# Private insurance subsidies and public health care markets: evidence from Canada

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*Abstract.* In this study I examine the effects of government subsidies to employer-provided health insurance on the decision to purchase insurance, and on utilization of publicly funded health services. Using unique variation in tax subsidies across Canadian provinces as an instrument, I estimate the effects of these subsidies on the demand for supplemental health insurance and their extended effects on the decision to use publicly-funded health services. My results show that government subsidies through tax exemptions have significant effects on the decision to purchase insurance. Furthermore, additional insurance policies lead to moral hazard in the use of publicly funded health services. JEL Classification: H2,H4, I1

*Subventions aux programmes d'assurance privée et les marchés publics des soins de santé : résultats canadiens.* Ce mémoire examine les effets des subventions gouvernementales à l'assurance santé fournie par l'employeur sur la décision d'acheter de l'assurance, et sur l'utilisation des soins fournis par le système public. Utilisant les données provinciales, compte tenu du fait que les subventions varient d'une province à l'autre, l'auteur calibre les effets de ces subventions sur la demande d'assurance santé supplémentaire et sur la décision d'utiliser les sevices fournis par le système public. On montre que la taille des subventions via des exemptions fiscales a des effets significatifs sur la décision d'acheter de l'assurance supplémentaire. De plus, l'existence de polices d'assurance supplémentaires a aussi un effet sur l'utilisation des services fournis par le régime public: on utilise davantage le système public.

## 1. Introduction

In both the United States and Canada, governments subsidize employment-based health and dental insurance through the tax system. Both countries exempt any

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portion of a worker's health insurance that is paid by the employer from income tax. The government thus effectively subsidizes the cost of a dollar's worth of health insurance at the insurance-purchaser's marginal tax rate. These subsidized prices cause increased purchasing of health insurance if individuals (or their representatives) are responsive to changes in price.

The effects of these tax subsidies on social welfare and the public treasury may extend beyond increased insurance-purchasing. As in both countries public funds cover some, but not all, of the cost of medical treatment, subsidies to private insurance policies that cover additional portions of the cost of treatment (such as the cost of prescription drugs) can generate moral hazard in the use of publicly funded health services (such as doctors' visits). Subsidies to private health insurance may therefore have a series of effects: while reducing tax revenues, they stimulate the purchase of health insurance, which may trigger increased use of publicly funded health services.

In the United States, this series of effects can be most easily found in the Medicare program. The U.S. Medicare program publicly funds health insurance for the elderly and disabled. Many Americans choose to supplement Medicare with private coverage, which is commonly referred to as 'Medigap' insurance. Medigap insurance typically pays for deductibles and for items that are not covered by Medicare (such as prescription drugs). Many individuals receive tax-subsidized Medigap coverage as part of their current or previous employers' health plan. Research has shown that individuals who hold Medigap insurance use more health services covered by Medicare (Christensen, Long, and Rodgers 1987).

Canadian National Health Insurance is analogous to U.S. Medicare in many ways. While health insurance for all medically necessary hospital and physician services is publicly funded, many people choose to supplement this publicly funded coverage with private insurance. Private supplemental health insurance is typically provided through an employer. Supplemental insurance covers items such as prescription drugs and semi-private or private rooms in the hospital. By subsidizing the cost of supplemental insurance through tax exemptions, the Canadian government encourages individuals to purchase such coverage. Individuals who hold this insurance may use more publicly funded health services in this situation as well. For example, if they hold supplemental insurance that covers the cost of prescription drugs, individuals may see a doctor more often. Therefore, the Canadian system demonstrates an interaction between private and public funding analogous to that of the U.S. Medicare system. Unlike the U.S. Medicare system, however, Canadian employees purchase private coverage and consume publicly funded health care simultaneously during their working careers. This significantly simplifies studying the relationship between tax subsidies, private insurance, and publicly funded care. Furthermore, in other areas of the health system where privately insured services may substitute for publicly insured services (for example, drugs substituting for surgery), the dynamics between tax subsidies, private insurance, and public insurance in Canada may differ from those commonly found in the United States and hence warrant further investigation.

Estimating the magnitude of the link between supplemental coverage and the use of public services is complicated by the possibility of adverse selection. It is unclear whether individuals who purchased supplemental coverage did so because they knew they would require more health services (adverse selection), or whether individuals used more health services because they held supplemental coverage (moral hazard).

Empirically measuring the extent of tax subsidies' stimulation of insurance purchasing also poses several challenges. One key difficulty is that of separating the positive correlation between higher income and non-wage benefits from the true price effects that may result from the tax subsidies. Because tax rates depend on income, one effect cannot be easily separated from the other. An empirical investigation of the implications of health insurance subsidies thus requires variation in tax rates such that individuals with identical incomes face different tax subsidies for their employer-provided health insurance.

Both of these empirical problems are addressed in this paper by (a) exploiting the unique characteristics of Canadian tax treatment of employer-provided health insurance, and (b) tying the two problems together. The Canadian federal/provincial tax system offers considerable variation in provincial tax levels – individuals in different provinces face substantially different tax subsidies for their health insurance. In addition, tax law in Quebec, and only in Quebec, does not exempt employer-provided health insurance from provincial taxes. This magnifies the variation in tax subsidies to health insurance purchases. I use this variation to investigate whether individuals respond to changes in the tax-price of insurance and to measure the magnitude of such a response.

It is often difficult to separate the effects of adverse selection (sicker people purchasing more insurance) from the effects of moral hazard (people using more health services because they have insurance). Empirically separating these two effects on the decision to utilize public health services requires variation in the decision to purchase health insurance that is uncorrelated with health status. If tax subsidies do influence individual decisions to purchase insurance, then they provide such variation. By examining government subsidies to health insurance in conjunction with public utilization of health services, I show that tax subsidies directly affect the consumption of health insurance. Tax subsidies can therefore be used to help identify the moral hazard effect of holding private health insurance on the utilization of public services. I also use information about an individual's health status and past health utilization, newly available in Canadian health data sets, to help separate the adverse selection effects from the moral hazard effects.

My findings show that the tax subsidies to employer-provided health insurance have a two-part effect. They not only stimulate the purchase of supplemental insurance, but they also result in an increase in the utilization of publicly funded health care services. Estimates of the semi-price elasticity of demand for supplemental insurance in Canada range from $-0.3$ to $-0.6$. My estimates of the effect of holding private insurance on the use of public health services suggest that individuals with private insurance use 10 per cent more public health services than do those

who do not have insurance, and that approximately half of this additional use is due to moral hazard.

## 2. Research to date

There has been considerable research in the United States on the effects of tax subsidies on the decision to purchase health insurance. Many of these studies use differences in marginal tax rates as the main source of variation and estimate a price elasticity of demand for health insurance (see Marquis and Phelps (1987) for details). The estimated price elasticities for health insurance range from $-0.16$ to $-0.7$. Other research has used simulation models (Feldstein 1973) and found similar results. More recently, Gruber and Poterba (1994) use the cross-sectional variation created by the Tax Reform Act of 1986, which significantly changed both the marginal tax rates and the tax treatment of health insurance benefits for the self-employed. Their estimates of the semi-price elasticity of demand for health insurance – the number of percentage points by which the insured fraction of the population would change if the price of insurance increased by 1 per cent – ranges from $-0.24$ to $-0.69$. Finkelstein (1999) exploits the changes in Quebec tax laws over the 1990s to examine the effects of tax laws on the provision of insurance in Quebec and estimates elasticities between $-0.42$ and $-0.54$.

There are also several studies on problems of asymmetric information and the purchase of health insurance, including the interaction between public and private insurance. Previous research examining the role of moral hazard associated with supplemental coverage in the use of public health services has focused on the interaction between Medicare and Medigap coverage in the population over age 64. Christensen, Long, and Rodgers (1987) investigate the impact of Medigap policies on the use of services covered by Medicare using a two-part model of utilization behaviour. They find that Medicare enrolees who have Medigap coverage use 24 per cent more in-patient hospital and physicians' services than those who do not. Several studies (see Wolfe and Goddeeris 1991 and Ettner 1997, for example) have investigated the extent of adverse selection in the Medigap market and found evidence of adverse selection. A few studies have also found that access to prescription drug medication has had no measurable effect on utilization of health services and even that there have been small declines in hospital utilization (Lingle et al. 1987).

## 3. A model of the interactions between private subsidies and public health care markets

In this section I present a simple model of the decision to purchase supplemental health insurance. The set-up is a static utility maximization model in which individuals choose to purchase insurance if the indirect utility from wages minus the cost of insurance is greater than the indirect utility without insurance (and with some probability of paying for medical services out of pocket).

To begin, consider an individual with indirect utility function $v(\cdot)_i$, and wage, $w_i$. The probability of getting sick for any individual, $i$, is $\rho_i$. Let the cost of illness, be $M_i$. Individuals face average tax rates $t_i$. Assume that all individuals face the same cost of insurance, $c$, whether insurance is purchased through an employer or purchased privately. Assume, further, that the utility function is well behaved. In the absence of any tax policy regarding health insurance, an individual's decision to purchase health insurance (or choose a job that offers insurance) can be characterized as follows: an individual will purchase insurance if

$$v_i(w_i(1-t_i)-c) > \rho_i v_i(w_i(1-t_i)-M_i) + (1-\rho_i)v_i(w_i(1-t_i)). \quad (1)$$

That is, an individual will purchase insurance if the indirect utility from purchasing insurance is greater than the indirect utility from not purchasing insurance. The decision to purchase health insurance does not affect a worker's total compensation. If the worker values health insurance at its full cost, then the worker will be indifferent between \$1 in wages and \$1 worth of health insurance benefits. Alternatively, one might want to consider the firm's decision to offer health insurance in order to attract the marginal employee. In many cases the decision to offer health insurance in the workplace may be the result of collective bargaining, in which case the preferences of the median employee may be relevant. Employers care only about the total compensation bill and are therefore indifferent between paying workers in the form of wages or through health insurance benefits. Given that the employer is indifferent between alternate forms of compensation, the employer will act in the interests of the potential employee. Here, I consider the perspective of the marginal employee.[1]

Now, suppose that the cost of insurance is tax exempt if purchased through an employer. The individual's decision to purchase insurance then becomes purchase insurance if

$$v_i(w_i(1-t_i)-c(1-t_i)) > \rho_i v_i(w_i(1-t_i)-M_i) + (1-\rho_i)v_i(w_i(1-t_i)). \quad (2)$$

The subsidy per dollar of insurance is the tax that would be paid on that dollar if it was received in wages. That is, the cost to the employee of one additional dollar of insurance coverage is not one dollar, but one minus the marginal tax rate that he/she pays on that dollar. If marginal tax rates vary with income, then the cost of health insurance is different depending on the employee's gross income. The tax exemption of health insurance as a non-wage benefit lowers the effective price of health insurance to a worker, and if health insurance is a normal good, it increases the quantity of health insurance purchased. Therefore, excluding contributions to health

1 Whether the decision to offer insurance is driven by supply or demand is discussed in greater detail by Pauly (1997) and Long and Marquis (1992). They present evidence that worker preferences do influence firm decisions and that workers sort themselves, to some extent, according to health insurance preferences.

insurance policies from employees' taxable income distorts the individual's decision concerning the purchase of health insurance.[2]

In systems wherein both public and private insurance exist, an overlap of insurance coverage may result in complementarities between the two systems. Consider, for example, an insurance system in which basic medical needs are covered by public insurance, and private insurance markets exist to cover additional medical expenses not covered by public insurance. In such a system, although fees paid to doctors or hospitals are covered by public insurance, the marginal cost to the patient of a doctor or hospital visit is not zero. There may be additional expenses associated with visiting the doctor that are not covered by public health insurance; consequently, these costs may affect an individual's decision to seek medical care. If individuals have supplemental private insurance (which further reduces the marginal cost of such visits), they may choose to use publicly funded services more frequently. For example, a visit to a general practitioner frequently results in a prescription for medication. While the doctor visit is covered under public insurance, the cost of the drug is not. The cost of the prescription may affect whether the individual decides to seek publicly funded care (for evidence in support of this hypothesis see Williamson and Fast 1998). Individuals with drug coverage face a reduced cost of using the doctor and may, therefore, use more doctors services. The magnitude of this 'public moral hazard' – the use of additional public services as a result of private coverage – thus is influenced by government subsidies to private health insurance. If individuals purchase more private health insurance as a consequence of the tax-exempt status of employer contributions, then public expenditure on health care is likely to rise as a result.

## 4. The interaction between public and private health insurance in Canada

The Canadian health care system offers the cross-household variation required to test the interaction between public and private health insurance in Canada. Each of the ten provinces administers its own public health care system (subject to federal regulations) and coverage is portable from province to province. Although the provinces differ in the generosity of their coverage, each plan covers medically necessary hospital and physician care. Despite relatively generous coverage, however, there is significant demand for supplementary health insurance. Such health insurance generally covers prescription drugs, semi-private or private hospital accommodation, dental services, special nursing, ambulance services, and other services not fully covered under provincial plans (Canadian Life and Health Insurance Association 1997c). Since many visits to the doctor involve prescription medication or other costs/equipment not covered by Medicare, it is often the case that individuals will incur some out-of-pocket expense when using health services.

2 In many countries, including the United States and Canada, $M_i$, the out-of-pocket health costs may be tax deductible after a certain threshold has been reached. To model these countries more closely one would want to incorporate these tax allowances as well.

A large part of the cost outside the Canadian Medicare program comes in the form of drugs used outside the hospital.[3] In 1996, 14.4 per cent of health expenditures, or $10.8 billion was spent on pharmaceuticals (both prescription and over-the-counter). The amount is equal to that spent on payments to physicians that same year (Dingwall 1997). In Canada individuals consumed, on average, four doctor visits per year in 1995 (author's calculations). However, Canadians received, on average, eight prescriptions per year in 1995 (Dingwall 1997), or two prescriptions per visit. Provincial health plans differ in their coverage of prescription drugs. Most provinces have some form of drug plan to assist seniors and individuals with low incomes with the cost of prescription drugs. For the most part, these provincial plans are meant not to replace supplemental coverage, but to assist those who are unlikely to be able to afford such coverage and who are likely to have high drug costs.

The limitations on coverage afforded by the public system have given rise to substantial demand for supplemental coverage. Most Canadians who desire supplementary health coverage obtain it through their employer (Human Resources and Development Canada 1998 estimates that 68 per cent of full-time workers received such insurance in 1995). Individuals may choose to obtain this coverage through an employer because the federal government, along with nine of the ten provincial governments, exempts employer contributions to health plans from taxable income. The Quebec government, which is alone in administering its own provincial tax collection, does not exempt contributions to health plans from taxable income. The variation in provincial tax rates, even in the absence of the Quebec variation, allows me to more clearly identify the impact of tax subsidies on health insurance purchases than in previous research. While federal tax rates are highly correlated with income, provincial tax rates differ substantially for individuals who are otherwise observationally identical (who have the same after-tax income, sex, marital status and other observable characteristics). The marginal tax rate, depending on the province, can vary from 0 per cent to 54.2 per cent. The unique Quebec tax laws allow even further identification of the price effect of the tax subsidy. Table 1 summarizes the variation in marginal tax rates and the tax-price of insurance by province in Canada.

The residents of Quebec are a particularly useful source of additional variation because of the uniqueness of the province in other ways. Quebec is the only Canadian province that is predominantly French speaking. As a result, most of the province's citizens are very unlikely to migrate to other parts of the country. This barrier reduces the potential measurement error that might result if people moved frequently across provinces.

## 5. Data

My empirical analysis draws on two data sources. The first is the 1995 Survey of Work Arrangements (SWA). The SWA is a national cross-sectional survey con-

3 Prescription drugs consumed by inpatients are covered under the Medicare program in every province.

TABLE 1
Provincial marginal tax rates and tax prices for health insurance

| Province | Mean marginal tax rate (%) | Median marginal tax rate (%) | Median tax price of insurance ($) |
|---|---|---|---|
| Newfoundland | 30.4 | 29.1 | 0.709 |
| P.E.I. | 28.4 | 27.6 | 0.724 |
| Nova Scotia | 27.1 | 27.6 | 0.724 |
| New Brunswick | 29.6 | 28.4 | 0.716 |
| Quebec | 35.1 | 38.2 | 0.825 |
| Ontario | 32.3 | 41.8 | 0.582 |
| Manitoba | 31.3 | 28.4 | 0.716 |
| Saskatchewan | 29.6 | 28.9 | 0.711 |
| Alberta | 28.0 | 25.8 | 0.742 |
| British Columbia | 31.3 | 40.3 | 0.597 |

SOURCE: 1995 Survey of Work Arrangements. Marginal tax rates are calculated by author.

ducted as a supplement to the larger Canadian Labour Force Survey, a monthly survey of employment and demographic data. The SWA sample contains information on approximately 25,000 employed individuals. In addition to information on employment status, the SWA provides detailed information about job characteristics for a subset of the workers surveyed in the Labour Force Survey. The SWA asks a series of questions on non-wage benefits, including whether supplemental health insurance and dental insurance are offered through the primary employer. Benefit questions were asked of only non-self-employed individuals. The SWA also includes detailed information regarding the labour status and income of spouses. After eliminating self-employed individuals and individuals missing important wage information, the data set consists of 15,688 observations. I calculate marginal tax rates for individuals in the SWA using tax information from the 1995 federal and provincial tax handbooks and from information contained in *Tax Facts* (KPMG 1996). The marginal tax rates are based on wage and salary income and take into account the federal and provincial tax rates; federal and provincial surtaxes; and standard deductions, including pension plan deductions, unemployment insurance deductions, and deductions that might result from marital status and dependent children.[4]

The second data set I use is the National Population Health Survey (NPHS), a longitudinal survey conducted in 1994 and 1996. The NPHS is a nationally representative survey that includes information on demographic characteristics as well as detailed information on health services usage and health status. The 1996 wave of the survey also contains information on whether or not individuals are covered

4 Canadian income taxes are based on individual income, not family income. However, family income is used as the base for determining federal and provincial refundable tax credits.

by supplemental health insurance, including prescription drugs,[5] eyeglasses, and additional hospital insurance for semi-private or private rooms. Health utilization information includes that on the number of nights spent in the hospital, visits to doctors (both general practitioners and some specialists) and visits to any health practitioner. For my analysis I focus only on visits to general practitioners and hospital stays. Health status information is available on chronic conditions, medication taken, and self-assessed health status. I use data only for those individuals of working age who had complete responses in both survey years, so that the resulting data set consists of 12,655 observations in each year. In so doing I lose a small number individuals who were surveyed in 1994 but not in 1996. Since the questions on supplemental insurance are contained only in 1996, however, I need to restrict my sample to individuals with responses to these questions.

## 6. Empirical strategy

In my empirical analysis, I first use the variation in marginal tax rates across individuals as well as the differences in the tax structure in Quebec to test how subsidizing employer-sponsored health insurance affects the demand for insurance. That is, exploiting the differences in the tax-subsidized price of an additional dollar of insurance, I examine whether individuals respond to the subsidies by purchasing additional supplemental insurance.

Returning to the model of the decision to purchase supplemental insurance outlined earlier, note that an individual will purchase supplemental insurance if

$$V^* = v_i(w_i(1 - t_{fi} - t_{pi}) - c(1 - t_{fi} - t_{pi})) - [\rho_i v_i(w_i(1 - t_{fi} - t_{pi}) - M_i) + (1 - \rho_i)v_i(w_i(1 - t_{fi} - t_{pi}))] > 0, \quad (3)$$

where $v_i$ is the individual's indirect utility function. Here, I have broken down the tax rate into its federal and provincial components (subscripts $f$ and $p$, respectively). We can therefore describe $V^*$ as

$$V_i^* = P_i\delta + \ln(w_i(1 - t_{fi} - t_{pi})\gamma + X_i\beta + \epsilon_i. \quad (4)$$

We observe not the latent variable, $V_i^*$, but instead a dummy variable, $hi_i$, which equals unity if $V_i^* > 0$ and zero otherwise. The individual decision to purchase insurance can then be represented by

$$\text{Prob}(hi_i = 1) = \text{Prob}(V_i^* > 0) = \text{Prob}[\epsilon_i > -(P_i\delta + \ln(w_i(1 - t_{fi} - t_{pi})\gamma + X_i\beta)]. \quad (5)$$

where $P_i$ is the tax-subsidized price of an additional dollar of health insurance (hereafter referred to as the tax-price of insurance), which is equal to $(1 - t_{fi}^m - t_{pi}^m)$

5 Here, the question does not distinguish between private and public supplemental insurance.

for residents of Canada excluding Quebec (the superscript $m$ is to clarify that this is the marginal, not the average rate) and equal to $(1 - t_{fi}^m)$ for residents of Quebec, reflecting the variation in the subsidy across provinces and the fact that Quebec residents cannot deduct employer contributions to supplemental insurance from their provincial income tax. $w_i(1 - t_{fi} - t_{pi})$ is the after-tax wage of the individual, including the cost of health insurance if the individual chooses to purchase insurance, $X_i$ is a vector of observable demographic characteristics, and $\epsilon_i$ are unobservable characteristics that influence the decision to purchase supplemental insurance. I estimate equation (5) by fitting a probit model for insurance purchases for the 1995 Survey of Work Arrangements data. The coefficient on the tax-price of supplemental health insurance, $\delta$, can be used to calculate the semi-price elasticity of demand for health insurance. I estimate a similar equation using the National Population Health Survey to confirm coefficient estimates and to include information on health status and utilization to control for the possibility of adverse selection in the decision to purchase health insurance.

Authors of previous studies have raised concerns that by using marginal tax rates to estimate price elasticities, the estimated price response may simply be second-order wage effects rather than true price effects (see, especially, Gruber and Poterba 1994). This concern arises primarily because marginal tax rates are highly correlated with income. The Canadian tax laws, however, permit a more direct test of whether individuals actually respond to changes in the tax-price of insurance. In particular, one can exploit the differences in the tax-price of supplemental health insurance between residents of Quebec and residents of the rest of Canada. The tax-price of insurance is simply a function of both the federal and the provincial marginal tax rates. Decomposing the price into its component parts and including a variable for the interaction between the provincial tax subsidy and residents of Quebec, equation (4) can then be expressed as

$$V_i^* = t_{fi}^m \delta_1 + t_{pi}^m \delta_2 + (t_{pi}^m * quebec_i)\theta + \ln(w_i(1 - t_{fi} - t_{pi})\gamma + X_i\beta + \epsilon_i, \quad (6)$$

where, as above, we do not observe $V_i^*$, but rather $hi_i$ equal to unity if $V_i^* > 0$, and equal to zero otherwise. Here, the tax rates, wages, and $X$ are defined as above, and $t^m * quebec$ is an interaction between being a resident of Quebec and the individual's provincial marginal tax rate.

The estimated value of $\delta_2$ should be positive, reflecting the response to changes in the tax-price of health insurance. If individuals respond to the value of the tax subsidies offered, not only to increases in income, $\theta$ should be equal, in absolute value, to $\delta_2$, reflecting the reduced subsidy to supplemental health insurance in Quebec.[6]

I then link the effects of the tax subsidies to public health service utilization. I first estimate the direct effect on health utilization of holding supplemental insur-

6 I thank Shubham Chaudhuri for pointing this out.

ance. I model health utilization using a two-part model as in Duan et al. (1983). I use a two-equation model to reflect the unique characteristics of the distribution of health utilization: First, a significant portion of the population uses no health services in a given year. Second, among positive users the distribution is heavily skewed. The first equation models whether or not an individual uses any doctor's services or hospital services using a probit model. The second equation models utilization conditional on using services using OLS on the sample for which utilization is greater than zero. I use the natural logarithm of utilization to lessen the impact of extreme values in the distribution. The two-period panel allows me to control for health usage and status in both 1994 and 1996. By controlling for health status in two periods and health utilization in the previous period, I can control, at least in part, for the possibility of adverse selection in the decision to purchase health insurance. Ignoring the possibility of adverse selection leads to overestimates of the effect of moral hazard on utilization (Wolfe and Goddeeris 1991).

Although I attempt to control for adverse selection through prior use of health services and health status, the purchase of supplemental health insurance still may be correlated with unmeasured health status. Because simply including health insurance as an exogenous regressor may produce estimates of the effect of health insurance that are upwardly biased, I re-estimate the two-part model treating whether or not an individual holds supplemental health insurance as endogenous and using the individual's marginal tax rate – a primary determinant of whether an individual holds supplemental health insurance – as an instrumental variable. By using the marginal tax rate to identify the moral hazard effect of holding supplemental insurance on health utilization, I avoid the biases due to correlation between holding supplemental insurance and health status.[7]

Unfortunately, the NPHS contains information on family income category but not on individual income. Canadian income taxes are based on individual income, with the possibility of deductions depending on marital status, spouse's income, and family size. In order to calculate marginal tax rates for the sample I first predict individual income based on family income and family characteristics.[8] I then calculate marginal tax rates from the predicted individual income based on data from *Tax Facts* (1996) and use them as an instrument for holding supplemental insurance.

I also include a set of dummy variables representing those groups covered by publicly provided drug plans in the different provinces. For example, in New Bruns-

7 While there may be some correlation between adverse health and income, the Canadian health system publicly provides insurance for all necessary medical treatment, as well as generous disability payments, thus reducing the impact of adverse health on an individual's earnings.

8 I use the SWA, which contains both family income and individual income. I regress individual income on the family income category, marital status, family size, education, province, race, age, and hours worked and then predict individual income for the NPHS sample. The regression used to predict income had an $R^2$ of 0.7 and the smallest root mean squared error of the various prediction equations used. As a check to the accuracy of the calculated marginal tax rates I re-estimate equation (5) using this sample. The results are similar to those using the SWA.

wick, seniors who qualify for the Federal Guaranteed Income Supplement[9] are entitled to prescription drugs with a $9.00 co-payment. I therefore control for the effect that such public programs might have on utilization.[10] I also estimate all the above models both including and excluding those individuals who might qualify for such plans.[11] For those provinces in which all individuals are technically eligible for a public drug plan, some individuals in the NPHS claiming to have supplemental insurance may be referring to public insurance. The Survey of Work Arrangements is not subject to this problem, however, since it specifically asks about employer-provided plans.

## 7. Principal findings

### *7.1. The Demand for supplemental insurance*

The tax-preferred treatment of employer-provided health benefits reduces the price of a dollar of health insurance by the marginal tax rate faced by the individual. I first present estimates of equation (5), using one minus the individual's marginal tax rate as the tax-price of insurance in all provinces except Quebec and one minus the federal tax rate as the tax-price of insurance in Quebec. In the specifications reported I use the natural log of after-tax wages and its square to control for income. I repeat the analyses using dummy variables for each $5,000 of income as well as wages cubed. These alternate specifications do not change the magnitude or significance of the estimated coefficient on the tax-price of insurance and are not reported here. The marginal tax rates and wages in this specification are not compensated for the cost of health insurance. Thus, this specification does not suppose a perfectly competitive labour market, as I assumed in equations (1)–(4) above, wherein the cost of health insurance is exactly subtracted from wages if an individual receives employer-sponsored insurance.

As the results in table 2 show, the tax-price of supplemental insurance has a strong negative effect on the propensity to hold insurance. The marginal effect of a change in the tax-price of insurance on the probability of holding supplemental insurance is $-0.4$. Most other estimated coefficients have their expected effect on the probability of holding supplemental insurance. Log hourly wages have a strong positive effect, as do the number of hours worked per week. Length of tenure with the current employer is positively correlated with holding supplemental insurance.

9 The GIS is available for elderly citizens of Canada, or those individuals who have been residents for forty years with incomes below a certain threshold. The threshold is based on income apart from government pensions, marital status, and age of spouse.

10 I also include these dummy variables in the estimates of the decision to purchase health insurance to be sure that qualifying for a provincial supplemental plan does not affect the estimates of the decision to purchase supplemental insurance.

11 To eliminate individuals who qualify for elderly drug assistance I re-run all regressions, excluding individuals 65 and older. To eliminate individuals who qualify for low income assistance I exclude individuals based on various income cut-offs. The results are robust to these various specifications.

TABLE 2
Estimates of the probability of holding supplemental health insurance and dental insurance coverage

| | Pre-insurance income | | Total compensation | |
|---|---|---|---|---|
| N = 15688 | Health | Dental | Health | Dental |
| Tax-price | −0.417** | −0.604** | −0.572** | −0.801** |
| | (0.079) | (0.082) | (0.083) | (0.085) |
| Ln (after-tax wage) | 1.32** | 1.43** | 1.93** | 1.76** |
| | (0.125) | (0.132) | (0.143) | (0.142) |
| Ln (after-tax wage) squared | −0.203** | −0.225** | −0.317** | −0.291** |
| | (0.026) | (0.027) | (0.029) | (0.029) |
| Age | −0.011** | −0.028** | −0.016** | −0.031** |
| | (0.0051) | (0.0052) | (0.0052) | (0.0053) |
| No. of children | −0.014** | −0.015** | −0.015** | −0.015** |
| | (0.0047) | (0.0048) | (0.0048) | (0.0048) |
| Hours worked | 0.013** | 0.012** | 0.012** | 0.011** |
| | (0.0007) | (0.0008) | (0.0008) | (0.0008) |
| Married | 0.052** | 0.065** | 0.034** | 0.056** |
| | (0.016) | (0.017) | (0.017) | (0.017) |
| Sex | −0.026** | −0.041** | −0.037** | −0.048** |
| | (0.011) | (0.011) | (0.011) | (0.011) |
| Spouse employed | 0.018 | 0.0088 | 0.020 | 0.0081 |
| | (0.016) | (0.016) | (0.016) | (0.016) |
| Tenure | 0.093** | 0.084** | 0.090** | 0.082** |
| | (0.0038) | (0.0039) | (0.0039) | (0.0040) |
| Senior member present | −0.026 | −0.0052 | −0.020 | −0.00041 |
| | (0.020) | (0.020) | (0.020) | (0.021) |
| Spouse's age | −0.019** | −0.017** | −0.017** | −0.015** |
| | (0.0032) | (0.0033) | (0.0033) | (0.0034) |
| Firm size 20–99 | 0.279** | 0.290** | 0.278** | 0.289** |
| | (0.015) | (0.016) | (0.016) | (0.016) |
| Firm size 100–500 | 0.356** | 0.346** | 0.350** | 0.341** |
| | (0.016) | (0.016) | (0.016) | (0.016) |
| Firm size 500+ | 0.390** | 0.431** | 0.384** | 0.427** |
| | (0.014) | (0.014) | (0.014) | (0.015) |
| Member of a union | 0.140** | 0.125** | 0.122** | 0.114** |
| | (0.012) | (0.012) | (0.012) | (0.012) |
| PEI | 0.022 | 0.076* | 0.022 | 0.082* |
| | (0.042) | (0.042) | (0.043) | (0.042) |
| Nova Scotia | 0.040 | 0.033 | 0.047 | 0.041 |
| | (0.036) | (0.035) | (0.037) | (0.035) |
| New Brunswick | −0.0097 | 0.070** | −0.010 | 0.073** |
| | (0.036) | (0.035) | (0.037) | (0.035) |
| Quebec | −0.0013 | −0.135** | 0.0082 | −0.111** |
| | (0.033) | (0.033) | (0.034) | (0.033) |
| Ontario | −0.040 | 0.107** | −0.057* | 0.103** |
| | (0.031) | (0.030) | (0.032) | (0.030) |
| Manitoba | −0.038 | 0.122** | −0.047 | 0.122** |
| | (0.035) | (0.034) | (0.035) | (0.034) |
| Saskatchewan | −0.201** | 0.170** | −0.214** | 0.170** |
| | (0.035) | (0.036) | (0.036) | (0.036) |
| Alberta | −0.081** | 0.121** | −0.092** | 0.125** |
| | (0.034) | (0.034) | (0.035) | (0.034) |
| British Columbia | −0.084** | 0.116** | −0.103** | 0.111** |
| | (0.034) | (0.034) | (0.035) | (0.034) |
| R-squared | 0.4041 | 0.3911 | 0.4216 | 0.4019 |
| Implied semi-price elasticity of demand for HI | −0.3 | −0.4 | −0.4 | −.06 |

NOTES: Standard errors in parentheses. **Denotes significance at 5% level; *denotes significance at 10% level. Reported as marginal effects.
SOURCE: 1995 Survey of Work Arrangements

When I include tenure in the model, the effect of age on the probability of holding insurance is no longer positive, implying that age is acting as a proxy for job tenure. Union membership is strongly correlated with holding health insurance benefits. Employees at large firms are much more likely to have health insurance than employees in smaller firms. Somewhat surprisingly, having more children has a negative effect on the probability of holding insurance.

The second column of table 2 reports analogous results for the probability of holding dental insurance only. The marginal effect of the tax-price of dental insurance on the probability of holding insurance is −0.6, larger than the coefficient on supplemental health insurance. Other explanatory variables have similar effects on the probability of holding dental insurance as on health insurance.

One can translate the marginal effects reported in table 2 into a semi-price elasticity of demand for supplemental health insurance by multiplying the marginal effect by the average tax-price of insurance. This yields a semi-price elasticity of demand for supplemental health insurance of about −0.3. An estimated elasticity of this magnitude is well within the range of previous estimates using data from the United States. The estimated semi-elasticity for dental insurance is about −0.4.

These findings suggest that the tax-price of insurance influences the decision to purchase supplemental insurance. Under the assumption of perfectly competitive labour markets, however, when the individual makes the decision to purchase supplementary insurance (or seek employment that offers such), that decision is based on his/her total compensation, including both wages and the cash value of health insurance. Therefore, the relevant marginal tax rate in the decision process is the rate that reflects the tax owed on his/her total compensation.[12] To calculate the semi-price elasticity of demand more precisely, one should use total compensation to calculate the marginal tax rates faced by an individual. Similarly, as in equation (2), the wage the individual uses in the decision process is the wage before the cost of health insurance is deducted, and after tax. To adjust my estimating equation for these changes, I calculate the marginal tax rate by adding the average value of a supplemental health or dental insurance package to the total compensation of those people who purchase supplemental health insurance. I then recalculate the marginal tax rates and after-tax wages based on this total compensation. These adjustments yield an estimating equation that reflects the decision to purchase supplemental insurance modelled in equation (5) above.

The third column of table 2 presents results from estimating equation (5). The marginal effect of increasing the tax-price on the decision to purchase supplemental health insurance is −0.6, considerably higher than the result based on the previous marginal tax rates. The corresponding semi-price elasticity of demand for supplemental health insurance is −0.4. Again, I include after-tax wages as a quadratic term to allow for slope of the income effect to vary. Both the wage and wage-

12 One might expect that individuals who have income levels close to the cut-off levels of higher tax brackets would have a large incentive to purchase insurance if it places them in a lower income tax bracket, thus raising concerns of an endogenous marginal tax rate. It turns out that only a small percentage (approximately 10 per cent) of the sample falls into this category.

squared variables are significantly correlated with the decision to purchase supplemental health insurance. The effects of other regressors on the decision to purchase insurance are essentially unchanged from the previous estimates.

Analogous to the earlier tests, the fourth column of table 2 presents the results for dental insurance coverage. The estimated coefficients obtained using marginal tax rates based on total compensation and after-tax wages are, again, considerably higher than the results based on income only. The marginal effect of the tax-price on the decision to purchase dental insurance is about $-0.8$, and the corresponding semi-price elasticity of demand for dental insurance is about $-0.6$.

Estimates of equation (6), which separates the subsidy into its federal and provincial components, are reported in table 3. Equation (6) directly tests whether individuals respond to changes in the subsidy by contrasting otherwise identical Quebec-resident and non-Quebec-resident individuals. The first column of table 3 reports the results for health insurance. Both the federal and the provincial marginal tax rates positively affect the decision to purchase health insurance (replacing the marginal tax rates with prices equal to one minus the marginal tax rate produces identical coefficients but of the opposite sign). The estimated coefficient on the interaction between the provincial marginal tax rate and residency in Quebec is negative (though it is not as precisely estimated as the previous two coefficients are), as would be expected if individuals respond to changes in the tax-price of insurance. I reject the hypothesis that the estimated coefficient on the provincial marginal tax rate is equal in absolute value to the estimated coefficient on the interaction between the provincial marginal tax rate and residency in Quebec ($p = 0.03$).[13]

The second column of table 3 repeats this analysis for dental insurance. In this case, although the provincial marginal tax rate is positively correlated with the decision to purchase dental insurance, the estimated coefficient on the federal marginal tax rate is positive, but not statistically significant. The reduced significance of the federal rate confirms that much of the identification for the response to the tax subsidy for dental insurance comes from provincial, not federal, variation in tax rates. The estimated coefficient on the interaction between the provincial marginal tax rate and residency in Quebec again is negative, and this time is quite significant, strongly suggesting that residents of Quebec do respond to differences in the provincial subsidy. I fail to reject that the coefficient on the provincial marginal tax rate is equal in absolute value to the estimated coefficient on the interaction between the provincial marginal tax rate and residency in Quebec ($p = 0.30$).

The third and fourth columns of table 3 present estimates of equation (6) without splitting the federal and provincial marginal tax rates. The advantage of estimating the equation in this form is that I avoid any potential collinearity between the two tax rates that may reduce the precision of the estimates. The estimated coefficients

13 I also limit the sample to various income categories and repeat the above analysis. For some income categories, the coefficient on the interaction between the provincial marginal tax rate and Quebec is significant and equal in absolute value to the coefficient on the provincial rate. For others, the sample size is too small for any reasonable inference. The reported coefficients can be considered the average of these coefficients.

TABLE 3
Estimates of the effects of marginal tax rates on the decision to purchase health insurance

| N=15688 | Health | Dental | Health | Dental |
|---|---|---|---|---|
| Combined marginal tax rate | – | – | 0.593** | 0.800** |
| | – | – | (0.084) | (0.086) |
| Federal marginal tax rate | 0.491** | 0.193 | – | – |
| | (0.232) | (0.232) | – | – |
| Provincial marginal tax rate | 0.776* | 1.89** | – | – |
| | (0.396) | (0.397) | – | – |
| Provincial marginal tax rate*Quebec | −0.383 | −2.08** | −0.251 | −1.31** |
| | (0.320) | (0.320) | (0.156) | (0.166) |
| Ln(after-tax wage) | 1.93** | 1.77** | 1.92** | 1.76** |
| | (0.144) | (0.142) | (0.143) | (0.142) |
| Ln(after-tax wage) squared | −0.317** | −0.291** | −0.315** | −0.288** |
| | (0.030) | (0.029) | (0.029) | (0.029) |
| Age | −0.016** | −0.031** | −0.016** | −0.031** |
| | (0.0052) | (0.0053) | (0.0052) | (0.0053) |
| No. of children | −0.014** | −0.016** | −0.014** | −0.016** |
| | (0.0048) | (0.0048) | (0.0048) | (0.0048) |
| Hours worked | 0.012** | 0.012** | 0.012** | 0.011** |
| | (0.0008) | (0.0008) | (0.0008) | (0.0008) |
| Married | 0.035** | 0.055** | 0.035** | 0.054** |
| | (0.017) | (0.017) | (0.017) | (0.017) |
| Sex | −0.038** | −0.047** | −0.037** | −0.047** |
| | (0.011) | (0.011) | (0.011) | (0.011) |
| Spouse employed | 0.019 | 0.0082 | 0.019 | 0.0087 |
| | (0.016) | (0.016) | (0.016) | (0.016) |
| Tenure | 0.090** | 0.083** | 0.090** | 0.082** |
| | (0.0039) | (0.0040) | (0.0039) | (0.0040) |
| Senior member present | −0.020 | 0.00042 | −0.020 | −0.00006 |
| | (0.020) | (0.021) | (0.020) | (0.021) |
| Spouse's age | −0.017** | −0.016** | −0.017** | −0.016** |
| | (0.0033) | (0.0034) | (0.0033) | (0.0034) |
| Firm size 20–99 | 0.277** | 0.288** | 0.277** | 0.289** |
| | (0.016) | (0.016) | (0.016) | (0.016) |
| Firm size 100–500 | 0.349** | 0.343** | 0.349** | 0.343** |
| | (0.016) | (0.016) | (0.016) | (0.016) |
| Firm size 500+ | 0.383** | 0.429** | 0.383** | 0.429** |
| | (0.014) | (0.015) | (0.014) | (0.015) |
| Member of a union | 0.121** | 0.115** | 0.121** | 0.115** |
| | (0.012) | (0.012) | (0.012) | (0.012) |
| PEI | 0.025 | 0.104** | 0.022 | 0.083** |
| | (0.044) | (0.043) | (0.043) | (0.042) |
| Nova Scotia | 0.050 | 0.063* | 0.047 | 0.042 |
| | (0.037) | (0.036) | (0.037) | (0.035) |
| New Brunswick | −0.0087 | 0.086** | −0.010 | 0.074** |
| | (0.037) | (0.036) | (0.037) | (0.035) |
| Quebec | −0.026 | 0.093* | −0.037 | 0.024 |
| | (0.049) | (0.052) | (0.044) | (0.046) |
| Ontario | −0.053 | 0.124** | −0.056* | 0.103** |
| | (0.033) | (0.032) | (0.032) | (0.031) |
| Manitoba | −0.046 | 0.131** | −0.047 | 0.123** |
| | (0.036) | (0.035) | (0.035) | (0.034) |
| Saskatchewan | −0.213** | 0.180** | −0.214** | 0.172** |
| | (0.036) | (0.036) | (0.036) | (0.036) |
| Alberta | −0.083** | 0.169** | −0.090** | 0.125** |
| | (0.038) | (0.037) | (0.035) | (0.034) |
| British Columbia | −0.097** | 0.145** | −0.102** | 0.112** |
| | (0.037) | (0.036) | (0.035) | (0.034) |
| R-squared | 0.4219 | 0.4032 | 0.4219 | 0.4028 |

NOTES: Standard errors in parentheses. **Denotes significance at 5 per cent level, *denotes significance at 10 per cent level. Reported as marginal effects
SOURCE: 1995 Survey of Work Arrangements

for both health and dental insurance on the interaction between Quebec residency and the provincial tax rate are once again negative, and this time they are measured with more precision, providing more evidence that individuals in Quebec alter their behaviour as a result of the reduced provincial subsidy.[14]

To summarize, there is evidence that individuals in Quebec do respond to the reduced subsidy and are less likely to purchase supplemental health insurance than individuals in other provinces. The negative coefficient on the interaction between living in Quebec and the provincial tax rate, which remains significant (although only marginally in the case of health insurance) after including quadratics in wage, cubics in wage, or dummy variables for each $5,000 of income, provides further evidence that the tax subsidies are driving part of the differences in insurance coverage and that we are not simply picking up second-order wage effects.

### *7.2. Estimates of public moral hazard*

Using the two-equation model developed in section 6, one can estimate the effect of holding supplemental health insurance on the use of publicly funded health services. In particular, I examine two different types of utilization: visits to doctors (general practitioners only), and overnight stays in the hospital. I use two different types of insurance variables in the analysis: supplemental hospital insurance; and a combined variable of supplemental insurance, including supplemental hospital and prescription drug insurance.

I present estimates of the probit model examining the decision to use any doctor's services in the first column of table 4. Holding supplemental insurance increases the probability of using any doctors' services by 2 per cent. Dummy variables for self-assessed health levels have a positive effect on the probability of using any doctors' services with worse reported health increasing the probability of using services over the base case of excellent health. Both having chronic conditions and taking medications positively affect the probability of using doctors' services.[15] Self-assessed health from two years prior has no significant impact on the probability of using doctors' services, but utilization of health services in 1994 increases the probability of using doctors' services in 1996. Higher-income families are more likely to use any doctors' services than lower-income families. Going to the doctor in 1994 is a strong predictor of going to the doctor in 1996.

The third column of table 4 presents estimates of the probability of having any overnight stays in the hospital. In contrast to the case of doctors' visits, the probability of spending at least one night in the hospital is no higher for those who hold supplemental hospital insurance. Family income has little correlation to the proba-

14 A potential concern might be that the distribution of health insurance and workers by firm size may be different in Quebec, leading to the results reported above. This is not the case. The distribution of health insurance by firm size in Quebec is similar to that of other provinces, with the smallest firms' being slightly less likely to offer coverage (a potential result of the reduced subsidy). The distribution of workers by income across firm size is similar in all provinces.

15 I use two measures of chronic conditions, a dummy variable for having any chronic conditions, and an index of the number of conditions. The results are almost identical.

TABLE 4
Marginal effects from the two-part model of physician and hospital utilization

| N=12050;12089 | Probability of any doctor's visit | Ln (visits) \| visits > 0 | Probability of any stay in hospital | Ln (hospital stays) \| stay > 0 |
|---|---|---|---|---|
| Supplemental health insurance | 0.021** | 0.035** | 0.0043 | 0.035 |
| | (0.0072) | (0.015) | (0.0054) | (0.055) |
| Self assessed: very good health, 1996 | 0.028** | 0.104** | 0.017** | 0.084 |
| | (0.0083) | (0.019) | (0.0078) | (0.089) |
| Self assessed: good health, 1996 | 0.051** | 0.247** | 0.037** | 0.180* |
| | (0.0100) | (0.021) | (0.0085) | (0.093) |
| Self assessed: fair health, 1996 | 0.064** | 0.549** | 0.082** | 0.325** |
| | (0.017) | (0.030) | (0.011) | (0.106) |
| Self assessed: poor health, 1996 | 0.129** | 0.849** | 0.147** | 0.538** |
| | (0.039) | (0.047) | (0.015) | (0.130) |
| Any chronic conditions, 1996 | 0.069** | 0.196** | 0.021** | −0.088 |
| | (0.0076) | (0.017) | (0.0067) | (0.072) |
| Taking any medications, 1996 | 0.073** | 0.124** | 0.025** | −0.084 |
| | (0.0079) | (0.020) | (0.0078) | (0.088) |
| Income level <$5000 | 0.024 | 0.041 | −0.023 | −0.076 |
| | (0.036) | (0.069) | (0.029) | (0.282) |
| Income level $5000–9999 | −0.0077 | 0.010 | 0.0081 | 0.166 |
| | (0.019) | (0.038) | (0.014) | (0.136) |
| Income level $10000–14999 | −0.0015 | 0.0060 | −0.0017 | 0.130 |
| | (0.015) | (0.028) | (0.010) | (0.104) |
| Income level $15000–19999 | −0.00043 | −0.027 | −0.0018 | 0.037 |
| | (0.014) | (0.028) | (0.010) | (0.103) |
| Income level $20000–29999 | 0.00049 | −0.012 | 0.0046 | 0.124 |
| | (0.011) | (0.023) | (0.0086) | (0.088) |
| Income level $40000–49999 | 0.0079 | −0.042* | 0.0036 | −0.0058 |
| | (0.012) | (0.024) | (0.0093) | (0.097) |
| Income level $50000–59999 | 0.024** | −0.049* | −0.0072 | −0.107 |
| | (0.012) | (0.025) | (0.010) | (0.108) |
| Income level $60000–79999 | 0.033** | −0.024 | −0.015 | 0.072 |
| | (0.013) | (0.026) | (0.011) | (0.120) |
| Income level $80000+ | 0.029** | −0.080** | −0.00024 | −0.027 |
| | (0.014) | (0.029) | (0.011) | (0.122) |
| Self assessed: very good health, 1994 | −0.0088 | −0.030 | −0.0086 | −0.055 |
| | (0.0082) | (0.018) | (0.0073) | (0.047) |
| Self assessed: good health, 1994 | −0.012 | −0.00029 | −0.0060 | −0.077 |
| | (0.0100) | (0.021) | (0.0081) | (0.081) |
| Self assessed: fair health, 1994 | −0.029* | −0.030 | −0.0095 | 0.023 |
| | (0.017) | (0.029) | (0.011) | (0.085) |
| Self assessed: poor health, 1994 | −0.030 | 0.0056 | 0.011 | 0.182* |
| | (0.037) | (0.048) | (0.016) | (0.105) |
| Chronic conditions in 1994 | 0.00053 | −0.020 | −0.017** | 0.00084 |
| | (0.0077) | (0.016) | (0.0064) | (0.136) |
| Any medications in 1994 | 0.018** | 0.034* | 0.0046 | 0.019 |
| | (0.0077) | (0.018) | (0.0071) | (0.067) |
| Ln (no. of visits to doctors 1994) | 0.080** | 0.209** | 0.0056 | −0.0038 |
| | (0.0072) | (0.014) | (0.0051) | (0.076) |
| Ln (no. of visits to health professionals 1994) | 0.025** | 0.025** | 0.012** | 0.0038 |
| | (0.0061) | (0.012) | (0.0045) | (0.048) |
| Ln (no. of nights in hospital 1994) | – | – | 0.015** | 0.027 |
| | – | – | (0.0034) | (0.043) |

NOTES: All coefficients are reported as marginal effects. Supplemental Health Insurance includes hospital and drug insurance for doctor's visits and hospital insurance only for hospital stays. Standard Errors in parentheses. **Denotes significance at 5 per cent level; *denotes significance at 10 per cent level. Regressions also include controls for race, provincial dummy variables, public drug plans, work status, age, sex, marital status, household size, number of children, education, and a constant term.
SOURCE: National Population Health Survey, 1994–96

bility of a hospital stay. Other health measures have similar effects, as is true for the use of physician services.

The second equation of the two-equation model estimates the effect of supplemental health insurance on utilization behaviour conditional on an individual having a positive number of visits. The second column of table 4 reports estimates of the conditional utilization of doctors' services. Supplemental health insurance increases the number of visits to a doctor by 4 per cent. This number is similar for holders of prescription drug insurance alone. Conditional on having a positive number of visits to the doctor, higher family income is associated with lower utilization rates.

While we would expect that supplemental health insurance that reduces the cost of using a doctor might affect the probability of visiting a doctor, we would not expect supplemental insurance that does not complement the public system, such as dental insurance, to have such an effect.[16] To check whether or not this is borne out in the data, I include dummy variables for both supplemental health and supplemental dental insurance in the model (the results are not shown here). As expected, the inclusion of a dummy variable for dental insurance has no significant effect on the use of doctors' services in either equation, and the coefficient on supplemental health insurance remains almost unchanged.

Finally, I examine the number of overnight stays in a hospital given at least one night spent in a hospital (the fourth column of table 4). As is true in the probit models, having supplemental insurance is not a significant predictor of overnight stays in a hospital.[17] Chronic conditions and taking medications in both 1996 and 1994 were also insignificant predictors of hospital stays. Family income is not significantly correlated with number of nights spent in the hospital, as is the case with the probability of any visits to the hospital.[18]

To summarize, supplemental private insurance has a positive and significant effect on both the probability of using health and doctors' services and, conditional on positive use, on the magnitude of utilization. Supplemental insurance does not significantly affect the decision to stay overnight in a hospital.[19]

16 I thank one of the referees for making this observation.

17 Note that a visit to a hospital that did not result in an overnight stay would be categorized based on the type of treatment received. For example, if an individual went to a hospital and saw a nurse, it would be classified as a visit to a health practitioner.

18 By controlling for past health utilization and health status, I attempt to purge the moral hazard coefficients of some of the bias due to adverse selection in the purchase of supplemental health insurance. To test whether this is in fact the case I re-estimate the models above using only the data from the 1996 cross-section. The estimated coefficients on supplemental health insurance are of similar magnitude for the decision to utilize any health services and up to 3 percentage points larger (60 per cent larger) for the effect on utilization conditional on positive use than the estimates which control for past use and health status.

19 Many provinces offer some sort of prescription drug coverage for the elderly and poor. Individuals who qualify for such subsidies may use more services as a result. To separate the effects of such plans on utilization from the effects of private coverage on utilization, I include dummy variables for individuals who live within a province and whose characteristics would qualify them for such a plan. I do not have information on whether individuals actually received help from such a plan. The coefficients on the dummy variables representing these plans are included in the two equation model estimates, although not reported here.

Individuals with private information about their health status and future utilization may purchase health insurance to offset anticipated future expenses. This adverse selection in purchasing supplemental insurance may create biased estimates of the effect of holding health insurance on utilization. Partially to control for this selection, I include information on past and present health status and past utilization in my estimated model. However, the possibility that health insurance is still correlated with unmeasured health status may bias the above results. I therefore use an instrument for holding supplemental insurance in analysing determinants of health utilization in both the probit and the ordinary least squares regression (using two-stage probit and two-stage least squares models). As an instrument for holding health insurance I use the individual's tax subsidy for supplemental health insurance. The subsidy (as shown above) is a significant predictor of whether an individual has supplemental insurance, but is not correlated with unobservable health status. Also, as noted above, the tax subsidy differs significantly across provinces, even among individuals with identical incomes. As in the regressions on the effects of tax-prices on the decision to purchase insurance, I rely on the combined federal and provincial marginal tax rate for individuals in provinces other than Quebec and the federal marginal tax rate alone for individuals residing in Quebec. With these tax subsidies as instruments I can better separate any moral hazard effects from potential adverse selection effects.

The results from the two-stage probit model (part one of the two-part model) confirm the earlier results. Holding supplemental health insurance significantly increases the probability of using any doctors' services. This result is consistent with evidence from the RAND health insurance experiment, which finds the strongest effects of health insurance on the probability of initiating contact with a doctor (Newhouse 1993).[20] The results from the two-stage least squares model (part two of the two-part model) show no effects from holding supplemental insurance on the level of utilization given positive use. In contrast to the case of the single-stage results, which showed small increases in utilization, I cannot reject the fact that the marginal effect of holding supplemental insurance on utilization, given positive use, is zero. The coefficients on other regressors are not significantly different from those reported in the single-stage estimates. The second-stage results are reported in table 5.[21]

The two-stage estimates on the effect of supplemental hospital insurance on hospital use also are consistent with the single-stage estimates. Estimates of the effects of holding supplemental insurance on hospital use show no effects on either the decision to use any overnight hospital services, or on the level of services conditional on positive use. Again, coefficients on other regressors are similar to those presented in the single-stage results.

20 The context of the RAND study differed, however, in that it examined the direct effect of cost-sharing on utilization. Here, I examine the indirect effect of cost sharing for privately insured services on the use of publicly insured care.

21 The P value on Chi-squared statistic on the first stage is 0.00. The z-statistic on the excluded instrument is 2.5.

TABLE 5
Two-stage estimates of the two-part model of physician and hospital utilization

| | Two-stage probit: any doctors' services | 2SLS: ln(util\|util > 0) doctors' visits | Two-stage probit: hospital use | 2SLS: ln(util\|util > 0) hospital stays |
|---|---|---|---|---|
| Supplemental health insurance | 0.026 ** | −0.186 | −0.155 | 0.248 |
| | (0.013) | (0.593) | (0.250) | (1.110) |

NOTES: Coefficients reported as marginal effects. Corrected standard errors in parentheses. **Denotes significance at 5 per cent level; *denotes significance at 10 per cent level.
SOURCE: Survey of Work Arrangements, 1995 and National Population Health Survey, 1994–96

The two-stage results provide further evidence of the impact of supplemental insurance on the use of public health services and hence of the tax subsidies for such insurance on the use of public health services. The effect of supplemental health insurance on the use of doctors' services conditional on positive use decreases by 60 per cent once we control for past utilization and completely disappears once we further control for adverse selection using tax subsidies as an instrument for holding health insurance. In contrast, the effect of holding supplemental insurance on the decision to use any doctors' services remains constant both after controlling for past health utilization and after controlling for adverse selection using tax subsidies. This finding suggests that the estimated effect captures the moral hazard effect of holding supplemental insurance on the use of doctors' services.

## 8. Conclusions

Tax-based subsidies to employer-provided health insurance affect the demand for supplemental health insurance. I estimate semi-price elasticities of demand for supplemental health insurance in the range of −0.4, implying that removing the subsidies would cause levels of supplemental health insurance to decline by 13 percentage points, or roughly 20 per cent.

Combining the results from the two-part models, I estimate that individuals who hold supplemental insurance use approximately 10 per cent more publicly funded physician services than individuals who do not hold such insurance. As much as half of this additional use can be attributed to moral hazard from holding private supplemental health insurance. Hence, private insurance is increasing the public cost of certain health care services. Since government subsidies to employer-provided private insurance increase coverage levels, they thus indirectly increase the cost of certain publicly funded health care services as well.

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