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The determinants of the public–private mix in Canadian health care expenditures: 1975–1996

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Abstract

The health care policy issue regarding the balance between public and private health spending is examined. An empirical model of the determinants of the public–private mix in Canadian health care expenditures over the period 1975–1996 is estimated for total health care expenditures as well as separate expenditure categories such as hospitals, physicians and drugs. The results find that the key determinants of the split are per capita income, government transfer variables and the share of individual income held by the top quintile of the income distribution. Much of the public–private split is determined by long term economic forces. However, the importance of the federal health transfer variables and the variables representing shifts in fiscal transfer regimes suggest the increase in the private share of health spending since 1975 is also partly the result of the policy choice to reduce federal health transfers.

Keywords: Public–private health expenditure; Centralization

1. Introduction

Health care spending and its determinants are major issues around the world[1]. Like other major industrialized countries, Canada in the postwar era has seen a steady increase in per capita health expenditures and the share of gross domestic product (GDP) accounted for by health spending[2]. In 1996, Canada spent 75.2

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[1] For an overview of some of the issues in Canadian health care [1–6].

[2] 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 4.7–8.1%, Italy 3.3–7.2%, the United Kingdom 3.9–6%, Japan 2.9–6.8% and the United States from 5.2 to 11.2% ([7], p. 159).

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billion dollars on health representing 9.5% of GDP [8]. This figure is down substantially from the peak of 10.2% attained in 1992 (Fig. 1). While total health expenditures are still rising (Fig. 2), real per capita health expenditures peaked in 1992 at $1896 (in 1986 dollars) and have declined nearly 2% since then to reach $1861.

It appears that the upward trend in Canadian health care costs has been halted. However, this decline has been fueled primarily by a halt in public sector health expenditure growth as real private sector health expenditures continue to rise (Fig. 2). As a result, the share of health expenditures accounted for by the public sector is now below 70% for the first time. This shift in the balance from public to private

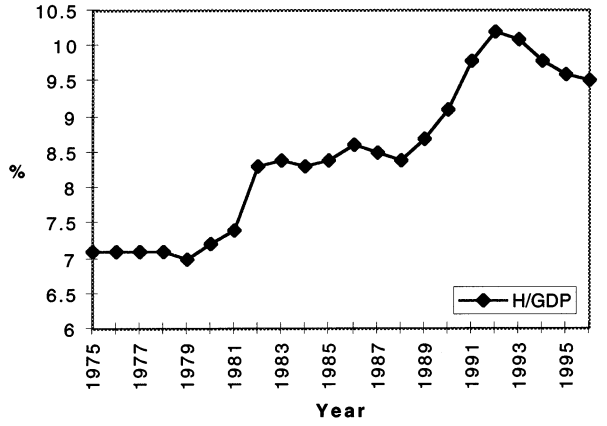

Fig. 1. Health expenditures in Canada as a percentage of GDP. Source: [8].

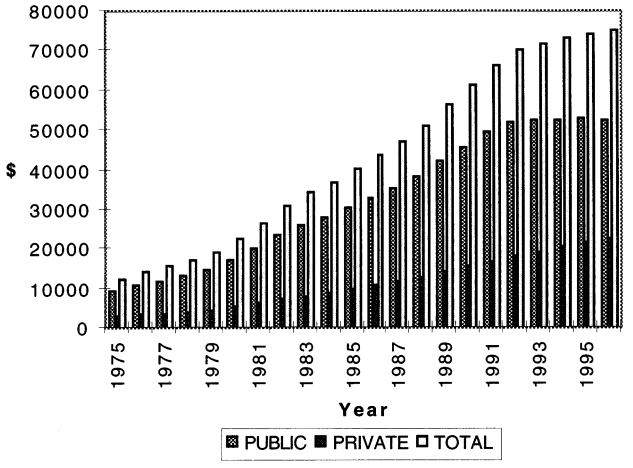

Fig. 2. Real total health expenditures (1986 Dollars). Source: [8].

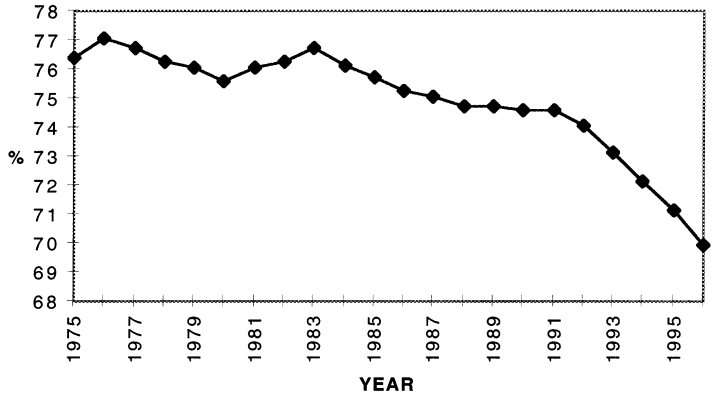

Fig. 3. The public sector share of health expenditures.

health care expenditures was noted by the media and concerns were raised about the potential impact on health care quality[3]. What these media reactions omitted was that the share of public sector health expenditures has declined steadily since the mid-1970s: from 76.4% in 1975 to 69.9% in 1996 (Fig. 3)[4]. In addition, the trend has been one of continuous as opposed to intermittent decline since 1984 with an acceleration since 1992. Moreover, it appears that the trend towards increasing privatization of Canadian health care is one that is continuing without public discussion of what the driving forces of the trend might be.

This paper estimates a simple model of the determinants of the public–private split in total health care expenditures in Canada over the period 1975–1996. As well, the public–private split across categories of expenditure such as hospitals, physicians and drugs is also examined. The results find that the key determinants of the split are per capita income and government health transfer variables. In addition, the increasing inequality of income distribution also appears to have been a factor eroding the public share in health spending. The importance of the federal health transfer variables and the variables representing shifts in transfer regimes, such as the Canada Health and Social Transfer, suggests the increase in the private share of health spending since 1975 is partly the result of explicit policy choices. This evolution is of concern in the absence of an explicit national debate on whether Canadians actually want a smaller role for the public health care sector.

[3] See 'Health-care funding moves from the public to private sector', The Globe and Mail, August 12, 1997 and 'Decline in health spending is a first,' The Toronto Star, August 11, 1997.

[4] Annual data on these expenditures from Health Canada has only been made available on an annual basis for the period since 1975. Point estimates for the years 1960 and 1970 show an increase in the ratio of public to private health expenditures from 43 to 70%. See Health Canada ([9], p. 14).

2. Overview of the data

The data used in this paper are national data and were obtained from Health Canada. Other socio-economic variables, such as population, income and age structure, are supplemented by Statistics Canada publications[5]. In Canada, the federal and provincial governments jointly finance public expenditures on health but under the provisions of the Canadian constitution it is provincial governments who deliver publicly funded health care to citizens. The federal government makes some direct health care expenditures with respect to special groups such as Aboriginals, members of the Armed Forces and health research. Provincial and territorial government health expenditures generally refer to expenditures for insured health services and extended health care and are funded by federal transfers as well as own source revenues. Private sector health care expenditures include expenditures from health insurance firms, out-of-pocket expenditures of individuals and patient service revenue paid by private insurers for items such as preferences for private hospital rooms or charges for services that are deemed not medically necessary[6].

National expenditure data for public and private health expenditure are available by eight expenditure categories[7]. They are: (1) hospitals; (2) other institutions; (3) physician expenditures; (4) other professional expenditures; (5) drugs; (6) capital expenditures; (7) public health; and (8) other expenditures. With the exception of public health, all these categories consist of both private and public health care expenditures.

'Hospital' expenditures are for public, proprietary and federal acute and chronic care hospitals as well as specialty hospitals such as pediatrics and neurology. 'Other institutions' refer to residential care facilities such as homes for the aged, homes for the physically and mentally handicapped or facilities to treat drug and alcohol problems. 'Physician' expenditures cover the professional health services provided by physicians. However, the payment of physicians on payrolls of hospitals or public agencies is excluded and is included with the relevant category. 'Other professional' expenditures include dentists, chiropractors, optometrists, private duty nurses and physiotherapists. The 'drugs' category includes expenditures on both prescription and non-prescription drugs as well as personal health supplies bought in retail stores. 'Capital' expenditures are expenditures on construction, machinery and equipment of hospitals and other health institutions. 'Public health' expenditures generally cover measures to prevent the spread of communicable diseases as well as food, drug and workplace safety. Finally, the 'other' expenditures category

[5] Health Canada [10] National Health Expenditures in Canada, 1975–1994 Summary Report; Health Canada [8] National Health Expenditures in Canada, 1975–1996 Fact Sheets. Much of this information is also replicated on the web site of the Canadian Institute for Health Information at http://www.cihi.ca.

[6] For an overview of Canada's health system, see Health Canada [11].

[7] For more detailed description of these categories, please refer to Health Canada [8].

represents remaining spending on home care, medical transportation, hearing aids and eye glasses.

Hospital expenditures is the largest expenditure category accounting for 34% of total health expenditure. Hospitals are followed by physicians and drugs at about 14% each, other expenditures at 11%, other institutions at 10%, other professionals at 9%, public health at 5% and capital at almost 3%. The largest categories in public health expenditures are hospitals (43%) and physicians (21%) followed by other institutions (10%) and other expenditures (8%). The largest categories in private health expenditures are drugs (31%) followed by other professionals (25%), other expenditures (17%) and other institutions (11%). Generally, public health expenditures emphasize hospital and physician services while private health expenditures focus on drugs and other professionals.

An overview of the health data is presented in Figs. 1–4 and Table 1. Between 1975 and 1996, the share of GDP devoted to health expenditures in Canada rose from 7.1% to peak at 10.2% in 1992 before declining to 9.5% by 1996[8]. Between 1975 and 1996, the public health expenditure share of GDP rose from 5.5 to 6.6% while the private share rose from 1.7 to 2.9%. The greater growth in private health spending has resulted in a shift towards a larger private share in total health care expenditure as documented in Fig. 3. Fig. 3 suggests a decline in the public share from 1976 to 1980 with a brief recovery from 1981 to 1983 and then a continuous decline since 1983 with the pace of the decline increasing after 1991. As Fig. 2 illustrates, in real terms, private health expenditures in the 1990s continued to grow whereas public spending leveled off. The decline in public health spending becomes more pronounced when real per capita figures are used.

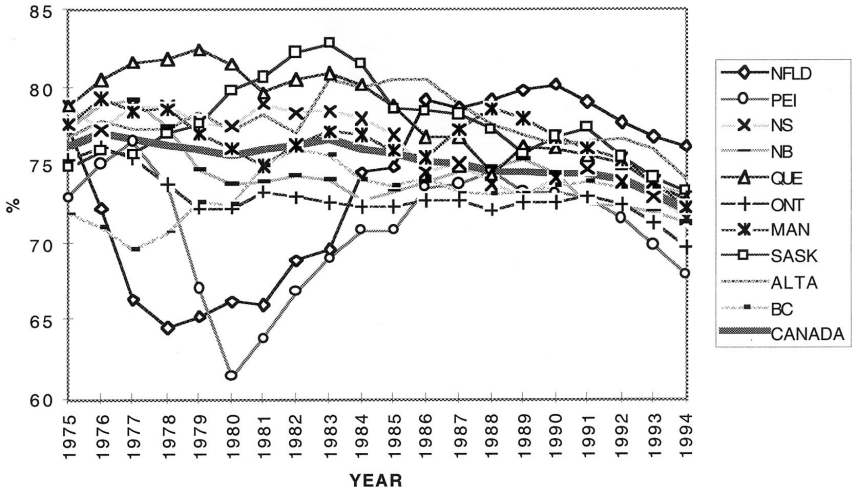

Fig. 4. The public sector share of health expenditures by province (1975–1994). Source: [10].

[8] The Canadian Institute for Health Information forecasts that in 1998, the share of GDP devoted to health spending will be 9.1%.

Table 1
Public sector health expenditure shares by category (%)[a]

Year	Hospitals	Other institutions	Physicians	Other professionals	Drugs	Capital	Other expenditures	Total
1975	94.1	70.8	98.5	15.0	26.0	70.3	49.4	76.4
1980	91.9	71.7	98.4	18.9	33.6	66.3	55.8	75.6
1985	90.5	74.5	98.6	18.3	37.2	77.5	54.6	75.7
1990	91.2	72.4	99.0	17.3	39.4	77.0	55.8	74.6
1995	88.6	68.8	99.1	14.7	37.2	73.2	54.5	71.1
1996	87.7	68.1	99.0	14.3	35.2	72.4	52.6	69.9

[a] Source: [8].

In 1986 constant dollars, total per capita health spending rose from $1256 in 1975 to $1861 in 1996. However, public per capita health expenditures rose from $913 to peak at $1421 in 1992 and then declined to $1290 by 1996. Private real per capita health expenditures rose steadily from $282 in 1975 to $556 in 1996. Real per capita public health expenditures declined by 9% between 1992 and 1996 whereas over the same period real per capita private health expenditures rose by 12%. The increases in private health care expenditures since 1990 have been most pronounced in hospital and other institutions, drugs and other expenditures. The only category in private sector health expenditures to experience declines was capital spending. The declines in public sector spending have occurred largely in the hospital, other professional and capital categories. The fact that health expenditures in the capital category have been declining in both the private and public spheres probably does not bode well for long term health care infrastructure.

In Table 1, the balance between public and private health care expenditures is presented for all the health expenditure categories except for public health as it is 100% publicly funded. For hospitals, the decline in the public share has been continuous since a high of 94% in 1975 to approximately 88% in 1996[9]. Other institutions saw an increase in the public share to almost 75% in the mid-1980s but declined to 68% in 1996. The public share of physician expenditures has remained high and relatively constant while that for other professionals has declined. The public share of drug health expenditures rose from 26% in 1975 to peak at 39% by 1990 but then declined to 35% by 1996. The public sector share of capital health expenditures also declined from a peak of nearly 78% in 1985 to 72% in 1996. These results suggest that prior to 1985, the public–private split fluctuated across categories and kept the overall decline modest but since 1985, all categories, with the exception of physicians, have seen the public share of health care expenditures decline.

Finally, in Fig. 4, the public share of total health expenditures is plotted for each province along with the national figure for the period 1975–1994[10]. A definite downward trend in the public share across provinces is noticeable from the mid-1980s and onwards but the period prior to the mid-1980s is characterized by a large amount of variation. The results by province are quite intriguing for they suggest a divergence in the public share of spending across provinces over the 1975 to early 1980s and then a convergence since the mid-1980s. Between 1975 and 1980, for example, the public share of heath expenditures rose in Quebec and Saskatchewan but dropped in Ontario, Newfoundland and Prince Edward Island. In 1975, the public share of health expenditures across provinces ranged from 72 to 79% whereas by 1980 the range was 61–81%. By 1985, it ranged from 71 to 81%

[9] Part of this decline reflects the downsizing of Canada's hospitals since the mid-1980s which saw the number of approved beds in public hospitals drop 11% and the number of public hospitals fall by 14% [12].

[10] At the time research on this topic began, provincial public/private health data were only available for total health spending and were not broken down into expenditure categories.

and by 1994 it ranged from 68 to 76%. In 1994, the provinces with the largest public share of health expenditures were Newfoundland, Alberta and Saskatchewan while the lowest were Prince Edward Island, Ontario and New Brunswick.

3. Issues in the public–private health mix

The balance between public and private provision of health care services is one with a long history in Canada as well as much of the world. Privatization of health care serves 'to transfer ownership of resources or enterprises from a collective, public basis to an individual private one'. In essence, the distinction between public and private provision of health care is in the nature of the property rights over the resource allocation decision as the industry itself is already largely privately owned [13]. There is a large public role in health care in most developed countries and from the 1960s to the 1980s, this public share expanded with the OECD average rising from 61% in 1960 to 80% by 1982 followed by a stabilization in those shares [14]. Even the United States, via its Medicare and Medicaid programs, has developed a large public share in its total health care expenditures. Indeed, between 1965 and 1990, the public share of total health expenditures in the United States rose from 20 to 41% [15].

The debate over whether health care should be provided publically, privately or in some combination thereof can be dealt with on two levels. First, it can be treated as a problem in public economics with the theoretical case for or against public provision based on some concept of market failure due to spillover effects in either consumption or production. Second, and more commonly, it is an ideological debate between the proponents of a libertarian/market view versus those who advocate an egalitarian/non-market view. At the heart of the debate between private and public provision is who gets to set the expenditure priorities and therefore directs resource allocation. Health care is by nature a private good because unlike a pure public good, individuals can be excluded from consumption if they do not pay for it. However, health care can be subject to public provision because its private provision is subject to potential market failure.

For example, there are problems of asymmetric information. Physicians generally know more about medical treatments and practices than their patients. Hence, in their role as gatekeepers to the medical system and as a result of pursuing their own self-interest, they may over-prescribe treatments resulting in inefficient resource allocation. On the other hand, patients may know more about their health circumstance than a health care provider or insurer — a situation known as adverse selection. Since the sick may be more likely to purchase insurance than the healthy, under a system of private insurance, premiums might be so high as to discourage lower income individuals from buying insurance. This latter problem definitely creates a rationale for government involvement. There is also the problem of moral hazard, whereby if patients are insured and do not bear the direct costs of a treatment they may tend to overuse a service[11]. These underlying problems can

[11] This problem is often cited as a justification for user fees or copayments but solid evidence on the extent of such abuse is difficult to find [16,17].

occur whether health care is provided publicly or via some type of private insurance arrangement and can lead to inefficient and inequitable outcomes.

There are also more general externalities to health care expenditures, which create a role for public expenditures. An externality is a spillover effect that is not taken into consideration by a market transaction, which results in an inefficient market outcome. Health care is likely to produce many positive externalities for society, which would be foregone if health care was provided solely by private market arrangements. For example, the health of the general population is improved when many members of the public are immunized thereby reducing disease transmission. If immunization was left to private resources, a much smaller proportion of the population would get their 'shots' as many would 'free ride' on those who did. Also, a population in poor health is less productive than a healthy one, again creating production externalities for the economy as a whole. As a result, only those aspects of health care provision should be under private provision that can be characterized as pure private goods with no externalities or other market failures. Therefore, those parts of the health care system subject to market failure should be publicly provided[12].

Public economics analysis suggests that most countries will likely have a mixed system of health care provision and indeed in most countries there are both public and private health care expenditures. These dual systems of provision characterize not only health but other publicly provided goods that have privately available counterparts such as education and crime prevention. The issue is really not whether to have public or private health care but to set the balance between the two. Epple and Romano [19] suggest that a dual provision regime for a public good is preferred by the majority of the population to either market or government only provision. However, dual systems of provision create a dilemma as Epple and Romano [20] discuss for: 'On the one hand, the private alternative reduces the demand on the public system, thereby reducing its costs, to the benefit of users of the public system. On the other hand the loss of clientele to the private sector can be expected to reduce public support for a high quality public service'. The Epple and Romano analysis suggests that the balance between public and private provision may be the outcome of interplay between voter coalitions.

The public–private health care debate is rarely framed in terms of public economics theory and is usually more ideological in tone. For example, advocates of a greater role for markets in health care provision argue that a larger role will foster more efficiency in health care and reduce health spending. However, this argument is inappropriate because 'one of the main reasons for the observed differences is that governments tend to supply goods and services that are inherently more difficult to produce than those supplied by the private sector, hence the greater inefficiency' [13]. Culyer [21], however, argues that 'The amount of health care expenditure in any country seems to be unrelated to the degree of governmental involvement in the financing or delivery of health services; instead, it can almost

[12] For further discussion of market failure, externalities and public goods, see Rosen ([15], pp. 61–118) or Boadway and Wildasin ([18], pp. 55–137).

entirely be accounted for by differences in the various countries' national income Leu [22] finds that there is a significant relationship between the degree of public financing of health care and the size of total health care expenditures but finds the effect small and therefore 'it seems inappropriate to attribute differences in medical care expenditures entirely to differences in the mode of financing as is sometimes done in the political debate'. Moreover, Leu [22] finds that centralized national health systems have lower expenditures than the decentralized non-nationalized systems. Culyer [23] reports that 'detailed microeconomic evidence casts serious doubts on the empirical validity of the claim that public provision is relatively X-inefficient[13].

As Williams [24] notes, the proponents of private health care systems tend to view access to health care as part of a society's reward system whereas the advocates of public health care see access to health care as every citizen's right. Williams [24] argues that public health care systems rely on strong feelings of social solidarity whereas private systems 'exist precisely to enable the rich, healthy, wise and well-informed to 'opt out' and look after themselves'. As a result, a mixed system, with private and public components, is essentially a compromise that respects the views of the minority whether that minority be adherents of the public or private system. In most developed and liberal democratic countries, any swing in the balance will require some mobilization of coalitions of voters and therefore the debate is likely to be ideological appealing to a priori philosophical dispositions and self-interest rather than empirical analysis.

The political and ideological nature of the process is evident in the Canadian debate over user charges. Support for user charges appears correlated with expected benefits as the self-employed and upper income respondents to polls, who would benefit the most from the substitution of user charges for tax support in health care, express the greatest support for them [25]. Moreover, the declining opposition to user charges has been accompanied by a decline in support for increased taxes suggesting a possible realignment in voter priorities away from a large public sector role in health care provision. This type of behavior has been demonstrated in theoretical economic models.

Epple and Romano [20] show that under a dual public–private system of provision, a possible equilibrium exists where the rich and poor 'together' prefer reduced public provision while the middle class prefers an increase. Applying this analysis to health care, the rich would prefer low public expenditures on health care because they do not need to use public health care and dislike the higher tax rates required to extend public health care to others. The poor prefer lower expenditures on public health care because they are less willing to substitute public health expenditures for other public goods such as income support. Middle income households, on the other hand use public health care and prefer it be of relatively high quality. Thus a coalition of middle income households would prefer higher

[13] It is interesting to note that in 1990, real per capita health expenditure in United States dollars was $1794 in Canada and $2566 in the United States — a 43% difference ([15], pp. 229). At the same time, the public sector share of health spending was about 41% in the United States and 74% in Canada.

public health expenditures whereas a voting coalition of high- and low-income households would prefer a reduction. It is possible that the decline in Canadian household incomes during the 1990s may have eroded the middle-class base of support for public health expenditures.

4. Modeling the public–private mix

Examining the public–private mix is fundamentally a study in economic centralization. Centralization has been a source of interest in policy debates in western countries. Economies have been marked by intergovernmental or fiscal decentralization, the devolution of governmental responsibilities to lower tiers, as well as market decentralization, the devolution of functions from the public to the private sector [26,27]. Fiscal centralization has become an important policy field as the United States tries to cut its federal budget deficit by reducing state and local grants, Canada tries to address the issue of Quebec and the European Community tries to decide what policies to harmonize and what not to [28]. In Canada, health care is a provincial responsibility and therefore it is market decentralization rather than fiscal centralization that is of interest. It should be noted that the term centralization as used in this paper will refer to the economic concepts of either market or fiscal centralization. In the health care field, decentralization is also a concept relating to the actual delivery point of services in either an acute or home care setting [29–31].

In fiscal federalism, centralization attempts to measure the distribution and concentration of power among various levels of power in a federation and therefore usually constructs measures based on a level of government's share of either revenues or expenditures relative to total government revenues or expenditures.[14] Measuring market decentralization in health care can be done in a comparable fashion by constructing an index based on the public sector health care expenditure share relative to total health care expenditures.

A simple theoretical framework[15] within which to build an econometric model of the determinants of the public–private health care mix can be constructed around an index of health expenditure centralization ϕ such that:

$$\phi = G/(G + X) \tag{1}$$

where G is public health care spending and X is private health care spending. An increase in ϕ implies an increase in the public sector share of health spending. In order to theoretically model the determinants of ϕ, we assume that public and private health care spending are related to per capita income (Y)[16] and the per unit cost or price of providing services (C)[17] such that:

[14] For a theoretical discussion of centralization measures ([32], pp. 22–30).

[15] This analysis is based on work in state-local centralization by Giertz [33].

[16] Per capita income reflects the demand for health care expenditures. As per capita income rises, the demand for public and private health expenditures rises.

$$G = G(Y,C) \tag{2}$$

$$X = X(Y,C) \tag{3}$$

Changes in centralization or $d\phi$ are therefore going to be a function of how changes in income and costs affect public and private expenditure which can be represented by the following expression derived by taking the total differential of the expression in Eq. (1) after substituting in Eqs. (2) and (3). (See Appendix A for derivation):

$$d\phi = [1/(G+X)^2][(GX/Y)(E_{gy} - E_{xy})dY + (GX/C)(E_{gc} - E_{xc})dC] \tag{4}$$

In this expression, changes in the centralization ratio are a function of changes in income and costs but whether the impact is positive or negative depends on the relative sensitivity of private and public expenditure to income and costs known as elasticity. In economics, the elasticity of one variable to another is defined as the percentage response of a given variable to a percentage change in another variable. In Eq. (4), E_{gy} is the income elasticity of public health spending, E_{xy} is the income elasticity of private health spending, E_{gc} is the cost elasticity of public health spending and E_{xc} is the cost elasticity of private health spending.

This final expression suggests that the effect of an increase in income or costs on centralization will depend on the size of the income and cost elasticities of the respective provider levels. An increase in income will lead to an increase, decrease or no change in centralization depending on whether the public elasticity is greater, smaller or the same as the private elasticity while an increase in cost will lead to an increase, decrease or no change depending on whether the public elasticity is smaller, greater or the same compared to the private elasticity.

These theoretical results imply a model in which centralization is a function of income and cost variables with the sign of the variables the outcome of estimation rather than prior theory. The estimated coefficients become indicators of the relative strength of public and private income and cost elasticities of health expenditure. These elasticities to a large extent measure the reaction of the public demand for private and public health care expenditures to economic forces.

The operationalization of this model requires selecting variables to represent the income and cost factors that are the determinants of public and private health care expenditures. Over the last quarter of a 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 as well as 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

[17] We are also assuming that expenditures at each level are independent of the other level. That is, public health expenditures do not react to private health spending. With respect to Eq. (2) and Eq. (3) we assume that G and x are positively related to income and negatively related to cost. That is: $dG/dY > 0$, $dG/dC < 0$, $dX/dY > 0$ and $dX/dC < 0$.

proportion of population either over 65 or under the age of 15, the public finance share of health care spending, urbanization, the amount of foreign aid and the number of practicing physicians per capita.[18] Much attention has focused on the role of income in explaining international variations in health care expenditures and has created what Culyer [44] 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.

In the basic model estimated in this paper, the ratio of public health expenditure to total health expenditure is a function of real per capita income, the proportion of the population over the age of 65 and real per capita federal government health transfers. These variables have been found to be significant determinants of health expenditures in Canada [43]. In addition, dummy variables for the onset of Established Program Financing, the Canada Health and Social Transfer and the Canada Health Act are included. Moreover, the impact of the changing income distribution is captured by the inclusion of a variable representing the share of individual income held by the top and bottom quintiles of the income distribution.[19] Finally, a time trend is also included to capture any additional effects on the public–private split due to a continuation of any underlying patterns not captured by the other variables. The determinants of the health expenditure centralization ratio (ϕ) will be estimated for total health expenditures as well as the separate expenditure categories. The model specification is log–log so that the coefficients can be interpreted as elasticities. The estimation technique is ordinary least squares (OLS) and the data is annual from 1975 to 1996.

The inclusion of a per capita income variable is standard in studies of health care expenditure determinants with higher income associated with greater health care spending. However, the impact on centralization will depend on the size of the relative private and public elasticities. For example, if private health expenditures are more income elastic than public ones, then rising incomes would be associated with a decline in the health expenditure centralization ratio (as defined above).[20] For the regressions, the income variable is defined as real per capita GDP in 1986 dollars.[21]

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 and federal health transfers. The proportion of the population aged over 65 is expected to have a positive effect on real per capita health expenditures.[22] 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

[18] There is a well-developed international literature on the empirical determinants of health expenditures [22,34–43].

[19] That is, the top and bottom fifths of the income distribution.

[20] More specifically, given a 1% increase in per capita income, if public health care spending rises by a larger percentage than private health care spending, then the centralization ratio defined here will rise.

[21] Real GDP was constructed by dividing nominal GDP by the Consumer Price Index with 1986 = 100.

[22] While the proportion over the age of 65 is a 'cost' side variable it does not actually represent an increase in per unit health care costs.

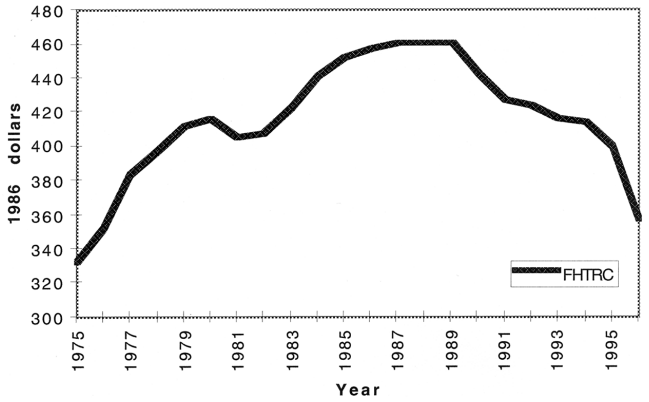

Fig. 5. Real per capita federal health transfers to the provinces and territories. Source: [10,58].

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 [45].[23] 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 the fastest growth in the use of specialist care [49]. Studies for the United States also show similar patterns and trends in health care expenditures associated with the aging of the population [50,51]. Given that the proportion of population over the age of 65 was 7.6% in 1961 and is expected to reach 18% by 2025 [52], it can be assumed that the growing number of elderly will be a major factor in rising health care expenditures. If the reactions of public and private health expenditures to an aging population differ, then one can expect an impact on the centralization ratio.

The federal health transfer revenue variable is important to a study of the determinants of real per capita health care expenditures because transfers are an important source of revenue to Canada's provincial governments though they vary in importance across the country. Historically, about 20% of provincial government revenue was obtained from federal transfers but this declined to approximately 15% by the 1996/97 fiscal year as the result of the federal government's deficit fighting agenda and reductions in provincial transfers. In per capita terms, the largest federal transfer recipients were the Atlantic provinces, Quebec and the Prairies. Real per capita federal health transfers in 1986 dollars (including both cash transfers as well as tax points[24]) are plotted in Fig. 5 and they show a downward

[23] For additional discussion of the impact of aging on Canada's health care costs, see Refs. [46–48].

[24] Under the Canadian intergovernmental financial arrangements, the federal government makes cash transfers to the provinces as well as transfers based on points of the income tax which have been vacated by the federal government. While the latter constitute a transfer in technical terms, they are essentially now a form of own-source revenue for the provinces.

trend since 1989, which accelerated into 1995 and 1996 as federal spending restraint took affect. As a share of provincial government health expenditures, federal health transfers accounted for 40% of expenditures in 1975 and declined to 33% by 1994. Their importance across provinces in 1994 ranged from a high of 38% in Nova Scotia to a low of 32% in Ontario.

Estimated federal cash transfers to the provinces and territories in 1996/97 totaled 25 billion dollars (total transfers including tax points were 38.5 billion) of which 32% was general purpose transfers (e.g. equalization[25]) and the remainder was specific purpose transfers mainly under the rubric of the Canada Health and Social Transfer [53]. These transfers are down substantially from the 1995/96 fiscal year which saw total cash transfers at a value of 28.9 billion dollars.[26] In 1995/96, 35% of federal cash transfers to the provinces and territories were general purpose and the remainder were specific purpose. Of these specific purpose transfers, 6.9 billion were for insured health services, 2.2 billion were for post-secondary education for a total of 9.1 billion under what was termed established program financing (EPF). Another 7.2 billion dollars was transferred under the Canada Assistance Plan, which finances provincial welfare. The 1990s have seen a shift in federal transfer funding not only in dollar amounts but also in the institutional arrangements governing those transfers, which have evolved considerably since the mid-1970s.

Prior to 1977, the federal government was providing cash transfers that essentially funded 50% of all provincial health care expenditures.[27] The rapid increases in provincial health care expenditures of the 1970s alarmed the federal government and this open-ended grant system was replaced 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. This severed the direct link between provincial health expenditures and the federal cash contribution. In 1986, as part of its deficit control strategy, Ottawa further restricted the growth of EPF transfers.[28] Finally, effective in 1996 (the 1996/97 fiscal year),

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

[26] This represents a 1-year reduction of 13.5% in total transfers. For 1997–1998, total transfers are set to decline to 35 billion of which 19.8 billion is to be a cash transfer. The floor for the CHST cash transfer was eventually set at 12.5 billion dollars and for 1997–1998, the CHST was estimated to be 12.6 billion dollars. In 1994/1995, the value of the cash transfer for EPF and the Canada Assistance Plan was over 16 billion dollars.

[27] 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 ([54], pp. 623–677).

[28] For additional information on EPF and transfers, see Carter [55,56], and Perry ([54], pp. 446–453, pp. 651–652).

insured health services, post-secondary education and the Canada Assistance Plan were collapsed into the new Canada Health and Social Transfer.

This rearrangement has made it much more difficult to obtain data on federal health transfers as they are now incorporated into a much more general transfer payment. 'National Health Expenditures in Canada 1975–1994' provides a consistently defined health transfer variable that includes both the cash and tax point transfers. For the purposes of this paper, the 1995 and 1996 federal health transfer variables were constructed by taking the ratio of federal health transfers (cash and tax points) to the total of cash and tax point transfers in 1994 and then applying it to total transfers for 1995 and 1996.

The onset of EPF and the Canada Health and Social Transfer (CHST) were fiscal transfer events that also represented efforts to control federal expenditure. Along with a federal health transfer variable to capture changes in values, it is also necessary to capture these regime changes. Dummy variables were specified in an effort to capture these changes in the Canadian federal transfer system. In an effort to see if the onset of EPF affected the ratio of public to total health expenditures, an EPF dummy variable was specified which took on a value of 1 for the period 1977–1995 and zero otherwise. In an effort to capture the impact of the onset of the Canada Health and Social Transfer, a dummy variable CHST was specified which takes on a value of 1 in 1996 and zero otherwise.

A dummy variable was also included to capture the effect of the Canada Health Act in 1984 and takes on a value of 1 in 1984 and afterwards and zero otherwise. The Canada Health Act replaced the existing legislation under which federal grants for health care in Canada had been paid: namely, the Hospital Insurance and Diagnostic Services Act and the Medical Care Act.[29] The federal government attempted to establish more precise conditions under which provincial health programs would qualify for federal assistance in light of the tendency for some provinces in the early 1980s to apply special charges to patients by hospitals and doctors. The Canada Health Act was supposed to ensure that medically necessary health services (in essence, hospital and physician services) are available to all residents of Canada regardless of financial circumstance and was portrayed by the federal government as a strengthening of public health care. In order to receive federal transfers, provinces are expected to meet the Act's criteria and conditions that include public administration, comprehensiveness, universality, portability and accessibility. Provinces which applied user charges or extra fees that contravened the Canada Health Act would find a financial penalty applied to their federal government grant.

Finally, in an effort to test the Epple–Romano hypothesis that middle income households might prefer higher public health expenditures whereas a voting coalition of high and low-income households would prefer a reduction, income distribution variables were specified. It is possible that the decline in Canadian incomes as well as a shift in the distribution away from middle incomes during the 1990s may

[29] For an account of the issues around the Canada Health Act, see Perry ([54], pp. 647–677).

have eroded the middle-class base of support for public health expenditures. The percentage distribution of families by income groups in 1996 dollars shows that between 1980 and 1996, the proportion of families with income under $39 999 rose from 34.5 to 38.3%, those between $40 000 and $74 999 fell from 43.8 to 37.9% and those over $75 000 rose from 21.7 to 23.8%. Data for the same period on income shares of all individuals by quintiles shows that the share of the three middle quintiles (that is the middle 60% of the income distribution) has declined from 50.3 to 49.6%. The decline was much more pronounced amongst individual male income where the three middle quintiles share dropped from 54.2 to 51.4%.[30] At the same time, the share of the top quintile over this period rose from 47.1 to 47.3% and the lowest quintile from 2.6 to 3.1%. In an effort to capture the potential effect of this change in income distribution on the public–private split, the proportion of individual income held by the top and bottom quintiles were specified as the income distribution variables.

5. Empirical estimates

Regression results are presented in Table 2. Public expenditure centralization ratios for each of the major expenditure categories as well as total health care are regressed on real per capita GDP (1986 dollars), the proportion of the population over the age of 65, real per capita federal health transfers (1986 dollars), the individual income share held by the top and bottom quintiles, dummy variables for EPF, CHST and the Canada Health Act and finally a time trend. The results show that the key determinants of public health expenditure centralization are income, the federal health transfer variables and the individual income share of the top quintile though there are differences in impacts across expenditure categories. As well, there are some effects on the public share of health expenditures from the onset of the Canada Health Act, EPF, CHST and the share of population over age 65. All the regressions are significant at the 5% level based on the F-test with the exception of the one for capital expenditures.[31] Given the lumpiness of capital spending on hospital and medical facilities as well as their long duration, the time span of data was inadequate for the task at hand in the case of capital spending.

Real per capita GDP is negative and significant for all the expenditure categories except for physicians and capital as well as for total health expenditures. These results suggest that for most categories of health expenditure, public sector expenditure is less income elastic than private sector expenditure and as a result, rising incomes should over time see a movement towards a reduced public role, all other things given. The effect on total health expenditures is small as a 1% increase in real per capita GDP would only result in just over one-quarter of a percent decrease in the share of total health expenditures accounted for by the public sector.

[30] Source: Statistics Canada, 1996 [59], 13-207-XPB; 13-207 Annual 1980 [60].

[31] None of the regressions are corrected for serial correlation as the Durbin–Watson statistics were generally satisfactory.

Table 2
Regression results: determinants of public–private health expenditure centralization ratio (sample range: 1975–1996; estimation technique: OLS' Model Specification: Log–Log) [a]

Independent variables	Hospitals	Other institutions	Physicians	Other professionals	Drugs	Capital	Other expenditures	Total health
Constant	3.45[b] (3.34)	3.17 (1.28)	0.38 (1.90)	19.91[b] (1.96)	8.20[b] (2.23)	−2.67 (−0.28)	2.43[b] (2.06)	3.10[b] (2.52)
Real per capita GDP	−0.15[b] (−2.82)	−0.28[b] (−3.06)	0.004 (0.39)	−1.65[b] (−2.80)	−0.76[b] (−3.27)	−0.44 (−0.77)	−0.28[b] (−4.47)	−0.29[b] (−4.39)
Proportion of population aged >65	0.11 (0.95)	−0.30 (−1.06)	0.03 (1.53)	−0.005 (−0.002)	0.75 (1.86)	0.70 (1.23)	−0.10 (−0.80)	−0.01 (−0.13)
Real per capita federal health transfers	0.18[b] (3.15)	0.32[b] (2.04)	0.0001 (0.01)	2.09[b] (2.54)	0.95[b] (4.53)	0.59 (1.90)	0.25[b] (3.09)	0.37[b] (6.12)
EPF	−0.01 (−1.16)	−0.03 (−1.20)	−0.002 (−0.70)	−0.28 (−1.68)	−0.04 (−1.05)	0.02 (0.33)	−0.04[b] (−4.98)	−0.04[b] (−3.86)
CHST	0.001 (0.11)	0.01 (0.37)	−0.003 (−1.14)	−0.04 (−0.18)	0.01 (0.26)	0.06 (1.12)	−0.03[b] (−3.71)	−0.01 (−0.85)
Canada Health Act	−0.01 (−0.86)	0.01 (0.36)	0.001 (0.73)	−0.15[b] (−2.17)	−0.005 (−0.24)	0.05 (0.96)	−0.03[b] (−3.07)	−0.01 (−0.79)
Individual income share of bottom quintile	−0.03 (−0.55)	−0.04 (−0.23)	−0.01 (−0.62)	−0.40 (−0.89)	−0.06 (−0.36)	0.11 (0.27)	−0.03 (−0.67)	−0.04 (−0.67)
Individual income share of top quintile	−0.73[b] (−3.37)	−0.87 (−1.42)	−0.09[b] (−2.16)	−4.55 (−1.78)	−1.49[b] (−2.09)	1.24 (0.81)	−0.45 (−1.88)	−0.68[b] (−2.61)
Time	−0.03[b] (−2.32)	0.02 (0.83)	−0.002 (−0.82)	0.12 (0.42)	0.02 (0.38)	−0.10 (−2.34)	0.04[b] (2.50)	−0.02 (−1.40)
Adj R-Squared	0.91	0.66	0.82	0.58	0.97	0.33	0.85	0.94
F-statistic	24.74	5.43	11.47	4.23	86.90	2.14	13.88	37.81
Durbin–Watson	1.22	1.58	1.81	1.69	1.50	2.85	1.94	1.61

[a] Figures in brackets represent t-statistics. All estimates done using Heteroskedasticity-consistent covariance matrix. Estimates done using MicroTSP.
[b] Denoting significance at 5% level.

The proportion of the population over the age of 65 has a positive and significant impact on the public sector expenditure for drugs[32] but only at the 10% level of significance. A 1% increase in the proportion of population over the age of 65 would increase the public sector share of drug expenditures by seven tenths of 1%. Overall, it would appear that there is no significant differential impact of an aging population on public and private health spending.

The federal health transfer variable had a positive and significant impact on the public sector share of health spending for health expenditures overall as well as on all the separate expenditure categories with the exception of physicians and capital (though capital is significant at the 10% level). The reason that the physician category may have not been significantly affected by the value of transfers is that provincial health insurance programs must cover necessary physician services in order to qualify for federal transfer funding. As a result, by making the funding contingent on public provision, the actual dollar value of the transfer has not been as relevant to the public/private mix. In the other categories where provinces have more discretion in provision, there is a strong relationship between the value of transfers and the extent of public provision. As well, for total health expenditures, the elasticity of centralization with respect to per capita federal health transfers in absolute value terms is larger than for income.

As for the specific transfer regime changes of EPF and the CHST, they had some effect on the public share of health expenditures. The CHST had a significant negative impact on the public share of other health expenditures. The onset of EPF on the other hand had a negative and significant impact on the public share of the other and total health expenditure categories and if considered at the 10% level, also on other professional expenditures.

Finally, the onset of the Canada Health Act appears to have had no significant impact on the public/private split in health care spending aside from the other professional and other expenditure categories where the impact was negative. It may be that since these categories, unlike hospitals and physicians, were not deemed as medically necessary under the Act, they may have borne the brunt of provincial public sector health expenditure reductions. These results suggests that the onset of the Canada Health Act did little to strengthen the overall public role in health spending.

As for the share of individual income held by the top and bottom quintiles, the bottom quintile variable is insignificant at the 5% level for all regressions. On the other hand, there was a negative and significant relationship between the income share of the top quintile and expenditures on hospitals, physicians, drugs and total health expenditures. There was also a negative relationship between the income share of the top quintile and other professional expenditures and other health expenditures though it was only significant at the 10% level. Moreover, for total

[32] This demonstrates the impact of provincial drug expenditure plans.

health expenditures the elasticity was large relative to the other variables suggesting that a 1% increase in the share of individual income held by the top quintiles would decrease the public share of health care expenditure by seven-tenths of 1%. The results from the income distribution variables suggest a lack of empirical support for the Epple–Romano hypothesis as the significant negative relationship between income distribution and the public share of health expenditures is observed only for the top quintile.

Finally, the time trend variable suggests a negative and significant trend for hospital and capital expenditures and a positive and significant trend for other health expenditures. With respect to hospital and capital expenditures, there appears to be a significant decline in the public share of spending that is independent of factors such as income, transfer payments, aging of the population and income distribution. On the other hand, there appears to be a distinct trend in other health expenditures such as home care, medical transportation, and hearing and visual aids towards greater public expenditure. Whether these trends are due to changes in medical technology and a differential impact across the public and private sector or some institutional factor is not readily apparent. For health expenditures as a whole, the time trend is not statistically significant.

Of course, the key concern is why have these variables impacted on the public–private share in the manner that they have? For example, income had a negative and significant relationship with the public–private share in most health expenditure categories. In terms of elasticity, this would suggest that private health care expenditures have a higher income elasticity than public health care expenditures and therefore as per capita income rises, there would be some substitution of private for public health care. The only categories where this does not appear to hold is for physicians, which are provided mainly under public insurance, and capital expenditures. Income can have more of an impact on the public/private split in areas where more choice exists between public and private health services such as expenditures on drugs or other professionals. Therefore, it appears that the institutional arrangements under which health services are provided may help determine the impact of economic variables on the public/private split.

Given the importance of income and the individual income share of the top quintile, it may indeed be that the middle income base of support for public health care is indeed being eroded though not via an Epple–Romano type coalition of low and high income voters. Moreover, of the key economic determinants, the income share variable has the largest elasticity. One is tempted to conclude that much of the decline in the public share of health care expenditures since 1975 is merely a function of natural adjustment to economic forces. However, one must qualify this with the importance of real per capita federal health transfers as well as the EPF transfer regime dummy variables especially in the regression for total health expenditure. The overall result is that the balance

between public and private health expenditures is a function of economic forces as well as policy choices.[33]

One could argue that the decline in federal health transfers is itself the outcome of political decisions made by voters and therefore evidence of an Epple–Romano type mechanism in which a coalition of high and low income voters have opted for a larger private role in health care. The problem with this interpretation is that over the period covered by this paper no Canadian federal political party has ever campaigned on a platform to cut federal health transfers and provide a larger private role in health care. Even at the provincial level, governments, which have closed hospitals and restructured their health care sectors, have never announced during their election campaigns that they were going to create a larger role for private health care.

While rising income and increasing income inequality may be responsible for most of the long term decline in the public share of health care expenditure, the acceleration in the shift in the public/private health care mix which has occurred since 1990 may be blamed on transfer cuts needed to improve government fiscal positions. However, this was not the outcome of an explicit policy debate. Given the importance that Canadians have continually attached to a public health care system, this shift would appear to have occurred contrary to the wishes of Canadians. In words of one popular Canadian news magazine, 'Canadians are anguishing over a medicare system they proudly regard as a fundamental characteristic of their country.'[34] After several years of public sector health care cutbacks, there has now been a lobbying effort on the part of several provinces to restore health transfer funding and this has been coupled by a concerted effort by the provinces to demand that the Canada Health and Social Transfer be increased.[35] Indeed, the 1999 Federal Budget boosted spending on health transfers to the provinces.[36] The decline in the public sector share of health care expenditures that has occurred since 1975 and continuously since 1984, will likely continue given trends in income levels and income distribution. However, the rapid decline of the 1990s may be about to come to an end given that the federal government is moving into a period of budgetary surpluses.[37]

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[33] The role of policy in the evolution of public and private health care spending has been explicitly noted in a recent Health Canada publication by a division of the last 37 years into distinct policy periods. The years 1960–1975 saw the introduction of hospital insurance and medicare. The years 1975–1990 saw social program expansion while the period 1990–1996 was a period of cost control and health sector reform. See Health Canada ([9], p. 5).

[34] Maclean's, June 15, 1998, 'The Health Report', p. 14.

[35] See 'Provinces push for $6 billion', Toronto Star, June 16, 1998.

[36] The 1999 Federal budget vowed to increase transfers to the provinces for health by adding 11.5 billion dollars to CHST payments over the next 5 years.

[37] While the presence of the Federal Spending Power (see Ref. [57], p. 201) combined with surpluses could conceivably tilt the balance back towards public sector health expenditures, some of the reforms currently underway in health care management will operate in opposite effect. For example, in Ontario, as elsewhere, there is an increasing emphasis on home care. Home care is not a 'medically necessary' service like hospital or physician services under the Canada Health Act. Moreover, Ontario plans to open bidding for $1 billion worth of provincial home care spending next year — in essence shifting this expenditure to private companies. See 'Home care: Sold to the highest bidder', Ottawa Citizen, Monday June 1, p. A6, 1998.

6. Conclusion

The key determinants of the public–private mix in Canadian health care are real per capita income, the income share of the top quintile and the value of federal health transfers. Overall, increases in per capita income have tended to be associated with more private health care spending relative to public spending thereby reducing the public share of health care spending. Real per capita federal health transfers are positively related to the public share and their rapid decline since 1989 combined with the onset of the Canada Health and Social Transfer in 1996 has resulted in much of the reduction in the public share of health care expenditures since 1990. Finally, the rise of the top quintile share of income is also associated with a decline in the public share of health care expenditure.

The decline in the public sector share of health care expenditures has been continuous since 1984, coinciding with the onset of the Canada Health Act, which was supposed to protect public health care. While the Canada Health Act makes federal financial assistance for health care conditional on provincial health insurance programs meeting criteria, which include public administration, under the Constitution, the provinces are responsible for health care and can define what a medically necessary procedure is. Some of the shift from public health care expenditure towards private expenditure is the result of the fact that the Canada Health Act was accompanied by declining federal health transfers putting a strain on provincial health care systems which were required to meet federal legislation with fewer federal dollars. Moreover, the deficit cutting agenda and the onset of the Canada Health and Social Transfer has further eroded health transfers forcing the provinces to reduce per capita public health care expenditures. The presence of the Canada Health Act has meant that transfer cuts have been disproportionately transferred onto health care categories such as other professional care and other expenditures.

An intriguing aspect in Canadian health policy terms is that popular discussion seems to continually indicate that the majority of Canadians prefer a mainly public health system and dislike the trend towards greater privatization of health care. Indeed, during federal and provincial election campaigns, references are made about the importance of public health care. As a result, the reduction in federal health transfers and the decline in the public sector share of health care spending is seemingly at odds with what seems to be opposite public sentiment. On the other hand, the regressions in this paper imply that rising incomes are accompanied by greater demand for private health expenditures. With rising incomes being accompanied by greater income polarization, it may be that the erosion of the middle class is reducing support for public health expenditure and that the public expressions in Canada for public health care are coming largely from those with middle class incomes. Those in the top 20% of the income distribution appear to have a preference for greater private health expenditures. If the middle income classes are

indeed the most important proponents and beneficiaries of publicly funded health care, then one would expect the opposition to increased privatization of the health care system to be the strongest in this segment of Canadian society.

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Appendix A. Mathematical derivation

$$\phi = G/(G+X) \tag{A1}$$

$$G = G(Y,C) \quad \partial G/\partial Y > 0 \ \partial G/\partial C < 0 \tag{A2}$$

$$X = X(Y,C) \quad \partial X/\partial Y > 0 \ \partial X/\partial C < 0 \tag{A3}$$

$$\begin{aligned} \mathrm{d}\phi &= [(\partial\phi/\partial G)\mathrm{d}G/\mathrm{d}Y + (\partial\phi/\partial X)\partial X/\partial Y]\mathrm{d}Y \\ &\quad + [(\partial\phi/\partial G)\mathrm{d}G/\mathrm{d}C + (\partial\phi/\partial X)\partial X/\partial C]\mathrm{d}C \\ \mathrm{d}\phi &= [\{X/(G+X)^2\}\mathrm{d}G/\mathrm{d}Y - \{G/(G+X)^2\}\mathrm{d}X/\mathrm{d}Y]\mathrm{d}Y \\ &\quad + [\{X/(G+X)^2\}\mathrm{d}G/\mathrm{d}C - \{G/(G+X)^2\}\mathrm{d}X/\mathrm{d}C]\mathrm{d}C \end{aligned} \tag{A4}$$

$$\begin{aligned} \mathrm{d}\phi &= 1/(G+X)^2[X\mathrm{d}G/\mathrm{d}Y - G\mathrm{d}X/\mathrm{d}Y]\mathrm{d}Y \\ &\quad + 1/(G+X)^2[X\mathrm{d}G/\mathrm{d}C - G\mathrm{d}X/\mathrm{d}C]\mathrm{d}C \end{aligned} \tag{A5}$$

Multiplying the first square-bracketed term by $(Y/GX)(PL/Y)$ and the second square-bracketed term by $(C/GX)(GX/C)$ and factoring out $1/(G+X)^2$, we obtain:

$$\begin{aligned} \mathrm{d}\phi &= [1/(G+X)^2][(Y/GX)(GX/Y)\{X\mathrm{d}G/\mathrm{d}Y - G\mathrm{d}X/\mathrm{d}Y\}\mathrm{d}Y \\ &\quad + (C/GX)(GX/C)\{X\mathrm{d}G/\mathrm{d}C - X\mathrm{d}X/\mathrm{d}C\}\mathrm{d}C] \\ \mathrm{d}\phi &= [1/(G+X)^2][\{(GX/Y)(\mathrm{d}G/\mathrm{d}Y)(Y/G) - (GX/Y)(\mathrm{d}X/\mathrm{d}Y)(Y/X)\}\mathrm{d}Y \\ &\quad + \{(GX/C)(\mathrm{d}G/\mathrm{d}C)(Y/C) - (GX/C)(\mathrm{d}X/\mathrm{d}C)(Y/C)\}\mathrm{d}C] \\ \mathrm{d}\phi &= [1/(G+X)^2][(GX/Y)(E_{\mathrm{gy}} - E_{\mathrm{xy}})\mathrm{d}Y + (GX/C)(E_{\mathrm{gc}} - E_{\mathrm{xc}})\mathrm{d}C] \end{aligned} \tag{A6}$$

References

[1] Brown MC. Health Economics and Policy Problems and Prescriptions. McClelland and Stewart, Toronto, 1991.

[2] Brown M.C. Caring for Profit: Economic Dimensions of Canada's Health Industry.' Fraser Institute, Vancover, 1987.
[3] Blomqvist A., Brown D.M. Limits to Care Reforming Canada's Health System in an Age of Restraint.' C.D. Howe Institute, Toronto, 1994.
[4] Evans RG. Hang together, or hang separately: the viability of a universal health care system in an aging society. Canadian Public Policy 1987;XIII(2):165–80.
[5] Evans RG. Health care in Canada: patterns of funding and regulation. Journal of Health Politics, Policy and Law 1983;8(1):1–43.
[6] Evans RG, Lomas J, Barer ML, Labelle RJ, Fooks C, Stoddart GL, Anderson GM, Feeny D, Gafni A, Torrance GW, Tholl WG. Controlling Health Expenditures — The Canadian Reality. The New England Journal of Medicine 1989;320(9):571–7.
[7] Schieber GJ. Health expenditures in major industrialized countries, 1960–87. Health Care, Financing Review 1990;11(4):159–67.
[8] Health Canada. National Health Expenditures in Canada, 1975–1996 Fact Sheets, 1997.
[9] Health Canada. The Evolution of Public and Private Health Care Spending in Canada, 1960–1997, 1999.
[10] Health Canada. National Health Expenditures in Canada, 1975–1994 Summary Report, 1996.
[11] Health Canada. Canada's Health System, 1997.
[12] Tully P, Saint-Pierre E. Downsizing Canada's hospitals, 1986/87 to 1994/9. Statistics Canada Health Report 1997;8(4):33–9.
[13] Stoddart GL, Labelle RJ. Privatization in the Canadian Health Care System: Assertions, Evidence, Ideology and Options (Ministry of Supply and Services, Canada) 1985.
[14] Poullier J.P. Levels and trends in the public–private mix of the industrialized countries' health systems. In: Culyer A.J., Jonsson B., (eds.) Public and Private Health Services. Oxford: Basil Blackwell, 1986, pp 11-40.
[15] Rosen HS. Public Finance, 4th ed. Toronto: Irwin, 1995.
[16] Stoddart GL, Barer ML, Evans RG, Bhatia V. Why Not User Charges? The Real Issues (Premier's Council on Health, Well-Being and Social Justice), 1993.
[17] Evans RG, Barer ML, Stoddart GL, Bhatia V. Who Are the Zombie Masters, and What Do They Want? (Premier's Council on Health, Well-Being and Social Justice), 1994.
[18] Boadway RW, Wildasin DE. Public Sector Economics, 2nd ed. Boston, MA: Little, Brown and Company, 1984.
[19] Epple D, Romano RE. Public provision of private goods. Journal of Political Economy 1996;104:57–84.
[20] Epple D, Romano RE. Ends against the middle: determining public service provision when there are private alternatives. Journal of Public Economics 1996;62:297–325.
[21] Culyer AJ. Public or private health services? A skeptics view. Journal of Policy Analysis and Management 1983;2(3):386–402.
[22] Leu RE. The public–private mix and international health care costs. In: Culyer AJ, Jonsson B, editors. Public and Private Health Services. Oxford: Basil Blackwell, 1986, pp 41–66.
[23] Culyer AJ. Cost Containment in Europe, Health Care Systems in Transition. Paris: OECD, 1990.
[24] Williams A. Priority setting in public and private health care a guide through the ideological jungle. Journal of Health Economics 1988;7:173–83.
[25] Barer ML, Bhatia V, Stoddart GL, Evans RG. The Remarkable Tenacity of User Charges: A Concise History of the Participation, Positions, and Rationales of Canadian Interest Groups in the Debate over 'Direct Patient Participation' in Health Care Financing (Premier's Council on Health, Well-Being and Social Justice), 1994.
[26] Bennett RJ. Decentralization, intergovernmental relations and markets: towards a post-welfare agenda? In: Bennett RJ, editor. Decentralization, Local Governments and Markets Towards a Post-Welfare Agenda. Oxford: Clarendon Press, 1990:1–26.
[27] Bird RM. Threading the fiscal labyrinth: some issues in fiscal decentralization. National Tax Journal 1993;XLVI(2):207–27.
[28] Gramlich EM. A policymaker's guide to fiscal decentralization. National Tax Journal 1993;XLVI(2):229–35.

[29] Wistow G. Decentralisation from acute to home care settings in England. Health Policy 1997;41(Suppl.):S91–S108.
[30] Johansson L. Decentralisation from acute to home care settings in Sweden. Health Policy 1997;41(Suppl.):S131–43.
[31] Wasem J. A study on decentralizing from acute care to home care settings in Germany. Health Policy 1997;41(Suppl.):S109–29.
[32] Breton A, Scott A. The Economic Constitution of Federal States. Toronto: University of Toronto Press, 1978.
[33] Giertz JF. State-local centralization and income: a theoretical framework and further empirical results. Public Finance 1983;XXXVIII(3):398–408.
[34] Kleiman E. The determinants of national outlay on health. In: Perlman M, editor. The Economics of Health and Medical Care. London: MacMillan, 1974, pp 66–81.
[35] Newhouse JP. Medical care expenditure: a cross-national survey. The Journal of Human Resources 1977;XII(1):115–25.
[36] Parkin D, McGuire A, Yule B. Aggregate health care expenditures and national income: is health care a luxury good. Journal of Health Economics 1987;6:109–27.
[37] Gerdtham UG, Sogaard J, Andersson F, Jonsson B. An econometric analysis of health care expenditure: a cross-section study of the OECD countries. Journal of Health Economics 1992;11:63–84.
[38] Gbesemete KP, Gerdtham U-G. Determinants of health care expenditure in Africa: a cross-sectional study. World Development 1992;20(2):303–8.
[39] Hitiris T, Posnett J. The determinants and effects of health expenditure in developed countries. Journal of Health Economics 1992;11:173–81.
[40] Rubin RM, Koelln K. Determinants of household out-of-pocket health expenditures. Social Science Quarterly 1993;74(4):721–35.
[41] Murthy NRV, Ukpolo V. Aggregate health care expenditure in the United States: evidence from cointegration tests. Applied Economics 1994;26:797–802.
[42] Hansen P, King A. The determinants of health care expenditure: a cointegration approach. Journal of Health Economics 1996;15:127–37.
[43] Di Matteo L, Di Matteo R. Evidence on the determinants of Canadian Provincial Government Health Expenditures: 1965–1991. Journal of Health Economics 1965;17:211–28.
[44] Culyer AJ. Health Care Expenditures in Canada: Myth and Reality; Past and Future, Canadian Tax Paper No. 82 (Canadian Tax Foundation), 1988.
[45] Denton FT, Spencer BG. Health-care costs when the population changes. Canadian Journal of Economics 1975;VIII(1):34–48.
[46] Denton FT, Spencer BG. Population aging and future health costs in Canada. Canadian Public Policy 1983;IX:2.
[47] Denton FT, NenoLi S, Spencer BG. How will population aging affect the future costs of maintaining health care standards? In: Marshall VW, editor. Aging in Canada. Fitzhenry and Whiteside, Don Mills, 1987.
[48] Denton FT, Spencer BG. Demographic change and the cost of publicly funded health care. Canadian Journal on Aging 1995;14(2):174–92.
[49] Barer ML, Pulcins IR, Evans RG, Hertzman C, Lomas J, Anderson GM. Trends in use of medical services by the elderly in British Columbia. Canadian Medical Association Journal 1989;141:39–45.
[50] Waldo DR, Sonnefeld ST, McKusick DR, Arnett RH. Health expenditures by age group, 1977 and 1987. Health Care Financing Review 1989;10(4):111–20.
[51] Schrimper RA, Clark RL. Health expenditures and elderly adults. Journal of Gerontology 1985;40(2):235–43.
[52] Marzouk MS. Aging, age-specific health care costs and the future health care burden in Canada. Canadian Public Policy 1991;XVII(4):490–506.
[53] Canadian Tax Foundation. Finances of the Nation 1996, 1997.
[54] Perry JH. A Fiscal History of Canada — The Postwar Years, Canadian Tax Foundation, Canadian Tax Paper No. 85, 1989.

[55] Carter GE. Established programs financing: a critical review of the record. Canadian Tax Journal 1988;36(5):1225–43.
[56] Carter GE. Federal restraints on the growth of transfer payments to the provinces since 1986–87: an assessment. Canadian Tax Journal 1994;42(6):1504–32.
[57] Boadway RW. Fiscal federalism and social policy reform. Canadian Journal of Regional Science 1995;XVIII(2):199–220.
[58] Canadian Tax Foundation (1997) Finances of the Nation 1996.
[59] Statistics Canada. Income distributions by size in Canada. Catalogue no. 13-207-XPB, 1996.
[60] Statistics Canada Income distribution by size in Canada. Catalogue 13-207 Annual 1920.