases rather than short-run adjustments in employment and wages and that wages appear to adjust more rapidly than employment to implementation of NHI.

Finally, our analysis suggests that NHI is associated with lower rates of employment and wage growth in provinces that use general revenues rather than lump-sum premiums to finance NHI. We also find lower rates of post-NHI wage growth in sectors with high initial rates of private insurance coverage.

1. BACKGROUND ON CANADA AND NHI

NHI was implemented in two steps, introduction of public insurance for hospital expenses in the 1950s and introduction of public insurance for medical services in the 1960s. In both cases, a few provinces initiated programs that served as models for federal legislation. The federal government then passed legislation that promised federal matching funding to approved provincial plans. Finally, the remaining provinces added public plans that conformed to federal guidelines.

The implementation of public insurance for hospital expenses in Canada spanned the period from 1947 to 1961. The federal government passed legislation supporting provincial hospital-insurance programs in 1957. By January 1961 all provinces had implemented a hospital-insurance program. Because our data are not available prior to 1961, our article will not focus on the impact of extending hospital-insurance coverage.

The implementation of public insurance for medical expenses began in Saskatchewan in 1962, precipitating a prolonged doctors' strike (Taylor 1987). Alberta, Ontario, and British Columbia then introduced voluntary public insurance programs that offered subsidized rates to the poor. On July 1, 1968, the federal government introduced legislation that promised 50% federal funding to qualified provincial programs. Both Saskatchewan and British Columbia automatically qualified at passage of federal legislation. Five other provinces enrolled during 1969, followed by Quebec and Prince Edward Island in 1970 and New Brunswick in January 1971. These dates of entry are presented in Table 1. Two dates are indicated for Saskatchewan, the date it adopted universal medical insurance (7/62) and the date it entered the federal program (7/68).

Although provincial medical insurance programs offered similar services and conditions for enrollment, their financing mechanisms differed substantially. Half of the provinces financed part of provincial costs with premiums assessed on individuals; the remaining provinces (as well as the federal government) relied exclusively on general or earmarked tax revenues. These premiums approximated "lump-sum" taxes for moderate and upper income individuals because the total contribution did not vary with employment or hours of work (they only varied between individual and family coverage). For low-income individuals, premium contributions were subsidized, but these individuals typically received health-insurance subsidies prior to NHI, so there was no net change in their labor-supply incentives.

Table 1 presents information on the method of financing NHI used by each province, arranged by date of implementation of universal health insurance. This table presents estimates of each province's contribution toward medical (non-hospital) expenditures that is financed by premiums in the first year of each program (col. 3), and in 1975 (col. 4). The federal share of expenditures on this program is financed by general revenue taxes. The data are from Canada, Dominion Bureau of Statistics (selected years a). Estimates prior to 1970

Table 1. Date of Entry Into Canadian National Health Insurance Program

Province	Date of entry	% premium in first year	% premium in 1975	Real GDP per capita	% manufacturing	Real manufacturing wage	% collective bargain	% covered by health insurance
Saskatchewan	7/62 (7/68)	22	0	4,869.2	16.0	104.5	48.0	77.6
British Columbia	7/48	77	35	6,546.0	33.0	141.2	53.9	95.1
Manitoba	4/69	36	0	6,149.2	26.0	112.4	40.0	85.5
Nova Scotia	5/69	0	0	4,342.8	30.7	101.9	37.9	80.5
Newfoundland	5/69	0	0	3,644.5	21.3	102.4	42.6	70.5
Alberta	7/69	96	53	6,583.3	18.7	132.1	29.2	91.9
Ontario	10/69	97	47	9,762.3	46.8	140.9	40.8	90.6
Quebec	11/70	0	0	7,138.7	44.2	129.8	47.5	88.6
Prince Edward Island	12/70	0	0	3,986.2	31.8	73.7	22.1	65.3
New Brunswick	1/71	0	0	4,556.4	29.3	119.6	36.4	91.3

NOTE: Two dates are given for Saskatchewan because the province began its own program in 1962 and joined the federal program in 1968; we use the former date for our analysis. The third and fourth columns describe the percentage of provincial physician expenditures that are financed by lump-sum premiums; calculation of % premium financing is described in the text. Dollar figures are in 1971 Canadian dollars. Manufacturing wage is the average real weekly wage, in 1971 dollars. Fraction covered by collective bargaining agreements and health insurance are from the workplace survey for 1965, as described in the text; data for Saskatchewan are for 1962.

are based on medical expenses only. After 1970, we cannot separate hospital from other medical expenses. Thus we use trends in hospital *and* medical spending to adjust the 1969 figure forward through time. This table makes it clear that all provinces relied to some extent on general revenues and that, over time, all premium-financed provinces decreased their reliance on premiums. By 1975, Manitoba and Saskatchewan had removed premium financing altogether.

The final five columns in Table 1 explore whether there is a systematic relationship between date of implementation of NHI and provincial economic characteristics. As shown, there does not appear to be a simple monotone relationship between any of the characteristics shown here (real per capita gross domestic product [GDP], the % employment in manufacturing, real weekly manufacturing wages, the share of workers covered by collective bargaining, and the share of workers covered by private health insurance prior to introduction of NHI) and the order of entry into NHI.

At the time of implementation of NHI, the scope and sources of insurance coverage in Canada were quite similar to those in the United States today. Most of the Canadian population was covered by private health insurance, and that insurance was provided primarily through employers. Using estimates based on private insurance enrollments, Berry (1965) reported that 53% of the population had medical insurance in 1961, and Shillington (1972) reported that 70% had private insurance in 1966 (this figure excludes Saskatchewan, which already had a public insurance program at this point). In the United States in 1991, 70% of the nonelderly population was covered by private insurance (based on author's tabulations from the March 1992 Current Population Survey).

The structure of the Canadian insurance market differed in two key ways from the current structure of the U.S. market, however. The first is the extent of "experience rating"—that is, the extent to which a firm's insurance costs reflects its own claims experience. There were two types of private medical insurance coverage in Canada in the mid-1960s. The "Medical Prepayment Plans," run by the provincial medical associations, were community-rated; premiums were not based on a group's own experience but on the experience of all groups (or some subset of groups) using that insurer. On the other hand, commercial insurance plans were experience-rated. These two types of insurers each occupied about one-half of the market in the mid-1960s (Shillington 1972). In contrast, in the United States in 1991 there was much less use of community-rating. Commercial insurance companies, which have 60% of the market for traditional private insurance (Health Insurance Association of America 1990), fully experience-rate their customers. Blue Cross/Blue Shield plans, which control the remaining 40% of the market, only community-rate the smallest firms in most states (Congressional Research Service 1988).

The second major difference is the cost of health insurance. Several sources of data for this era suggest that the cost of private medical insurance was relatively modest, ranging from 3%–4% of average wage levels. The Royal Commission on Health Services (1965) reported that the cost of a medical insurance plan in Alberta was $159 for a family, or 3.8% of the average annual earnings in that province in 1963. In Manitoba, family coverage cost only $138 per year, which was 3.5% of the average annual earnings. And Berry (1965) reported costs from a large insurance company in Manitoba of $108 per year for a family in 1961, which was 2.9% of annual earnings in that province/year. In the United States in 1989, a typical employer-provided family insurance policy cost $262 per month (based on unpublished Health Insurance Association of America data) or approximately 16.6% of average annual earnings as compared to the 3%–4% estimate for Canada. This comparison overstates the difference in costs because the U.S. estimate includes both medical and hospital insurance costs, whereas the Canadian figure covers only medical insurance. Since Canada's medical insurance costs in this period represented about one-half of total expenses, however, U.S. insurance costs as a fraction of wages are at least twice as large as they were in Canada in the 1960s.

Finally, there are important differences in labor-market institutions in both countries. In Canada in 1965, 39% of workers in firms with 15 or more employees were in firms in which the majority of workers were covered by collective-bargaining agreements. In constrast, in the United States in 1991, 18% of all wage and salary workers were represented by unions (U.S. Department of Commerce 1992). As Summers, Gruber, and Vergara (1993) highlighted, differing labor-market institutions may inhibit comparisons of the effects of public policies across countries.

2. NHI AND THE LABOR MARKET

In this section, we develop a simple one-sector model of the labor market to illustrate how introduction of NHI might affect employment and wages and how this effect should vary with prior health-insurance provision and method of financing NHI. The model used follows that presented by Gruber and Krueger (1991). We then discuss extensions that might affect the predictions of this model.

Prior to the introduction of NHI, labor demand is determined by the market wage, W, plus firm expenditures on health-insurance benefits, H. The supply of labor is determined by the value of labor-market compensation to the worker, $W + \alpha H$, where $0 < \alpha < 1$ is the worker's dollar valuation of a dollar of firm expenditures on health insurance, and total nonlabor income, Y. Thus the initial labor-market equilibrium is determined by the following equations:

$$L^d = f^d(W + H) \tag{1a}$$

$$L^s = f^s(W + \alpha H, Y). \tag{1b}$$

Now suppose that the government introduces a health-insurance benefit equivalent to that provided by the firm, which it finances by levying a lump-sum premium on all workers of an amount P. The amount of health insurance that is financed by this premium levy is $H = Pk$, where $0 < k < 1$ represents the efficiency with which the government provides health insurance (relative to the private sector, for

which k is 1). The new equations determining the labor-market equilibrium are

$$L^d = f^d(W) \tag{2a}$$

$$L^s = f^s(W, Y + \alpha Pk - P). \tag{2b}$$

In this case, it is a simple matter to show that the equilibrium change in wages will be (where W_0 is wages before NHI and W_1 is wages afterward):

$$(W_1 - W_0)/P = \{k\eta_d - \alpha k\eta_{sw} + \eta_{sy}(\alpha k - 1)\}/(\eta_d - \eta_{sw}) \tag{3a}$$

if the firm initially offered health insurance and

$$(W_1 - W_0)/P = \{\eta_{sy}(\alpha k - 1)\}/(\eta_d - \eta_{sw}) \tag{3b}$$

if the firm did not initially offer health insurance, where η_d is the elasticity of labor demand with respect to the wage, η_{sw} is the uncompensated labor-supply elasticity with respect to the wage, and n_{sy} is the labor-supply elasticity with respect to nonlabor income.

Suppose instead that the government finances the program through a tax on each employee of $P = H/k$. Because our model only considers the choice of whether to work or not, this tax is modeled as a lump-sum wage tax; the analysis would be similar with a proportional tax on earnings. In that case, the change in wages will be

$$(W_1 - W_0)/P = \{(k\eta_d - \alpha k\eta_{sw} + \alpha k\eta_{sy} - \eta_{sw})\}/(\eta_d - \eta_{sw}) \tag{4a}$$

if the firm offered health insurance initially and

$$(W_1 - W_0)/P = \{(\alpha k\eta_{sy} - \eta_{sw})\}/(\eta_d - \eta_{sw}) \tag{4b}$$

otherwise.

The change in employment will depend on the change in wages according to

$$(L_1 - L_0)/L_0 = \eta_d\{W_1 - (W_0 + H)\}/(W_0 + H) \tag{5a}$$

if the firm offered health insurance initially and

$$(L_1 - L_0)/L_0 = \eta_d\{W_1 - W_0\}/W_0 \tag{5b}$$

if the firm did not. Thus, for firms that offered insurance, employment will increase if the wage does not increase enough to fully offset the reduction in health-insurance expenditures by the firm; for firms not offering insurance, the effect on employment will depend on whether the wage rises or falls.

Using the preceding equations, plus standard assumptions regarding the labor-supply and labor-demand elasticities ($\eta_d < 0$, $\eta_{sw} > 0$, $\eta_{sy} < 0$), we can derive the following predictions:

1. Wages are likely to rise in the insured sector. Wages will only fall in the case in which the term $\eta_{sy}(\alpha k - 1)$ is positive and large enough to offset the remaining terms in the numerator of Equation (3a)—that is, when the income effects of government-provided health insurance are positive and sizable. This will occur when the elasticity of labor supply with respect to income, η_{sy}, is large in magnitude and when $\alpha k \ll 1$—that is, when workers do not value the health insurance highly and the government provides insurance relatively inefficiently, causing individuals to work harder due to a decrease in their real income. If both $\alpha = 1$ and $\alpha k = 1$, then the wage rise in the insured sector will exactly offset the decreased cost to employers from no longer having to provide health insurance.

2. The effect on employment in the insured sector is ambiguous. If $\alpha = 1$ and $\alpha k = 1$ so that there are perfect wage offsets, employment will be unchanged because the net cost of compensation has not changed. If $\alpha < 1$ and $\alpha k < 1$, then employment will rise; if $\alpha > 1$ and $\alpha k > 1$, it will fall. Once again, the key factors are the workers' valuation of health insurance and the efficiency of government provision of health insurance. If these are low, then the provision of NHI is like a drop in the real income of workers, because they are paying more for insurance than it is worth to them. Thus there will be a supply shift, and employment will rise.

3. Wage growth should be higher in insured relative to uninsured sectors after passage of NHI [as found by comparing Equation (3a) to Equation (3b) or Equation (4a) to Equation (4b)]. Employment growth may be higher or lower in insured sectors after passage of NHI; for $\alpha > 1$ (i.e., workers overvalue health insurance), employment will decrease in insured relative to uninsured sectors, for $\alpha = 1$ relative employment will remain constant, and for $\alpha < 1$ relative employment will increase.

4. Wages should increase and employment should decrease where NHI is financed by taxation, as opposed to lump-sum premiums. This is the standard result found by Browning and Johnson (1980), who predicted a negative supply shift resulting from an additional tax on labor.

Thus the key findings from this model are that NHI should cause a rise in wages, with an ambiguous prediction for employment. There should also be faster relative wage growth, and uncertain relative employment growth, in the insured sector relative to the uninsured sector. Finally, provinces that finance their program through taxation should see a larger employment fall and wage rise relative to provinces with premium financing.

This is a simplified model that can be extended in several ways. First, in the case in which firms offer health insurance, labor-market rigidities can cause a rise in employment. That is, if firms were unable to adjust wages upward when NHI was put in place, then their total labor costs would drop, leading to a rise in labor demanded. Such rigidities could arise from collectively bargained contracts, given the high rate of unionization in Canada.

Second, we do not consider the effects of NHI on the productivity and health of the work force. Recent research (Madrian 1993) has uncovered strong evidence for insurance-induced immobilities in the labor market, or "job lock." Although the welfare implications of job lock are unclear ex ante, it is at least possible that increasing mobility can raise the productivity of the work force by increasing the efficiency of job matches. Similarly, investments in health care may improve the health and productivity of the work force; because the gains are to general productivity, it may not

have been in the interest of individual firms ex ante to invest in health insurance to capture these gains. Hanratty (1992) found strong evidence of the effects of NHI on at least one indicator of health outcomes, infant mortality. These productivity increases may lead to a long-run rise in employment with the implementation of NHI.

Third, NHI may cause a shift in labor supply across sectors by changing the relative cost of health insurance. For example, NHI may increase the cost of health insurance in insured sectors relative to uninsured sectors if uninsured sectors initially faced higher costs of health insurance due to risk-selection and experience-rating practices of health-insurance firms. Alternatively, NHI may decrease the cost of health insurance in insured sectors if the insured sectors bear most of the costs of uncompensated care prior to NHI and NHI increases contributions of the uninsured toward health care.

3. DATA AND SPECIFICATION

3.1 The Data

Our data for this analysis contain information on wages, employment, and hours for 8 industries in 10 provinces for each month from 1961 to 1975. The 8 industries are forestry; mining; manufacturing; transportation; construction; trade; financial, insurance, and real estate; and some service industries (hotel, restaurants, laundry and dry cleaning, recreation, and business services). Health-care services are *not* included in this survey. Data are missing for forestry, mining, construction, and services for some provinces, so our total sample has 12,240 observations. Table 2 provides a description, along with means and standard deviations, of each variable.

We have drawn our information on employment, wages, and hours from published data based on Statistics Canada's Monthly Survey of Employment and Weekly Payrolls. Prior to 1966, this was a survey of all Canadian firms that "usually employed" 15 or more workers; starting in 1966 it includes all firms that have employed 20 or more employees in at least one month during the preceding year. The change in the firm-size restriction had little impact on the scope of the survey: Aggregate data for Canadian industries by year shows that the average percentage of employees in each industry represented in the survey did not change by more than 3% from 1964 to 1966. This incomplete coverage means that our employment results will not account for movements of workers from very small to larger firms or vice versa; however, the high overall coverage of the survey (approximately 75% of employment) implies that this may not be an important problem.

Our primary labor-market outcome measures are total employment and average weekly earnings. Total employment includes all workers on the payroll during the last week of the month; it includes both full-time and part-time workers. The average weekly earnings measure includes base wages plus overtime or bonus payments. It includes employee contributions and excludes employer contributions to workers' compensation, pensions, unemployment insurance, or medical-insurance plans.

We also have information for a restricted sample of industries (mining, manufacturing, construction) on weekly hours and average hours per week for employees paid by the hour for the years 1965 to 1975. We impute weekly hours for salaried employees by assigning them a value of 37.5 hours.

Our basic measure of the effect of introducing NHI is a dummy variable that equals 0 prior to the month of implementation of NHI in each province and that equals 1 afterward. These dates are shown in Table 1. For Saskatchewan, we assume that NHI equals 1 from July 1962, the date that this province implemented its universal health-insurance program (rather than the date it entered the federal program).

We also interact the NHI dummy with a variable, %tax, which is equal to 1 minus the share of provincial expenditures on nonhospital medical services under NHI that are financed by premiums. As shown in Table 1, there is substantial

Table 2. Means and Standard Deviations of Data Set

Variable	*Description of variable*	*Mean*	*Standard deviation*
LEMP	Log total employment	9.947	1.309
LHOURS	Log total hours per week; hours = (hourly employees * avg hrs. of hourly workers) + (nonhourly workers * 37.5).	13.774	1.301
LAVGHOURS	Log average hours per week; avg. hours = hours/total employment. Hours are computed as above.	3.674	.072
LWAGE	Log of average weekly earnings.	4.673	.407
NHI	= 1 if province has passed national health insurance, = 0 otherwise.	.465	.499
NHI * %tax	= NHI * % provincial NHI contributions financed by general revenues.	.333	.419
HICOV	Share of employees in firms that provide health insurance to a majority (>50%) of their employees in 1965.	.889	.131
LGDP	Log of provincial GDP (annual).	8.314	1.379
LGDPI	Log of industry GDP (monthly).	9.714	.753
DLGDP	Change in log provincial GDP (year to year)	.103	.053
DLGDPI	Change in log industry GDP (month to month)	.047	.063

NOTE: Sample consists of monthly data for 10 Canadian provinces for 8 industries from 1961 to 1975 (N = 12,240), except for hours data, which only exist for 3 industries for 10 provinces for the years 1965–1975 (N = 3,250).

variation in this variable both across provinces at a point in time and within provinces over time.

Finally, we interact NHI with HICOV, a measure of the share of the work force covered by private health plans prior to NHI. This measure comes from a survey of working conditions among firms in Canada in 1965. This source has the natural advantage for our analysis that it focuses on employer-provided insurance coverage. In addition, it uses the same sampling frame as our labor-market data (firms with 15 employees or more). The main disadvantage of this data source is that it is not very precise: The figures are for the fraction of workers who are in firms in which the majority of employees were covered by a health-insurance plan.

Unfortunately, the published data from the survey provide information by province and by industry but not industry within province. We have therefore imputed rates of insurance coverage for each industry by province "cell" in two steps. First, we calculate the "excess" coverage rate in a given province as the actual coverage rate relative to that which would have been expected given the industrial mix of the province and the average rates of insurance coverage (nationwide) across industries. For each industry in each province, we then adjust the nationwide coverage rate for that industry by the "excess" coverage rate for that province.

The only control variables in the model are the log, or change in log, annual GDP by province and monthly GDP by industry (nationally); the former is from Canada, Dominion Bureau of Statistics (selected years a, b, c), and the latter is from Statistics Canada (1988). In earlier work, we also controlled for population levels and changes; these variables never entered significantly and did not effect the coefficients of interest, so we excluded them from this analysis.

3.2 The Model

Our basic regression specification for the employment equation is

$$E_{piym} = \alpha + \beta_1\tau_y + \beta_2\mu_m + \beta_3\pi_p^*\gamma_i + \beta_4 NHI_{pym} + \nu_{piym}, \quad (6)$$

where p indexes provinces, i indexes industries, y indexes years, and m indexes months; E_{piym} is log employment in an industry/province/month/year; NHI_{pym} is a dummy for NHI in a province/month/year, π_p, γ_i, τ_y, and μ_m are province, industry, year, and month dummies, respectively; and ν_{piym} is a random-error term that is assumed to be uncorrelated with π_p, γ_i, τ_y, μ_m, and NHI_{piym}. Thus this specification implies that the log of employment in an industry within a province in a given month and year is a function of the NHI variable, plus a set of year, month and province * industry dummy variables.

We have expressed Equation (6) in terms of the total employment level rather than the employment to population ratio for two reasons. First, because we are trying to explain variations in employment by industry, it is not clear what the appropriate unit of observation for the denominator should be. Second, it is not possible to obtain data on population that vary by province and month. As noted previously, population never entered significantly as a control variable in these regression models.

The goal of Equation (6) is to control for factors that might be correlated with the passage of NHI and thereby confound our interpretation of β_4. For example, we control for year effects to capture nationwide time series shocks to employment or wages that might be correlated with NHI. We control for month effects to capture cyclicality in the output of different industries. We include dummies for every industry/province cell to pick up fixed differences across these cells that may be correlated with the likelihood of NHI passage.

This specification may not control for all factors that are associated with the passage of NHI. For example, if provinces with rapid growth in output and employment are more likely to pass NHI, then our estimate of the impact of NHI on employment will be biased upward. To control for this effect, we add two controls for output, the (year-to-year) change in log annual GDP by province and in log monthly GDP by (national) industry. We control for the change rather than the level of log GDP because it is likely that wage and employment deviations from province/industry means are caused by deviations in output from its expected province/industry growth path. These measures are themselves potentially endogenous because NHI may *cause* changes in productivity across provinces or industries.

As an alternative, we include not only province/industry fixed effects but province/industry trends as well. That is, following Jacobson, Lalonde, and Sullivan (1993), we include in the basic model a monthly trend and interact that trend with each province/industry fixed effect. This specification captures the effect of NHI on deviations of employment and wages from their province/industry growth paths rather than on deviations from their average levels. In this specification, we control for the log of output rather than the growth rate. This is because we want to retain the consistent interpretation of a control for deviations of GDP from its expected growth path; because we control for the growth path here, the level of GDP picks up the deviation. The results are not sensitive to the use of GDP changes in this specification.

Finally, we add to Equation (6) an additional dummy that is equal to 1 if NHI will be passed in the next year and 0 otherwise. If the measured coefficient on NHI is an artifact of a spurious correlation betweem employment growth and the propensity for a province to implement NHI, then the lead value of NHI should enter significantly.

The province/industry cells that make up our data set are of varying sizes; employment ranges from 570 to over 850,000. This may induce heteroscedasticity in our error terms. We therefore report heteroscedasticity-consistent standard errors (White 1980).

4. RESULTS

4.1 Basic Findings

Table 3 presents estimates of the impact of NHI on log employment and log wages. There is a significant rise in employment with the passage of NHI; it is associated with a 2% rise in employment. This finding runs counter to the usual presumption that NHI would have major disemployment

Table 3. The Impact of NHI on Employment and Wages

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Employment				
NHI	.0197	.0257	.0216	.0248	.0138	.0131	.0171	.0141
	(.0061)	(.0063)	(.0074)	(.0076)	(.0060)	(.0060)	(.0082)	(.0083)
NHI next year			.0037	−.0018			.0044	.0014
			(.0065)	(.0065)			(.0067)	(.0067)
Log provincial GDP						.0829		.0820
						(.0249)		(.0252)
Log individual GDP						.2156		.2155
						(.0289)		(.0290)
Change in log provincial GDP		.2378		.2388				
		(.0436)		(.0436)				
Change in log individual GDP		.3027		.3028				
		(.0480)		(.0480)				
Provincial individual trend?	No	No	No	No	Yes	Yes	Yes	Yes
				Wages				
NHI	.0325	.0322	.0421	.0418	.0146	.0141	.0167	.0156
	(.0023)	(.0023)	(.0027)	(.0027)	(.0024)	(.0024)	(.0031)	(.0031)
NHI next year			.0188	.0193			.0029	.0020
			(.0026)	(.0026)			(.0028)	(.0028)
Log provincial GDP						.0332		.0319
						(.0108)		(.0108)
Log individual GDP						−.0362		−.0363
						(.0124)		(.0124)
Change in log provincial GDP		−.0134		−.0241				
		(.0154)		(.0150)				
Change in log individual GDP		−.0136		−.0144				
		(.0162)		(.0162)				
Provincial individual trend?	No	No	No	No	Yes	Yes	Yes	Yes

NOTE: Standard errors are in parentheses. All regressions include year, month, and province * industry effects. "Trend" regressions also include trend and trend interacted with province * industry effects. Number of observations is 11,424. Dependent variables are all in logs.

effects. In fact, NHI in Canada appears to have promoted employment growth.

This finding is consistent with the basic model only in the case in which $\alpha < 1$ and $\alpha k < 1$—that is, where workers do not value insurance highly and the government is relatively inefficient in providing health care. It may also be consistent with several extensions to the basic model, such as improved efficiency in the operation of the labor market from reduced "job lock." Alternatively, it may simply be an artifact of the fact that provinces with rapid employment growth are more likely to pass NHI. The remainder of the top half of Table 3 is devoted to assessing this alternative hypothesis.

In column (2), we include controls for the change in log provincial GDP and in log industrial GDP. Both variables indicate a strong positive correlation between output growth and employment growth. The coefficient on NHI, however, *increases* with the inclusion of these controls and now indicates that NHI is associated with a 2.6% rise in employment.

In columns (3) and (4), we include a lead value of NHI (NHI next year) to test for the endogeneity of passage of NHI. As shown, both with and without controls for GDP, the coefficient on NHI next year is small and statistically insignificant. The coefficient on NHI remains strong and significant, indicating employment growth in excess of 2%.

The final four columns include province/industry trends; columns (5) and (7) exclude GDP controls, but columns (6) and (8) include them. As shown, adding controls for province/industry trends reduces the estimated magnitude of the impact of NHI to 1.3%–1.7%, and NHI remains at least weakly significant in all specifications. As before, controls for GDP are positive and significant but do not substantially affect the measured impact of NHI. Furthermore, the specification check discussed previously once again provides no evidence of reverse causality: The coefficient on NHI next year is always substantively and statistically insignificant.

The bottom panel of Table 3 examines the effect of NHI on wages, using the same set of specifications just discussed. As shown, in the specification without trends [cols. (1)–(4)], NHI is associated with a very strong and significant rise in wages, on the order of 3%–4% of wages. This is consistent with the basic incidence model. This finding is robust to the inclusion of controls for GDP or NHI next year. The lead value of NHI is significant and positive [cols. (3) and (4)], however, suggesting potential endogeneity between the passage of NHI and wage growth.

With the inclusion of province/industry trends [cols. (4)–(8)], the impact of NHI decreases in magnitude to 1.4%–1.6%, although it remains highly significant in all specifications. This specification is not sensitive to the inclusion of either GDP controls or controls for the lead value of NHI. In this specification, the coefficient on NHI next year becomes very small in magnitude and in statistical significance, suggesting that the NHI variable is not endogenously related to the deviation of wages from trend.

To summarize, the specification with trends included passes our endogeneity test for both employment and wages, but the basic specification passes our endogeneity test for employment only. In addition, the inclusion of trend controls has little impact on the precision of the estimated impact of NHI and NHI next year on employment and wages. Thus our preferred specification for both employment and wages is the model that includes trend effects. In further tables we present estimates only for the model with trend controls.

4.2 Hours Effects

One explanation for the positive correlation between NHI and employment may be that NHI causes an increase in part-time employment. Because publicly provided health insurance reduces the fixed costs of employment, it may encourage firms to hire part-time workers. Gruber (1994) found evidence that mandating employment benefits increases hours and decreases employment. If the reverse of this effect holds true when Canada implements NHI (since employers no longer offer health insurance), then NHI may increase employment even while it has no effect on total hours of work.

To test this hypothesis, we use published data on total weekly hours, total employment, and average weekly hours that are available for a subset of our data. This subset includes 3 industries (mining, manufacturing, and construction) in 10 provinces for the years 1965–1975. In Table 4, we estimate the impact of NHI separately on log weekly hours [cols. (1)–(2)], log weekly employment [cols. (3)–(4)], and log average hours per week [cols. (5)–(6)]. The first column for each dependent variable estimates the impact of NHI alone, whereas the second column includes both NHI and NHI next year. All specifications control for year, month, province * industry, trend, and trend * province * industry effects.

Note that this is an imprecise test of the impact of NHI on part-time work because it reflects both changes in overtime and part-time employment. If NHI reduces the fixed costs of employment, it might both decrease overtime work and increase part-time work, thus resulting in little aggregate change in average hours per week. Unfortunately, we do not have more detailed measures of the changes in hours of work per week.

As shown, the positive impact of NHI on employment is not explained by an decrease in average hours per worker. In the specification with NHI only, the estimated impact of NHI on log hours (.037) for this subsample is quite similar in magnitude to the estimated impact of NHI on log employment (.035), whereas the estimated impact of NHI on average hours is small and insignificant. This indicates that most of the adjustment occurred through changes in employment rather than through changes in average hours of work per week.

As shown, for this subsample, the NHI-next-year variable enters positively and significantly in both the employment and the total-hours equation. This suggests that our trends specification is not sufficient to remove all spurious effects in this subsample. This may account for the somewhat larger positive employment effect in Table 4 than in Table 3. This finding highlights the heterogeneity of the NHI impact across different provinces and industries, as noted in Section 4.4. Nevertheless, the lead coefficient is insignificant for the hours equation, so our conclusion that NHI had little effect on average hours of work appears to be robust.

4.3 Time Pattern of Effects

In Table 5, we trace out the time pattern of effects of NHI on employment and wages. We include dummies for NHI implemented 4, 3, 2, and 1 quarter from now and NHI implemented 1, 2, 3, 4, 5, 6, 7, 8, and more than 8 quarters ago. This specification allows for a more detailed test of the endogeneity of NHI: it also enables us to discern how rapidly the effect of NHI on employment and wages is realized. In both equations, we include year, month, province * industry, trend, and trend * province * industry effects, as well as controls for log provincial and log industrial GDP.

The employment equation [col. (1)] suggests a slow adjustment of employment to NHI: There is little effect in the first two quarters, then a rise of approximately 2% over the next four quarters, followed by a larger rise from quarters 7–8 and continuing onward. The wage equation [col. (2)] suggests a somewhat faster adjustment to NHI for wages than for employment: After NHI is passed, the effects are small for three quarters, then rise to a significant 2.5%–3% level from quarter 4 onward.

As before, the lead values of NHI are all insignificant in the employment equation [col. (1)], although the coefficient on NHI in quarter 1 is weakly significant at the 11% confidence level. In the wage equation [col. (2)], the lead values

Table 4. Impact of NHI on Employment, Hours, and Average Hours/Week

Dependent variable	*Total hours (1)*	*Total hours (2)*	*Employment (3)*	*Employment (4)*	*Av. hours (5)*	*Av. hours (6)*
NHI	.0371	.0682	.0346	.0624	.0025	.0058
	(.0118)	(.0151)	(.0097)	(.0122)	(.0042)	(.0051)
NHI next year		.0389		.0348		.0041
		(.0116)		(.0091)		(.0042)
Log province GDP	.0611	.0254	.0800	.0481	−.0189	−.0227
	(.0575)	(.0577)	(.0471)	(.0471)	(.0193)	(.0195)
Log industry GDP	.4480	.4439	.3865	.3829	.0615	.0610
	(.0424)	(.0423)	(.0354)	(.0353)	(.0135)	(.0135)

NOTE: Standard errors are reported in parentheses. The table represents a subset of the sample that has information on hours; this includes 3 industries for 10 provinces for the years 1965–1975. $N = 3,250$. Regressions also include year, month, province * industry, trend, and trend * province * industry effects. Dependent variables are all in logs.

Table 5. Dynamics of NHI Implementation

Dependent variable	Employment (1)	Wages (2)
NHI in 4 quarters	−.0098	.0057
	(.0098)	(.0048)
NHI in 3 quarters	−.0031	.0012
	(.0102)	(.0041)
NHI in 2 quarters	.0135	−.0009
	(.0096)	(.0043)
NHI in 1 quarter	.0159	.0093
	(.0097)	(.0039)
NHI 1 quarter ago	−.0034	.0061
	(.0110)	(.0046)
NHI 2 quarters ago	.108	.0079
	(.0116)	(.0041)
NHI 3 quarters ago	.0281	.0018
	(.0106)	(.0045)
NHI 4 quarters ago	.0251	.0234
	(.0102)	(.0408)
NHI 5 quarters ago	.0105	.0280
	(.0122)	(.0043)
NHI 6 quarters ago	.0205	.0234
	(.0129)	(.0042)
NHI 7 quarters ago	.0373	.0240
	(.0114)	(.0042)
NHI 8 quarters ago	.0275	.0261
	(.0114)	(.0054)
NHI more than 8 quarters ago	.0316	.0294
	(.0104)	(.0036)
Log province GDP	0928	.0419
	(.0258)	(.0110)
Log industry GDP	.2150	−.0372
	(.0289)	(.0124)

NOTE: Standard errors are in parentheses. All regressions include year, month, province * industry, trend, and trend * province * industry controls. All regressions have 11,424 observations. Dependent variables are all in logs.

of NHI for quarters 2–4 are all insignificant. As in the employment equation, however, NHI in quarter 1 is positive and significant. This suggests possible endogeneity of the NHI variable; alternatively it may reflect anticipatory adjustment in employment immediately prior to adoption of NHI.

4.4 Effect of NHI Across Province/Industries

As noted in Section 2, we anticipate that the impact of NHI should vary both with the mechanism of financing NHI used in each province and with the relative cost of private health insurance in each industry/province prior to NHI. Thus, in Table 6, we allow the impact of NHI to vary across province/industry by adding two interaction variables: NHI * %tax is an interaction of NHI with the percent of provincial expenditures on NHI that are financed by general-revenue taxation and NHI * HICOV is an interaction of NHI with the share of private insurance coverage in each province/industry prior to NHI. To the extent that high-cost sectors had lower rates of private insurance coverage prior to NHI, this measure is a proxy for variations in health-insurance costs.

In Table 6, we present estimates for both employment and wages. As before, we include controls for year, month, province, province * industry, trend, and trend * province * industry. In columns (1) and (3) we do not control for GDP. In columns (2) and (4) we add controls for log provincial and

Table 6. The Impact of NHI on Employment and Wages by Financing Method and Insurance Coverage

Variable	Employment (1)	Employment (2)	Wages (3)	Wages (4)
NHI	.0049	.0177	.1075	.1076
	(.0230)	(.0232)	(.0128)	(.0129)
NHI * % HICOV	.0271	.0200	−.0914	−.0873
	(.0239)	(.0240)	(.0133)	(.0133)
NHI * % tax	−.0419	−.0547	−.0322	−.0403
	(.0057)	(.0060)	(.0032)	(.0033)
Log province GDP		.1224		.0837
		(.0161)		(.0097)
Log industry GDP		.0726		−.0545
		(.0132)		(.0081)

NOTE: Standard errors are in parentheses. All regressions include year, month, province * industry, monthly trend, and trend * province * industry effects. Sample excludes construction and forestry industries. $N = 9,072$. Dependent variables are in logs.

log industrial GDP. Because information on health-insurance coverage is not available for the forestry or construction industries, these data contain a more limited sample of observations ($n = 9,072$).

As shown, NHI * %tax is negative and highly significant in both employment equations [cols. (1)–(2)]. The estimates suggest that shifting from a 100% premium-financed to a 100% general-revenue-financed program would decrease employment by 4%–5%. In addition, NHI * %tax is negative and highly significant in the wage equations [cols. (3)–(4)], suggesting lower rates of wage growth in provinces with general-revenue financing. These results are not consistent with standard tax-incidence models: As outlined by the simple model in Section 2, if general-revenue financing increases the tax on labor, it should cause a decrease in labor supply and thus decrease employment and increase wages.

This counterintuitive finding may reflect the effects of the other factors described in Section 2. Alternatively, it may be that our rough grouping of provinces by percentage premium financing captures more than the mode through which NHI is financed. If the "treatment" of passing NHI has heterogeneous effects across the provinces, then these heterogeneous effects may be correlated with the financing mode used. With only a limited number of degrees of freedom for our test, we are unable to convincingly address this alternative hypothesis.

The measured effect of NHI * HICOV on employment is insignificant in both models with and without controls for GDP [cols. (1)–(2)], suggesting that the composition of employment was relatively stable across sectors with high and low initial rates of private insurance coverage. As shown in columns (3) and (4), NHI * HICOV is negative and highly significant in the wage equations. This suggests that sectors with high initial insurance-coverage rates experience substantial wage declines relative to sectors with low initial coverage rates. Again, this finding runs counter to the predictions of our simple partial equilibrium model, which suggests that sectors with higher initial rates of private insurance will also have higher rates of wage growth after NHI to compensate for the reduction in in-kind compensation provided by firms.

This finding suggests that there may have been a supply shift from sectors with initially low rates of insurance to

sectors with initially high rates of health insurance, as would be the case if NHI decreased the relative costs of health insurance in high-coverage sectors. Alternatively, once again, these findings may simply reflect treatment heterogeneity that is correlated with the percentage of the population insured. This test could be refined in future work using firm-level data on insurance coverage, which would surmount this heterogeneity problem.

5. DISCUSSION AND CONCLUSIONS

Contrary to expectations, our research finds no evidence that implementation of NHI resulted in a decrease in employment. In fact, we find that both employment and wages *increased* with implementation of NHI. This result is robust to several specifications that control for the potential endogeneity of NHI, and it does not appear to be an artifact of a change in the average number of hours per employee.

In Section 2, we suggested several hypotheses that would be consistent with this paradoxical result. Although we are not able to structurally test these competing hypotheses, our findings do offer us some ability to distinguish between them. The fact that the employment adjustment appears to have occurred with a substantial lag casts some doubts on explanations based on the income effects of low employee valuation of government-provided health insurance. In addition, the faster rate of adjustment of wages than employment, along with the effects on employment in the long run only, suggests that our finding is not due to labor-market rigidities that prevent nominal wages from adjusting upward after passage of NHI. Finally, the positive employment impact of NHI does not appear to reflect a shift in employment across sectors because we did not find a significant difference in employment growth between low and high health-insurance-coverage sectors after implementation of NHI. The hypothesis that is most consistent with our findings is that NHI caused a systematic increase in labor demand across all sectors. This may have arisen due to increases in labor productivity that followed increased job mobility or improvements in the health of the labor force. Distinguishing between these hypotheses remains a task for future research.

When we disaggregate our results to determine whether the impact of NHI is uniform across sectors, we also find results that are counter to simple models of the labor force. First, NHI is found to decrease both employment and wages in sectors that rely on general-revenue financing relative to sectors that rely on lump-sum premiums, but a simple partial-equilibrium tax-incidence model predicts an employment decrease and wage increase. In addition, we find a relative decrease in wages in sectors with initially high rates of private insurance coverage, but the simple model predicts a relative increase. This may reflect either a weakness of the simple model used or correlated heterogeneity in the effect of NHI. Future research with firm-level data on insurance coverage could usefully address this question.

Prior to implementation of NHI, Canada was similar to the United States in its reliance on employer-provided health insurance and in its mixture of commercial experience-rated and nonprofit community-rated plans. Thus it is plausible that our results can generalize to the U.S. case. Several factors may cause the impact of NHI to differ in the United States however. First, the cost of private hospital and medical insurance now represents a much larger share of U.S. wages than did medical insurance in Canada. If the necessary revenues are raised by distortionary general-revenue taxes, the United States may well experience a decline in employment On the other hand, the U.S. insurance market is more highly segmented than was the market in Canada, with many firms unable to purchase insurance at all. This may lead to larger sectoral shifts when NHI is put in place; if these shifts are into labor-intensive sectors, the increase in employment will be larger than in Canada.

ACKNOWLEDGMENTS

We are grateful to Josh Angrist, Janet Currie, Richard Freeman, Jim Poterba, George Tauchen, and two referees for helpful comments; to Matt Barmack, Sharieff Mansour, Cory Rattelman, and Michael Cooper for research assistance; and to the Canadian Employment Research Forum for financial support.

[*Received July 1993. Revised July 1994.*]

REFERENCES

Berry, C. H. (1965), *Voluntary Medical Insurance and Prepayment*, Ottawa: Queen's Printer.

Browning, E. K., and Johnson, W. R. (1980), "Taxation and the Cost of National Health Insurance," *National Health Insurance: What Now, What Later, What Never?* ed. Mark V. Pauly, Washington, DC: American Enterprise Institute, pp. 31–51.

Canada Dominion Bureau of Statistics (selected years a), *Provincial Government Finances*, Ottawa: Author.

——— (selected years b), *Population Estimates by Marital Status Age and Sex for Canada and Provinces*, Ottawa: Author.

——— (selected years c), "*National Income and Expenditure Accounts: Annual Estimates*," Ottawa: Author.

Congressional Research Service (1988), *Costs and Effects of Extending Health Insurance Coverage*, Washington, DC: Author.

Gruber, J. (1994), "The Incidence of Mandated Maternity Benefits," *American Economic Review*, 84, 622–641.

Gruber, J., and Krueger, A. (1991), "The Incidence of Mandated Employer-Provided Insurance: Lessons From Worker's Compensation Insurance," in *Tax Policy and the Economy 5*, ed. D. Bradford, Cambridge, MA: MIT Press, pp. 111–143.

Hanratty, M. (1992), "Canadian National Health Insurance and Infant Health," mimeo, Cornell University,

Health Insurance Association of America (1990), *Source Book of Health Insurance Data*, Washington, DC: Author.

Jacobson, L., Lalonde, R., and Sullivan, D. (1993), "Earnings Losses of Displaced Workers," *American Economic Review*, 83, 685–709.

Madrian, B. C. (1993), "Employment-Based Health Insurance and Job Mobility: Is There Evidence of Job-Lock?" Working Paper 4476, National Bureau of Economic Research, Cambridge, MA.

Moore, M., and Viscusi, W. K. (1990), *Compensation Mechanisms for Job Risks*, Princeton, NJ: Princeton University Press.

Newhouse, J. P. (1992), "Medical Care Costs: How Much Welfare Loss?" *Journal of Economic Perspectives*, 6, 3–21.

Royal Commission on Health Services (1965), *Report of the Royal Commission on Health Services*, Ottawa: Queen's Printer.

Shillington, H. (1972), *The Road to Medicare in Canada*, Toronto: Del Graphics.

Statistics Canada (1988), *Industrial Production: 1960–1987*, Ottawa: Author.

Summers, L. (1989), "Some Simple Economics of Mandated Benefits," *American Economic Review*, 79, 177–184.

Summers, L., Gruber J., and Vergara, R. (1993), "Taxation and the Structure of Labor Markets: The Case of Corporatism," *Quarterly Journal of Economics*, 108, 385–412.

Taylor, M. G. (1987), *Health Insurance and Canadian Public Policy*, Montreal: McGill–Queen's University Press.

U.S. Department of Commerce, Bureau of Census (1992), *Statistical Abstract of the United States* (Table 672), Washington, DC: U.S. Government Printing Office.

U.S. General Accounting Office (1991), *Canadian Health Insurance: Lessons for the United States*, Washington, DC: Author.

Viscusi, W. K., and Moore, M. J. (1987), "Workers' Compensation: Wage Effects, Benefit Inadequacies, and the Value of Health Losses," *Review of Economics and Statistics*, 69, 249–261.

White, H. (1980), "A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity," *Econometrica*, 48, 817–838.