Hold the Applause: Why Provincial Restraint on Healthcare Spending Might Not Last

During the mid-1990s, there were four years of declining per person health spending that were followed by a lengthy period of rapid growth. Is the current period of health spending restraint likely to repeat the past and give way to rapid growth? What can policymakers do to prevent history from repeating itself?

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The Study In Brief

Provincial government health spending has entered a new era of restraint – the second such era in Canada's history. However, it is not clear that publicly funded health systems have achieved lasting efficiency gains by "bending the healthcare cost curve." After all, we have seen a similar narrative before: in the mid-1990s, there were four years of declining per person health spending that were followed by a lengthy period of rapid growth. Are we likely to see a repeat of the past – in other words, are we witnessing a temporary pause on the upward trajectory of health spending – or have permanent, lasting changes to health spending growth taken root?

This *Commentary* compares the two major periods of restraint in Canadian healthcare spending and finds that, after controlling for broader economic and fiscal variables – such as provincial GDP and federal transfers – as well as physician supply growth and population aging, there is no clear evidence that a lasting period of health spending restraint is underway. There are a number of reasons to speculate that the current period of cost restraint may be temporary, such as the inability of provinces to maintain relatively large decreases in capital spending, rising cost pressures from "nichebusting" drugs, and the large number of medical school graduates being assimilated into the health system each year. However, there are policies that could strengthen provincial government efforts to achieve effective cost restraint in healthcare and put publicly financed healthcare on a more sustainable footing.

For starters, the federal government should, in discussions with the provinces over a new health accord, not yield to provincial demands for more money. Since 2004, the Canada Health Transfer has been growing at 6 percent per year – nearly doubling in overall size over the last decade – and is currently scheduled to grow at a slower pace starting in 2017. Given evidence that federal transfers can be a key driver of provincial health spending, a return to something near a 6 percent escalator – the same size as in the 2004 health accord – would likely spark an increase in provincial health spending and forestall efforts to bend the cost curve.

The federal government should instead stick to the formula set by the previous government that would see provincial health transfers grow with the Canadian economy and never fall below 3 percent annually. When originally announced in 2011, the prospects for economic growth were robust and a 3 percent floor seemed unlikely to come into effect. With much more subdued prospects for economic growth in 2016 and going forward, guaranteeing that the health transfer grow by no less than 3 percent annually should be considered generous.

Efforts to control health costs will always be subject to criticism. In particular, the sharpest concerns will come from groups whose incomes may be squeezed by government efforts. Without data on patient outcomes, however, governments cannot demonstrate that patients are unaffected by cost-control efforts and that quality of care is maintained – this makes governments particularly vulnerable to claims that patient care is being eroded by budget cuts. Better data keeping should help create an environment that would allow governments to achieve lasting improvements in financing healthcare while maintaining, or improving, care quality.

How to best achieve health-system sustainability has stoked lively debates for more than 25 years.

The issue has been addressed in numerous studies (Robson 2002, TD Economics 2010, Di Matteo 2010, Dodge and Dion 2011, Constant, Peterson, Mallory and Major 2011, Busby, Robson and Jacobs 2014) focusing on health expenditures – in total, public versus private, and by category of spending – as well as on projections of economic growth.

The evolution of Canadian public-sector health spending can be divided into three phases: rapid growth averaging 2.6 percent annually, in inflation-adjusted terms, between 1976 and 1991;[1] the retrenchment period of 1992 to 1996; and renewed and quite pronounced growth since 1997. Indeed, annual Canadian public healthcare spending increased at a 7.4 percent rate in the decade ending in 2008, double the growth rate for government revenue.[2]

These trends have generated some alarming predictions. For example, the TD Economics (2010) report argued that if Ontario's health expenditures continued to grow at 6.5 percent annually, healthcare would consume about 80 percent of the provincial budget by 2030, up from 46 percent in 2009.

However, a new narrative has emerged since 2010 as the upward trend in provincial health spending first halted and then declined. Over the 2011-2015 period, governments have focused on fiscal restraint, and the rate of provincial health-expenditure growth has been slower than economic growth. As a result, the ratio of provincial/territorial health spending to GDP fell from 7.6 percent in 2010 to 7.4 percent in 2013 and to 7.2 percent in 2015.[3] Over the same period, real per capita total health expenditure has declined by an annual average rate of 0.6 percent.

Marchildon and Di Matteo (2015, xvii-xviii) note that: "Canada – like most advanced industrial countries – appears to have entered a new phase of dampened [health spending] growth since the fiscal crisis and recession of 2008-09." But is the current period of slowly growing health spending the result of unique, explicit constraint efforts that put it on a more sustainable trajectory, or is this just a temporary pause containing pressure in the system that will soon boil over? We have seen a similar narrative before: in the mid-1990s, a prolonged recession, fiscal crisis and accompanying transfer cuts resulted in four years of declining real per capita public-health spending. However, these years were followed by a period of high rates of health-spending growth.

1   We apply the Government Current Expenditure Implicit Price Index as used in the Canadian Institute for Health Information's (CIHI) National Health Expenditure Database.

2   See CIHI, "Health Care Cost Drivers: The Facts" (2011). This period saw rapidly growing health expenditures caused by cost drivers such as population aging, general inflation, rising physician and health professional remuneration, changes in prescription drug costs and utilization of new diagnostic technologies. See also Di Matteo (2010) and Blomqvist et al. (2013). For another discussion of cost challenges facing healthcare, see Decter (2002).

3   In addition, annual CIHI spending numbers are frequently revised and, therefore, may lead to premature conclusions (see Robson 2014).

There are key differences between the current health-spending restraint period and the 1990s experience. Despite mounting provincial debt levels, combined federal/provincial government debt is much more manageable today as interest rates remain at all-time lows, and there is no impending fiscal crisis facing the country. Clouding this good news, however, are sombre prospects for future government revenue and GDP growth along with the possibility of interest rate increases down the road. The post-2009 economic recovery has sputtered with future growth projections modest at best.

This *Commentary* examines whether the recent downward bending of the provincial healthcare cost curve can be sustained. It examines past and recent trends in provincial healthcare expenditures and uses a regression analysis of common health-expenditure drivers. Our results compare the two major periods of restraint in Canadian healthcare spending and find that, after controlling for economic and fiscal variables – such as provincial GDP and federal transfers – as well as physician supply growth and population aging, there is no clear evidence that a lasting period of health-spending restraint is underway.

We also conclude that provincial and territorial demands for renewed, large increases in federal healthcare transfer payments would quickly unwind efforts to contain the growth of provincial/territorial health spending. Furthermore, we speculate that Canada lacks the appropriate health outcomes measures required to bring about lasting progress in healthcare cost constraint. Measuring health service quality, particularly for patient outcomes, could show if restraint's impact on the price or volume of services truly impacts quality. Without evidence of patient outcomes, efforts to improve value by reform will be subject to countervailing pressure from interest groups who can, over time, effectively undermine government efforts.

Why Bend? Does the Health/GDP Ratio Really Matter?

There is no single consistently accepted research framework to analyze healthcare-spending sustainability. Reinhardt (2015) opines that researchers "owe to the public – and especially to the providers of healthcare who book health spending as revenue – a thorough explanation of why the trajectory of health spending must be bent down through policy… (pages 4-5)."[4] Questions of healthcare-spending sustainability are, however, linked to measures of affordability – healthcare-spending increases alone are not an issue, but they become one when spending grows faster than the ability to pay for it.

The most common measure for analysing healthcare sustainability is the ratio of public health spending to GDP because it compares the size and growth of such spending to society's total income.[5] When healthcare is publicly financed, a projected increase in the health/GDP ratio has, in the long run, several possible implications. Taxes will need to rise to match the increased health spend, private

4   A possible retort to Reinhardt comes from American muckraker Upton Sinclair who said that, "It is difficult to get a man to understand something, when his salary depends upon his not understanding it!" Nonetheless, we see some merit in Reinhart's point.

5   Affordability analyses often use different denominators such as government revenues, government spending and GDP. The first two indicators are, however, problematic in that there are accounting inconsistencies in how provinces account for revenues or spending, which complicates interprovincial and historical comparisons. Furthermore, they are strongly influenced by historical decisions to change tax rates or preferences vis-à-vis other forms of government spending. While both public and private sources of financing are important in the overall healthcare-sustainability discussion, the focus on public financing is specifically important because of government's predominant role in financing healthcare services.

financing will need to increase, or there must be a decrease in public spending on other forms of government services.[6] Political commitments to maintain the current level of health services without future tax increases compels officials to prioritize attempts to contain the growth of healthcare costs in line with the overall economy.[7]

Trends in Provincial Government Healthcare Expenditures

Healthcare spending in Canada can be characterized as "tap on, tap off" (Figure 1).

When final figures are available in 2015, they are expected to show a decrease in real per capita government health spending from $2,568 in 2010 to $2,447 – a 4.7 percent decline. More dramatically, real per capita spending during the 1991-1996 period fell from $1,830 to $1,668, or by 8.9 percent, nearly double the pullback of the current period.

The stop-go changes to health spending appear to be linked to economic cycles, slowing down not long after recessions (represented by the vertical shaded bars in Figure 1) and increasing when the economy is expanding rapidly. During the 1990s recession and post-recession periods, the economic slowdown reduced revenue, and health spending contracted for a while, but pressures grew and spending increased, growing at a faster annual rate than prior to the recession.

This stop-go pattern exists in every province (See Table 1). They all saw average annual health-spending growth rates decline during the early to mid-1990s, only to resume growth soon after and then fall again since 2010. There is some variation in the size and scope of restraint and growth, with the 1991 to 1996 retrenchment most pronounced in Alberta, Nova Scotia, Saskatchewan and Manitoba, while the 2010 to 2013 decline was most pronounced in Alberta, Ontario and New Brunswick.

Comparing Restraint Periods

Using aggregate data, an examination of the two restraint periods shows some interesting differences. Real per capita provincial-territorial health spending over the 1991-1996 period fell at an annual average rate of 0.8 percent (Figure 2). Broken down by spending category, almost all this decline resulted from a steep contraction in hospital expenditures. Small reductions also occurred in physician spending, other professional spending, capital and administration. However, these small reductions were offset mostly by increases in spending on public health, drugs, other institutions such as long-term care homes, and the "other health spending" category, which includes health research and medical transportation, among other things.

During the most recent restraint period, nearly 80 percent of the cutbacks have come from two categories – hospital and capital spending – and to a lesser extent, drugs (Figure 3).[8] The other areas accounting for the decrease are other institutions, other health spending and administration.

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6   Empirical investigations on the elasticity of government revenues to GDP have shown that for every percentage point increase in economic growth, government revenues generally increase by a similar amount – an elasticity of one. There is some evidence that elasticities for certain tax sources are greater than one (mainly personal income taxes), but the standard assumption based on past evidence is that government revenues grow in lock step with the economy.

7   This reality focuses policymakers' attention on strategies for faster economic growth – this, however, would imply lower, not higher taxes.

8   Using the distribution of provincial/territorial health spending in 1991 and 2011 and applying these shares to the growth rates from 1991-1996 and 2011-2015 points to the major spending decline contributors.

Figure 1: Real Per Capita Provincial Government Health Spending

1997 Dollars
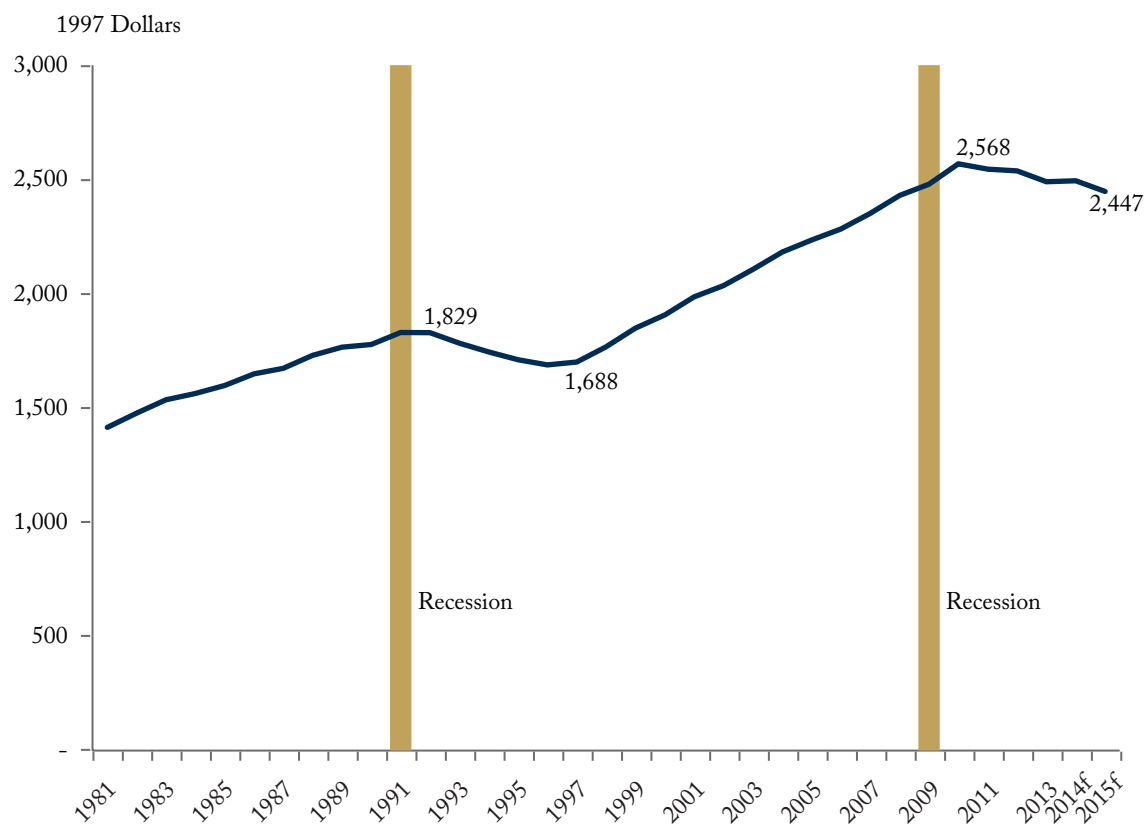
Source: CIHI (2015), authors' calculations.

Table 1: Average Annual Growth Rates of Real Per Capita Provincial Government Health Spending, by Time Period (*Percent*)

Time Period	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC
Long Growth (1976-1990)	3.3	1.8	4.0	4.5	1.9	2.8	3.1	3.5	3.0	2.8
First Restraint Period (1991-1996)	0.8	1.2	-1.8	-0.2	0.1	-0.7	-1.0	-2.6	-3.8	-0.5
Rapid Growth (1997-2010)	4.7	4.0	4.4	3.5	2.6	2.9	3.6	3.5	4.6	2.3
Current Restraint Period (2011-2013)	-0.3	-0.6	-0.1	-2.4	-0.2	-1.7	0.7	-0.4	-1.8	-0.4

Source: CIHI (2015), authors' calculations.

Figure 2: Contribution to Average Annual Growth Rate of Real Per Capita Provincial-Territorial Government Health Expenditures by Spending Category, 1991 to 1996
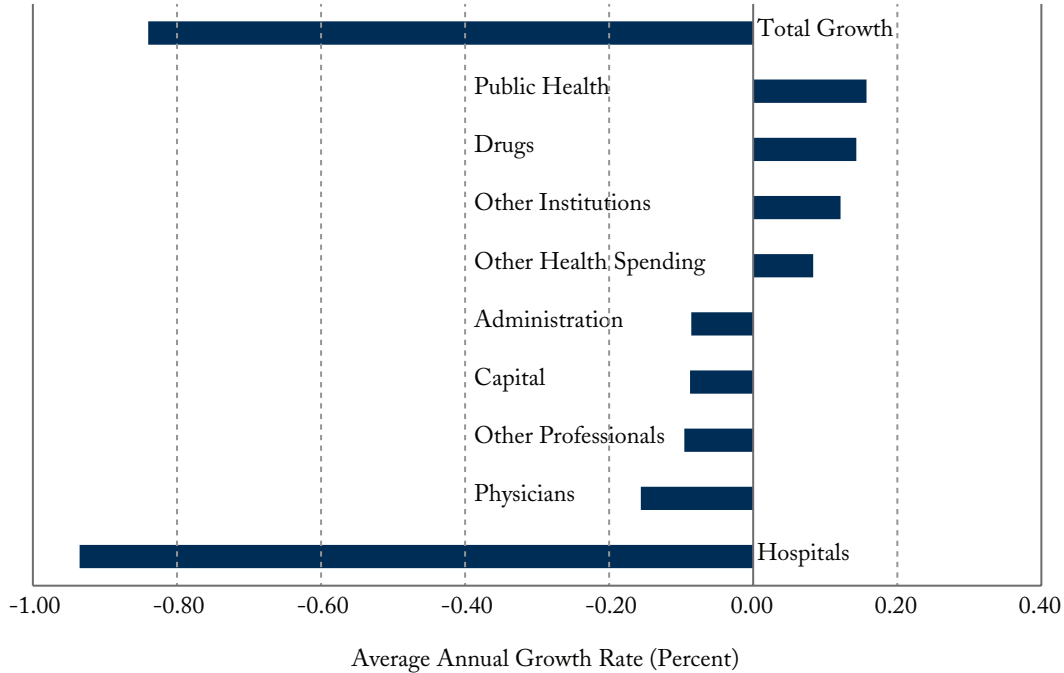
Source: CIHI (2015), authors' calculations.

However, public health spending, physician and other professional spending moved in the opposite direction during the period of overall decline.

Since 2010, all provinces have seen declines in drug spending, and these declines are much deeper in the current restraint period relative to that of the 1990s (Table 2, last column).[9] Capital spending also appears to be a much greater source of restraint in the post-2010 era, which is worrying because this might mean that necessary projects are being delayed, calling into question how much longer deferred maintenance spending can continue.[10]

Among the three main areas of provincial health spending, recent cutbacks, relative to the earlier 1990s restraint period, have so far been deeper only for the "other institutions" category, which includes long-term care homes. Hospital costs have been coming down, but not as deeply and consistently as they did during the 1990s. Furthermore, physician costs have actually been rising recently, in contrast

9   Expenditure was deflated using the Government Current Expenditure Implicit Price Index (1997=100).
10   CIHI records capital spending on a cash basis, not on an accrual basis, the latter recording capital spending as it is consumed (i.e., depreciates) whereas the former records capital costs as they are incurred.

Figure 3: Contribution to Average Annual Growth Rate of Real Per Capita Provincial-Territorial Government Health Expenditures by Category, 2011 to 2015f
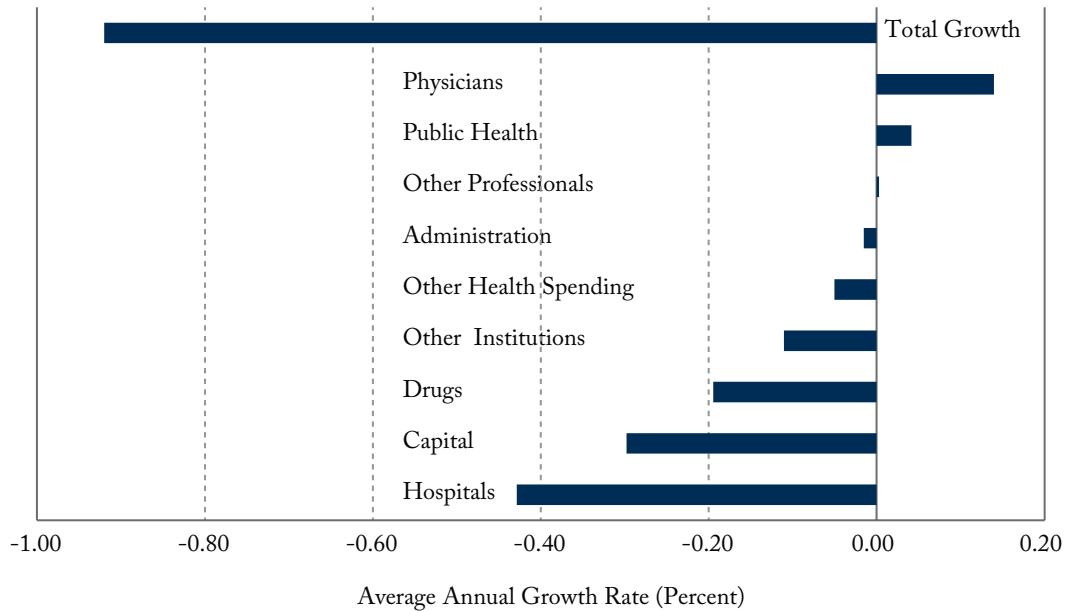
Source: CIHI (2015), authors' calculations.

to the 1990s experience when there were significant declines in a number of large provinces. Only Ontario, New Brunswick and PEI have seen declines in physician costs in the recent restraint period.

Indeed, physicians appear to have emerged relatively unscathed in many provinces during both retrenchment periods. Between 1991 and 1996, the average annual growth rate of real per capita provincial physician expenditures was -0.6 percent. Only four provinces saw a negative average growth rate for this category. For the 2011 to 2013 period, the average growth rate was 1.1 percent ranging from a low of -2.6 percent for PEI to a high of 4.1 percent for Quebec.

Government revenue growth also differed during these periods. From 1991 to 1996, own-source revenues grew at roughly 1.7 percent annually, compared to 0.2 percent annually during the 2011-2013 period. While the 1991-1996 retrenchment is commonly associated with federal fiscal transfer cuts to the provinces as a result of the federal debt crisis and deficit reduction program, the 2011-2013 period also saw declines in real per capita total federal transfers to the provinces despite the growth in healthcare transfers.

This decline in federal cash transfers is mainly due to the rapid withdrawal of economic stimulus funds to the provinces, which occurred in 2010 and 2011, as a response to the global recession. During this time, federal health and social transfers continued growing at 6 percent and 3 percent annually, respectively. When one removes much

of the one-time flow of infrastructure cash,[11] the average growth rate in real per capita federal cash transfers was positive at 1.2 percent over the 2011-2013 period. This suggests that more of the impetus for spending retrenchment this time around has come from the provinces' own fiscal pressures and concerns, rather than those downloaded from Ottawa.

Assessing Drivers of Provincial Government Health Spending and Restraint Efforts

While there has been a decline in real per capita provincial health spending since 2010, there is debate about the causes. Is it a function of economic factors, other drivers of health spending, or unique efforts at curbing health costs? Answering this question requires controlling for well-known and studied expenditure determinants such as fiscal factors, economic conditions and other drivers of healthcare spending. Building from a substantial international literature on the determinants of

health expenditures, our analysis and model replicates findings established in previous examinations. Some of our expenditure drivers include population growth, physician numbers, population aging, income, inflation and enrichment factors such as technological change.[12]

Identifying the role of each factor inevitably requires a regression analysis (See Appendix 1 for a more complete discussion of methodology). We regress real per capita provincial health spending on a standard set of variables.[13] Specifically, we look at the influence of:

- economic and fiscal factors, such as real per capita GDP, federal cash transfers, the ratio of net provincial government debt to GDP (which should identify heightened fiscal pressures), as well as the ratio of health-sector inflation to general inflation;

- supply-side factors, such as the number of family and specialist doctors per 1,000 persons, given their key role as gatekeepers to the healthcare system;[14]

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11 For the adjusted transfer figures, we also removed equalization given the variability in equalization payments over time as resource intensive provinces lost their equalization (e.g., Newfoundland) while other provinces became equalization recipients (e.g., Ontario).

12 See Constant et al. (2011). For an excellent survey of the international health-expenditure determinants literature, see Gerdtham and Jonsson (2000). See also Leu (1986), Parkin et al. (1987), and Gerdtham et al. (1992). See also Hitiris and Posnett (1992), Barros (1998), Gerdtham et al. (1998), Di Matteo and Di Matteo (1998) and Ariste and Carr (2003). For some more recent papers, see Di Matteo (2010, 2014) and Di Matteo and Emery (2014).

13 We omit time trend in the final specification. A time trend is sometimes used to account for technological change's impact, although modelling the impact of technological extension on healthcare spending can be complicated. Traditionally, technological change has been viewed as a cost-enriching decision, but if new techniques generate cheaper health procedures, there could be expenditure reductions. Cutler et al. (1998) report that the real quality-adjusted price of heart attack treatments declined at an annual rate of 1.1 percent between 1983 and 1994. At the same time, technological change can be associated with rising health expenditures for other new treatments. Given that technological change occurs over time, a time index is a way to control for its effect on health expenditures. However, it is imperfect due to the fact many macroeconomic variables are correlated with time. Moreover, using a time trend was also correlated with the time-period restraint variables we included. Indeed, a time-trend variable correlates with many of the variables in our regression but especially with population-aging variables. Some specifications with the time trend were also estimated and are provided in Appendix IV as a supplement. When including the time trend variable, the results for most other variables are unchanged, and each year is associated with about a $40 increase in real per capita provincial health spending.

14 The focus on the number of physicians as a cost driver is traditionally linked to the argument that physicians influence the demand for their services; i.e., supplier-induced demand. See Evans and McGrail (2008, 23).

Table 2: Revenue Sources and Provincial Health Expenditures (Two Retrenchment Periods and Average Annual Real Per Capita Provincial Growth Rates)

	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC	Pop. Weighted Avg.
1990s Restraint Period (1991–1996)											
Health Spending (*Percent Change*)											
Hospitals	-0.9	1.1	-3.2	-0.5	-1.3	-1.5	-2.1	-3.8	-5.6	-1.9	-2.0
Other Institutions	7.1	1.2	5.2	1.6	2.0	-0.9	-0.1	-1.0	7.7	0.7	1.3
Physicians	1.1	-0.1	2.6	0.7	1.4	-1.6	1.6	0.4	-3.7	-1.6	-0.6
Other Professionals	-10.5	-2.2	-10.0	-7.4	-5.9	-1.0	-2.3	-11.6	-13.9	1.1	-4.3
Drugs	6.5	2.2	-2.4	-3.6	4.3	4.3	5.4	-6.0	0.2	1.9	2.9
Capital	-3.2	37.2	-14.2	0.1	6.2	0.2	-12.3	-12.0	-4.4	-3.1	-0.4
Public Health	6.6	-0.2	-5.1	5.3	-1.0	5.7	1.8	6.4	0.9	14.1	4.1
Administration	-1.0	12.6	6.0	-0.9	-6.7	-6.7	-4.5	-6.4	0.3	1.1	-4.2
All Other Health Spending	-3.8	5.3	6.7	5.9	1.3	1.5	3.2	8.7	2.5	0.4	1.9
Total	0.8	1.2	-1.8	-0.2	0.1	-0.7	-1.0	-2.6	-3.8	-0.5	-0.9
Provincial Revenues (*Percent Change*)											
Own Source Revenues	4.3	2.2	-0.1	1.5	0.2	3.2	3.0	4.6	0.3	0.0	1.7
Federal Transfers	1.3	-3.2	-0.7	-2.1	-2.6	-2.1	-2.1	-12.2	-12.0	-7.0	-4.0
Adjusted Federal Transfers*	4.1	-0.7	1.7	0.6	-0.2	0.4	0.4	-7.8	-9.6	-4.5	-1.5
GDP	0.8	2.6	0.0	1.3	0.7	0.3	0.3	1.8	2.0	-0.1	0.6

* Adjusted Real Per Capita Federal Cash Transfers (minus equalization and adjusted for one time infrastructure funding after 2009 recession).
Source: CIHI (2015), authors' calculations.

Table 2: Continued

	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC	Pop. Weighted Avg.
Current Restraint Period (2011-2013)											
Health Spending (*Percent Change*)											
Hospitals	-1.4	1.7	-0.7	-2.8	-2.5	-1.5	-1.0	-1.4	-1.0	3.6	-1.0
Other Institutions	-2.6	3.1	3.4	-0.3	-2.2	-0.4	1.2	-0.7	-1.1	-9.6	-2.0
Physicians	0.8	-2.6	0.9	-1.7	4.1	-0.4	1.7	1.5	1.0	0.5	1.1
Other Professionals	39.9	-7.0	2.5	4.5	3.5	-1.4	0.8	-4.7	-0.9	4.1	1.3
Drugs	-0.9	-3.8	-1.1	-5.8	-3.7	-3.0	-3.1	-5.6	-2.0	-3.5	-3.2
Capital	2.8	-1.1	4.4	8.5	10.8	-12.9	16.4	10.7	-16.5	-14.0	-4.9
Public Health	2.7	-1.3	-6.4	2.2	-2.8	0.8	0.1	-1.6	0.2	5.2	0.2
Administration	-5.0	-10.3	-0.8	-12.8	0.2	-2.2	-1.9	19.6	-12.5	6.9	-1.2
All Other Health Spending	5.4	3.4	3.6	-2.5	0.0	-0.5	1.9	1.3	-4.7	-10.7	-1.9
Total	-0.3	-0.6	-0.1	-2.4	-0.2	-1.7	0.7	-0.4	-1.8	-0.4	-1.0
Provincial Revenues (*Percent Change*)											
Own Source Revenues	-3.3	-1.1	-3.3	-2.0	0.7	-0.2	1.1	-3.8	3.0	0.4	0.2
Federal Transfers	-14.1	-4.8	-1.0	-4.5	-1.3	-4.6	-5.3	-4.5	5.6	-4.9	-2.8
Adjusted Federal Transfers*	-14.5	1.0	3.3	-0.1	2.6	-0.5	-0.7	-1.5	9.7	-0.8	1.2
GDP	1.5	0.7	0.2	-0.2	0.5	0.8	1.3	2.9	2.2	1.5	1.1

* Adjusted Real Per Capita Federal Cash Transfers (minus equalization and adjusted for one time infrastructure funding after 2009 recession).
Source: CIHI (2015), authors' calculations.

- demand-driven factors, such as the shares of population in old-age groups; and

- variables to capture province-specific effects.

Precise definitions and data sources for these variables are presented in the Appendices.

We attempt to capture the specific impact of the restraint periods by specifying variables for the 1991-1996 period and for 2011-2013. The coefficients on these two variables can help answer two questions: 1) After controlling for a broad range of socio-economic expenditure determinants, what is the impact of provincial healthcare spending cost-control initiatives? and 2) Are these two periods comparable in terms of their downward impact on real per capita healthcare spending?

Results

Our model[15], which is summarised in Table 3, explains approximately 90 percent of the variation in real per capita provincial health spending. Positive and significant drivers of real per capita spending include real per capita GDP, the number of family and specialist physicians per 1,000 population, real per capita core federal cash transfers and the proportion of the population aged 75 years and older. As well, the impact of health-sector inflation rising faster than general inflation also exerts a positive and significant impact on real per capita health expenditures. The provincial variables show that after controlling for all other factors, Nova Scotia, Quebec, Alberta and Manitoba, generally spend less per capita than Ontario. Negative and significant determinants of real per capita provincial health spending include the net debt to GDP ratio.

Interestingly, the proportion of the population aged 65 to 74 is generally not a significant contributor to rising health spending while the proportion aged 75 years and older definitely is, suggesting a more complicated impact of aging on healthcare spending than popularly assumed. As a result, an aging population can be divided into the "young" old and the "old" old, with the latter more likely to generate healthcare spending increases, especially due to the cost of health services provided immediately prior to death.[16]

The results show that a one-dollar increase in real per capita GDP increases real per capita health spending by approximately two cents while a one-dollar increase in real per capita federal healthcare transfers increases health spending by 36 cents. This suggests that health spending is much more sensitive to a dollar of grants than a dollar of income – a result referred to as the flypaper effect.[17]

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15 We use Ordinary Least Squares (OLS) to estimate both linear and log-linear specifications. Full results are presented in Appendix II. Results using an alternative regression technique – Generalized Least Squares – are presented in Appendix II for comparison purposes. One variable not explicitly included is technological change. Modelling the effects of technological change can be a complicated issue particularly with aggregate macro-level data. Aside from time trend, another way to measure it is simply to ascribe it to the residual, after accounting for all other factors. Given that technological change occurs over time, a time index is another way to control for its effect on health expenditures. However, its true impact would likely not be captured by a simple time trend that assumes a constant effect over time. See Folland, Goodman and Stano (2013, 121-127) and Di Matteo (2005).

16 There is considerable debate about an aging population's significance as a healthcare expenditure driver. For a sample of Canadian research on this question, see Denton and Spencer (1995), Hogan and Hogan (2002), Seshamani and Gray (2004) and Brown and Suresh (2004).

17 The flypaper effect results when a dollar of exogenous grants leads to significantly greater public spending than an equivalent dollar of citizen income: that is to say, money sticks where it hits. See Inman (2008).

Table 3: Summary of Final Model Results

Variable	Effect on per Capita Provincial Health Spending (in 1997 terms) in Our Model
Real per Capita GDP	Each $1 in real per capita GDP (in 2002 terms) is associated with about 2 cents in additional per-capita spending.
Real per Capita Federal Transfers	Each $1 in increased transfers is associated with about 36 cents in additional per-capita spending.
Net Debt to GDP Ratio	Each increase of 1 percent in net debt to GDP is associated with about $5 less in real per-capita spending.
Healthcare Cost Inflation Relative to General Inflation	Each increase of 1 percent in this ratio is associated with $12 in additional per-capita spending.
Family Physicians per 1,000 Persons	*No significant effect.*
Specialist Physicians per 1,000 Persons	Each specialist physician per 1,000 persons is associated with $720 in additional per-capita spending.
Proportion of the Population Aged 65 to 74	*No significant effect.*
Proportion of the Population Aged 75 and Older	Each increase of 1 percent in this ratio is associated with $110 in additional per-capita spending.
Provincial Variables	Each of Nova Scotia, Quebec, Alberta, and Manitoba generally spend less per capita than Ontario.
First Restraint Period (1991-1996)	In this period, per capita spending was about $67 lower.
Second Restraint Period (2011-2013)	In this period, per capita spending was about $75 higher.

Source: Authors' calculations as described in text. Final Model. OLS results. Appendix II. Table AII2. Linear with restraint periods.

As well, a one-percentage-point increase in a province's net debt to GDP ratio is associated with a just more than $5 decrease in real per capita provincial health spending, suggesting that fiscal conditions can indeed spill over into the health sector. This also suggests the potential for downward pressure in the future, given the high government debt levels among several provinces.

In addition, adding one specialist physician per 1,000 persons is associated with an additional $720 in real per capita provincial health spending. In 1981, the average number of specialist physicians per 1,000 persons across Canada's provinces was 0.6 and grew to 1.1 by 2013 – an increase of nearly one-half a specialist physician per 1,000 persons. This near doubling would be associated with a $295 increase in real per capita provincial health spending. Furthermore, specialist physician numbers are set to grow in the future, given increased medical school enrolment.

Of particular interest for this study, the 1991-1996 period is indeed a period of significant decreases in health spending while the 2010-2013 restraint era does not demonstrate similar significant drops. Real per capita provincial health spending was 3.5 percentage points lower as a result of the 1991-1996 restraint period compared to 2010-2013.

This suggests that, after other health spending drivers and determinants are taken into account – including economic growth, aging populations and federal transfer growth – the 1991-1996 period saw explicit cost restraint on the part of provincial governments with respect to their healthcare systems.[18] In contrast, the decline in real per capita provincial health spending since 2010 can be ascribed largely to other factors such as the economic slowdown and its effects on revenues.

Why the Current Period of Cost Restraint Is Most Likely Temporary

After controlling for drivers of provincial health spending, such as real per capita GDP, federal cash transfers, provincial revenues, age distribution and debt/deficit situation, it would appear that the current restraint period is not similar in magnitude to the efforts that took place between 1991 and 1996. While poor economic performance is a factor in both periods of health-spending decline, explicit cost cutting appears to be a feature only of the 1991 to 1996 retrenchment period and even then the empirical evidence is not as strong as we would have thought.

Capital spending is a critical component of recent spending restraint: the category makes up only 5 percent of all provincial health costs, but accounts for around 25 percent of the current restraint period's decline in total spending. Yet, key capital projects and maintenance can only be delayed for so long. Therefore, we do not think declines in capital spending are a resilient source of spending restraint.

Although our results cast doubt on the seriousness of the current decline in real per capita provincial spending, governments are making efforts to reduce their healthcare expenditures. For instance, the focus on collective drug purchasing may be having an appreciable impact. Although it is hard to strip out the effects on lower spending related to drugs coming off patent and efforts at greater generic substitution and pricing, the consistency of drug-spending restraint across provinces, in spite of a rising number of enrollees in provincial drug plans for seniors, is some evidence that cost restraints are making inroads.

However, drugs make up only 7 percent of all public healthcare costs, so dramatic reductions in this area would be required to have a major impact in the overall health spend. Furthermore, recent estimated results show that drug spending may be once again picking up pace as so-called "nichebuster" drugs come into more common use. Significant fiscal improvement in health-cost restraint would likely need to come from all groups, including physicians. The challenges here are many, in particular with the large number of medical school enrollees set to graduate and being assimilated into the health system each year.

Holding the Line on Federal Transfers

Federal cash transfers and health transfer regimes (namely the Canada Health Transfer and Health Accord) can have an important impact on overall provincial health spending. If Ottawa wants to help bend the cost curve, while maintaining adequate support for social programs, it should maintain a health transfer that grows at the same rate as GDP but sets an appropriate floor, or minimum percentage increase for such transfers. Indeed, the new Liberal government's 2016 federal budget included these two commitments, continuing the 3 percent floor established by the previous federal government. Ottawa would be wise to maintain this formula during promised negotiations with the provinces for a new health accord.

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18   It should be noted that the GLS estimates in Appendix II suggest that both restraint periods were statistically insignificant.

When the Harper government announced in 2011 that it would abandon the 6 percent escalator not long after the 2004 Health Accord expired in 2014 in favour of increases tied to GDP growth, with a 3 percent floor, the prospects for average annual economic growth were around 5 percent. Currently, with lower growth expectations around 3 percent, the previously announced prior floor could be considered quite high.

Arguably, provincial health-spending plans may have already begun to adjust to changes in the federal health transfer and increasing the 3 percent floor could have a lasting, deleterious effect on cost-control efforts. To the extent that the provinces need more money to fund healthcare, they should do so by raising the revenue themselves. There is evidence to suggest that provinces find it easier to spend federal money than to spend the revenues they raise on their own.

Measuring Outcomes and Quality

In attempts to curtail the growth of health spending – mainly, changes to prices and the volume of services – policymakers must also highlight the impact on service quality. Without the appropriate measurement of healthcare outcomes, governments are exposed to public claims by vested interests that cost restraint leads to heightened patient safety risks and reduced quality care. Improved measurement of outcomes, particularly measures related to the patient experience (Veillard et al. 2015), should help guide policymakers through the challenges in bending lower the cost curve by ensuring that quality is not eroded. With more broadly based patient outcome measures, governments may be more comfortable engaging in promising areas for potential reform (see Box 1 for some examples).

Box 1: Options to Put a Lasting Bend in the Health-Cost Curve – Getting the Right Volume and Price for Health Services

Reinhart (2015) cites two key influencers of health-spending growth – the prices/unit of care and the units of care/population. There tends to be little flexibility in quickly negotiating down the prices per unit of care, while the volume of services provided is perhaps even harder to alter.

Getting the Right Volume and Mix of Services via Payments System Reforms

Primary care physicians in Canada have few financial incentives to obtain more appropriate use of services that they refer or prescribe (Blomqvist and Busby 2012). Prescribed drugs, the use of diagnostic tests, secondary-care followups, are decisions by primary care providers, but their decisions are not based on costs. In contrast, the UK National Health System seems to be taking more aggressive steps to put in place an environment to better control health costs and ensure quality than the provinces. The UK's recent establishment of clinical commissioning to oversee the purchase of services prescribed and referred by family doctors (who are paid by roster size and the number and complexity of patients under care) has put in place a payments system that matches quality care and low-cost objectives.

Box 1: Continued

Similar efficiency criticisms have been made of the way in which we finance hospitals (Sutherland et al. 2013). Payment reforms have shown potential to control costs and utilization without lowering quality of care (Chernew and May 2011). We encourage further attempts to put in place systems that promote efficiency, and we agree with Reinhardt's trenchant criticism: "[P] erhaps the thought is to let other nations do the research and development and experimentation with alternative approaches and then to adopt what is suitable for Canada. If I am correct, this is disappointing, as it represents a great opportunity missed…." (Reinhardt 2015, 19).

Payment reforms have the potential to coincide nicely with attempts to reduce the amount of waste and unnecessary resources used in healthcare. As we get a better understanding of the appropriateness and best practices of care, which often comes through an analysis of variations in care practices, opportunities will arise for eliminating unnecessary, and potentially harmful, care.

Choosing Wisely®, based on encouraging patient-physician discussions of treatment options, is a helpful initiative aimed at rooting out wasteful and unnecessary tests, prescriptions and procedures while improving patient care and reducing harm. Arguably, financial incentives should align with and emphasize these pursuits – at a minimum, financing formulas should be designed so not to encourage unnecessary costs.

The Prices We Pay

When it comes to reducing health services' price per unit – which can be a highly political endeavour – the potential solutions would benefit from a careful rethink of how we pay our providers of goods and services. On this score, the provinces and Ottawa have taken steps to create a more collective approach to negotiating drug purchases with manufacturers, which should lead to more cost-effective outcomes and appears to be having an impact on the current period of cost reduction. This is encouraging.

Although most observers agree that it makes sense for governments to collaborate in purchasing drugs, there seems to be little investigation of disjointed provincial efforts when it comes to negotiations with healthcare professionals and caregivers, which make up a much larger share of total health costs. The current approach instead lets provinces compete against one another in overall compensation, which, as long as one province is willing to pay more than others, leads to a longer-term leapfrogging trend, putting constant upward pressure on compensation.

Conclusion

The current period of healthcare-spending restraint is quite different than that of the 1990s. Current decreases are strongly driven by a slowdown in capital spending and, relative to the 1990s, drugs have become a more important source of savings, whereas hospitals and physicians have been less impacted. Furthermore, once one takes into account many drivers of health spending, such as economic, fiscal and supply-side factors, it is not clear that today's restraint represents a major change in trajectory from what would otherwise be expected.

Given the importance of federal transfers as an expenditure driver, any return to the transfer formula adopted in 2004 – such as an escalator

growing in the range of 5 percent to 6 percent annually – should be avoided. If this were to happen, health spending would likely once again begin to outstrip economic growth, forestalling efforts to push through difficult reforms that would help to bend the cost curve. At the same time, one potential reason why cost constraint efforts may have proven temporary or limited is because quality of care is not monitored closely, particularly using patient outcome and experience measures, leaving the public in doubt regarding the effectiveness of government efforts at both expenditure control and quality of care.

Appendix I: Regression Methodology

A pooled time-series cross-section regression[19] model is estimated for provincial healthcare expenditures taking the form:

$$(1)\ H_{it} = f(z_{1it}, z_{2it}, \ldots z_{nit})$$

where Hit is real per capita government health expenditures of the i-th province at period t, and z1 to zn represents a vector of social, demographic, economic and policy variables of the i-th province at time t that are determinants of Hit. These determinants are essentially expenditure drivers, and the literature has said they include population growth, population aging, income growth, inflation and enrichment factors such as technological change as accounted for by either time trend or residual effects.[20]

Specifically, the determinants of real per capita government health spending are defined as family and specialist physicians per 1,000 of population,[21] real per capita GDP, the proportion of population aged 65 to 74 years, the proportion aged 75 years and more, real per capita federal cash transfers,[22,23,24] the ratio of provincial net debt to GDP[25] and the ratio of the healthcare implicit price index to the consumer price index.

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19   The pooled regression is preferable to single-province estimates because pooling allows for a larger sample and more degrees of freedom.

20   See Constant, et al. (2011).

21   The variable for physicians is the number of physicians per 1,000 people. The intent is not to capture the effect of the total number of physicians on provincial health spending but the effect of physician intensity relative to population. See Di Matteo (2014).

22   The variable used is the real per capita value of total federal cash transfers adjusted for one-time stimulus-grant funding in the wake of the 2009 recession. Federal cash transfers are important provincial revenue sources – approximately 20 percent – although their importance varies among provinces. About half of federal transfers are specifically marked for health. However, general-purpose transfers like equalization can also be applied to health. It is difficult to separate health transfers, given the large amount of change in transfer arrangements over time, both in dollar amounts as well as in institutional arrangements. At present, federal cash transfers to the provinces and territories are provided in four main programs: the Canada Health Transfer (CHT), the Canada Social Transfer (CST), Equalization and the Territorial Formula Financing (TFF) for a total of $68 billion in 2015/16. The CHT has grown steadily from $20.3 billion in 2005 to an expected $34 billion for 2015/16 – an annual growth rate of nearly 6 percent. After 2017, the CHT is slated to increase in line with nominal GDP growth with a floor of 3 percent.

23   It should be noted that we ran initial regressions using both the unadjusted and the adjusted real per capita federal transfer variable (Table 2) that removed equalization and the one-time infrastructure funding of 2009 and 2010. The results closely paralleled the final results presented.

24   Over the years, a number of regime changes have occurred with respect to transfers. In 1977, there was the onset of Established Program Financing (EPF), which replaced federal-provincial cost sharing on health with a block grant. In 1984, there was the onset of the *Canada Health Act* (CHA), which tied the receipt of federal transfers to running a healthcare system that met basic conditions. In 1996, EPF and the Canada Assistance Plan, which funded income support, were collapsed into one transfer (and the cash portion reduced by one-third). This new transfer was called the Canada Health and Social Transfer (CHST). Finally, in 2005 the CHST was divided into two transfer payments – the CHT and the CST.

25   It should be noted that balanced federal budgets after the mid-1990s created a fiscal dividend that enabled provinces to spend more on health, even while lowering income and corporate taxes. See Landon et al. (2006).

Inflation is accounted for in all these regressions by using real expenditure data (in 1997 or 2007 dollars). However, to account for health-sector inflation being higher than general inflation and, therefore, a unique driver, the ratio of the healthcare implicit price index to the consumer price index (All-Items) is included as a variable.[26] Finally, provincial dummy variables are also included in the regressions to capture time-invariant fixed effects not captured by other variables in the model.[27]

An attempt to capture the effect of the restraint periods is made by specifying dummy variables – one for the 1991-1996 period and one for 2011-2013. The coefficients on these variables can help us see the effect of explicit cost-control efforts associated with provincial health spending on real per capita health spending, after accounting for other variables. As well, based on the size of their coefficients, we can see if these two periods are comparable in terms of their downward effect on real per capita provincial health spending.

The variables are defined in Appendix II: Table AII 1 with data sources explicitly described in Appendix III. The data for these regression variables were obtained from the National Health Expenditure database constructed by the Canadian Institute for Health Information[28] and also from CANSIM-Statistics Canada and the Federal Fiscal Reference Tables (See Appendix III for a summary). Final regression results are presented in Table AII 2, using Ordinary Least Squares as the estimation technique for both linear and log-linear specifications while Generalized Least Squares (GLS)[29] estimates are also included in Appendix II for linear and log-linear specifications (and in Appendix IV with years as a time-trend variable). GLS estimates are also done in an effort to deal with any autocorrelation or heteroscedasticity affecting the OLS estimates.[30] The GLS estimates assumed heteroscedastic panels with a common AR(1) correlation for all panels. Estimates were done using STATA 13 and testing was done on the data.

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26 While the regression is for the determinants of real per capita spending and the dependent and independent variables are generally provided in inflation-adjusted terms, health-sector price inflation is often above the rate of general inflation as well as for core services such as physicians and hospitals. Furthermore, health-sector price inflation is particularly associated with increases in remuneration, as employers and governments compete for a limited pool of human resources. See CIHI (2011:20-23).

27 Again, it should be noted that some of the initial specifications also included real per capita provincial own-source revenues, deficit-to-GDP ratios, the proportions of population aged 25 to 44 and 45 to 64, along with a time trend and some fixed-effects variables for transfer-regime changes. These specifications generally exhibited much higher degrees of multi-collinearity as measured by correlation coefficients between the variables being 0.5 or higher.

28 Physician numbers were also obtained from the CIHI National Physician Database.

29 These estimates are pooled-time series cross sections using Generalized Least Squares (GLS), assuming heteroskedastic panels with cross-sectional correlation, assuming common AR(1).

30 Inspection of plots of residual plots against the regression variables did not show heteroscedastic patterns. Also, in initial work with the data, Box-Cox testing found a linear specification for real per capita total provincial health spending to be more suitable than log-linear. As well, a Ramsay-Rest test on the variables used, as well as the Box-Cox test, show that the model has no omitted variables. Nonetheless, the omission of explanatory variables or the use of an incorrect functional form can also lead to the conclusion that autocorrelation or heteroscedasticity is present. A common practice is to use a GLS technique to construct additional estimates. See also Thursby (1987).

Levin-Lin-Chu and Fisher Type[31] unit root tests for panel data were conducted for the variables in the data set, and the variables exhibited a high degree of stationarity,[32] with the null hypothesis of a unit root being rejected for many of the variables. In addition, when a correlation matrix was done for the variables in the final model, the correlation coefficients were generally all below 0.5, suggesting a limited multi-collinearity impact.

31 The Levin-Lin-Chu test requires that the ratio of the number of panels to time periods tend to zero asymptotically and does not suit datasets with a large number of panels and relatively few time periods. This data set has a small number of panels (10) and a fixed number of time periods. The Levin-Liu-Chu tests were done with trend assumed. The Fisher-Type tests assumed the fuller option, drift and two lags, and were done both with and without the demean option. It should be noted that panel test outcomes are often difficult to interpret if the null of the unit root is rejected and the best that can be concluded is that "a significant fraction of the cross section units is stationary or cointegrated." See Breitung and Pesaran (2005).

32 A stationary time series is one whose mean and variance do not change with time. If variables in a regression are non-stationary, then the implication is that the regression may be spurious. If the error term is stationary, then the variables are co-integrated with the error term representing short-term deviations from that relationship. Tests for stationarity are available, but their power can be limited by both the quality and the time span of the data. See for example Hendry (1986) and Muscatelli and Hurn (1992). Some research has suggested that stationarity may not be as serious a problem in panel data when panel level tests are employed. See Roberts (2000) and Mckoskey and Seldon (1998).

APPENDIX II

Table AII 1: Regression Variables		
Dependent Variable	Real per capita provincial government health expenditures	Real per capita provincial government total health expenditures deflated using government current expenditure implicit price index, 1997=100
Economic and Fiscal Factors	Real per Capita GDP	Real per capita provincial GDP (Deflated using GDP deflator, 2007=100)
	Real per Capita Core Federal Cash Transfers	Real per Capita Core federal cash transfers to province - federal cash transfers minus one-time infrastructure funds
		(Deflated using government current expenditure implicit price index, 1997=100)
	Net Debt to GDP Ratio	Provincial government net debt divided by provincial GDP times 100
	Healthcare Inflation Relative to General Inflation	Ratio of Healthcare Implicit Price Index (1997=100) to Consumer Price Index All-Items (2002=100)
Supply Side Factors	Family Physicians per 1000 pop.	Number of family physicians per 1,000 of provincial population
	Special. Physicians per 1000 pop.	Number of medical specialist physicians per 1,000 of provincial population
Demand Side Factors	Proportion of Population Aged 65 to 74 Years	Provincial population aged 65 to 74 years divided by total provincial population
	Proportion of Population 75 years and Older	Provincial population aged 75 years and older divided by total provincial population
Other Variables	Provincial Control Variables	
Restraint Variables	First Restraint Period 1991-1996	
	Second Restraint Period 2011-2013	
Source: Authors' calculations as described in text.		

Table AII 2: Final Regression Results – Ordinary Least Squares (OLS) Estimates Dependent Variable: Real Per Capita Provincial Government Health Expenditures								
	Without Restraint Period Variables				With Restraint Period Variables			
	Linear		Log-Linear		Linear		Log-Linear	
	Coefficient	t–statistic	Coefficient	t–statistic	Coefficient	t–statistic	Coefficient	t–statistic
Real per Capita GDP	0.02	**5.99**	0.00001	**5.97**	0.02	**5.61**	0.00001	**5.54**
Real per Capita Core Federal Cash Transfers	0.39	**7.62**	0.00019	**7.49**	0.36	**7.01**	0.00018	**7.05**
Net Debt to GDP Ratio	-6.33	**-5.28**	-0.002	**-3.24**	-5.23	**-4.23**	-0.00137	**-2.20**
Healthcare Inflation Relative to General Inflation	1354.87	**4.69**	0.40	**2.76**	1175.07	**3.88**	0.39	**2.54**
Family Physicians per 1000 pop.	167.35	1.19	0.19	**2.66**	228.06	1.63	0.22	**3.06**
Special. Physicians per 1000 pop.	731.17	**4.05**	0.37	**4.11**	720.20	**4.03**	0.38	**4.23**
Proportion of Population Aged 65 to 74 Years	2912.16	1.29	-0.05	-0.04	1198.77	0.5	-0.23	-0.19
Proportion of Population 75 years and Older	10458.98	**3.89**	6.30	**4.68**	11003.09	**4.02**	6.06	**4.39**
NL	10.68	0.13	-0.06	-1.58	7.56	0.1	-0.07	*-1.76*
PE	-112.26	-1.08	-0.07	-1.29	-94.01	-0.92	-0.06	-1.11
NS	-278.83	**-4.51**	-0.18	**-5.77**	-282.64	**-4.62**	-0.18	**-5.99**
NB	-82.24	-1.04	-0.05	-1.34	-71.21	-0.92	-0.05	-1.22
QC	-88.90	*-1.76*	-0.06	**-2.55**	-102.58	**-2.03**	-0.08	**-2.97**
MB	-138.82	**-2.33**	-0.08	**-2.55**	-124.07	**-2.12**	-0.07	**-2.36**
SK	-96.19	-1.11	-0.05	-1.09	-78.66	-0.91	-0.03	-0.69
AB	-265.93	**-2.78**	-0.11	**-2.31**	-226.83	**-2.36**	-0.09	*-1.76*
BC	45.44	0.85	0.01	0.55	47.52	0.9	0.02	0.71
First Restraint Period 1991-1996					-66.96	**-2.87**	-0.04	**-3.00**
Second Restraint Period 2011-2013					74.45	*1.92*	0.01	0.42
Constant	-1952.63	**-7.40**	5.84	**44.23**	-1656.31	**-5.43**	5.87	**38.25**
n	330		330		330		330	
Adjusted r-squared	0.89		0.89		0.89		0.89	
F-statistic	153.51		153.86		143.26		141.59	

Note: Bold denotes significant at 5% level. Bold italic denotes significant at 10% level.
Source: Authors' calculations as described in text.

Generalized Least Squares Regressions (GLS) Supplementary Estimates

Assuming Heteroskedastic panels and common AR(1) coefficient for all panels.
Dependent Variable: Real Per Capita Provincial Government Health Expenditures.

	Without Restraint Period Variables				With Restraint Period Variables			
	Linear		Log-Linear		Linear		Log-Linear	
	Coefficient	*z*	*Coefficient*	*z*	*Coefficient*	*z*	*Coefficient*	*z*
Real per Capita GDP	0.01196	**3.70**	0.00001	**3.64**	0.01218	**3.71**	0.00001	**3.72**
Real per Capita Core Federal Cash Transfers	0.04205	**1.97**	0.00002	**2.05**	0.04189	*1.95*	0.00002	**2.02**
Net Debt to GDP Ratio	-4.59829	**-3.60**	-0.00148	**-2.35**	-4.64112	**-3.62**	-0.00153	**-2.42**
Healthcare Inflation Relative to General Inflation	398.28620	*1.67*	0.11362	0.98	404.80020	*1.69*	0.12132	1.04
Family Physicians per 1000 pop.	386.76520	**3.29**	0.25669	**4.44**	382.05670	**3.21**	0.25549	**4.37**
Specialist Physicians per 1000 pop.	625.61150	**4.14**	0.30864	**4.16**	621.92440	**4.10**	0.31017	**4.16**
Proportion of Population Aged 65 to 74 Years	-4640.21400	*-1.95*	-3.49928	**-2.97**	-4631.44800	*-1.88*	-3.29043	**-2.70**
Proportion of Population 75 years and Over	21103.08000	**7.42**	11.44934	**8.10**	21095.90000	**7.31**	11.33645	**7.92**
NL	307.55770	**3.56**	0.08811	**2.00**	309.08750	**3.55**	0.08966	**2.03**
PE	65.42921	0.57	0.01344	0.23	67.79522	0.58	0.01717	0.29
NS	-155.47190	**-2.04**	-0.10534	**-2.59**	-151.39330	**-1.96**	-0.10301	**-2.53**
NB	85.96294	1.08	0.03054	0.76	87.76420	1.09	0.03336	0.82
QC	-39.64710	-0.71	-0.02589	-0.88	-36.59775	-0.64	-0.02454	-0.82
MB	-11.26390	-0.16	-0.01644	-0.47	-9.77159	-0.13	-0.01474	-0.41
SK	-105.36230	-1.24	-0.05426	-1.23	-107.03890	-1.24	-0.05413	-1.22
AB	-30.94891	-0.27	0.00224	0.04	-37.07219	-0.32	-0.00203	-0.03
BC	-1.48523	-0.03	0.00463	0.16	-0.81263	-0.01	0.00417	0.14
First Restraint Period 1991-1996					10.76619	0.69	0.00601	0.80
Second Restraint Period 2011-2013					-0.10712	0.00	-0.00662	-0.60
Constant	-617.3701	**-2.7**	6.335737	**56.58**	-626.57320	**-2.64**	6.31031	**54.34**
N	330		330		330		330	
Wald chi2	1048.28		1036.63		1019.51		1023.92	
Pseudo r-squared***	0.8666		0.8697		0.8651		0.8677	

Note: Bold denotes significant at 5% level. Bold italic denotes significant at 10% level. *** Correlation coefficient between fitted and actual value of dependent variable squared.
Source: Authors' calculations as described in text.

APPENDIX III

Appendix III: Data Sources	
Real per capita provincial government health expenditures	Canadian Institute for Health Information, National Health Expenditures, 2015
Family Physicians per 1,000 pop.	Canadian Institute for Health Information National Physician Database.
Special Physicians per 1,000 pop.	Canadian Institute for Health Information National Physician Database.
GDP	Statistics Canada
GDP Deflator (2007=100)	Statistics Canada
Federal Cash Transfers	Federal Fiscal Reference Tables, Finance Canada
Net Debt	Federal Fiscal Reference Tables, Finance Canada
Provincial Population	Statistics Canada
Proportion of Population Aged 65 to 74 Years	Statistics Canada
Proportion of Population 75 years and Older	Statistics Canada
Health Care Implicit Price Index (1997=100)	Canadian Institute for Health Information, National Health Expenditures, 2015
Government Current Expenditure Implicit Price Index (1997=100)	Canadian Institute for Health Information, National Health Expenditures, 2015
Consumer Price Index (2002=100)	Statistics Canada
Source: Authors' calculations as described in text.	

APPENDIX IV

Supplementary Generalized Least Squares Regressions (GLS) – With Year Variable for Time Trend

Assuming Heteroskedastic panels and common AR(1) coefficient for all panels.
Dependent Variable: Real Per Capita Provincial Government Health Expenditures.

	With Restraint Period Variables				Without Restraint Period Variables			
	Linear		Log-Linear		Linear		Log-Linear	
	Coefficient	*z*	*Coefficient*	*z*	*Coefficient*	*z*	*Coefficient*	*z*
Real per Capita GDP	0.00349	1.03	0.00000	1.40	0.00369	1.10	0.00000	1.35
Real per Capita Core Federal Cash Transfers	0.06147	**2.99**	0.00003	**2.94**	0.06519	**3.17**	0.00003	**3.00**
Net Debt to GDP Ratio	-6.10536	**-5.08**	-0.00222	**-3.69**	-6.05903	**-5.02**	-0.00213	**-3.52**
Health Care Inflation Relative to General Inflation	-353.36220	-1.47	-0.19298	-1.61	-322.23060	-1.34	-0.17071	-1.43
Family Physicians per 1000 pop.	268.31320	**2.41**	0.20277	**3.64**	253.08010	**2.28**	0.19366	**3.49**
Special Physicians per 1000 pop.	396.73310	**2.80**	0.22014	**3.10**	391.80650	**2.76**	0.21337	**2.99**
Proportion of Population Aged 65 to 74 Years	-1874.30800	-0.85	-1.93991	*-1.77*	-2902.87800	-1.36	-2.71899	**-2.51**
Proportion of Population 75 years and Over	-5959.07600	-1.58	-0.98396	-0.52	-4382.30300	-1.20	0.20561	0.11
NL	126.52560	1.49	0.00993	0.23	127.72000	1.50	0.01261	0.29
PE	69.90743	0.68	0.02490	0.48	54.68795	0.54	0.01396	0.27
NS	-77.41216	-1.16	-0.06843	**-1.96**	-81.04358	-1.20	-0.07057	*-1.93*
NB	30.91064	0.42	0.01276	0.34	22.25839	0.30	0.00675	0.18
QC	-94.18363	*-1.81*	-0.05122	*-1.93*	-88.68073	*-1.73*	-0.04717	*-1.75*
MB	154.59210	**2.49**	0.05957	*1.95*	139.51000	**2.27**	0.04989	1.60
SK	164.49950	**1.97**	0.07044	*1.66*	145.23130	*1.76*	0.05704	1.33
AB	-181.20640	*-1.70*	-0.07371	-1.35	-182.68130	*-1.72*	-0.06706	-1.21
BC	62.45406	1.16	0.03310	1.23	64.68248	1.21	0.03557	1.29
Year	41.89270	**8.94**	0.01854	**7.94**	40.01917	**8.74**	0.01734	**7.48**
First Restraint Period 1991-1996	-6.03778	-0.42	-0.00172	-0.24				
Second Restraint Period 2011-2013	-34.67249	-1.60	-0.02279	**-2.12**				
Constant	-81528.41000	**-9.02**	-29.51188	**-6.56**	-77831.98000	-8.83	-27.14436	**-6.08**
n	330		330		330		330	
Wald chi2	1404.3		1430.1		1398.97		1324.48	

Note: Bold denotes significant at 5% level. Bold italic denotes significant at 10% level.
Source: Authors' calculations as described in text.

References

Ariste, Ruolz, and Jeff Carr. 2003. *New Considerations on the Empirical Analysis of Health Expenditures in Canada: 1966-1998*. Ottawa: Health Canada, Health Policy Research Working Paper Series, Working Paper 02-06.

Barros, P.P. 1998. "The Black Box of Health Care Expenditure Determinants." *Health Economics* 7: 553-544.

Blomqvist, Ake, and Colin Busby. 2012. *How to Pay Family Doctors: Why 'Pay per Patient' is Better than Fee for Service*. Commentary 365. Toronto: C.D. Howe Institute. October.

Blomqvist, Ake, Colin Busby, and Don Husereau. 2013. *Capturing Value from Health Technologies in Lean Times*. Commentary 396. Toronto: C.D. Howe Institute. December.

Breitung, Joerg, and M.H. Pesaran. 2005. "Unit Roots and Cointegration in Panels." CESifo Working Paper No. 1565. October.

Brown, Robert, and Ulma Suresh. 2004. "Further Analysis of Future Canadian Health Care Costs." *North American Actuarial Journal* 8 (2): 1-10.

Bryant, John, et al. 2004. "Population Ageing and Government Health Expenditures in New Zealand, 1951-2051." New Zealand Treasury Working Paper, 04/14.

Busby, Colin, William B.P. Robson, and Aaron Jacobs. "Managing Healthcare for an Aging Population: Ontario's Troubling Collision Course." E-Brief 192. Toronto: C.D. Howe Institute. December.

Canadian Institute for Health Information. 2015. *National Health Expenditure Trends*, 1975 to 2015.

——————. 2011. *Health Care Cost-Drivers: The Facts.*

Chernew, Michael, and Dustin May. "Health Care Cost Growth." Chapter 14 in *The Oxford Handbook of Health Economics. Sherry Glied and Peter Smith* (eds.).

Constant, Alexandra, et al. *Research Synthesis on Cost Drivers in the Health Sector and Proposed Policy Options*. Ottawa: Canadian Health Services Research Foundation, Reports on Cost Drivers and Health System Efficiency: Paper 1.

Cutler, D.M., et al. 1998. "Are Medical Prices Declining? Evidence from Heart Attack Treatments." *Quarterly Journal of Economics* 113(4): 991-1024.

Decter, Michael. 2002. *Four Strong Winds: Understanding the Growing Challenges to Health Care*. Toronto: Stoddart.

Department of Finance. 2016. *Federal Budget 2016. Growing the Middle Class*.

Denton, F.T., and B.G. Spencer. 1995. "Demographic Change and the Cost of Publicly Funded Health Care." *Canadian Journal on Aging* 14(2): 174-192.

Di Matteo, Livio. 2014. "Physician numbers as a driver of provincial government health spending in Canadian health policy." *Health Policy* 115: 18-35.

——————. 2010. "The sustainability of public health expenditures: evidence from the Canadian federation." *European Journal of Health Economics* 11 (6): 569-584.

——————. 2005. "The macro determinants of health expenditure in the United States and Canada: assessing the impact of income, age distribution and time." *Health Policy* 71(1): 23-42.

Di Matteo, Livio, and Rosanna Di Matteo. 2009. *The Fiscal Sustainability of Alberta's Public Health Care System*. School of Public Policy Research Paper 2: 2. Calgary: University of Calgary.

——————. 1998. "Evidence on the Determinants of Canadian Provincial Government Health Expenditures: 1965-1991." *Journal of Health Economics* 17(2): 211-228.

Di Matteo, Livio, and J.C.H. Emery. 2014. "Common provincial determinants and cost drivers." Chapter 4, co-authored with J.C.H. Emery, in *Bending the Cost Curve in Health Care: Canada's Provinces in International Perspective*. G.P. Marchildon, and Livio Di Matteo (eds.). The Johnson-Shoyama Series on Public Policy. University of Toronto Press.

Dodge, David, and Richard Dion. 2011. *Chronic Healthcare Spending Disease: A Macro Diagnosis and Prognosis*. Commentary 327. Toronto: C.D. Howe Institute. April.

Evans, R.G., and K.M. McGrail. 2008. "Richard III, Barer-Stoddart and the Daughter of time." *Healthcare Policy* 3(3): 18-28.

Folland, Sherman, A.C. Goodman and Miron Stano. 2013. *The Economics of Health and Health Care, Seventh Edition*. New Jersey: Pearson.

Gerdtham, U.G., et al. 1992. "An econometric analysis of health care expenditure: A cross-section study of the OECD countries. *Journal of Health Economics* 11: 63-84.

Gerdtham, U.G., et al1998. "The Determinants of Health Expenditure in the OECD Countries: A Pooled Data Analysis." Peter Zweifel (ed.). *Health, The Medical Profession and Regulation. Developments in Health Economics and Public Policy* 6: 113-134.

Gerdtham, U.G., and Bengt Jonsson. 2000. "International Comparisons of Health Expenditure: Theory, Data and Econometric Analysis." *Handbook of Health Economics*, Vol. 1. A.J. Culyer and J.P. Newhouse (eds.). Elsevier Science.

Getzen, T. E. 1992. "Population Ageing and the Growth of Health Expenditures." *Journal of Gerontology: Social Science*s 47: S98–S104.

Hendry, D.F. 1986. "Econometric modelling with cointegrated variables: an overview." *Oxford Bulletin of Economics and Statistics* 48:201–27.

Hitiris, Theo, and John Posnett. 1992. "The determinants and effects of health expenditure in developed countries." *Journal of Health Economics* 11: 173-181.

Hogan, Seamus, and Sarah Hogan. 2002. *How Will the Ageing of the Population Affect Health Care Needs and Costs in the Foreseeable Future?* Discussion Paper No. 25, Commission on the Future of Health Care in Canada.

Inman, R.P. 2008. "The Flypaper Effect." NBER Working Paper No. 14579.

Landon, Stuart, et al. 2006. "Does Health-Care Spending Crowd Out Other Provincial Government Expenditures." *Canadian Public Policy* XXXII (2); 121-141.

Leu, Robert. 1986. "The public-private mix and international health care costs," in *Public and Private Health Services*. A.J. Culyer and Bengt Jonsson (eds.). pp. 41-63. Oxford: Basil Blackwell.

Marchildon, G.P., and Livio Di Matteo (eds.). 2015. *Bending the Cost Curve in Health Care: Canada's Provinces in International Perspective*. Toronto: University of Toronto Press.

McKoskey, S.K., and T. M. Seldon.1998. "Health care expenditure and GDP: panel data unit root test results." *Journal of Health Economics* 17:369–76.

Muscatelli V.A., and Stan Hurn. 1992. "Cointegration and dynamic time series models." *Journal of Economic Surveys* 6:1–43.

Palangkaraya, Alfons, and Jongsay Yong. 2009. "Population Ageing and its implications on aggregate health care demand: empirical evidence from 22 OECD countries." *International Journal of Health Care Finance Economics*. March.

Parkin, David, Alistair McGuire, and Brian Yule. 1987. "Aggregate Health Care Expenditures and National Income: Is Health Care a Luxury Good." *Journal of Health Economics* 6: 109-27. June.

Parliamentary Budget Office. 2015. Fiscal Sustainability Report 2015. Ottawa. Available at: http://www.pbo-dpb.gc.ca/web/default/files/files/files/FSR_2015_EN.pdf.

——————. 2014. Fiscal sustainability Report 2014. Ottawa. Available at: http://www.pbo-dpb.gc.ca/web/default/files/files/files/FSR_2014.pdf.

Reinhardt, Uwe. 2015. "Why We Should Bend the Cost Curve and How We Could Do It." Chapter in *Bending the Cost Curve in Health Care: Canadian Provinces in International Perspective*. Gregory Marchildon, and Livio Di Matteo (eds.). pp. 3 – 34.

Richards, John, and Colin Busby. 2015. "Tax Burdens and Aging." Chapter in Bending the Cost Curve in *Health Care: Canadian Provinces in International Perspective*. Gregory Marchildon and Livio Di Matteo (eds.). pp. 65 – 86.

Roberts, Jennifer. 1997. "Spurious regression problems in the determinants of health care expenditures: a comment on Hitiris." *Applied Economics Letters*. 2000(7): 279–83.

Robson, William. 2014. *Bending Canada's Healthcare Cost Curve: Watch Not What Governments Say, But What They Do*. E-Brief 185. Toronto: C.D. Howe Institute. October 2.

——————. 2002. *Saving for Health: Pre-Funding Health Care for an Older Canada*. Commentary 170. Toronto: C.D. Howe Institute. October.

Seshamani, Mena, and A.M. Gray. 2004. "A longitudinal study of the effects of age and time to death on hospital costs." *Journal of Health Economics*. 23, 217-235.

Sutherland, Jason, et al. 2013. *Paying for Hospital Services: A Hard Look at the Options*. Commentary 378. Toronto: C.D. Howe Institute. April.

Spillman, Brenda, and James Lubitz. 2000. "The effect of longevity on spending for acute and long-term care." *The New England Journal of Medicine*. 342(19): 1409–1415.

Standing Senate Committee on Social Affairs, Science and Technology. 2012. *Time for Transformative Change: A Review of the 2004 Health Accord*. Ottawa: Senate of Canada.

Thursby, J.G. 1987. "OLS or GLS in the Presence of Specification Error." *Journal of Econometrics* 35: 359-374.

TD Bank Financial Group. 2010. *Charting a Path to Sustainable Health Care in Ontario: 10 proposals to restrain cost growth without compromising quality of care*. TD Economics Special Reports. May 27.

Veillard, Jeremy, et al. 2015. *Measuring Outcomes in the Canadian Health Sector: Driving Better Value from Healthcare*. Commentary 438. Toronto: C.D. Howe Institute. November.

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