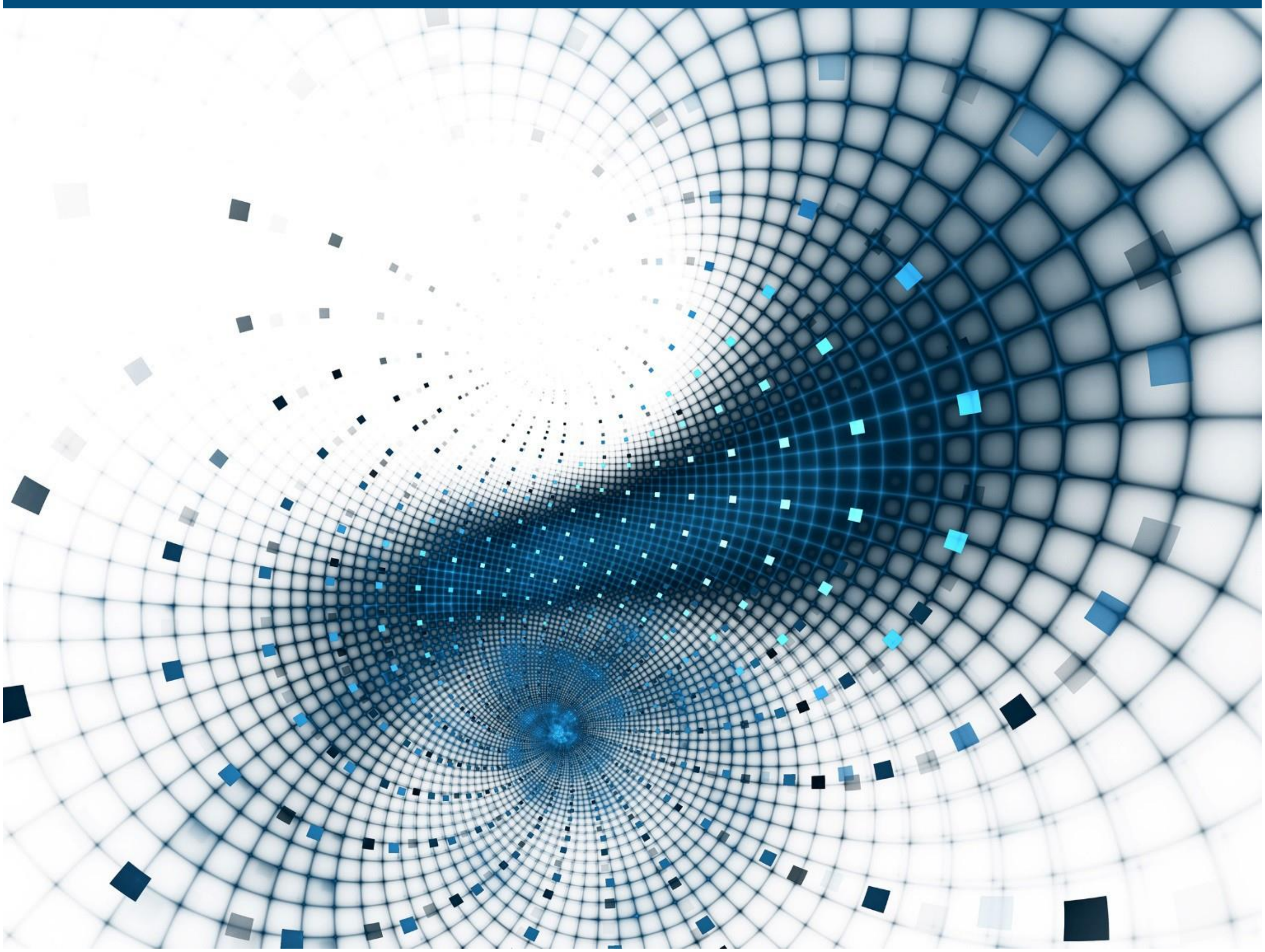
Model of Long-Term Health Care Cost Trends in Canada



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Model of Long-Term Health Care Cost Trends in Canada

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Caveat and Disclaimer

Contents

Executive Summary

The Model of Long-Term Health Care Cost Trends in Canada, hereafter referred to as the *McMaster Model*, provides long-run (to 2050 and beyond) forecasts of health care spending. The goals of the McMaster Model are first to provide a practical means by which actuaries can determine a long-term health care trend rate of growth; and second to provide guidance on the grade-down period over which such an ultimate trend rate is reached. It is important to note that the short-term rates in the model are used only in the iterative development of the long-term rates, and may not be appropriate for specific benefit plans.

The baseline version, built as an Excel spreadsheet, forecasts total health care spending at the all-Canadian level based on standard assumptions (or parameters) relating to,

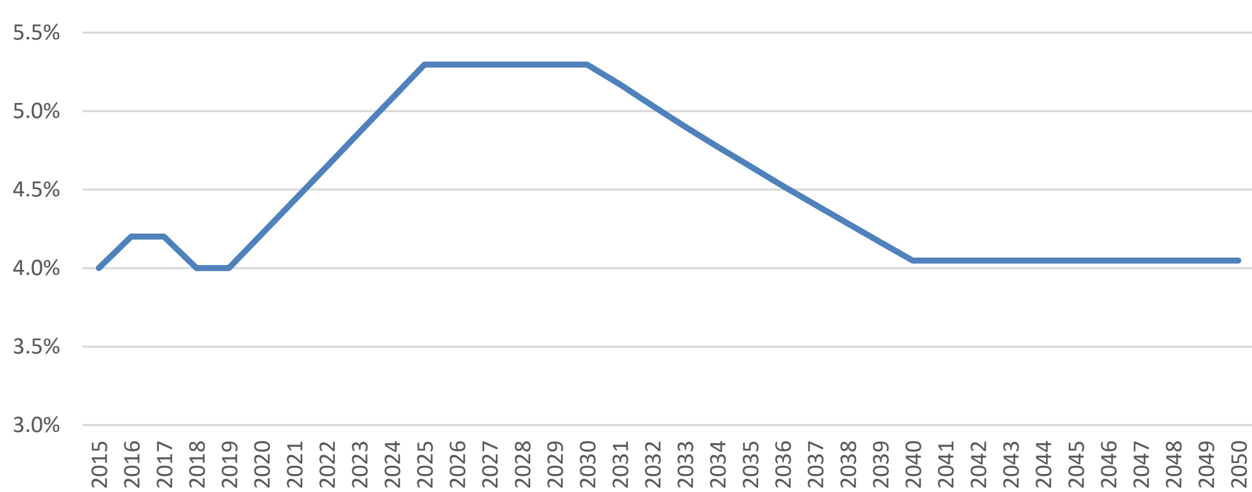
a) the rate of growth of total national health care spending in the short run (five years); and

b) the most plausible combination of drivers of health care spending in the longer run and policy responses to curb such growth.

Over the long-term, the model constrains trend rates of spending on all health care services to converge to the nominal rate of growth of GDP; otherwise, health care spending would eventually consume 100% of GDP. The precise point at which trend rates begin to revert to this long-term value is determined based on a key parameter of the model, the Resistance Share (RS). RS represents the level of public expenditure on health care, measured as a fraction of government budget, beyond which governments are not willing to move.

Baseline forecasts at the aggregate, all-Canada level have been provided by the authors after careful consultation with actuaries and budgetary experts in Canada and are shown in the graph below (figure 1).

Figure 1: Assumed Rates of Growth of Total Health Care Spending in Canada



The baseline scenario is expected to be updated and revised periodically to take account of new information. The frequency, timing, and nature (e.g. level of detail) of these updates is to be determined.

The model is intended to develop best estimate assumptions and does not include any margins for adverse deviation (implicit or explicit). Users can change the parameters (within reasonable bounds) to modify the aggregate-level trend forecasts.

In order to develop the long-term projections for health share in GDP, the McMaster Model relies on assumptions about short-term growth in per capita total health care cost. The national short-term growth will likely differ from the plan specific short-term health care cost trend rates used by an actuary in valuing a particular plan’s future costs. Users will need to apply their local information and estimation skills to establish the appropriate short-term health care cost trend forecasts for the first five years as well as the convergence of these rates to the central long-run trend to reflect the particulars of the specific groups, benefit packages, regional markets or providers for the plan being valued. In other words, the McMaster Model can be used to set valuation assumptions regarding ultimate trend rate and grade-down period, but users should not rely on the model exclusively when determining initial, short-term trend rates.

Section 1: Acknowledgments

The authors extend thanks to the individuals who volunteered their time and expertise to support the preparation of this report, including the actuaries recognized below. This report does not necessarily reflect their views or the views of their employers. Any errors are the authors' alone.

Data used in this report were obtained from the Canadian Institute for Health Information (CIHI) and Statistics Canada (see Section 9).

Technical review of the calculations presented in this report was conducted by Thomas Getzen, Consultant at Temple University.

1.1 Project Oversight Group

The Canadian Long-Term Health Care Cost Trends project oversight group (POG) is a collaboration of the Canadian Institute of Actuaries and the Society of Actuaries. It provides insight into the health care actuarial research needs and guidance over priorities. The authors, the Society of Actuaries, and the Canadian Institute of Actuaries thank them for their ongoing volunteer service.

Karen Dixon, FCIA, FSA (POG Co-Chair)

Kristina Percy, FCIA, FSA (POG Co-Chair)

Heike Reck, FCIA, FSA (POG Vice-Chair)

Michèle Boivin, FCIA, FSA

John Have, FCIA, FSA

Kevin Binder, FSA (POG Chair for US Getzen Model)

1.2 Reviewers

The following actuaries also generously volunteered their time and expertise to review and comment on this report prior to its publication. The authors, the Society of Actuaries and the Canadian Institute of Actuaries value their feedback tremendously and thank them for their service.

Uros Karadzic, FCIA, FSA

Kamran Quavi, FCIA, FSA

Erin Crump, FCIA, FSA

Section 2: Introduction

This manual presents and describes the McMaster Model, a user-friendly model (developed in Microsoft Excel) sponsored by the Canadian Institute of Actuaries (CIA) and the Society of Actuaries (SOA) to make long-run (2050 and beyond) forecasts of health care expenditure at the aggregate level (for Canada as a whole) and for each of the provinces. The goals of the McMaster Model are first to provide a practical means by which actuaries can determine a long-term health care trend rate; and second to provide guidance on the grade-down period over which such an ultimate trend rate is reached. When valuing a particular plan's future costs, users will need to apply their local information and estimation skills to establish the appropriate short-term health care cost trend forecasts for the first five years as well as the convergence of these rates to the central long-run trend to reflect the particulars of the specific groups, benefit packages, regional markets or providers for the plan being valued.

The SOA commissioned a similar project in 2007, Modeling Long-term Healthcare Cost Trends for Valuation. Thomas Getzen, a US health care economist, developed a benchmark projection of long-term per capita medical costs along with providing a user-friendly model for making alternative projections. The SOA model was developed to project US specific health care trends and is updated annually by Thomas Getzen for the SOA. A copy of the SOA Getzen model and related documentation can be found on the SOA website (see Section 9).

The baseline version of the McMaster Model forecasts the long-run trend for total health care spending at the all-Canada level based on standard assumptions (or parameters) relating to,

a) the rate of growth of total health care spending in the short run (five years); and

b) the most plausible combination of drivers of health care spending in the longer run and policy responses to curb such growth.

The baseline scenario is expected to be updated and revised periodically to take account of new information. The model is intended to develop best estimate assumptions and does not include any margins for adverse deviation (implicit or explicit). Actuaries can change the parameters (within reasonable bounds) to modify the aggregate-level trends to obtain customized long-term forecasts.

Income per capita and unit price are the main drivers of health care spending over the long term. There are many other drivers such as population aging, disease prevalence, policy decisions, and technical progress but the McMaster Model does not attempt to predict each of these separately. Economic theory is not able to say how each taken separately would affect long-run spending and it is impossible to disentangle their effects in time series analyses. However, statistical analyses show that, at the macro level, specific diseases (and population aging, which influences health care mostly through the diseases linked to old age) have little influence on health care spending. Of course, at the individual, micro level, cost is influenced by diseases and health care need; but empirical studies generally conclude that population aging or the prevalence of a given disease has almost no influence on how much a given country spends on health care. This might look counter-intuitive, but the reason is that health care delivery is a matter of choices and trade-offs: if we could find an inexpensive treatment for HIV-AIDS tomorrow, we would invest the resources thus freed to treat other diseases; or, if a new disease emerged, we would constrain how much we spend on all other diseases to find the resources to treat it. It is the case that all countries tend to increase the amount they spend on health care faster than their income (GDP), but aging and epidemiology play a minor part in this, compared to medical progress (what is available) and policy decisions (how much of what is available will be made accessible). Therefore, the McMaster Model combines all these drivers into an Excess Growth (EG) factor, which is a residual, reflecting the additional share that individuals choose to allocate to health care based on their preferences and what technical progress makes available to them.

The McMaster Model forecasts annual health care spending in response to the rate of growth of GDP, the rate of inflation, and the EG applied to health care spending in the previous year. In the short run (years 1 to 5), GDP growth and inflation are taken from macroeconomic forecasts and, consistent with recent history, EG is set at 1.2% per year. After year 5, GDP growth and inflation adjust towards their long-run growth levels by 2025; EG remains at its 1.2% level until the share of health care spending in GDP hits a key parameter of the model, the Resistance Share (RS). RS represents the point at which any incremental improvement in the quality or quantity of life afforded by technical progress is worth less than its cost, relative to marginal improvements in other areas of consumption; therefore, governments will begin to stop increasing the share of GDP allocated to health care. In the baseline scenario, RS is set at 13%; given current spending patterns, with 13% of GDP going to health care expenditures, provincial governments would spend 40% of their budgets on health care, on average. In the model, that will trigger a reaction intended to curb health care spending and, in time, reduce the EG to 0. Once that RS is reached (at the national level), all provinces will rein in spending, and two things will happen: the rate of growth of spending will decline and the EG will decrease linearly over the grade-down period. In the baseline scenario the grade-down period is ten years; that is, it is assumed to take ten years for governments to bring EG down to zero. Thus, in the baseline scenario, EG decreases by one tenth of its initial level of 1.2%, or by 0.12% each year after hitting RS. During the adjustment period, health care (and health share of GDP) will continue to increase; in the baseline scenario, RS is reached in 2030 and health care spending stabilizes at 13.75% of GDP in 2040.

The values of the parameters (long-run trend for GDP and inflation, initial EG, RS, and grade-down period) can be changed by the user, within reasonable bounds, which allows the user to estimate bounds on the projected values. However, as these assumptions are representative of the economy as a whole, actuaries may find it difficult to justify significant deviation from the default values. Plan- and province-specific information is incorporated only into the short-term rates.

Baseline forecasts are also provided for spending by type of service (hospital, other institutions, dental and vision[1], prescribed drugs, non-prescribed drugs, physicians, other professionals), type of payer (public or private), and province. The forecasts at the disaggregated levels are generated based on shares of total spending (the central trend) and the likely changes in those shares in the future. Because the shares of various types of service or payers have been stable historically or are expected to stabilize soon, the disaggregated forecasts at the service or payer levels converge very quickly toward the central trend. At the same time, because of persistent differences in provincial inflation rates, provincial shares of total spending as forecasted may continue to adjust for an extended period. The baseline scenario assumes that provincial inflation rates will all be equal by 2030 (ten years after the start of the forecast), but users can assume a longer or shorter convergence period. Note that while these detailed forecasts are available, the ultimate long-term trend rate and the year in which this trend rate is reached are consistent across all scenarios. We therefore expect that most users will be using the all-Canada forecast.

Section 3 provides an overview of the model and its components. Section 4 provides a comparison of the Canadian model to the US Long-Term Health Care Cost Trend Model. Section 5 provides a detailed description of the variables and the assumptions on which the baseline forecasts are made for health care spending at the all-Canada level and discusses the suggested range of values for use in making

[1] Dental and vision benefits are combined in CIHI data.

alternative forecasts. Details of the construction and calculation of scenarios in the spreadsheet for the aggregated model are also provided in this section. Forecasts at the disaggregated levels, by type of service and payer are provided in section 6 and by province, service, and payer in section 7. Section 8 discusses forecast accuracy and sources of uncertainty in the aggregate model. Section 9 provides links to data sources and additional resources that actuaries may find helpful.

Section 3: An Overview of the Model

Income and price are the main drivers of health care spending. There are many drivers beyond income and price, such as population aging, disease prevalence, policy decisions, and technical progress but the McMaster Model does not attempt to predict each of them separately. Economic theory is not able to say how each taken separately would affect long-run spending and it is impossible to disentangle their effects in time series analyses. What is clear is that, at the macro level, specific diseases (and population aging, which influences health care mostly through the diseases linked to old age) do not have a significant influence on health care spending. Of course, at the individual, micro level, cost is influenced by diseases and health need; but empirical studies generally conclude that population aging or the prevalence of a given disease has almost no influence on how much a given country spends on health care. This might look counter-intuitive, but the reason is that health care delivery is a matter of choices and trade-offs: if we could find an inexpensive treatment for HIV-AIDS tomorrow, we would invest the resources thus freed to treat other diseases; or, if a new disease emerged, we would constrain how much we spend on all other diseases to find the resources to treat it. It is the case that all countries tend to increase the amount they spend on health care faster than their income (GDP), but aging and epidemiology play a minor part in this, compared to medical progress (what is available) and policy decisions (how much of what is available will be made accessible). Therefore, the McMaster Model combines all these drivers into an Excess Growth (EG) factor, which is a residual, reflecting the additional share that individuals choose to allocate to health care based on their preferences and what technical progress makes available to them.

The forecast of health care spending is iterative, following the equation: $HCE_t = HCE_{t-1} * (1 + \delta HCE_t)$

The annual rate of growth of nominal health care spending per capita at the national level, **δHCE**, is the product of three rates of growth: $1 + \delta HCE_t = (1 + P_t) * (1 + \delta GDPpC_t) * (1 + EG_t)$, which can be approximated (neglecting second-order and higher terms) as: $\delta HCE_t = P_t + \delta GDPpC_t + EG_t$, the sum of the rate of inflation, **P**, the rate of growth of real income per capita, **δGDPpC**, and a component referred to as excess growth rate, **EG**, defined as the gap between **δHCE**, and the rate of growth of nominal GDP.

EG has been positive in most years since 1960, in Canada as in all other OECD countries, implying that the share of health care spending in GDP has increased.

If the rate of growth of health care spending were consistently greater than the rate of growth of income, health care would eventually eat up all income; that, of course, is not plausible (a rate of growth of spending lower than income would also yield a logically implausible result, and would not be empirically realistic). The McMaster Model, therefore, limits the very long-run rate of increase on health care spending to match the increase in GDP. However, between now and that steady state, the rate of growth of health care spending can and will be greater than the rate of growth of income.

The McMaster Model combines the empirical observation of a positive EG with the logical necessity of steady state in the long-run by making the assumption of government intervention to reduce the rate at which health care costs increase after a threshold of provincial government budget share[2] has been reached. Based on the forecast for EG, the model generates a share of health care spending in GDP for Canada as a whole from which the share of health care spending in provincial budgets is inferred (more details on this in Section

[2] Here, provincial budgets mean the sum of all budgets spent by all provinces in a given year, not the budget of any one particular province. The model uses provincial budgets because health care spending is a provincial responsibility.

5). The user-specified threshold provincial budget share is set at 40% in the baseline forecast. If the forecast value falls below the threshold, called the Resistance Share or RS, the value of EG for the following year will be determined by the empirical forecast (time series based on the initial year). However, if it is above (or equal to) the RS, two things happen:

a) spending is decreased in the following years by a fraction (modifiable by the user), and

b) the EG is phased out (brought down to 0) over a given period of time, called the grade-down period, which is set at 10 years in the baseline scenario (but modifiable by the user).

When the grade-down period is over, the rate of growth of health care spending is the same as the sum of the rates of growth of income and inflation; thus, in the steady state, the share of health care spending in GDP remains constant. In the baseline scenario, the ultimate rate is expected to be reached in the year 2040. While actuaries have the ability to modify inputs in the model that affect the grade-down period, we do not expect significant deviation from the baseline result.

Given the long-term trend for Canada as a whole, the McMaster Model can be used to generate forecasts by type of service, type of payer, and province. Again, it is logically impossible for any one category of expenditure to continue indefinitely to grow faster than the central trend; otherwise it would eventually eat up the entire Canadian health care budget. Therefore, in the very long-run, the model forecasts the same equilibrium or steady state rate of growth for all provinces, types of services and payers. However, in the mid-run (between 2020 and 2030 or 2050, depending on user choice) the model generates forecasts tailored to specific provinces, services, or types of payer. The logic of the model is that of a top-down decomposition: RS and the phasing-out period are specified at the all-Canada level and the model makes forecasts at the more disaggregated levels using a complex set of shares of total spending associated with each combination of type of service, payer, and province, and how they relate to the total. That complex set itself is based on empirical observations of how the components have changed (or remained stable) in the past, and the requirement that, in the future, all will become constant.

The analysis of the time series of shares by type of service and type of payer indicates that the steady state will be reached very quickly, and that detailed forecasts for each type of service or payer converge very rapidly toward the central trend (see empirical evidence in Section 6). The situation is slightly different for provinces. That is because provincial inflation rates historically have differed for extended periods. The baseline scenario assumes convergence in provincial inflation rates in 10 years; that means that health care spending in all provinces will grow at the national rate after 2030. However, users can change this parameter and project province-specific rates of growth under the assumption that inflation rates do not converge before, say, 2040 or 2050. In that case the model will forecast on-going differences in the rates of growth of spending across provinces for extended periods.

Section 4: Comparison to the US Long-Term Health Care Cost Trends Model

The McMaster Model builds on the Getzen model developed for the US, adapts it to empirical data available for Canada, and extends it by decomposing the forecast by type of service, payer, and province. The Getzen model projects the rate of growth of total health care spending at the national, US level.

The two models follow identical logic, according to which health care spending in the long-run is driven by prices, real income (GDP per capita), and an excess growth factor representing the share of its income that a given society decides to allocate to health care.

The models differ on some minor points:

1. The forecasts for income growth, based on observation from the past in each country, differ slightly.

2. EG is forecasted at a lower level in Canada than in the US, again based on what can be observed in the past for the two countries.

3. The two models apply slightly different rules regarding the evolution of EG in the long-run (other than its central trend). The Getzen model has a year limit, set at 2075, by which date the EG falls to 0, even if RS has not been reached. The reason is that, in the baseline scenario, the US RS is set at 25%, or eight percentage points higher than the share of health care in GDP in the base year, whereas in the McMaster Model, the baseline scenario sets the RS at 40% of provincial budgets; that translates into a health care share of GDP of approximately 13%, or two percentage points higher than the share in the base year (11% in Canada). As a result, the RS may not be reached in the US forecast and EG has to be forced to 0 before the horizon of the forecast. Such a risk does not exist in the McMaster Model.

Section 5: Model Forecasts of Total Health Care Spending for Canada

Values need to be set for the following parameters, separately for the short-term, 2015-2019, and after 2020: price inflation, income per capita, and excess growth. In the short-term, the McMaster Model uses official forecasts for inflation and income. In the long-run, the parameters are based on 30-year moving averages of past trends. EG is based on past trends and assumptions on the value of RS and the reactions of provincial governments once the share of health care spending in provincial budgets exceeds RS.

Baseline values and ranges for each variable in the forecast are presented below, along with the relevant data sources. The values and ranges were developed by the authors and reviewed by a group of experienced health actuaries. Historical annual rates of increase in medical costs are taken from the Canadian Institute for Health Information (CIHI) National Health Expenditure database (NHEX). Historical values of inflation and income (current dollar and real GDP) are from the International Monetary Fund.

5.1 Forecast of Short-Term Growth (2015-2019) in Health Care Spending

The McMaster Model is designed to make long-run forecasts. In order to develop the long-term projections for health share in GDP, the model relies on assumptions about short-term growth (2015-2019) in per capita total health care cost. The national short-term growth (all provinces, all types of services and payers) will likely differ from the plan-specific short-term health care cost trend rates used by an actuary in valuing a particular plan's future costs.

Users will need to apply their local information and estimation skills to establish both the appropriate short-term health care cost trend forecasts for the first five years and the pattern of convergence of the rates to the central long-run trend to reflect the particulars of the specific groups, benefit packages, regional markets, or providers for the plan being valued.

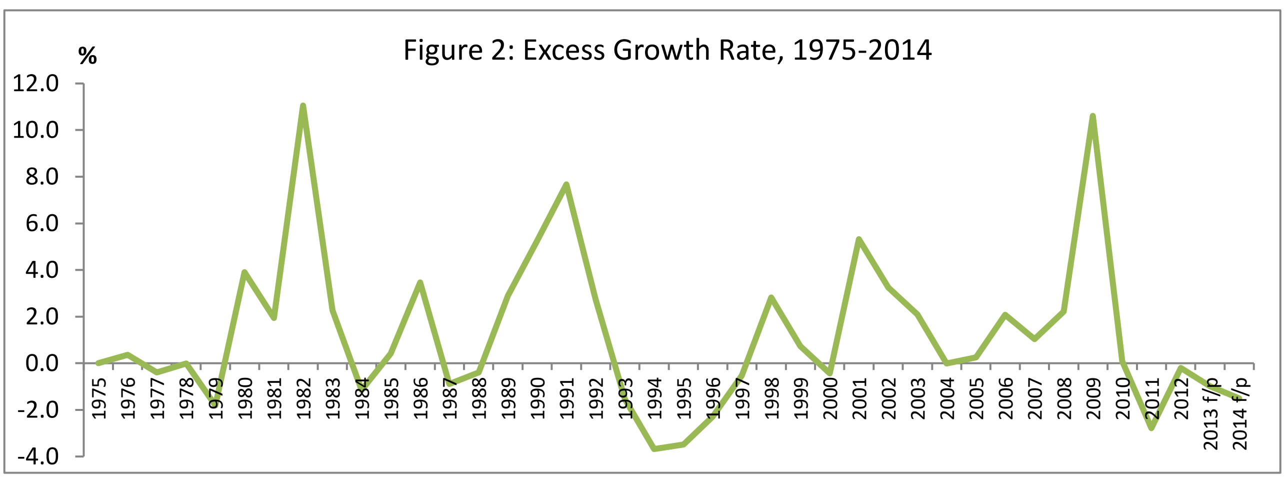
Baseline assumptions are equal to the rate of growth of real GDP per capita plus inflation (both as projected by Finance Canada) plus the excess growth rate (EG), which is set at 1.2%, the average over the 30-year period from 1984 to 2014. Table 1 presents the data for the national short-term growth in per capita total health care cost.

Table 1
Short-term growth in per capita total health care cost (%)

Year	Real GDP Growth[1][δGDP]	GDP Deflator [P]	Population Ratio[2](P_{t-1}/P_t)	Real GDP Per Capita Growth [δGDPpC][3]	Excess Growth [EG]	HCE Growth [δHCE]
2015	2.6	1.6	0.99	1.2	**1.2**	4.0
2016	2.4	2.0	0.99	1.0	**1.2**	4.2
2017	2.3	2.1	0.99	0.9	**1.2**	4.2
2018	2.2	2.0	0.99	0.8	**1.2**	4.0
2019	2.1	2.0	0.99	0.7	**1.2**	3.9

Notes:
1. Real growth: Strong Leadership: A balanced-budget, low tax plan for jobs, growth, and security, Table 2.2, page 60 http://www.budget.gc.ca/2015/docs/plan/budget2015-eng.pdf
2. Population: Population Projections for Canada, Provinces and Territories; http://www.statcan.gc.ca/pub/91-520-x/91-520-x2010001-eng.pdf
3. $\delta GDPpC = (\delta GDP+1)*(P_{t-1}/P_t)-1$
4. $\delta HCE=\delta GDPpC+P+EG$

There appears to be no clear trend in the Canadian EG series (Figure 2), unlike the US. The McMaster Model therefore uses the 30-year average of EG, 1.2%, for the short-term forecast. The authors discussed health care spending forecasts with individuals at both CIHI and the Parliamentary Budgetary Office (PBO) and confirmed that there is no consensus on values for EG that would differ significantly from the mean of the past 30 years, which is why it was selected as the baseline assumption.

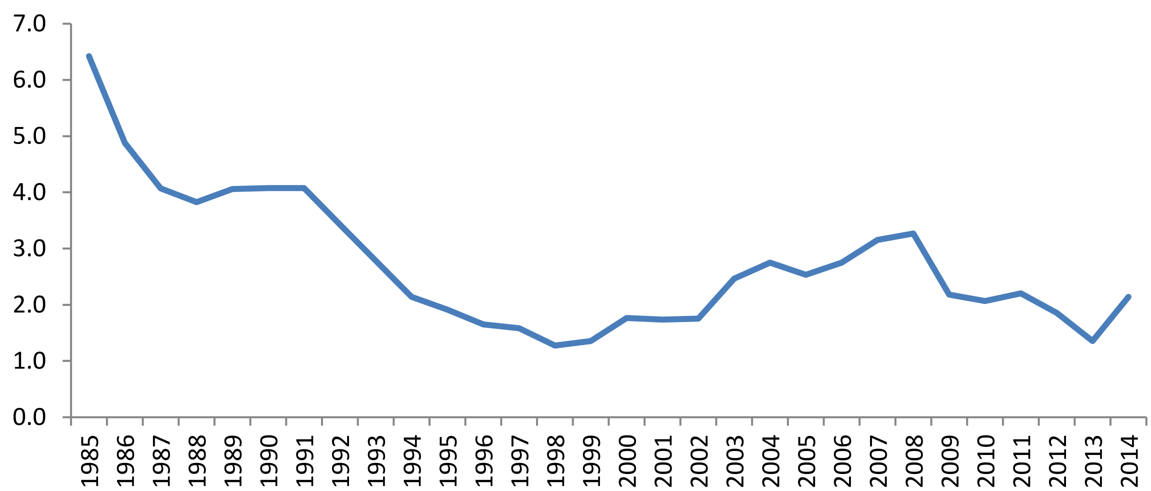


5.2 Forecast of Long-Term Growth (2025 & Following) in Health Care Spending

INFLATION

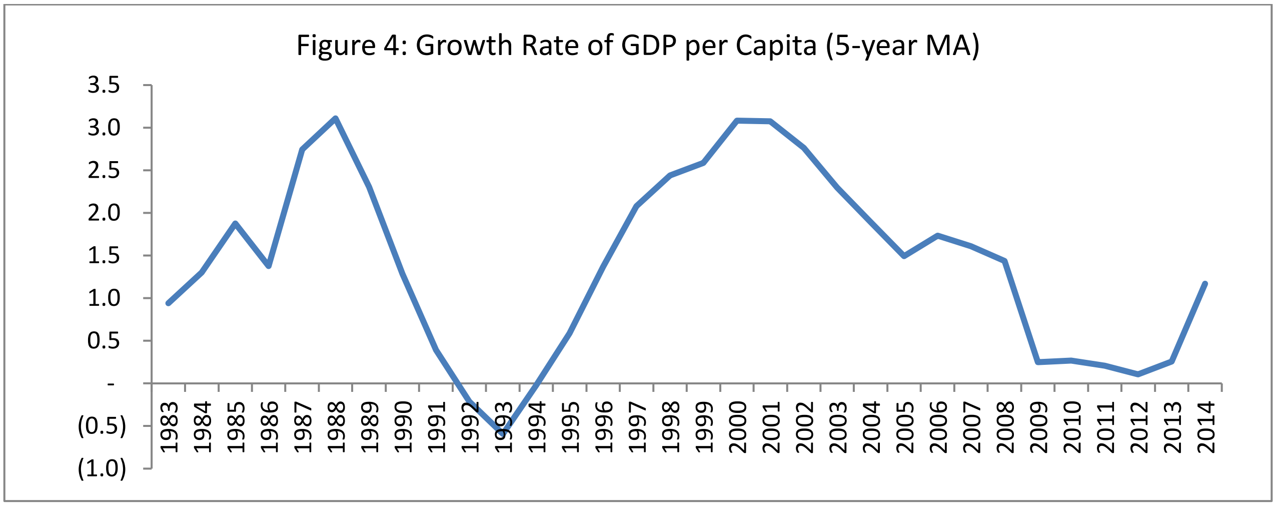
The baseline value for long-term inflation is 2.5% (range 1.3-6.4%). Baseline values are set at the average over the last 30 years (1984-2014). The range is determined by the minimum and maximum values of the five-year moving average over the last 30 years. Figure 3 plots the five-year moving average of the inflation rate.

Figure 3: Inflation Rate (5-year MA)



REAL GDP PER CAPITA (INCOME)

The baseline value for annual growth in real GDP per capita is 1.5% (range -0.6-+3.1%). Baseline values are set at the average over the last 30 years (1984-2014). The range is determined by the minimum and maximum values of the five-year moving average over that period. Figure 4 presents the five-year moving average of the growth rate of the real GDP per capita.



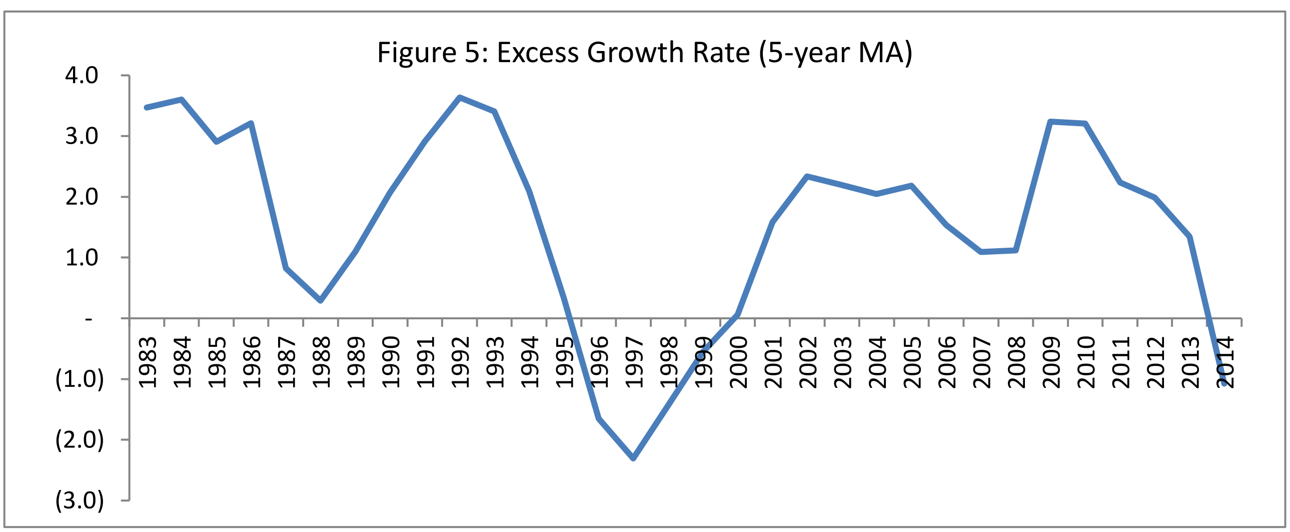
EXCESS GROWTH (EG) - ASSUMPTIONS ON TREND AND RESISTANCE SHARE

HEALTH CARE SHARE OF GDP IN BASE YEAR

The value entered in the model is the estimate provided by CIHI, which is 11.0% for 2014. Note that this number is subject to revision (the latest revised number published by CIHI, in February 2017, is 10.9%).

TREND OF EG

Over the last 30 years (1984-2014), average annual EG has been +1.2% (range -2.3-+3.6%), with no clear historical trends. Baseline values are set at the average over the last 30 years (1984-2014). The range is determined by the minimum and maximum values of the five-year moving average over the last 30 years. Figure 5 shows the five-year moving average of the excess growth.



Based on this trend, the expected health care share of GDP increases from 11.0% in 2014 to 11.8% by 2020 (range 11.0%-13.6%).

RESISTANCE SHARE (RS) OF HEALTH CARE EXPENDITURE IN PROVINCIAL BUDGETS

The baseline value for RS is 40% with a range of 30%-50%.

The McMaster Model makes the assumption that, given the share of public spending in total health care spending in Canada, resistance will stem from public payers and, more specifically, from provincial governments. It is further assumed that, as has been common historically, private payers will follow government spending patterns (for example, delisting of prescription drugs).

Because the model generates GDP per capita and health care spending per capita, but not provincial budgets per capita, we need to translate a share of health care in GDP into a share of provincial budgets spent on health care. The translation works as follows:

The share of health care in provincial budgets (represented by the letter v, and is provincial spending on health care, PuHCE, divided by total provincial budget, Pub) can be written as the ratio of the provincial share in total health care spending (PuHCE divided by HCE, that can be represented by the letter q) to a meaningless number (provincial budget divided by total health care spending, Pub divided by HCE).

This meaningless number can in turn be decomposed as the product of two ratios that have meaning: the share of provincial budgets in GDP (Pub divided by GDP, that can be represented by the letter r) multiplied by the inverse of the share of health care spending in GDP (GDP divided by HCE).

If the share of health care in GDP (HCE divided by GDP) is represented by the letter s, it is feasible to infer the share of health care in provincial budgets from three known (two observed parameters and one forecast value) quantities: $\mathrm{v} = \frac{\mathrm{q}}{\mathrm{r}} * \mathrm{s}$, where s is forecast by the model and q and r are parameters based on observation of past series (it therefore reads: $v_t = \frac{q}{r} * s_t$ for year t.)

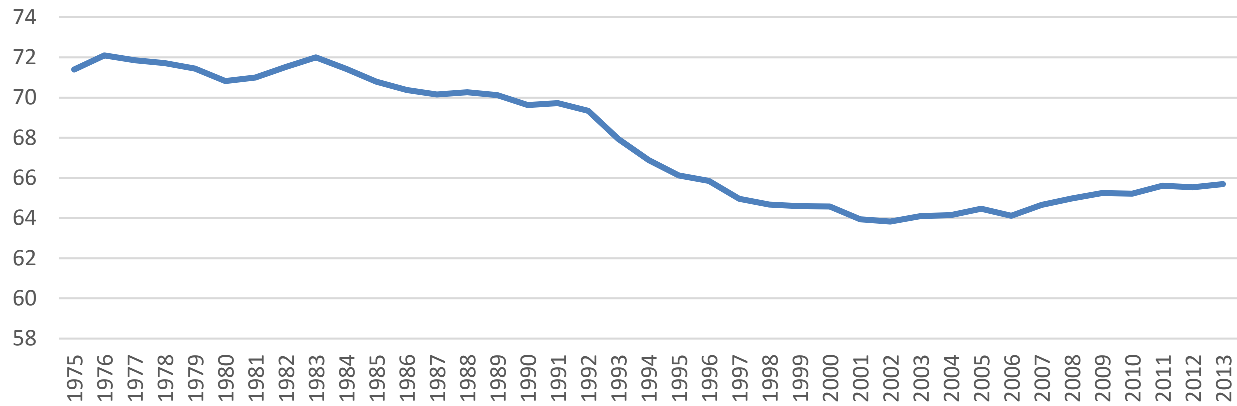
Details on estimates and trends for q (provincial share of total health care spending) and r (share of provincial budgets in GDP) are provided below:

Provincial share of total health care spending, q:

Public health care spending accounts for approximately 70.5% of total health care spending, but not all of that comes from provincial governments (about 5% comes from the federal budget and/or social insurance schemes such as the workers compensation boards). In 2013, the share of provincial government health care spending (PuHCE) in total health care expenditure (HCE) was 65.7% (CIHI, NHEX, Table B.4.3).

It was higher in 1975, at 71.4%; in that year, the public share of HCE was 75% (see Figure 6). Since then, the share of non-provincial public spending in total HCE has increased slightly, from 4.6% to 6.0% and the share of provincial governments has declined. The drop in the share of provincial governments in HCE took place entirely between 1991, when it was 69.7%, and 1998, at which point the share was 64.7%; that decline was likely the result of fiscal decisions at the federal level and their impact on provincial budgets.

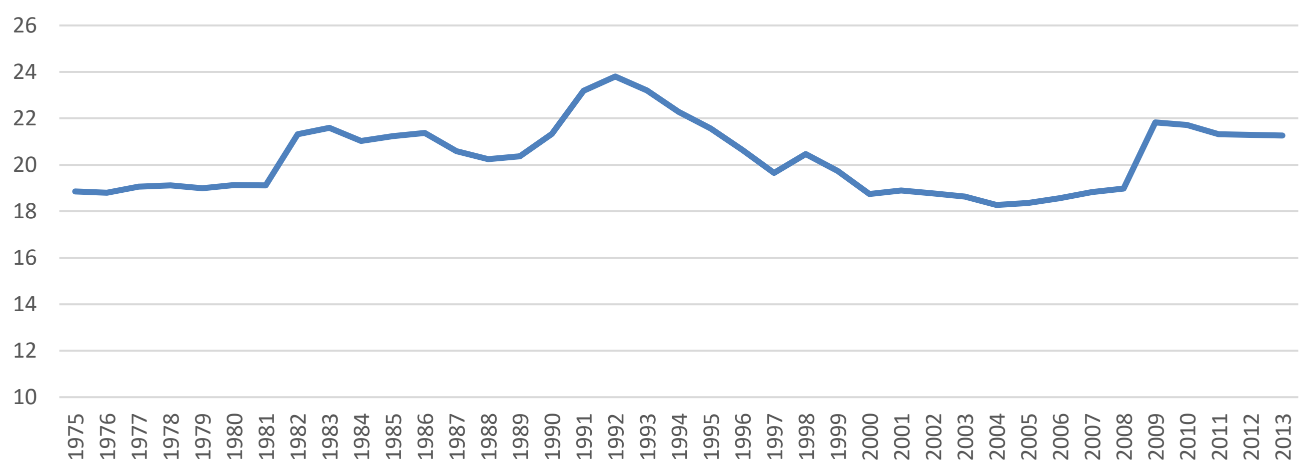
Figure 6: Provincial/Territorial Government Sector Health Expenditure as a Proportion of Total Health Expenditure



Share of provincial budgets in GDP, r:

Figure 7 shows that the share of provincial budgets (PuB) in GDP has been relatively stable, at around 20% (21.3% in 2013, range 18.3-23.8). The model therefore uses a value of 0.213 for r.

Figure 7: The Share of Provincial Budgets in GDP



Ratio q/r:

The model uses a value of 3.0845 (3.0845 = q/r = 0.657/0.213) to translate a share of health care in GDP into a share of health care in provincial budgets. If health care represents 10% of GDP in a given year, provinces will spend 30.845% of their budget on health care. Or, if resistance starts when health care spending goes beyond 30% of provincial budgets on average, the share of health care in GDP triggering resistance would be 9.72% (0.3/3.0845=9.72%) (and Canada would already be in a situation where provincial governments seriously try to rein in health care spending). An assumption that resistance would not start before the share of health care spending in provincial budgets reaches 40% would translate into resistance starting at 12.96% of GDP. If the user chooses to wait until provincial health care spending represents 50% of provincial budgets, it will set resistance at 16.2% of GDP.

Assumptions made by the model on the resistance share (RS) threshold on the value of q beyond which provinces rein in health care spending:

According to CIHI (NHEX 2015, table B.4.4), the ratio of total provincial health care spending to total provincial budget increased by 10.5 percentage points between 1975 and 2005, from 28.4% to 38.9%. Since then, it has stabilized at around 38% (See Figure 8).

Figure 8: The Share of Total Provincial Health Care Spending in Total Provincial Budget

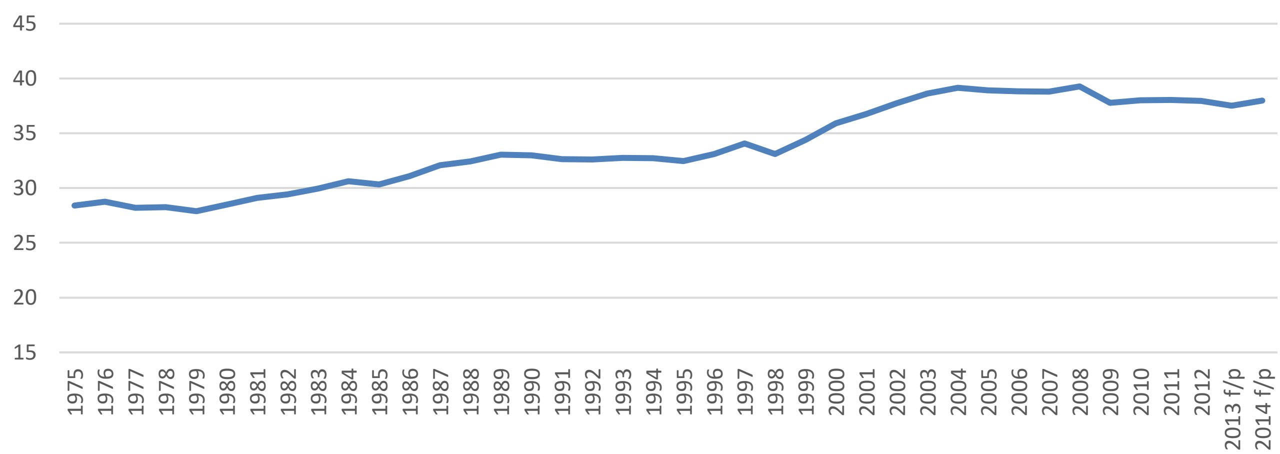
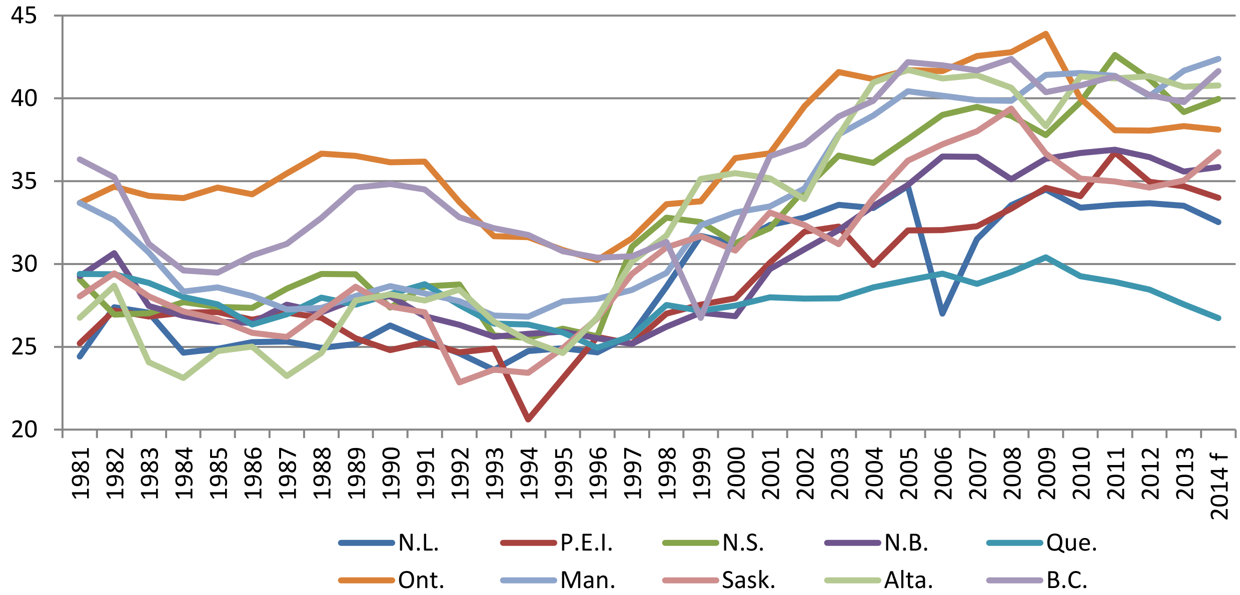


Figure 9 plots the share of the health care spending in each provincial budget. Quebec is a clear exception to the trend, having kept its share of health care spending in its provincial budget between 23% and 30% since 1978; the rest of Canada witnessed an increase in the share of health care cost in provincial budgets from 28% in 1975 to 41.5% in 2005 and 40.5% in 2013. In 2000, six provinces had more than 35% of their provincial budgets going to health care; the other three were between 30 and 35%. Four provinces (Nova Scotia, Ontario, Manitoba and British Columbia) were above 40% and three (New Brunswick, Saskatchewan, and Alberta) were between 38% and 40% in 2005. Since then, there has been some convergence to around 40%, except for Quebec, which has remained below 30%.

Therefore, 40% is a reasonable resistance share level for provincial budgets. This would translate into a maximum tolerable share of GDP spent on health care of 13%.

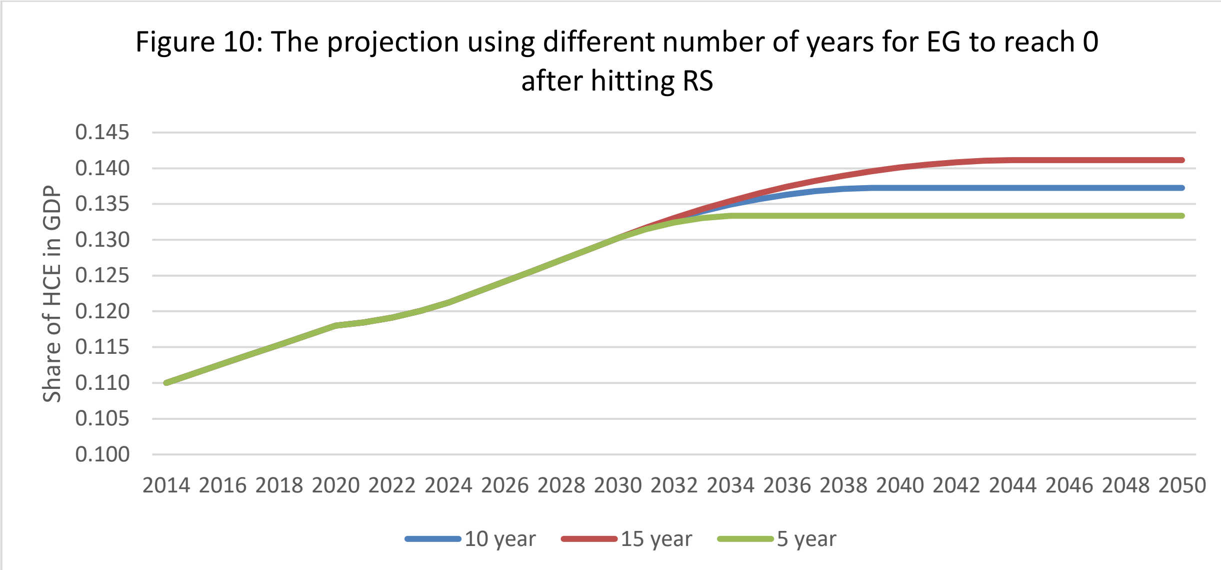
Figure 9: The Share of Provincial Health Care Spending in Provincial Budgets



NUMBER OF YEARS FOR EG TO REACH ZERO AFTER HITTING RESISTANCE SHARE

The baseline value for the number of years before EG reaches zero is 10 years with a model range of 5 to 15 years.

Once the resistance share is reached, provincial governments are assumed to take action to bring the EG factor to 0, after which health care spending increases (as a close approximation) at the sum of inflation and the rate of growth of real GDP per capita. A key parameter, therefore, is the number of years it takes for governmental action to bring the EG factor to 0. The parameter is intended as an indicator of how rapidly policymakers respond. In discussions with policy experts and policy-makers in the provinces and territories the authors asked about the assumption that it takes 10 years to bend the cost curve to bring health care spending in line with GDP growth; most tended to agree that governments could not do so in less than 10 years but, on the other hand, that a slower pace would not be seen as real action on their part. The users can input the number of years. Figure 10 shows the sensitivity of the forecast using different numbers of years for EG to reach zero after hitting the resistance share.



5.3 Calculation of Annual Growth Rates in Total

The spreadsheet for the forecast of total health care cost has been organized to make it transparent and easy to use, modify, and update. ***All input changes are made on the*** "INPUT" ***page*, steps 1 to 4**; the results appear automatically on the "OUTPUT" page; calculations are made in the "P-Matrix" page. In the P-Matrix page the years are in [column A] and aligned such that [A16] = 2016, [A19] = 2019, etc. Links to the values entered on the input page are made in cells [B14 - B19] *(estimated short run growth rates);* [C14] *(starting dollar premium/cost, assumed to be $6,050 in 2014)*; [D20] *(Expected health care share of GDP in 2020)*; [F6 - F8] *(growth rates for inflation, real GDP per capita and excess growth factor);* and [F11] *(Resistance Share)*

The short run forecasts begin in 2015 [row 15] and extend to 2019; mid-term forecasts begin in 2020 and extend to 2024; long-run forecasts begin in 2025 [row 25] and extend to 2090 [row 90]. The share of health care cost in GDP each year is in [column D]. The rates of increase of health care cost in each year are in [column B]. Each subsequent year's projected cost is increased by the cost % and reported in [column C]; it increases to $19,809 in 2040 in cell [C40]. The short run percentage cost increases for the first five years (2015-2019), cells [B15 - B19], are direct user inputs carried from the input page rather than calculations within the matrix. The next five "transitional" years, cells [B20-B24], are calculated as a linear extrapolation between 2019 and 2025.

The core of the model is the "adjusted excess growth rate" found in [column F] of the P Matrix page. It is the primary driver of the forecasts, and mathematically identical to the percentage rate of growth in the share (of GDP, wages, consumption, etc.). If the excess growth rate is zero, as it is after the year restriction is applied, then health care costs grow at the same rate as wages, GDP, consumption, etc. This keeps the model quite simple. It also highlights the fact that the most significant driver of costs in this model is excess growth, whether due to changes in technology, organizational changes, or any other sources. The basic rate of growth in health care costs each year is calculated as:

$$\delta HCE = (1 + P) * (1 + \delta GDPpC) * (1 + EG) - 1$$

The projected long-run growth rate of health care cost growth appears in the forecast matrix, [column B], and remains constant in this model until it starts to be reduced by the year or share limits. The projected shares are placed in [column D]. The initial value of the share for 2020 is user input and carried to the forecast matrix in cell [D20]. It is increased each year by the adjusted excess percentage growth in [column F] until it reaches the year limit and stabilizes.

Share resistance factor, [column G]: The share restriction value is copied from the user input to cell [F10] (0.130 in the baseline model) and the number of years for EG to reach zero after hitting RS is user input to cell [Input.H38] (10 in the baseline mode).

Two situations are possible: if the share of health care spending in GDP does not reach the RS before 2030, the excess growth rate is reduced by 1/10th each year for the nine years between 2031 and 2040, such that EG is zero in the year limit (2040 in the baseline model) and health care spending grows as the sum of price inflation and income per capita after 2040. In the model this adjustment calculation is made in [column F], multiplying long-run excess growth rate in cell [F9] by the ten years average of the year dummy in [column H]. If the projected share exceeds the share limit at t_0 and it is assumed that governments need 10 years to stabilize health care spending as a share of their budgets, the excess growth rate would be reduced by a fraction as seen in the equation below:

Share limit reduces excess growth at *t* by fraction = $\frac{(S_{t-1} - RS)}{RS} * \frac{10-(t-t_0)}{10}$ for $t_0 < t < t_0 + 10$

where S_{t-1} is the share of health care spending in GDP in year $t - 1$.

The model carries out the reduction by multiplying excess growth for each year by a factor of [1-reduction fraction]. Thus in the baseline model the excess growth for 2035, cell [F35], is reduced by 0.037, and becomes 0.58% (1.2%*0.963*0.5). Note that the excess growth rate never becomes less than 0% in this model.

Short- (1 to 5 years) and mid- (6 to 10 years) term forecasts: The forecasts for rates during the first five years (2015 to 2019) are included in the baseline scenario but can be changed by the user to reflect their perception, potentially based on more recent information than at the time of writing, on national trends Plan specific trends should not be reflected in the model; rather, the model should be based on global factors in order to determine the ultimate trend rate and grade down period. This can then be combined with short-term forecasts, incorporating plan specific information, for valuation purposes. The national short-term forecasts condition the long-term forecasts due to the iterative nature of the projection. Mid-term forecasts for 2020 to 2024 are a linear extrapolation between the final short-term rate in 2019 and the long-run rate in 2025, increasing from 4.2% to 5.1%. The focus of this model is on the forecast of long-run costs, rather than particular short-run variations or local conditions. However, it is important that a long-run model have a neutral set of short- and mid-term forecasts as a baseline.

Section 6: Model Forecasts of Total Health Care Spending by Type of Service and Payer

In broad terms, the steps are:

Step 1: Project total (all types of services combined) health care spending per capita at the national level.

Step 2: Forecast spending per capita for each type of service based on past information on the share of each type of service in total spending in Canada and their variation over time:

$HCE_{i,t} = \alpha_i(t).HCE_t$, *i* being the type of service (hospital, other institutions, dental and vision, prescribed drugs, non-prescribed drugs, physicians and others) and the projected share of total spending on service "*i*" in total spending.

Step 3: Project private spending. Following empirical validation, the model makes the assumption that, within each type of service, private spending grows at the same rate as total spending: $\delta PrHCE_{i,t} = \delta HCE_{i,t}$, where δ indicates rate of growth. This is equivalent to assuming that the share of private spending for each type of service does not change. Users can change that baseline assumption and forecast the effect in the long-run of a change in the public-private divide in health care spending, for instance following a decision by provincial governments to reduce coverage significantly. It must be noted, though, that this would not affect the RS, as the model keeps the feedback from health share of GDP to share of provincial budgets constant. We use health share of provincial budgets as the most likely pathway through which resistance would be met in Canada, but an increase in private costs would have the same effect on the electorate and, as a result, would trigger a similar need for action on the part of provincial governments. The model makes the further assumption that, within private spending, the shares of out-of-pocket and employer-based insurance remain constant. That implies that their rates of growth are all the same, i.e., $\delta EPHCE_{i,t} = \delta PHCE_{i,t} = \delta HCE_{i,t}$, but users are able to explore alternative assumptions. Of course public spending (PuHCE) is the complement to the private spending (PrHCE) in HCE (PuHCE = HCE - PrHCE).

6.1 Forecasting the Share of Each Type of Service

Baseline Values

The model breaks down the total health care cost forecast by type of service (hospital, other institutions, dental and vision, prescribed drugs, non-prescribed drugs, physicians, other professionals) using assumptions about the share of each type of service in total spending. These assumptions are derived from historical data on shares for the years 1975 to 2015 (CIHI) for Canada as a whole. The assumptions, and the bases for them, are as follows:

- The share of hospital spending decreased from 45% to 30% between 1975 and 2000, before stabilizing at the 2000 level. The model assumes it remains at 30% in the future.
- Other institutions, dental and vision, and non-prescribed drugs: there is some variation in the share over time, but no trend. The model assumes that the share remains at the 40 -year averages of shares in the past.
- Other professionals and prescribed drugs: the shares changed between 1975 and 2000, following

a clear upward trend, but have stabilized since then. The model assumes these shares remain at their averages of the last 15 years.

- Share of spending on physician services in total health care spending has increased steadily for the past 15 years. The model assumes that the rate of growth will decrease linearly, reaching 0 in 10 years after which the share of physician services in total spending will stabilize.

The forecasts are conducted separately for each type of service, so the shares do not sum to 100% in a given year. Shares are therefore prorated to make the sum to equal 100% in every year. (The adjustment is the projected value multiplied by the ratio of 100 to the sum of the projected values.) Table 2 presents the assumptions and adjustments of the shares for each type of service.

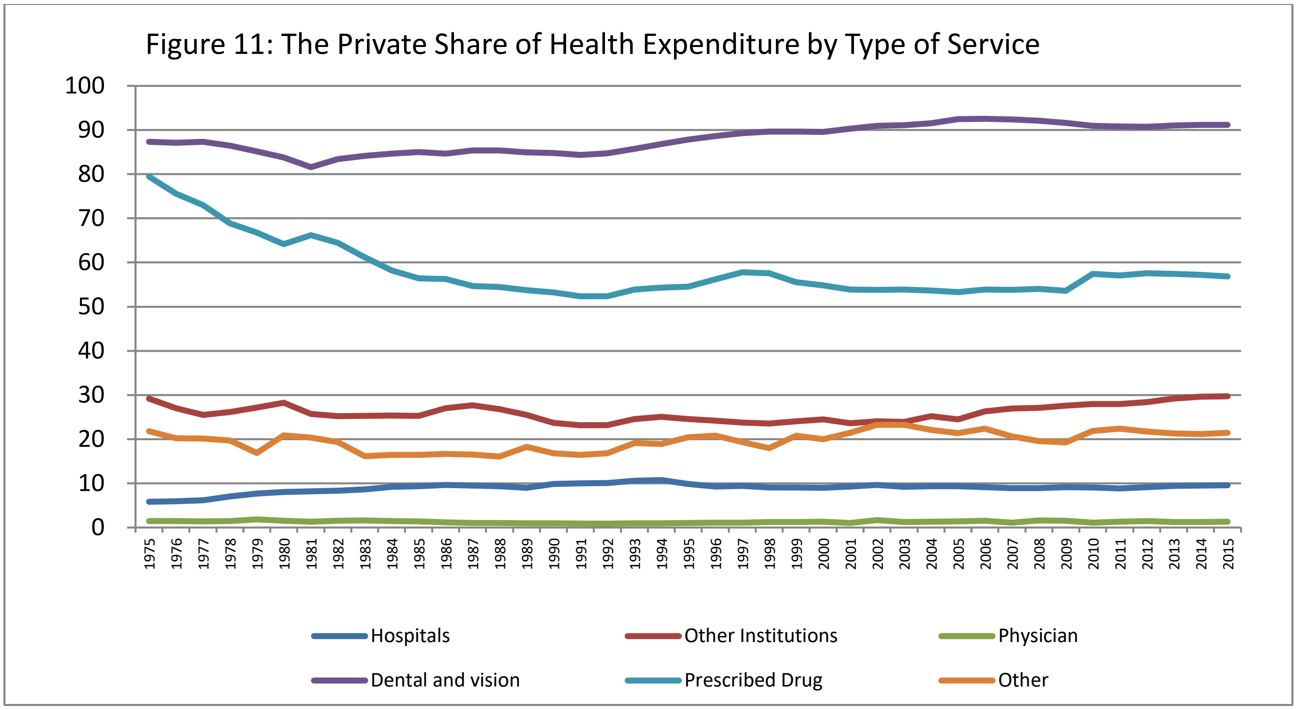
Table 2

Assumptions and Adjustments of the Share of the Types of Services in the Total Health Cost

	Initial Assumption	Adjusted Assumption	Basis
Hospital	30.0	29.1	Approx. latest level
Other Institutions	10.6	10.3	Long-term average
Dental and vision	10.6	10.3	Long-term average
Prescribed Drugs	13.5	13.1	15-year average
Non-Prescribed Drugs	3.0	2.9	Long-term average
Physicians	16.5	16.0	Phase out trend over 10 years
All other	19.0	18.4	Approx. last 15 years
Total	103.2	100.0	

6.2 Forecasting of Health Care Spending by Type of Payer

The model projects the private share for each type of service for Canada as a whole. Within the private share, it does not account for the distribution between out-of-pocket and private insurers. Figure 11 displays the time trend of the private shares by type of service. It can be observed that the private shares have remained relatively constant for the last 30 years and almost constant for the last 40 years (the only exception being a drop for prescribed drugs between 1975 and 1985).



Therefore, the model assumes that the private share in each type of service is constant; that implies that private spending would grow at the same rate as total spending for each type of service. In order to allow users to explore changes in government financing of health care, a parameter is added, representing a trend in the share of private spending in each type of service (set at 0 in the baseline model). These changes in the values of parameters must apply to all provinces collectively. It is not possible to assume a change in only one province in isolation. Users can make changes as they see fit but we provide a range of realistic shares, based on bounds observed for the past 30 years. The preferred shares (baseline) are estimated based on the average of the latest 10 years of historical data from CIHI. Table 3 displays the estimated private shares for each type of service.

Table 3
Estimated Private Share of Health Care Spending by Type of Service

	Private Share	
	Baseline	Suggested Range
Hospital	9.2	(8.9, 10.7)
Other Institution	26.7	(23.2, 29.7)
Dental and Vision	91.3	(84.4, 92.5)
Prescribed Drugs	55.2	(52.4, 57.8)
Physicians	1.3	(0.9, 1.7)
All other	21.4	(16.1, 23.2)

6.3 Calculation of Annual Growth Rates for Each Type of Service and Payer

By Type of Service

The forecast by type of services is in the sheet “type of service”. The year number of the forecast is in [column A] (The first forecast year, number 1, is 2016). Links are to the values entered on the “P-Matrix” page made in column [C] (estimated health cost) and column [D] (estimated health share in GDP)); column [E] shows the annual growth rate of heath care cost. For each type of service, we show the share of the service in total health care cost, the cost of the service, and its annual growth rate. We assume that it takes 10 years (cell [C6]) for policies to adjust the share to the target share, after which it is kept constant. Users may input other values. In 10 years, i.e., between 2016 and 2025, the shares are projected by linear interpolation; they are constant after 2025.

For each type of service, we show two graphs: the share of the service in total health care cost and the annual growth rate of health care cost. The corresponding data is presented in sheet “Data for Graph A”.

By Payer and Type of Service

The forecast of private health care spending for each type of service is in sheet “private spending by service”. The shares of private spending in each type of service are displayed in cells [D10-D16]. Starting from [row 21], [columns A-E] are the same as those in the sheet “type of service” with the values entered on the “P-Matrix” page. Four values used to calculate the annual growth rates of private spending are presented. Using hospital cost as an example: the share of hospital cost ([column H]), the hospital cost ([column I]), private spending on hospital ([column J]), and the annual growth rate of private hospital cost ([column K]). Private spending on the hospital cost ([column J]) is the product of hospital cost and the assumed private share. For each type of service, we show two graphs: Private spending in each type of service and the annual growth rate of private spending in each type of service. The corresponding data is presented in sheet “Data for Graph B”.

Section 7: Model Forecasts of Provincial Spending by Type of Service and Payer

7.1 Forecasting the Provincial Spending by Type of Service and Payer

The fourth step of the disaggregated forecast is to project spending in each province by expenditure category.

The model allows for provincial variation around the general trend, using the equation: $P_x HCE_{i,j,t} = \gamma_{0,j} + \gamma_1 P_x HCE_{i,t} + \gamma_2 t + \epsilon_{i,j,t}$,, *x* standing for *r* (private) or *u* (public). The gammas are estimated based on past data and are the same for all services and funders. They allow for fixed provincial differences in rates of growth of spending, some provinces growing faster and others growing slower (divergence). Again, users are able to explore alternative assumptions.

The model projects a share of national health care expenditures for each province and assumes (based on empirical validation) that it applies uniformly to all types of service. For instance, based on that projected share, the amount spent in Ontario on hospital care from private sources in a given year is the product of estimated total spending for that year, the share of hospital care for that year, the share of private spending in hospital for that year, and the Ontario share in total spending.

The assumption that the same provincial share applies to all services is based on empirical analysis of CIHI data: first, eye-balling trends by type of service in each province (Appendix B) indicates that the trends are very similar across provinces for a given type of service. The authors tested this hypothesis using log-log regressions of shares of spending for province *i* on type of service *j* to total spending (i.e., we regressed the log of E_{ijt}/E_t on the log of the shares of all-province spending on service types (E_{jt}/E_t) and the shares of provinces in all services (E_{it}/E_t). The regression explains more than 95% of the variance in the right-hand variable, indicating common time trends across provinces for each type of service. The formula for the share of the provincial spending is:

$$S_{it} = \frac{E_{it}}{E_t} = \frac{h_{it} * P_{it}}{h_t * P_t} = \frac{\frac{h_{it}}{h_t} * P_{it}}{P_t}$$

where h_{it} is the province *i* per capita spending on health care; h_{it} is Canadian spending per capita; P_{it} is province *i* population and P_t is total Canadian population. The share of the provincial spending can be expressed as the product of two ratios: relative spending per capita in province *i* compared to Canada as a whole and the share of province *i* population in the Canadian population. The first ratio, relating to relative expenditure, can be set by the user as follows: the user chooses a rate of growth of this ratio for each province (we provide a default value) for the first year of the forecast (2016). The rate of growth is assumed to converge toward 0 in ten years (the default choice), and to remain at 0 thereafter (hence, the only source of change in provincial shares after 10 years is demographic, at least until 2036). The convergence toward 0 is assumed to be linear between 2016 and 2025. The second ratio, relating to population, is based on projections provided by Statistics Canada to 2036; we assume the ratio to be constant after 2036.

After the provincial shares of spending have been projected, provincial spending by type of service and payer is projected by multiplying the province share by the level of expenditure for Canada as a whole for a given type of service and for a given type of payer (Section 6).

7.2 Calculation of Annual Growth Rates for Each Province

Forecasts of provincial spending are done in the sheet “provincial spending projection”. The user can input the annual growth rate of the relative (province/nation) health care expenditure ratio in cells [H3-R3] for each province. The baseline growth rates of the ratios are based on averages over the last 15 years (1990-2014); they are in cells [H4-R4]. The user can input a value in cell [G5] for the year in which growth is zero. For example, consider the province of Newfoundland (NL). Starting in [row 33], five values are presented for the calculation of the share of provincial spending: the relative per capita health expenditure ratio ([column G]), the relative population ratio ([column H]), per capita provincial health expenditure ([column I]), and the share of provincial spending ([column J]) and the annual growth rate of the provincial spending ([column K]). The default growth rate of the relative health expenditure ratio is +0.93% (cell [H3]) and the convergence year is set at 10 (cell [G5]). The growth rate is reduced by 1/10th each year for the nine years from 2016 to 2025 (cells [G35-G44]). Thereafter, the relative health expenditure ratio is constant. The NL share in total spending in Canada ([column J]) is the product of [column I] and [column H]. The annual growth rate of provincial spending is based on values in [column J].

For each province, we show two graphs: the share of the provincial spending and the annual growth rate of per capita provincial spending. The corresponding data is presented in sheet “Data for Graph C”.

The spreadsheet “Provincial spending by service” disaggregates provincial spending by types of service. Continuing with the province of NL as an example, the expenditure shares for hospital, other institutions, dental and vision, prescribed drugs, non-prescribed drugs, physicians, and other professionals in NL for each year are projected in [columns F-L]; they are the product of the share of provincial spending in total cost (Section IV, sheet “Provincial spending Projection”, [column J]) and the share of expenditure for the given service in total cost (Section II, sheet “type of service”, [column G] (hospital cost), [column K] (other institutions), [column O] (dental and vision), [column S] (prescribed drug), [column W] (non-prescribed drug), [column AA] (physicians), and [column AE] (other professionals)). The annual growth rates for each type of service appear under the share projections, after [row 81].

For each province, we show two graphs: the share of the provincial spending by type of service and the annual growth rate of provincial spending by type of service. The corresponding data is presented in sheet “Data for Graph D”.

The spreadsheet for projecting the shares of private provincial spending by type of service is in sheet “prvn. prvt spending by services”. The shares are estimated using the product of the share of provincial spending on the given service (sheet “Provincial spending by services”, [columns F-L], NL as an example) and the share of private expenditure in total cost (Section V-2, sheet “private spending by service”, cells [D10-D16]). The annual growth rates of private spending for each type of service are calculated and displayed below the share projection, after [row 63].

For each province, we show the graph of the annual growth rate of provincial private spending by type of service. The corresponding data is presented in [rows 63-101] and [columns F-CC].

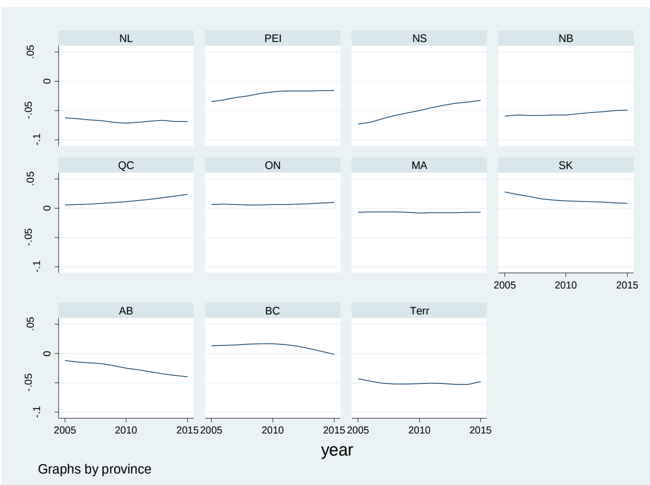
7.3 Assumption Test for the Projection of Provincial Spending by Types of Service

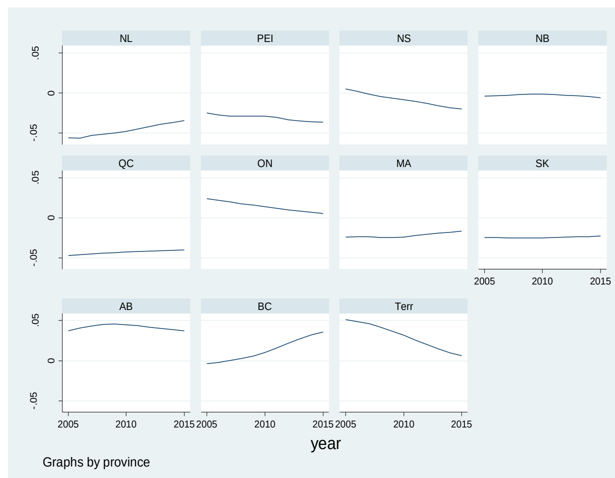
We make the crucial independence assumption that trends in shares of types of services are the same for all provinces:

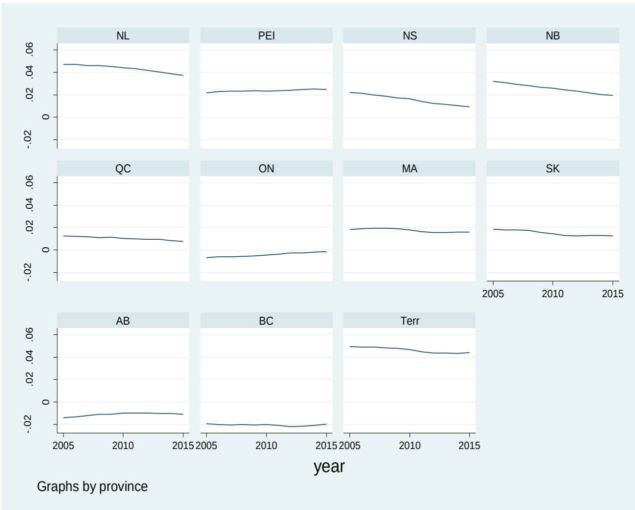
$$\frac{E_{ijt}}{E_t} = \frac{E_{it}}{E_t} * \frac{E_{jt}}{E_t}$$

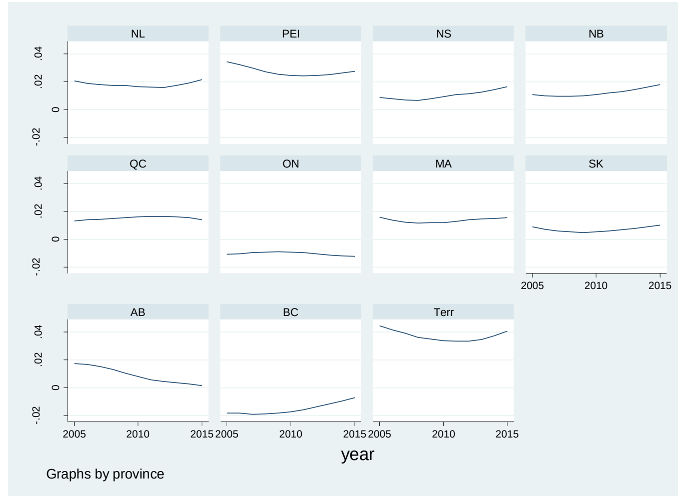
1. Empirical support for that assumption

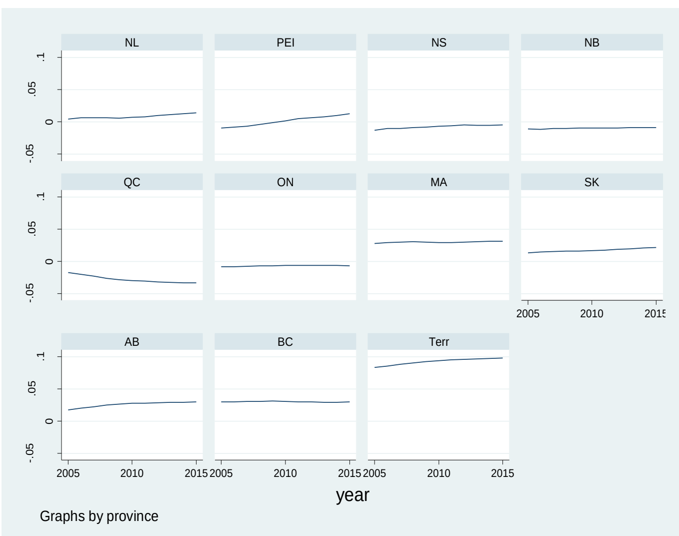
Graph the trend for each type of service and each province and check by eye-balling that trends seem to be close enough across provinces for a given type of service. We graph the 10-year moving average of the difference between the share of type of service in total spending and that in provincial spending.

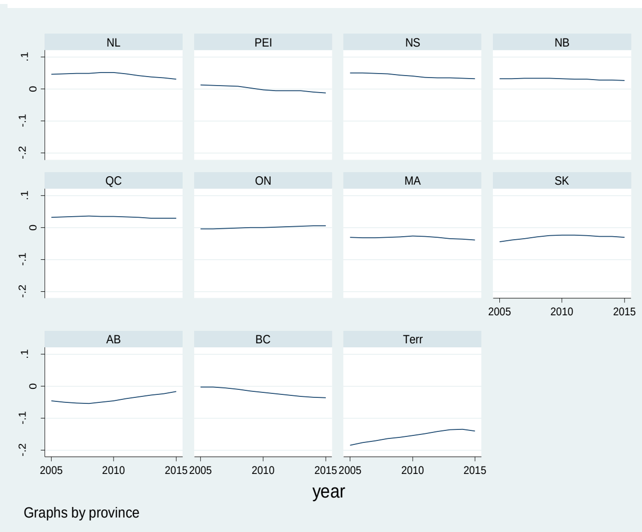












2. Regress log of $\frac{E_{i,j,t}}{E_t}$ on log of $\frac{E_{j,t}}{E_t}$ and log of $\frac{E_{i,t}}{E_t}$

We found the variances we can explain for each type of service are all above 95%.

Section 8: Accuracy, Uncertainty, and Suggestions for User Inputs

There are two main sources of uncertainty in the forecast results of the McMaster Model, at least for the central trend (at the national level, all types of services and payers combined):

1. in generating future values for the main drivers of health care spending (income and price), and
2. in generating the excess growth in the future (difference between the rate of growth of health care spending and the rate of growth of nominal GDP).

The authors of the model follow Getzen (2016a) in recommending that assumptions for the first source of uncertainty (income and price) be left to institutions with expertise in macroeconomic predictions, such as Statistics Canada. The remaining source of uncertainty and inaccuracy in the long-run is the excess growth, which in turn, can be subdivided into two sources of uncertainty:

The first source of uncertainty is the value of EG that is predicted in the short run. In the baseline version of the model, a value of 1.2% is recommended, based on the five-year moving average observed for Canada in the past 30 years (figure 5, section 5). We also suggest bounds for this parameter, also based on five-year moving averages (lower and upper bounds). The user is able to change this parameter, to reflect assumptions or information the user may have on the national trend in the short run (policy decisions or pharmaceutical breakthroughs) that were not known at the time the model was designed. It is important to keep in mind that such parameters apply to the national trend (all provinces, all types of services and payers), and do not reflect the specific plan the user is projecting (such as short-term, plan-specific forecasts, and the convergence of the plan to the national trend).

The second source of uncertainty is the value taken for the RS (health share of GDP at which resistance starts and EG is phased out) as well as the number of years needed to bring EG down to 0 from the year the RS is reached (grade-down period). The baseline model suggests a share of 13% (40% of provincial budgets spent on health care) and ten years to reach EG of zero. Users can change these values and figure 10 (section 5) shows the effect of various assumptions for the grade-down period: if set at five years, health care spending stabilizes slightly below 13.5% of GDP, and close to 13.75% if EG is set at ten to slightly above 14% if EG is set at 15 years.

We recommend using the cumulative annual excess growth (as defined in Getzen, 2016b) to compare forecasts run under various assumptions regarding the values of RS and the grade-down period.

The only additional source of uncertainty in the disaggregated model is at the provincial level. Trends over the past 20 years in shares of services and payers in total health care spending have been remarkably stable, as discussed above, and no theory would allow a user or a forecaster to credibly predict any substantial and durable change in these shares in the future. Provinces are allowed to diverge in their inflation rate for a given number of years, provided to users as a parameter. The baseline version of the model sets this number of years before convergence (all provinces have the same inflation rate) at ten years, but this parameter can be modified by users. At ten years, all disaggregated forecasts of rates of growth are the same after 2030 but if this parameter is set at 20 years, provincial spending will not converge before 2040. Again we recommend using the cumulative yearly EG as a way to establish boundaries on the variation in results around the baseline scenario.

Section 9: References

9.1 Data Sources

National Health Expenditure database (NHEX). Canadian Institute for Health Information (CIHI). https://www.cihi.ca/en/national-health-expenditure-database-metadata

Statistics Canada. http://www5.statcan.gc.ca/researchers-chercheurs/

Thomas E. Getzen (2016a) Getzen Model of Long-Run Medical Cost Trends, Technical Manual and Documentation. Society of Actuaries.

Thomas E. Getzen (2016b) Accuracy of Long-Range Actuarial Projections of Health Care Costs, North American Actuarial Journal, 20:2, 101-113, DOI: 10.1080/10920277.2015.1110490

9.2 Additional Resources

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About The Canadian Institute of Actuaries

The Canadian Institute of Actuaries (CIA) is the national, bilingual organization and voice of the actuarial profession in Canada. Its 5,000+ members are dedicated to providing actuarial services and advice of the highest quality. The Institute puts the public interest ahead of the needs of the profession and those of its members.

Vision: Financial security for Canadians.

Mission: As the trusted bilingual voice of the Canadian actuarial profession, we advance actuarial science and its application for the well-being of society.

Values: Values shape our attitudes and influence our professional conduct. Our values are:

> Community: We put the public interest ahead of our own. Our processes are transparent and volunteerism is at the heart of our activities.
>
> Integrity: We are honest and accountable professionals; we uphold strict ethical principles. We use our expertise, rigorous standards, and objectivity to deliver actuarial services and advice of the highest quality.
>
> Advancement: We are committed to demonstrating the value of effective risk management. We use innovation to advance actuarial science and its applications.

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About The Society of Actuaries

The Society of Actuaries (SOA), formed in 1949, is one of the largest actuarial professional organizations in the world dedicated to serving more than 28,000 actuarial members and the public in the United States, Canada and worldwide. In line with the SOA Vision Statement, actuaries act as business leaders who develop and use mathematical models to measure and manage risk in support of financial security for individuals, organizations and the public.

The SOA supports actuaries and advances knowledge through research and education. As part of its work, the SOA seeks to inform public policy development and public understanding through research. The SOA aspires to be a trusted source of objective, data-driven research and analysis with an actuarial perspective for its members, industry, policymakers and the public. This distinct perspective comes from the SOA as an association of actuaries, who have a rigorous formal education and direct experience as practitioners as they perform applied research. The SOA also welcomes the opportunity to partner with other organizations in our work where appropriate.

The SOA has a history of working with public policymakers and regulators in developing historical experience studies and projection techniques as well as individual reports on health care, retirement and other topics. The SOA's research is intended to aid the work of policymakers and regulators and follow certain core principles:

Objectivity: The SOA's research informs and provides analysis that can be relied upon by other individuals or organizations involved in public policy discussions. The SOA does not take advocacy positions or lobby specific policy proposals.

Quality: The SOA aspires to the highest ethical and quality standards in all of its research and analysis. Our research process is overseen by experienced actuaries and non-actuaries from a range of industry sectors and organizations. A rigorous peer review process ensures the quality and integrity of our work.

Relevance: The SOA provides timely research on public policy issues. Our research advances actuarial knowledge while providing critical insights on key policy issues, and thereby provides value to stakeholders and decision makers.

Quantification: The SOA leverages the diverse skill sets of actuaries to provide research and findings that are driven by the best available data and methods. Actuaries use detailed modeling to analyze financial risk and provide distinct insight and quantification. Further, actuarial standards require transparency and the disclosure of the assumptions and analytic approach underlying the work.

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