Evidence on the determinants of Canadian provincial government health expenditures: 1965–1991

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Abstract

Real per capita provincial government expenditures on health care over the period 1965–1991 are examined using pooled time-series cross-section regression analysis. Key determinants of real per capita provincial government expenditures on health care over the period 1965–1991 are real provincial per capita income, the proportion of the provincial population over age 65 and real provincial per capita federal transfer revenues. Established program financing had a negative and significant impact on real per capita provincial government health expenditures in Newfoundland and Quebec. An income elasticity of 0.77 implies that health care is not a luxury good. © 1998 Elsevier Science B.V.

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1. Introduction

Like other major industrialized countries, Canada has seen a steady increase in per capita health expenditures and the share of GDP accounted for by health

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spending in the postwar era. For example, over the period 1960–1987, the health care expenditure to GDP ratio for Canada rose from 5.5% to 8.8%. For France, it rose from 4.2 to 8.5%, Germany 4.7 to 8.1%, Italy 3.3 to 7.2%, the United Kingdom 3.9 to 6%, Japan 2.9 to 6.8% and the United States from 5.2 to 11.2% (Schieber, 1990: 159). Compared to these major OECD countries, Canada had one of the lowest rates of increase in the health care to GDP expenditure ratio over this time period [2].

Nevertheless, rising public expenditures on health care are a major policy concern in Canada and the recent public sector fiscal problems have placed additional stress on the public funding of health care. In Canada, the federal and provincial governments jointly finance public expenditures on health but under the provisions of the British North America Act it is largely up to the provincial governments to actually deliver publicly funded health care to citizens. About 47% of health care spending in Canada is financed by provincial governments while another 22% comes from federal transfers to the provinces which means that provincial governments in Canada are responsible for nearly 70% of health care expenditures in Canada.

An important question for policy purposes is what factors have determined growth in provincial government health care spending [3]. There is now an international literature examining the determinants of health expenditures across countries which can be applied to Canada's provinces. Moreover, the publication of public finance historical statistics for the period 1965/66–1991/92 now provides a consistent definition of government expenditures on health care across provinces which facilitates the analysis of provincial government health expenditures. This paper uses a pooled time-series cross-section approach to estimate and examine the determinants of provincial government health spending over the period 1965–1991.

The results of the paper show that the key determinants of real per capita provincial government expenditures on health care over the period 1965–1991 are real provincial per capita income, the proportion of the provincial population over age 65 and real provincial per capita federal transfer revenues. The estimated income elasticity of real per capita provincial government health care expenditures is 0.77 suggesting that over this time period, provincial government health expenditures were not a luxury good. In addition, the introduction of Established Program Financing (EPF) had a negative and significant impact on real per capita provincial government health expenditures in Newfoundland and Quebec.

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[2] The Canadian success in controlling health expenditures relative to GDP is quite striking when compared with the United States. See also Evans et al. (1989).

[3] For an overview of some of the issues in Canadian health care as well as patterns of funding, see Blomqvist and Brown (1994), Brown (1991), Culyer (1988) and Evans (1983).

Overall, the results suggest that federal transfers are a very important determinant of provincial health spending and the decline in federal cash transfer payments that will come about as a result of the new Canada Health and Social Transfer will lead to a decline in real per capita provincial health spending. When the transfer decline is combined with a growing proportion of population over age 65, it suggests that provincial health care expenditures will continue to be a demanding policy issue.

In the remainder of the paper the determinants of health care literature is surveyed in order to place the results of this paper into proper context. An overview of the provincial data is then provided which examines the trends in health care expenditures across Canada's provinces. This is followed by a discussion of model results using a pooled time-series cross-section regression analysis approach and concluding remarks.

2. The health expenditure determinants literature

Over the last quarter century, a body of literature examining the determinants of health care expenditures has arisen in an effort to explain why health expenditures have risen so much in the postwar era and to offer suggestions as to what variables can be influenced to reduce costs. Most of these studies have used a determinants approach in which per capita health care expenditures are regressed on variables thought to affect health expenditures. Among the determinants of per capita health expenditures have been income, the proportion of population either over 65 or under age 15, the public finance share of health care spending, urbanization, amount of foreign aid and the number of practicing physicians per capita. A great deal of attention has focused on the role of income in explaining international variations in health care expenditures and has given rise to what Culyer (1988, p. 5) refers to as one of the great 'monocausal' myths, namely, that health care is a luxury good because its income elasticity of demand is greater than one.

Newhouse (1977) regresses per capita medical expenditures on GDP per capita for 13 countries circa 1970 and finds that ''over 90% of the variance in per capita medical expenditure in these countries can be explained by variation in per capita GDP'' (Newhouse, 1977, p. 117). Newhouse finds an income elasticity for health care spending greater than one, ranging from 1.15 to 1.31, and concludes that medical care, by the technical definition, is a luxury good. These results were consistent with an earlier study by Kleiman (1974) and together these papers have given rise to a literature viewing income as a major determinant of health expenditure. Their results have been reinforced by many subsequent studies.

Leu (1986), using cross-sectional data for 19 OECD countries in 1974, found income elasticities ranging from 1.18 to 1.36. Parkin et al. (1987) using similar methods and data from 1980 found income elasticities of 1.12 to 1.18. Brown (1987) used a sample of 20 OECD countries circa 1978 and estimated an income

elasticity of 1.39. Gerdtham et al. (1992) used a single cross-section of 19 OECD countries in 1987 and reported per capita income, urbanization and the share of public financing to total health expenditure as positive and significant variables with the income elasticity being reported at 1.33.

Gbesemete and Gerdtham (1992) used a cross-sectional sample of 30 African countries in 1984 and reported that per capita GNP was the most significant factor in explaining per capita health expenditures but the elasticity was slightly less than 1.0. Other positive and significant factors included foreign aid received in per capita U.S. dollars and the percent age of births attended to by health staff, that is, hospital deliveries. The foreign aid variable is of particular interest in the Canadian case because it represents a source of external financing and thus makes a case for including federal transfer revenues as a determinant of provincial health care expenditures.

These international comparisons of health care expenditures are marked by a number of acknowledged problems. Among them are the fact that the definition of what constitutes health care expenditures is not internationally standardized, the difficulties of constructing exchange rate conversions for the data, and the fact that input prices may be correlated with the level of national income (see Leu, 1986, p. 43). As a result of the last problem, the high elasticities estimated may reflect pricing as well as quantity or use differences across countries. A further problem with many of these studies is the small sample size. Normally, the estimated elasticities have come from a small cross-section of 13–20 countries.

Some recent work on the international determinants of health care expenditures has attempted to deal with the small sample size problem by using pooled time-series cross-section data. As well as increasing the sample size, the use of pooled time-series cross-section data has enabled the use of country-specific shift dummies to allow for differences in expenditures across countries that might not be due to the exogenous variables alone. Such studies have relevance for the Canadian case in particular. Given that health expenditures are largely a provincial responsibility, the use of pooled time-series cross-section data is a good way to examine inter-provincial trends and differences in health expenditures while maximizing sample size.

Hitiris and Posnett (1992) used 560 pooled time-series and cross-section observations from 20 OECD countries over the period 1960–1987 and found a strong and positive correlation between per capita health spending and GDP with an income elasticity of about unity. They also introduced a set of country-specific shift dummies to test whether the countries in the sample represent a single homogeneous group or a number of heterogeneous groups and found these shift dummies to be significant. As well, they included the proportion of the population over age 65 as a variable and found it to be positive and significant while the public finance share of health expenditures was found to be insignificant.

A pooled time-series cross-section approach was used in this paper to study the growth of real per capita provincial government health care expenditures in

Canada because of the fact that it is the provinces that deliver health care to people [4]. While a time series regression of total per capita public sector health expenditure in Canada on per capita GDP is a legitimate way of studying the determinants of spending, it omits the obvious regional differences that can emerge across Canada. As well, such an approach limits the sample size of the study.

Some of the problems that have affected international studies of per capita health care expenditures are not relevant to a study of provincial health care spending and therefore simplify the analysis. For example, one does not have to worry about exchange rate differentials in any cross-sectional provincial study. As well, one need not be as concerned about separating price from quantity changes across provinces. Across countries, labour markets are more independent than within the regions of a country. As Brown (1991, p. 39) notes: ''Across regions of a country there tend to be common labour markets for most health professions, with the consequence that labour incomes (and, therefore, health care prices) are relatively constant. The main expenditure variation that emerges reflects differences in use''.

International income disparities are much greater than those within a country and since richer countries tend to pay their health practitioners more, in cross-country studies, this may be reflected in the correlation between health care expenditures and income and result in very high income elasticities. The interpretation of health care as a luxury good because of the high estimated income elasticities has been criticized because intuition suggests that health care is more of a necessity than a luxury (Culyer, 1988, p. 20). As well, since health care is so heavily subsidized in most countries, one would expect that ability to pay might be a less important determinant of expenditure.

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[4] Some recent studies on the determinants of health expenditures have criticized the time series literature on the basis of the issue of stationarity and applied a cointegration approach. (See Mills, 1994, pp. 92–103, 273–279; Davidson and Mackinnon, 1993, pp. 715–722; Hendry, 1986, pp. 201–227; Muscatelli and Hurn, 1992, pp. 1–43). Hansen and King (1996) use a model based on Hitiris and Posnett (1992) and a complete data set for 20 OECD countries over the period 1960 to 1987 to show that the variables in a 'standard' model of health care expenditure for 20 members of the OECD were not collectively stationary in levels. Applying the Augmented Dickey Fuller (ADF) test to the data, two-thirds of the variables tested were found to be nonstationary in levels implying that any positive correlations amongst the variables might be spurious. Murthy and Ukpolo (1994) used time series data for the United States over the period 1960–1987 and applied cointegration techniques to find that per capita income, age of the population, the number of practicing physicians and public financing of health care are important determinants of health care spending. Their results do not differ from the main body of literature as they found that the income elasticity of health care spending is not significantly different from one. An ADF test was applied to the variables in this study and found that half were stationary in levels. In light of the fairly high degree of stationarity exhibited by variables in this data set along with the inconclusive nature of testing for stationarity, there is no reason to opt for a cointegration approach using individual provincial regressions over a pooled time-series cross-section approach.

Culyer (1988) suggests that the luxury good view of health care may be based on a misspecification of the determinants of health. Hansen and King (1996, p. 136) also emphasize that the standard model may be misspecified. Culyer emphasizes the possibility of omitted variables as a cause of the misspecification in the determinants of health care literature [5]. However, the problem may also lie in the nature of the data being examined. Single cross-section cross-country studies may not be the most appropriate way to examine the determinants of health care expenditures given that the aforementioned problems could help generate income elasticities greater than one. The use of an international pooled time-series cross-section by Hitiris and Posnett (1992), on the other hand, resulted in an income elasticity estimate of one. Restricting analysis to one country with multiple jurisdictions that reduces the impact of price variations on the estimates might prove to be a further improvement. The Canadian federation, with its ten provinces, provides an excellent environment for such an analysis [6].

3. Overview of the data

The dimensions of provincial government health expenditures are outlined in Figs. 1–3 [7]. The rise in real per capita provincial government health expenditures was quite steady over the period 1965–1991 as Fig. 1 illustrates, with growth rates the highest over the period 1965–1975. In 1965, real per capita spending (1986 dollars) averaged $288 and was quite similar across the country at $317 in the Prairies (Alberta, Saskatchewan, Manitoba), $292 in Ontario, $286 in Quebec, $277 in the Atlantic provinces (Newfoundland, Prince Edward Island, Nova Scotia and New Brunswick) and $267 in British Columbia. By 1980, average real per capita spending had risen threefold to $928 but the variance was now much greater [8]. Spending was now highest in British Columbia at $1,068, followed by the Prairies and Quebec at $963 and $950 respectively, then Ontario at $861 and finally the Atlantic provinces at $796. By 1991, average real per capita expenditure rose to $1,202 and was highest at $1,294 in British Columbia, followed by Ontario at $1,284, the Prairies at $1,204, Quebec at $1,131 and finally the Atlantic provinces at $1,098.

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[5] Culyer (1988, p. 46) concludes that the missing variable is probably ''too subtle to be readily quantified'' but it lies in the public budgeting mechanism used to fund health care.

[6] As a further emphasis to these points, the Gbesemete and Gerdtham (1992) paper examines only African countries and reports an income elasticity of slightly less than 1. There is greater homogeneiety of income and other variables in a data set of African countries alone than in one that combines African and non-African countries.

[7] Sources: Statistics Canada, Public Finance Historical Data, 1965/66–1991/92, Catalogue No. 68-512; Provincial Economic Accounts, Catalogue No. 13-213.

[8] The coefficient of variation for average per capita health spending rises from 6.6 in 1965, to 11.2 in 1980 and falls to 7.3 by 1991.

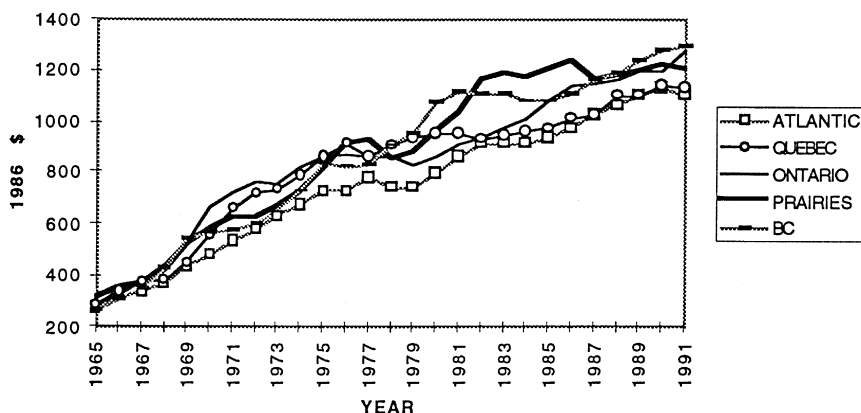REAL PER CAPITA PROVINCIAL GOVERNMENT
HEALTH EXPENDITURES

Fig. 1. Real per capita provincial government health expenditures.

As a share of provincial budgets (Fig. 2), the average share devoted to health care spending has remained remarkably stable over the 1965 to 1991 period. In 1965, about 28.2% of provincial spending was for health care and this fell slightly to 27.1% by 1980 and recovered to 27.7% by 1991. However, across provinces, there were variations in this figure with British Columbia and Ontario together at

PROVINCIAL GOVERNMENT EXPENDITURES ON
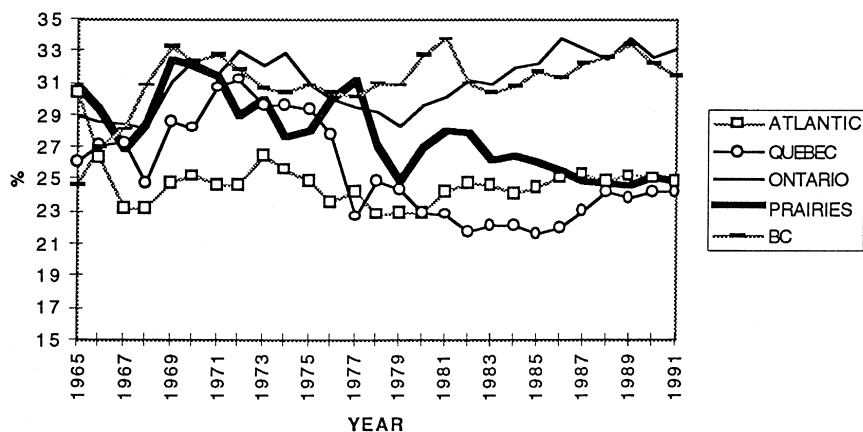HEALTH AS A SHARE OF TOTAL EXPENDITURE

Fig. 2. Provincial government expenditures on health as a share of total expenditure.

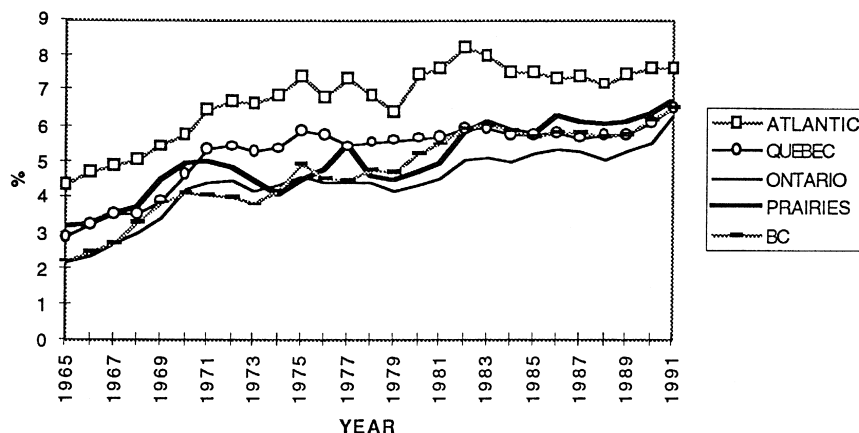## PROVINCIAL GOVERNMENT HEALTH EXPENDITURES
TO GDP RATIO

Fig. 3. Provincial government health expenditures to GDP ratio.

the upper end and the remaining provinces devoting much lower shares of their total expenditures to health. In the Atlantic provinces, spending on health care fell from 30.4% of provincial spending in 1965 to 24.9% by 1991. A similar decline occurred in the Prairies where the fall was from 30.8% to 24.9% while in Quebec the decline was much smaller, from 26.1% to 24.2%. On the other hand, the health care share of the budget rose in both Ontario and British Columbia over this period. Ontario saw an increase from 29% to 33.2% while British Columbia's share rose from 24.7% to 31.5%.

Another measure of the growth of provincial government health care expenditures is provided in Fig. 3 where the government health expenditure to GDP ratios are plotted. In 1965, provincial government expenditures on health averaged 3.0% of GDP and this rose to 5.5% in 1980 and 6.7% by 1991. Whereas there was some divergence in per capita provincial government health spending across provinces between 1965 and 1991, there was actually some convergence when it came to the proportion of GDP accounted for by provincial health expenditures [9]. The Atlantic provinces consistently devoted the highest proportion of GDP to provincial health expenditures. In 1965, the Atlantic provinces were followed by the Prairies, Quebec, Ontario and British Columbia. While Quebec's ratio was higher than the Prairies during the early 1970s, by 1991, the Prairies again had the second highest GDP share, followed by Quebec, Ontario and British Columbia.

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[9] The coefficient of variation for share of GDP accounted for by provincial government health spending rose from 86.8 in 1965 to 120.5 in 1980 and then falls to 51.2 by 1991.

These figures suggest that provincial expenditures on health care have indeed risen substantially since the 1960s but their overall share of provincial expenditure has remained stable. However, some provinces, notably the Atlantic and Prairies, have seen the proportion of their budgets devoted to health care shrink from just under one third to one quarter. On the other hand, Ontario and British Columbia have seen health care spending assume greater importance in their provincial budgets. The view of runaway growth in health spending may characterize the period before 1980 but the period since 1980 has been one of restrained growth particularly in comparison with other major industrialized countries. The share of GDP accounted for by provincial government health expenditures grew by 84% between 1965 and 1980 while from 1980 to 1991, it only grew 23%. As well, there are regional variations in health spending with the Atlantic provinces devoting the largest share of GDP to it and Ontario the lowest.

4. Model and estimates

The basic model estimated in this paper is drawn from the determinants of health expenditure literature. Real per capita provincial government expenditures on health care are assumed to be a function of real provincial per capita income, the proportion of the provincial population over age 65 and real provincial per capita federal transfer revenues. The model is specified in log–log form so that the coefficient estimates are elasticities and therefore enable us to interpret the responsiveness of provincial health expenditures to the variables [10]. As well, provincial and provincial-interactive dummies are specified to allow for differences across the provinces in real per capita provincial government expenditures. The data set consists of 10 provincial annual time-series over the period 1965–1991 resulting in 270 observations.

Provincial government expenditures on health care were obtained from Statistics Canada, Public Finance Historical Data, 1965/66–1991/92, 68–512. The provincial government health expenditure data for 1988–1991 were revised according to Statistics Canada, Public Sector Finance, 1994–1995, 68–212. The income variable used is provincial gross domestic product and was obtained from Statistics Canada's Provincial Economic Accounts, 13–213 as was the federal transfer revenue variable. These three variables were converted into real per capita form by dividing through by provincial population and deflating using the provincial consumer price index (CPI) for 1986 = 100 obtained from CANSIM (Statistics Canada). Population and the proportion of the population greater than 65 were obtained from Statistics Canada, Revised Annual Estimates of Population

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[10] The log–log specification is also the most used specification in the literature.
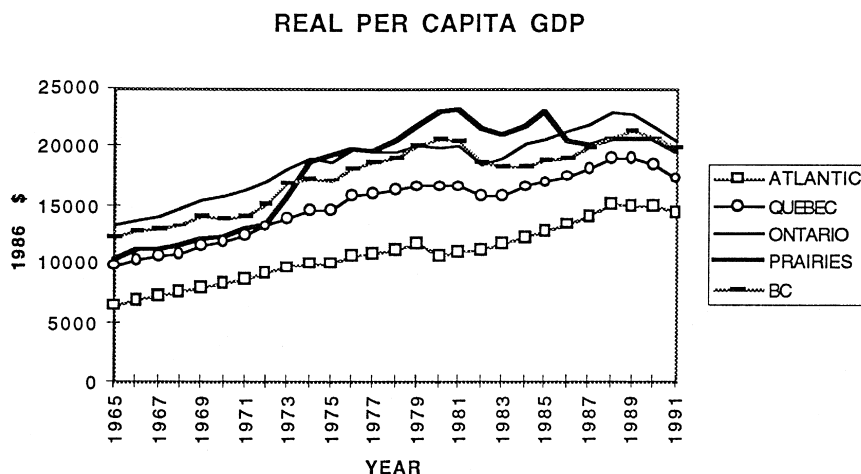
REAL PER CAPITA GDP

Fig. 4. Real per capita GDP.

by Sex and Age group, Canada and the Provinces, 91–512 (1965–1970) and Revised Intercensal Population and Family Estimates, 91–537 (1971–1991). The specified dummy variables included 10 provincial dummies as well as an Established Program Financing (EPF) dummy (one for each province) to capture the onset of EPF after 1977.

The inclusion of a per capita income variable is standard in studies of health care expenditure determinants and one would expect higher income provinces to spend more on health care. Real provincial per capita gross domestic product (GDP) is plotted in Fig. 4. Quebec and the Atlantic provinces have generally had much lower levels of real per capita GDP relative to the rest of the country over the period 1965–1991 and it is not surprising, therefore, that they generally were the lowest per capita spenders on health care.

While the inclusion of the income variable requires little additional discussion, a few points need to be raised regarding the proportion of population older than 65, federal transfers and EPF. The proportion of the population aged greater than 65 is expected to have a positive effect on real per capita provincial government health expenditures. Health care consumption is unevenly distributed over the life-cycle with increasing use by the elderly. In general, costs are relatively high for infants, decline sharply during the first few years of life and then rise, at first gradually, but then more sharply as the population ages.

Canadian studies have shown that the per capita costs of health care for a 60 year old are nearly double that for a 40 year old while those for a 70 year old are nearly triple those of a 40 year old (Denton and Spencer, 1975, p. 38). In a physician fee-for-service study done for British Columbia, the average annual per capita cost increase for people aged 75 and over was 5.5% with fastest growth in
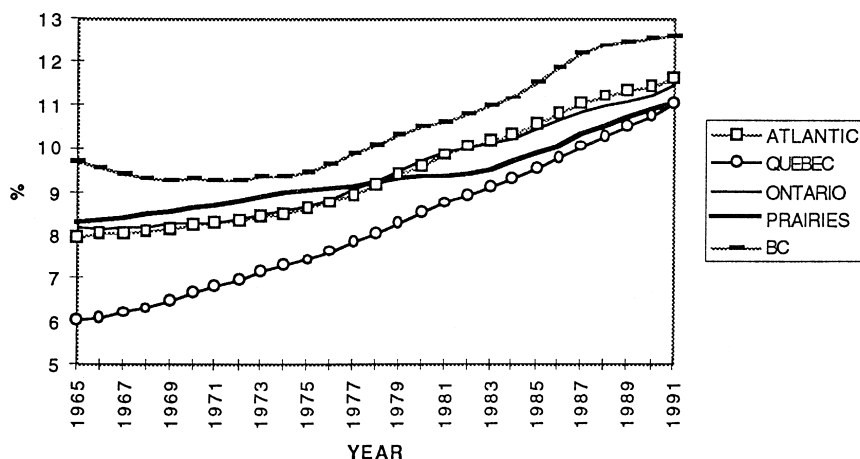
PROPORTION OF POPULATION > AGE 65

Fig. 5. Proportion of population > age 65.

the use of specialist care (Barer et al., 1989, p. 39). Studies for the United States also show similar patterns and trends in health care expenditures associated with the aging of the population (Waldo et al., 1989; Schrimper and Clark, 1985). Given that the proportion of population over age 65 was 7.6% in 1961 and is expected to reach 18% by 2025 (Marzouk, 1991, p. 490), it can be assumed that the growing number of elderly will be a major factor in rising health care expenditures. Over the period 1965–1991, the proportion of elderly grew in all of Canada's provinces as illustrated in Fig. 5. British Columbia consistently had the largest proportion of its population over age 65 while Quebec demonstrated the most phenomenal growth nearly doubling the share over age 65 during the 27 year period.

The federal transfer revenue variable is important to a study of the determinants of real per capita provincial government health care expenditures because transfers are an important source of revenue to Canada's provincial governments though they vary in importance across the country. About 20% of provincial government revenue is obtained from federal transfers but this ranges from over 40% in the Atlantic provinces, to a low of 12% in Alberta. Fig. 6 shows that real per capita federal transfers grew from 1965 until the mid 1970s and then leveled off and even declined (especially for Quebec) during the 1980s. In per capita terms, the largest federal transfer recipients were the Atlantic provinces, Quebec and the Prairies.

By 1991–1992, federal cash transfers to the provinces and territories totaled 24.2 billion dollars of which 41% was general purpose transfers (e.g.,
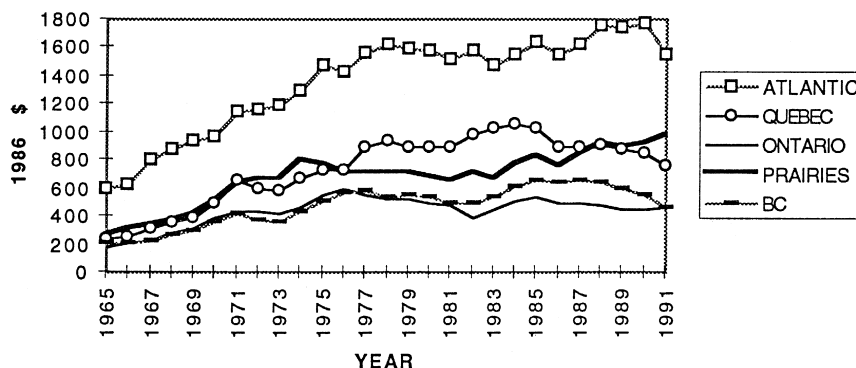
REAL PER CAPITA PROVINCIAL TRANSFER REVENUE

Fig. 6. Real per capita provincial transfer revenue.

equalization [11]), 28% was specific purpose transfers (e.g., Canada assistance plan, justice) and the remainder, 31%, was Established Program Financing (EPF) for health and post-secondary education (Canadian Tax Foundation, 1992 16:19). The EPF health grant in 1991–1992 was 5.8 billion dollars or about 24% of total cash transfers to the provinces. Thus, while only 24% of federal cash transfers are specifically designated for health care, general purpose transfers are also potentially available for use on health care meaning that up to two thirds of federal transfers to the provinces could be used to fund health care spending by the provinces.

A final point on transfers concerns EPF. Prior to 1977, the federal government was providing cash transfers that essentially funded 50% of all provincial health care expenditures [12]. The rapid increases in provincial health care expenditures of the 1970s alarmed the federal government and this open-ended grant system was replaced starting in 1977 with the established program financing system which linked the cash grant for health and post-secondary education to provincial income and population growth and thus cut the direct link between provincial health expenditures and the federal cash contribution. In 1986, as part of its deficit

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[11] Equalization is provided to provinces with below average fiscal capacity and current recipients include all the provinces except British Columbia, Alberta and Ontario.

[12] Under the provisions of Medicare which Canada's provinces entered between 1968 and 1970, the federal contribution was to be a per capita payment for provincial residents enrolled in the plan equal to one-half of the average national per capita cost. Use of national per capita cost figures benefited provinces that spent below the national average. For a discussion of the trials and tribulations involved in adopting Canadian Medicare, see Perry (1989, pp. 623–677).

Table 1
Final regression results

Independent variable: Real (1986 $) per capita provincial government health expenditures
Functional form: log–log
Estimation range: 1965–1991

Variable	Coefficient	t-statistic
Real per capita GDP	0.77	11.3
Proportion of population	0.81	7.3
Aged > 65		
Real per capita federal transfers	0.48	13.9
Constants		
Newfoundland	−5.49	−14.9
Prince Edward Island	−6.05	−17.4
Nova Scotia	−5.79	−15.7
New Brunswick	−5.83	−15.8
Quebec	−5.39	−13.3
Ontario	−5.53	−13.2
Manitoba	−5.84	−15.1
Saskatchewan	−5.79	−14.8
Alberta	−5.45	−12.7
British Columbia	−5.61	−13.7
EPF Newfoundland	−0.18	−3.4
EPF Quebec	−0.22	−5.9
Buse R-square[a]	0.92	
Log of the likelihood function	323.0	

[a] See Buse (1979).

control strategy, Ottawa further restricted the growth of EPF transfers [13]. In an effort to see if the onset of EPF placed downward pressure on provincial per capita health expenditures, interactive provincial EPF dummy variables were specified which took on a value of 1 for the period 1977–1991 and zero otherwise.

A pooled time-series cross-section regression was estimated for real per capita provincial government health expenditures using SHAZAM 7.0 with final results provided in Table 1. All the coefficient estimates are significant at the 5% level. The pooling technique used is that of Kmenta (1986) for data that is cross-sectionally heteroskedastic and time-wise autoregressive with the constant slope coefficients assumption [14]. Box-Cox testing for functional form yielded the log–log specification as the best. In the preliminary work, specifications were estimated

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[13] For additional information on EPF and transfers, see Carter (1988, 1994); Perry (1989, pp. 446–453, 651–652).

[14] The results presented in this paper assume cross-sectional independence but the model was also estimated under the assumption of cross-sectional dependence in the error terms and generated coefficients and significances very similar to those reported in this paper but with a slightly smaller R^2. For example, the per capita income coefficient was 0.79, 0.80 for proportion of the population over 65 and 0.40 for per capita federal transfers.

which also allowed for interaction between the provincial dummies and income, the proportion of the population aged 65 and over, the federal transfer revenue variables well as the EPF variables. These specifications allowed for variation across the provinces not only in the constants but also the coefficients. However, only the EPF provincial interactive dummies for Newfoundland and Quebec were significant and retained in the final specification.

The results in Table 1 show that real per capita provincial government health expenditures are positively and significantly related to real per capita provincial income, the proportion of the provincial population aged 65 and over and real per capita provincial federal transfer revenue. As well, the constant differed across the provinces [15]. In addition, the onset of EPF appears to have had a negative and significant effect on the level of real per capita provincial government health expenditures only in Newfoundland and Quebec. The regression explains about 92% of the variation in real per capita provincial government health expenditures.

The income elasticity of real per capita provincial government health expenditures is less than one at 0.77 [16]. While this estimate is smaller than those from the international literature that usually places the income elasticity at one or greater, it is reasonable given the earlier discussion that international cross-section studies are capturing cost as well as use differences in the income coefficient and therefore may represent an overestimate of the income elasticity of health expenditures. These results suggest that health care expenditures are indeed more of a necessity than a luxury good.

In terms of elasticity, the proportion of provincial population aged greater than 65 has a larger impact than income with an elasticity of 0.81. In accord with the literature, all things given, the aging Canadian population will result in higher real per capita provincial government health expenditures. In 1991, the proportion of population in Canada aged 65 and over was 11.6%. If this proportion does increase to 18% by 2025 as per the cited projection, then this will result in a 45% increase in real per capita provincial government health expenditures over the period 1991–2025. Averaged out over the 34 year period, aging of the Canadian

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[15] *F*-tests were conducted to test for the collective significance of the constants as well as to whether there should be a common intercept for the provinces. A test for the collective significance of the constants with the null hypothesis H_o: $B_1 = B_2 = \ldots B_n = 0$ yielded an *F*-value of 21.5 allowing us to reject the null hypothesis and conclude that the constants were collectively significantly different from zero. More importantly, we also addressed the question as to whether there should be a common constant or whether the constants should differ across cross-sections. In essence should the model have constrained intercepts (a regression with a single common intercept for the cross-sections) or unconstrained intercepts (separate intercepts for each cross-section). Both specifications were run and we used an *F*-test with the null hypothesis being that the intercepts are all equal, that is: H_o: $B_1 = B_2 = \ldots B_n$. The value of the *F*-statistic was 21.3 allowing us to reject the null hypothesis and conclude that the constants should not be constrained to a common value.

[16] Again, it must be stressed that this elasticity pertains to provincial government health expenditures. The income elasticity of total health expenditures may be larger.

population alone would add about 1.3% per year to real per capita provincial government health expenditures [17].

Federal transfers are also important determinants of the level of real per capita provincial government health expenditures with an elasticity of 0.48. Given that direct federal transfers for health services by 1991 accounted for about 25% of cash transfers, a 0.48 elasticity (implying nearly half of every federal per capita transfer dollar is going to real per capita provincial government health expenditure) suggests that large portions of unconditional federal transfers to the provinces were being directed into health care expenditures. The implication is that much of the equalization payments received are being spent on the provision of health care. As the importance of the cash component of federal transfer payments declines with the onset of the new Canada Health and Social Transfer, equalization payments will assume even greater importance to recipient provinces for the funding of their health care systems.

Finally, the negative coefficient on EPF is not unexpected though why it would be significant only for Quebec and Newfoundland does require some explanation. A possible explanation is that health care expenditures may have been less of a government priority but it is difficult to effectively measure that. It is possible that other provinces were able to offset the EPF declines either via other grant income or through own source revenues in a manner not available to Newfoundland or Quebec. As well, there may be institutional factors in the delivery or even composition of health care expenditures that may have made the impact of EPF more significant in these two provinces.

Both Newfoundland and Quebec experienced government revenue growth at or just below the national provincial government average over the period 1981/82–1991/92. While average revenue grew 109% over this period, Newfoundland's grew 110% while Quebec's grew only 99%. In contrast, Ontario grew at 144% and Manitoba at 129%. The generally weak performance of the Quebec and Newfoundland economies would have weakened own source revenue capabilities and therefore the EPF system could have had more of a negative impact on their health care systems.

Another possible explanation is rooted in the composition of health care expenditures in these two provinces. Both Quebec and Newfoundland had an above average share of their health expenditures in more capital intensive hospital and institutional care. In 1985, while an average of 59.2% of health expenditures across Canada's provinces were for institutional and related expenses, the comparable figures were 65.8% in Newfoundland and 62.7% in Quebec (Brown, 1991, p. 19). In terms of nurses per 100 000, the national average was 1026 while the figure was 1187 for Quebec and 1024 for Newfoundland. Given the more institutionally

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[17] Evans (1987, p. 167) estimates that the impact of aging on total per capita health costs to be in the neighborhood of 1% per annum over the next 20–40 years.

Table 2
Average annual growth rate (%) of real per capita (1986$) provincial transfer revenues

Year	Atlantic	Quebec	Ontario	Prairies	BC
1966–70	10.70	15.44	16.56	13.19	11.82
1971–75	9.20	9.22	7.20	9.70	7.48
1976–80	1.46	4.53	−1.56	−2.54	1.90
1981–85	0.80	2.81	2.23	4.42	4.23
1986–90	1.72	−3.49	−3.83	2.29	−3.40

intensive nature of health care in these two provinces, the onset of EPF combined with slower revenue growth may have placed more strain on the funding of health care in Newfoundland and Quebec and resulted in declines in their real per capita health spending.

These results suggest that federal transfer payments have been important in determining health care expenditures by provincial governments. The slowing down in the rate of growth of Canadian health expenditures relative to other industrialized countries in the post 1970 period may have a purely fiscal federal explanation. Culyer (1988, pp. 24, 25) noted that after 1971, the Canadian rate of growth of health expenditures fell dramatically and that standard models tend to overpredict its health expenditures in the post 1980 period. This suggests that there must be some important determinant of health care spending that has been omitted in models estimated to date. It is possible that this variable is federal transfers to the provinces.

The decline in health expenditure growth rates coincides with large reductions in the rate of growth of federal transfer payments beginning in the mid-1970s. As Table 2 shows, between 1971–1975 and 1976–1980, average annual growth in real per capita federal transfer payments fell from 9.2 to 1.5% in Atlantic Canada, 9.2 to 4.5% in Quebec, 7.2 to −1.6% in Ontario, 9.7 to −2.5% in the Prairies and 7.5 to 1.9% in British Columbia. Growth rates of federal transfers to the provinces have never recovered to their pre-1975 levels and are poised to undergo further reductions as the Canada Health and Social Transfer is implemented.

The implementation of the Canada Health and Social Transfer, which will combine health, social assistance and post-secondary education transfers into one block grant, will see total major transfer entitlements from the federal government to the provinces drop from a high of 28.9 billion dollars in 1995–1996 to 25.1 billion by 1997–1998, a 13.1% decline [18]. When converted into real per capita figures [19], this translates into a decline of 18.2% which based on a real per capita

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[18] Source: Canadian Tax Foundation, 1996 (2:5, 8:1).

[19] Given a population of 29.6 million and a CPI (1986 = 100) of 133.5 in 1995, assuming 1% population growth till 1997 and 2% inflation, real per capita federal transfers are $731 in 1995–96 and $598 in 1997–98.

federal transfer elasticity of 0.48, generates a decline in real per capita provincial government health expenditures of 8.7%, all other things given.

5. Conclusion

This paper has utilized a pooled time-series cross-section data set for Canada's provinces over the period 1965–1991 to examine the determinants of real per capita provincial government health expenditures. The regression results explain 92% of the variation in real per capita provincial government health expenditures and show that real per capita provincial government health expenditures are positively and significantly related to real provincial per capita income, the proportion of the provincial population aged 65 and over and real provincial per capita federal transfer revenue. In addition, the onset of EPF had a negative and significant effect on the level of real per capita provincial government health expenditures only in Newfoundland and Quebec.

Health expenditures in Canada exhibit an income elasticity of 0.77 and therefore imply that real per capita provincial government health expenditures are a necessity rather than a luxury good. The results of the international literature showing income elasticities greater than one are based mainly on single year cross-sections with the income coefficient capturing not only differences in quantity but also differences in the relative cost of medical services across countries.

These results also illustrate the importance of an aging population and federal transfer payments to health expenditure. About half of every dollar transferred by the federal government to the provinces goes to fund health care but the new Canada Health and Social Transfer, which replaces EPF and the Canada Assistance Plan, will see federal cash transfers to the provinces reduced resulting in a decline in per capita health expenditures. At the same time, the increase in the proportion of the population over age 65 will add on average about 1.3 per year to real per capita provincial government health expenditures. The aging of Canada's population coupled with a decline in federal transfer payments suggests that the public funding of health care at the provincial level will be a source of policy concern well into the next century.

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