Productivity in Residential Care Facilities, 1984 to 2009

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Abstract

This paper constructs a direct output measure of residential care facilities in order to examine their productivity growth and productivity levels in Canadian provinces. It finds that labour productivity increased at 0.2% per year in residential care facilities in Canada over the period 1984 to 2009. The growth was much slower than that in the business sector. There is a large variation of annual labour productivity growth in residential care facilities across Canadian provinces ranging from 1.4% growth in Newfoundland to 1.3% decline in Manitoba.

The level of labour productivity in residential care facilities differs across the provinces. Residential care facilities in three Atlantic provinces (Newfoundland, PEI, and New Brunswick) had the highest level of labour productivity in 2009. Nova Scotia and three prairies provinces had the lowest levels of labour productivity in that year. Some of the differences in labour productivity levels across provinces are associated with the difference in the ownership of residential care facilities. Private residential care facilities are found to be more productive than public facilities. The facilities that are owned by the provincial governments are the least productive.

1. Introduction

The paper constructs an experimental measure of output and labour productivity of residential care facilities in Canada. While residential care facilities mostly provide care for the aged,[1] they also provide care for other types of residents including persons with physical disabilities and persons who are developmentally delayed. In Canada, those facilities are licensed or funded by provincial/territorial departments of health and/or social services.

The productivity performance and the efficiency of residential care facilities and other health care providers have received increased attention in the discussion about sustainability of heath care system. The improvement in health sector productivity contributes to the sustainability of health care system. When health sector productivity increases, the same level of resources can be used to provide more and better health care services.

But there are no measures of productivity performance for the sector in the Canadian System of National Accounts at Statistics Canada. In the national accounts of Canada, output of health sector is measured by inputs that used to provide services. This implies that there are no changes in the productivity performance of the sector.

The paper has a number of objectives. First, it compares the growth of output and labour productivity in residential care facilities in Canadian provinces over the period 1984 to 2009. Second, the paper compares the level of labour productivity in residential care facilities across Canadian provinces and examines potential contributing factors to that difference. Those factors include scale of the facilities, and ownership type (public vs. private ownership).

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[1] In 2009, the residents 65 year or older accounted for about three quarters of all residents in the residential care facilities in Canada excluding Quebec. The residents that are developmentally delayed are the second largest group accounting for 9% of all residents in 2009. Other residents include persons with psychiatric disabilities, persons with alcohol and drug problems, emotionally disturbed children, transients, and young offenders. For Quebec, the information on types of residents is not available.

This paper continues our previous research that constructs output and productivity measures of the non-market service sector in Canada. Gu and Wong (2012) constructed an experimental measure of output and productivity in the education sector. Gu and Morin (2014) constructed a measure of output and productivity in the hospital sector. In this paper, we construct a measure of output and productivity in the residential care facility sector.

The output of residential care facilities is estimated as a cost-weighted output index of residents by type of care. An alternative measure is the value-weighted output index that uses the value of the output as weights.[2] Often those value weights are not available. Therefore, the cost-weighted output index represents a practical approach for the measurement of the direct output measure for the non-market sectors (Aktinson, 2005, Eurostat 2001, Schreyer 2010)

A challenge that has emerged from previous empirical work in Canada and other countries relates to the adjustment of quality changes for output. The reason for such adjustment is the argument that the change in unit costs or values arising from the change in the quality of the output should be counted as an increase in the volume of the quality-corrected output measure.

The choice of method for such adjustment is often affected by data availability. In our work for the measurement of output of the education sector, the quality indicators are measured by test scores, implicit prices associated with the test scores are estimated from a hedonic regression that relates the price of education output to test scores. The changes in the price of education output associated with changes in test scores is counted as the change in the quality-adjusted volume of education output.

In our work on the output of the hospital sector output, the quality improvement that was incorporated is the substitution of treatments towards outpatient treatments that are less

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[2] Gu and Wong (2010) constructed a value-weighted output index of the output of the education sector where the value of education to student is estimated an increase in the present discounted value of the lifetime income arising from education.

expensive and provide similar or improved health effects to the patients. The adjustment of quality changes resulting from such substitution requires the classification of outpatient and inpatient treatments into the same group and the use of similar weights to aggregate the various types of treatments to derive an output measure for the hospital sector.

In this paper, we take into account quality changes in the output of residential care facilities using the quality of labour input. The share of personnel that provide direct care to residents is used as an indicator for the quality of the care to residents. Those personnel include registered nurses, registered nursing assistants, physiotherapists/occupational therapists. The share of the group increased over time in Canada. For the period from 1984 to 2009, the share of direct care personnel in the total hours increased from 65% to 75%.

To construct the cost-weighted output index derived from the aggregation of resident days by level of care, we need to estimate unit costs or costs per resident day by level of care. Residential care facilities often provide more than one level of care. But expenditures are only available at the facility level. The total expenditures must be broken down into the expenditures by levels of care to derive unit costs by level of care. The paper explores alternative methods to generate a breakdown of total expenditures and examines the effect of alternative methods on the estimate of unit costs and output measures of residential care facilities.

The rest of the paper is organized as follows. Section 2 presents the methodology for constructing the output and production measure of residential care facilities. Section 3 presents the annual survey of residential care facilities (the RCF survey) of Statistics Canada that is used for empirical analysis in this paper. Section 4 presents the estimate of the output and productivity in residential care facilities in Canada and in Canadian provinces. Section 5 concludes the paper.

2.   Methodology

The construction of direct output for residential care facilities starts with the choice of unit of output and weights that can be used to aggregate heterogeneous types of outputs.

For the measurement of output of the hospital sector, the complete treatment of a disease represents the ideal concept of a unit of output (Eurostat 2001, Schreyer 2010). But for residential care facilities, that concept is not very meaningful. Some of these facilities are maintained for chronically ill or disabled people who reside there more or less permanently. This is in contrast to a hospital where patients are accommodated on the basis of medical need.

For residential care facilities, resident days (or patient days) are used to measure the output. The number of resident days can be differentiated by a detailed Resource Utilisation Groups (RUG) classification. For Canada, the RUG is only used for Ontario for more recent years in the Continuing Care Reporting System (CCRS) by the Canadian Institute for Health Information (CIHI, 2006).

For other provinces, the RUG classification is not used to classify resident days. Rather, the number of resident days is classified by level of care in the Residential Care Facility (RCF) survey. Level of care will be used in this paper to differentiate the output of residential care facilities. There are seven levels of care in our data. [3] Those levels are: 1. self-sufficient – room and board only; 2. self-sufficient – room and board with guidance/counselling with respect to social, employment, addiction problems, or parental guidance with skilled counselling (i.e. child care homes); 3. self-sufficient – room and board with custodial care and/or special school, sheltered workshop, etc.; 4. type I - supervision/or assistance with daily living and meeting

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[3] For Quebec the type of care is unidentified. Quebec data are collected through Centre de santé et services sociaux (Health and social services centers, CSSS) and no detailed information is collected on types of care. Three missing values in "level of care" for Quebec in 1993 in the imputed dataset; a value of zero is then applied to these facilities.

psycho-social needs 5. type II – medical and professional nursing supervision, etc.; 6. type III-medical management, skilled nursing care, etc.; 7, higher type.

Those various types of resident days represent different type of services and need to be weighted to derive a measure of output for the RCF sector. The weights can be based on expenditures per resident day to derive a cost-weighted output index. Alternatively, the weights can be based the value price of output for residents to obtain a value-weighted output index. As residential care facilities in Canada are mostly funded by the provincial and municipal governments, the value of the output for patients is not available. For that reason, the costs will be used to aggregate different types of output to derive cost-weighted output index.

The volume index of the output of RCF sector in year Q is constructed as a Tornqvist aggregation of resident days by level of care using the share of expenditure as weights:

$$\ln Q_t - \ln Q_{t-1} = \sum_i \bar{s}_i \left(\ln q_{it} - \ln q_{it-1} \right),$$

(1) *where,*,

$$\bar{s}_i = \frac{s_{it} + s_{it-1}}{2}, \quad s_{it} = \frac{c_{it} q_{it}}{\sum_i c_{it} q_{it}}$$

where is q_{it} is the number of resident days for level of care i, c_{it} is costs per resident day or unit cost for level of care i, and s_{it} is the cost share of level of care *i in total costs.*

The nominal value of output of the RCF sector is estimated as total costs of inputs including capital, labour and intermediate inputs. The costs of capital input include the cost of depreciation and the rate of return on capital is not included in the measure of the nominal output measure of the RCF sector as is the case in measurement of output of other non-market sectors in Canada.

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The implicit price index for the output of the RCF sector is the ratio of the nominal value of output to the volume index of the output of the RCF sector estimated from equation (1).

Labour productivity in the RCF sector is the ratio of the volume index of the output to hours. It increases when output increases faster than hours.

To take into account the changes in quality of the output of the RCF sector, we use the quality of labour input as the quality indicators of the care to the residents. The quality of labour input is estimated as the share of personnel providing direct care in total labour input. Those personnel include registered nurses and physiotherapists/occupational therapists.

3. Data

The data for estimating direct output, hours worked and labour productivity are derived from the Annual Survey of Residential Care Facilities (RCF survey) of Statistics Canada. The RCF survey is a census of residential care facilities across Canada. It is a combination of survey of self-completed mail-out/mail-back questionnaire and administrative data from Quebec. Generally, only facilities which have four beds or more are surveyed.

The residents in residential care facilities are classified into one of seven levels that the residents receive at the end of fiscal year. Those seven levels of care are listed in Table 1.[4]

Outside of Quebec, facilities providing self sufficient, minimal or Type I care with less than ten beds receive a short or abbreviated form. These facilities represent about half of residential care facilities. These facilities report totals for personnel and expenses and they do not provide a breakdown of personnel and expenses between direct care services and general services.

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[4] In the RCF survey, the facilities are assigned to a level of care that is equal to the level of care that most of the residents receive in the facilities (called dominant level of care).

The remainder of facilities -- those providing Type I care with ten beds or more and those providing Type II care or higher -- receive the long or standard form. These facilities report totals and detailed breakdown for personnel (direct care services and general services) and expenses (direct care services, general services and other expenses).

For Quebec facilities, Statistics Canada receives administrative data files from the Ministère de la Santé et des Services sociaux. These are obtained from public and private facilities through the M-30 system for financial data and from forms AS-478, AS-480, AS-484 and AS-485 for statistical data.

The annual survey of RCF used for this paper covers the fiscal years from the 1984/1985 fiscal year to the 2009/2010 fiscal year. The fiscal year starts from April 1 of a year to March 31 of the following year. The survey was cancelled for the fiscal year 1994/1995 and was terminated in 2011. For the discussion in the rest of the paper, we will often refer to fiscal year 1984/1985 as year 1984, and fiscal year 2009/2010 as year 2009.

At the end of fiscal year 2009/2010, there were about 4600 residential care facilities in Canada serving about a quarter million residents. Overall, those facilities generated 17.1 billion dollar in revenues, and 17.0 billion dollars in expenses (Statistics Canada 2011).

For facilities sent short forms and some facilities sent long forms, total hours and total expenses were reported without a detailed breakdown. They are then imputed. For the facilities that did not report total hours or expenses, total hours and total expenditures are also imputed (see appendix for a discussion on imputation).

To estimate the direct output of the RCF sector, the time-series data on resident days and unit costs by levels of care need to be constructed first. As shown in Table 2, about 30% of residential care facilities provide more than one level of care accounting for about 40% of total residents in the RCF sector.

A number of interesting findings are also worth noting from Table 2. Most facilities in Canada provide one level of care. The facilities with single level of care accounted for 72.5% of total number of facilities in 2009.

The share of facilities with single level of care increased over time. It increased from 46.0% in 1984 to 72.5% in 2009. The share of facilities that provides multiple levels of care declined over time. This perhaps reflects a trend towards specialization in residential care facilities. For example, the share of facilities that provide two levels of care decline from 20.4% to 13.6% over the period 1984 to 2009.

The facilities that provide multiple levels of care tend to be larger than those facilities with single level of care. The facilities that provide all seven levels of care to the residents are the largest. Those have an average of 715 residents at the end of the fiscal year 2009-2010.

3.1 Estimation of resident days by level of care

As the RCF survey only collects information on total expenditures and total resident days without a breakdown by level of care, they must be estimated first for those facilities that provide more than one level of care.

The variables used to estimate resident days by level of care are total number of resident days during the fiscal year (line 136 in the RCF) and the number of residents in the facilities by level of care on the last day of the fiscal year (line 240 and lines 228 to 238).

To estimate the number of resident days by level of care in a facility, the total number of resident days during a fiscal year is allocated using the mix of residents by level of care at the end of the fiscal year. The number of resident days by level of care is then aggregated across all facilities to obtain the number of resident days by level of care in a province. This will be called "resident-level estimation method".

Alternatively, each facility is assigned a level of care that most of its residents receive (or the dominant level of care). Total number of resident days in a facility is allocated to level of care that is assigned to that facility. The number of resident days is then aggregated across all facilities to obtain the number of resident days by level of care in a province. This will be called the "facility-level estimation method".

3.2 Estimation of unit costs by level of care

The RCF survey collects data on total expenditures during a fiscal year (line 497 and lines 402-484). But it does not collect data on a breakdown of total expenditures by level of care.

Total expenditures need to be allocated among different levels of care for the facilities that provide more than one level of care. This is a similar task that empirical researchers face when allocating total expenditures on patients (who often have multiple diseases) across different diseases to derive health care costs by type of disease (Hall and Highfill, 2013).

In this paper, we have experimented with alternative methods for allocating total expenditures among level of care to examine the robustness of estimates. A simple method for estimating expenditures by level of care is used when the facility-level estimation method is used to estimate resident days by level of care. For this method, we assign all facilities a single level of care that equals the dominant level of care that the facilities provide. Total resident days and total expenditures are aggregated across the facilities to obtain time-series data on resident days and total expenditures by dominant level of care in a province. Unit costs are estimated by diving total expenditures by total number of resident days by level of care. The method will be called Method A.

More complex methods are used to allocate total expenditures among level of care for facilities with multiple levels of care when the resident-level estimation method is used to estimate resident days by level of care. This is done using either unit cost estimates from

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Method A or unit costs estimates from a hedonic regression. For the former, we use unit costs by dominant level of care from Method A as a proxy for relative unit costs for a level of care. For the latter, we estimate an equation that relates average unit costs at the facility level to shares of residents by various levels of care. The equation is essentially a hedonic regression that relates unit costs of facilities to the characteristics of facilities as represented by the share of residents by level of care. The sample for estimation consists of all facilities that provide both single level of care and those facilities that provide multiple levels of care.

In sum, we experiment with three alternative methods for estimating time series data on resident days, expenditures and unit costs by level of care in a province:

- Method A. Facility-level estimation of resident days, total expenditures and unit costs by level of care;

- Method B. Resident-level estimation of resident days and facility-level estimation of unit costs by level of care; and

- Method C. Resident-level estimation of resident days and hedonic regression estimation of unit costs.

4. Growth in output and productivity of residential care facilities at the national level

This section presents the estimates of output and labour productivity in residential care facilities in Canadian provinces. Quebec is not included in our empirical analysis, as the RCF survey does not provide information on level of care for facilities for Quebec. In addition, the data from the RCF survey are not entirely consistent over time for Quebec as a result of changes in imputation method and survey methodology for fiscal years 1994/1995 and 2004/2005.

The section begins with a discussion of the trend in the composition of residents over time in residential care facilities. It then presents the growth in output and productivity in the RCF sector at the national level, and compares the growth in output and productivity in residential care facilities across the provinces. The last part of the section compares the level of labour productivity among Canadian provinces and examines the factors contributing to the difference in the level of labour productivity in residential care facilities. Those factors include the scale and ownership of the facilities.

4.1   The composition of residents and unit costs by level of care

Figure 1 and Table 3 show the trend in the composition of residents by level of care over time in the RCF sector. Type II care is the most prevalent form of care. It accounted for 38.9% of all residents in residential care facilities at the end of fiscal year 2009/2010. Those residents are senior residents with chronicle illness that require on-going medical attention.

Type III care is the next important form of care, followed by Type I care. Type III care accounted for about 32% of all residents at the end of fiscal year 2009/2010, while Type I care accounted for 20% of all resident.

Over time, there has been a shift in the composition of level of care away from Type I care towards Type II and Type III care which tend to be more expensive. The share of residents with type III care increased most. The share of residents receiving Type III care increased from 10.9% to 32.0% for the period 1984 to 2009, while the share of residents with Type II care increased from 34.8% to 38.9% during that period. The share of residents with Type I care declined from 32.1% to 20% over that period.

The share of residents with room and board declined over time. At the end of 2009/2010 fiscal year, the residents with room and board accounted for small share of all residents (7.6% in total).

The share of residents with the highest level of care (level 7) was small and did not change much over time. It accounted for about 1.5% of all residents at the end of period.

Table 5 presents two alternative estimates of unit costs of residential care by level of care averaged over the period 1984 to 2009. The second column presents unit costs estimates that were derived by assigning a level of care to facilities according to the level of care most of the residents receive and then aggregating total resident days and total expenditures by this dominant level of care across all facilities. The unit costs for a level of care are calculated as a ratio of total expenditures to total resident days.

The third column presents estimates from a hedonic regression of average unit costs on the share of the residents by level of care in a facility. More specifically, we estimate the following regression.

$$(2) \quad unit\cos t_{it} = \alpha_0 + \sum_{j=2}^{7} \alpha_j share(j)_{it} + \varepsilon_{it} \,,$$

where the variable unitcost is the ratio of total expenditures to total number of resident days in facility i in year t, $share(j)_{it}$ is the share of residents with level of care j in the total number of residents in facility i in year.

The coefficient estimate α_o represents the average unit cost for level of care 1. The average unit costs for level of care j = 2 to 7 is estimated as $\alpha_o + \alpha_j$.

The regression can be modified to allow for the changes in unit costs over time by introducing interaction terms between the variables for share of a level of care and the year dummy variables. This is not done here for this paper. Rather, we use average unit costs estimated from equation 2 to aggregate resident days across level of care.

The coefficient estimates from estimating regression (2) are presented in Table A2 in the appendix. Column 4 of Table 4 presents the average unit costs by level of care estimated from those coefficient estimates.

Overall, the two estimates of unit costs provide a similar ranking of relative unit costs among the levels of care. The level one care with room and board is the least expensive while the level 7 care is the most expensive.

4.2 Growth in output of the residential care facility sector

Figure 2 presents the trend in the number of resident days and the weighted sum of the resident days across level of care using cost share as weights. The weighted sum of resident days across level of care is used to measure the output of the RCF sector. As discussed above, we have experimented with three alternative estimates of the output of the RCF sector.

The number of resident days showed little changes before 2000. After 2000, it increased at much faster rate. The rapid increase in resident days is likely to continue as a result of the aging of the Canadian population.

All three estimates of the output index increased faster than the number resident days. This reflects the composition shift towards the levels of care (Type II and Type III) that are more expensive.

The cost-weighted output indices that are estimated from methods A and B show similar growth over time. Unit costs used to aggregate resident days across level of care are the same for method A and B. The difference between the two methods is in the difference in the estimation of resident days by level of care. For Method A, the number of resident days by level of care is estimated by attributing total number of resident days in a facility with multiple levels of care to its dominant level of care. For Method B, the number of resident days is derived from estimating resident days by level of care in a facility with multiple levels of care and then aggregating resident days by level of care across facilities. Since the two methods yield a similar shift in the composition of resident days by level of care, the output indices from the two methods have similar growth rates.

The cost-weighted output index from Method C has the highest growth rate. The main difference between Method C and Methods A and B is in the estimation of unit costs. The unit costs for each level of care in Method C are estimated from running a hedonic regression (2) that relates average unit costs to the share of residents by level of care. The unit costs from hedonic regression for Method C, as shown in Table 4, are relatively high for level 6 care (Type III care) compared with the estimates used for Methods A and B. As the number of resident days receiving type III care increase the most over time, estimates from Method C that assign relatively high unit costs to type III care increases the fastest compared with estimates from Methods A and B.

4.3 Growth in total number of hours and total expenditures

This section presents labour input and nominal value of output on the RCF sector. The labour input is used as the divisor for the volume index of output to derive a measure of labour productivity.

Labour input is estimated as the number of hours paid during a fiscal year (line 383 and lines 303-371 in the RCF survey). While the proper concept of labour for measurement of labour productivity is the total number of hours worked, the data on hours worked are not available from the RCF survey. Instead, the RCF survey collects data on hours paid. The trend in hours paid and hours worked have been found to be similar in previous studies.

The nominal value of output is estimated as total expenditures from the RCF survey. Total expenses include the costs of labour, the costs of intermediate inputs and depreciation.

Figures 3 and 4 present trend in the number of hours and total expenditures. The trend in hours mirrors the trend in resident days. It experienced little change before 2000 and a rapid change after 2000.

The nominal value of output as measured by total expenditure increased throughout the entire period. It also increased for the period before 2000 when the number of residents showed little changes.

4.4   Growth in labour productivity

Figure 5 presents the growth in labour productivity defined as the ratio of output to hours in residential care facilities. It presents three alternative estimates of labour productivity based on three alternative estimates of the volume index of output.

All three estimates of labour productivity declined over time, especially before 1990. After 1990, they show a small increase.

The rest of presentation will focus on estimates from Method C or the hedonic regression method. The hedonic regression method is the most common method that is used to allocate total heath care expenditures among treatment of various diseases (Hall and Highhill

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2013). In our case, the hedonic method is used to allocate total expenditures among multiple levels of care.

4.5   Quality adjustment for the output of the RCF sector

The volume index of output in the RCF sector presented above does not take into account changes in the quality of care in residential care facilities. In this section, we take into account quality changes in the estimates of the output of the RCF sector.

We use the quality of labour input to adjust for the quality of output. Our hypothesis is that the share of hours that is spent on direct care to residents in total number of hours is associated with improvement in the quality of residential care. A similar approach is used to adjust for quality improvement in the output of the education sector, where the experience and quality of teachers is used as indicator for the quality of education output.

The RCF survey collects hours by type of personnel in residential care facilities. The employees in the RCF survey are classified into 11 types, as listed in Table A1 in the appendix. The first six types of employees provide direct care to residents while the remaining 5 types provide general service to the residents.

The six types of employees whose time is mainly spent on direct care to residents are: 1. registered nurses; 2. registered qualified nursing assistants/licensed practical nurses; 3. physiotherapists/occupational therapists; 4. other therapists, 5. activity/recreation staff; 6. other direct care staff not included above.

Figure 6 presents the share of employees that provide direct care to residents in the total number of hours. It increased from 65% in 1984 to 75% in 2009.

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The increase in the share of direct care in the number of hours is used as an indicator for the improvement in the quality of care to residents. It can also be due to the increase in the number of older and sicker patients in the RCF. In both cases, that increase represents the increase in the output of the RCF sector.

When the increase in the share of personnel that provides direct care to residents is associated with the increase in the quality of care to residents, the implicit price or hedonic price associated with the changes in the price of the output of residential care facilities should be counted as the increase in the volume of output. That association can be estimated from running a regression that relates the price of output of residential care facilities to the change in the share of direct-care personnel and other factors that affects the price of the output:

$$(3) \quad \Delta \ln P_t^{RCF} = \alpha_0 + \alpha_1 share \ of \ direct \ care + \alpha_2 \ln wage + \alpha_3 \ln P_i^V + \varepsilon_t$$

The price deflator for the output of RCF deflator is expressed as a function of the share of direct care in total hours, the average wages of employees that provide direct care, a general inflation term that represents the increase in the price of other expenditures that includes drugs, the depreciation of capital, and wages for general service personnel.

Wages and salaries accounted for the largest component of total expenditures. In 2009, labour costs accounted for 64% of total expenditures. This share remains relatively constant for the period.

The regression results are presented in Table 5. The share of direct care in hours is positively related with the change in the price of output of the RCF sector. A one percentage point increase in the share of direct care in total hours is associated with 0.02% increase in the price of output of the RCF sector. This increase represents the increase in the output of the RCF sector associated with the increase in the share of direct care.

The wages of direct care personnel are positively associated with the price of output of the RCF sector. A one-percent increase in the hourly wage rate of direct care personnel is associated with about 1 percent increase in the output of the RCF sector. The coefficient on the wages of direct care is more than its share in the nominal output, as the coefficient may capture the effect of changes in other costs.

Figure 7 presents the index of labour productivity in the RCF sector that takes into account the quality changes in output. Table 6 presents the annual growth of output and labour productivity in the RCF sector for the period 1984 to 2009. For a comparison, the table also presents the annual growth of output and labour productivity in the business sector.

The nominal value of output in the RCF sector increased faster than that in the business sector over the period 1984 to 2009. Over that period, the nominal value of output in the RCF sector increased at 5.4% per year, compared with 4.9% per year for the business sector.

Most of the increase in nominal output in the RCF sector was due to the increase in the price index of output in the RCF sector. The price index of the output of the RCF sector increased at 3.3% per year for the period 1984 to 2009. That growth is much faster than the growth in the price index of output of the business sector, which is 2.2% per year for that period.

The volume index of output increased at 2.1% in the RCF sector for the period 1984 to 2009. The number of hours increased at 1.8% per year. The growth in labour productivity in the RCF sector, which is the difference between growth in output and growth in hours, was 0.2% per year over that period.

5. Growth in output and productivity of residential care facilities at the province level

This section compares output and labour productivity growth across Canadian provinces. Once again we do not include Quebec as the detailed data on residents by level of care are not available.

Table 7 presents the annual average growth of output, hours worked and labour productivity growth in Canadian provinces over the period 1984 to 2009. The output growth is estimated using Method C and unit costs by level of care are set equal to the national average as presented in Table 4. The quality adjustment is based on the share of direct care in total hours in a province.

There is a large variation of labour productivity growth across Canadian provinces. Labour productivity growth was positive in four provinces (Newfoundland, New Brunswick, Ontario and British Columbia), and was negative in the other provinces (PEI, Nova Scotia, Manitoba, Saskatchewan and Alberta.

Newfoundland has the fastest labour productivity growth at 1.4% per year for the period 1984 to 2009. Manitoba has the slowest labour productivity growth during that period. Labour productivity growth in the Manitoba RCF sector declined by 1.3% per year.

6. Relative productivity levels of residential care facilities in Canadian provinces

This section compares the level of labour productivity across Canadian provinces. For that purpose, we use a parametric approach and estimate a regression that expresses the level of labour productivity in logarithm in a facility as a function of dummy variables for the provinces and a number of control variables. Those control variables include binary variables for seven dominant levels of care, a variable for scale, and binary variables for ownership. Labour

productivity in a facility is defined as the number of resident days divided by the number of hours. The scale is defined as total number of residents at the end of a fiscal year.

Alternatively, we can adopt a non-parametric approach for estimating the level of labour productivity across the provinces. The relative price level of residential care is constructed first. Those relative prices are then used to deflate the relative level of the nominal output of the provinces to derive the relative level of the volume of output of the RCF sector. The relative labour productivity is the ratio of relative output to relative hours worked (Schreyer 2010).

Table 8 presents the results using data for the fiscal year 2009/2010. The first two columns present the estimation results that do not control for the effect of scale. The second two columns present the estimates that control for the effect of scale. The two specifications in the table all control for the effect of ownership. We have also estimated two alternative specifications that do not control for the effect of ownership.

The coefficient estimates on the province dummies represent the log difference in the labour productivity between that province and Ontario in 2009. The level of labour productivity in a province relative to that of Ontario can be calculated from those coefficients and is presented in Table 9 and Figure 8.

We will focus on the results that control for the effect of scale and level of care, but do not control for the effect of ownership. We are essentially comparing the labour productivity level of facilities with the same size and same level of care in 2009. Residential care facilities in three Atlantic provinces (Newfoundland, PEI, and New Brunswick) and British Columbia have higher levels of labour productivity than those in Ontario. All other provinces (Nova Scotia and the prairies provinces) have lower labour productivity levels than Ontario.

New Brunswick has the highest labour productivity level in 2009, followed by Newfoundland and PEI. In 2009, residential care facilities in Newfoundland are about 44% more productive than those in Ontario.

Nova Scotia has the lowest labour productivity level. In 2009, residential care facilities in Nova Scotia are about 20% less productive than those in Ontario.

Some of the differences in labour productivity levels across provinces are due to the difference on ownership. When we control for the effect of ownership, three Atlantic provinces and B.C. still have higher labour productivity levels than Ontario. But three Prairies provinces no longer have lower productivity levels than Ontario. Those provinces now have similar productivity levels compared to Ontario.

The regression results in Table 8 also show that facilities that are proprietary are the most productive. Those facilities are private corporations operating for a profit. Residential care facilities that are owned by religious organizations have the second highest labour productivity level. The facilities that are owned by the provincial governments are the least productive.[5]

The full ranking of ownership in labour productivity level from high to low in 2009 is: proprietary, religious, municipal, regional health authority, lay (not for profit), and provincial. [6]

7.   Conclusion

This paper examines the productivity performance of residential care facilities in Canadian provinces. For that purpose, the direct output measure is constructed as the cost-weighted output index from aggregating resident days by level of care.

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[5] Kessler and McClellan (2001) finds that the areas with the presence of for-profit hospitals have lower levels of expenditures, but virtually the same patient health outcomes.

[6] We have also estimated the relative levels of labour productivity averaged over two years 2008 and 2009 using the sample of facilities for years 2008 and 2009. This is done to reduce potential measurement errors in the data. The results are similar.

The paper finds that the nominal value of output in residential care facilities increased faster than that in the business sector over the period 1984 to 2009. Much of the increase in nominal output in the RCF sector was due to the increase in the price of output in residential care facilities.

Labour productivity increased at 0.2% per year in residential care facilities over the period 1984 to 2009. The rate of growth was much slower than in the business sector. During that same period, labour productivity increased at 1.2% per year in the business sector.

There is a large variation of labour productivity growth in residential care facilities across Canadian provinces. Labour productivity growth was positive in Newfoundland, New Brunswick, Ontario and British Columbia, and was negative in other provinces (PEI, Nova Scotia, Manitoba, Saskatchewan and Alberta). Newfoundland has the fastest labour productivity growth at 1.4% per year over the period 1984 to 2009. Manitoba has the slowest labour productivity growth during that period at negative 1.3% per year.

There is also a large variation in the level of labour productivity in residential care facilities across the provinces. Residential care facilities in three Atlantic provinces (Newfoundland, PEI, and New Brunswick) have the highest labour productivity level in 2009. The labour productivity of residential care facilities in those provinces is much higher than that in Ontario. British Columbia also has a higher level of labour productivity than Ontario. All other provinces (Nova Scotia and the Prairies provinces) have lower labour productivity levels than Ontario.

New Brunswick has the highest labour productivity level in 2009, followed by Newfoundland and PEI. In 2009, residential care facilities in Newfoundland are about 44% more productive than those in Ontario. Nova Scotia has the lowest labour productivity level. In 2009, residential care facilities in Nova Scotia are about 20% less productive than those in Ontario.

Some of the differences in labour productivity levels across provinces are associated the difference on ownership of residential care facilities. Private residential care facilities are more productive that public residential care facilities. Private residential care facilities that are proprietary are the most productive. Those facilities are private organizations or corporations operating for a profit. The facilities that are owned by the provincial governments are the least productive.

Future research should focus on understanding the sources of the difference in labour productivity across Canadian provinces and across residential care facilities. While little studies exist the factors contributing to productivity growth in the RCF sector, much has been learned about the factors contributing to productivity growth in the business sector (see, e.g. Baldwin, 1995; Baldwin and Hanel, 2003). The factors contributing to productivity growth in the business sector include competition, innovation, entrepreneurship, and scale economies. How these factors contribute to productivity growth in the health sector should be the topic of future research.

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Table 1

Level of care provided by residential care facilities

Level of care	Description
1	Room and board only
2	Room and board with guidance/counselling
3	Room and board with custodial care and/or special school, sheltered workshop, etc.
4	Type I - supervision/or assistance with daily living and meeting psycho-social needs
5	Type II – medical and professional nursing supervision, etc.
6	Type III- medical management, skilled nursing care, etc.
7	Higher type

Table 2

The share of number of facilities and residents by the number of levels of care provided and average number of residents

Number of level of care provided	1984			2009		
	share of number of facilities	share of residents	average number of residents	share of number of facilities	share of residents	average number of residents
1	46.0	23.6	21	72.5	59.4	39
2	20.4	17.8	36	13.6	15.1	52
3	15.1	17.9	49	5.8	7.2	59
4	11.8	20.7	73	5.3	10.2	91
5	4.1	9.7	97	2.3	4.4	92
6	1.8	6.7	153	0.4	1.6	180
7	0.7	3.7	215	0.1	2.1	715

Table 3

Changes in the share of resident days by level of care, 1984 to 2009

Level of care	1984 %	2009 %	Change (%)
1	3.9	0.3	-3.7
2	9.1	6.0	-3.1
3	8.1	1.3	-6.8
4	32.1	20.0	-12.1
5	34.8	38.9	4.2
6	10.9	32.0	21.1
7	1.1	1.5	0.4

Source: The authors' tabulation from the RCF data

Table 4

Average unit costs by level of care (dollars per resident day)

Level of care	Facility level estimates	Hedonic regression
1	47.6	19.2
2	115.9	99.2
3	118.9	71.3
4	94.7	76.2
5	106.3	101.9
6	123.3	134.4
7	173.6	152.3

Table 5

Coefficient estimates from regression of output price on the characteristics of residential care facilities

	1		2	
Variables	Coef.	t-stat	Coef.	t-stat
Share of direct care	1.88	2.15	1.93	2.06
Log of hourly wages of direct care personnel	0.98	4.16	0.98	3.84
Gross output deflator	…	…	0.04	0.18
Constant	0.01	0.70	0.01	0.56

Table 6

Annual growth of output and labour productivity in the RCF sector in Canada, 1984 to 2009

	RCF	Business sector
Nominal output	5.4	4.9
The volume index of output	2.1	2.6
Price index of output	3.3	2.2
Hours worked	1.8	1.5
Labour productivity	0.2	1.2

Table 7

Annual growth of output and labour productivity in the RCF sector in Canadian provinces, 1984 to 2009

	output growth	Hours growth	labour productivity growth
Newfoundland	3.1	1.7	1.4
Prince Edward Island	1.4	2.0	-0.5
Nova Scotia	0.7	1.7	-1.0
New Brunswick	1.7	1.5	0.2
Ontario	2.1	1.5	0.6
Manitoba	0.6	1.9	-1.3
Saskatchewan	1.0	1.6	-0.5
Alberta	3.2	3.2	-0.1
British Columbia	2.9	2.2	0.8

Table 8

Regression results for labour productivity level of residential care facilities in 2009

	Coeff.	t-stat	Coeff.	t-stat
Indicators for province				
Newfoundland	0.13	2.62	0.17	3.74
Prince Edward Island	0.25	3.36	0.25	3.63
Nova Scotia	-0.21	-5.13	-0.13	-3.61
New Brunswick	0.13	4.19	0.25	8.73
Manitoba	-0.11	-2.91	-0.01	-0.30
Saskatchewan	-0.06	-1.65	0.06	1.65
Alberta	-0.12	-4.34	-0.01	-0.51
British Columbia	-0.02	-0.68	0.12	4.75
Indicators for level of care				
Level 2	-0.64	-1.16	-0.73	-1.43
Level 3	-0.58	-1.05	-0.66	-1.29
Level 4	-0.54	-0.98	-0.68	-1.34
Level 5	-0.57	-1.03	-1.02	-1.99
Level 6	-0.62	-1.12	-1.13	-2.21
Level 7	-0.45	-0.81	-1.02	-1.98
Indicators for ownership				
Lay (i.e. not for profit)	-0.20	-1.41	-0.15	-1.14
Religious	0.20	1.35	0.10	0.70
Municipal	0.09	0.58	-0.06	-0.42
Provincial	-0.39	-2.57	-0.31	-2.19
Proprietary	0.47	3.21	0.42	3.10
Regional heath authority	-0.08	-0.55	-0.09	-0.65
Size			0.22	26.80
Constant	-1.11	-1.94	-1.57	-2.97

Note. The omitted categories for the indicators are Ontario for the province indicators, level one for the level indicators, ownership categories not classified elsewhere for the ownership indicators.

Table 9

Relative level of labour productivity in Canadian provinces (Ontario = 100), 2009

	Without ownership control		With ownership control	
	No scale control	Scale control	No scale control	Scale control
Newfoundland	133.7	135.6	113.8	118.7
Prince Edward Island	127.8	127.2	129.0	128.8
Nova Scotia	74.8	81.7	81.3	87.4
New Brunswick	128.2	143.8	113.3	127.8
Ontario	100.0	100.0	100.0	100.0
Manitoba	75.6	86.4	89.7	99.0
Saskatchewan	74.9	88.9	93.7	106.3
Alberta	79.3	91.2	88.5	98.7
British Columbia	91.7	108.3	98.2	112.2

Figure 1. The Percent Share of Residents by Level of Care
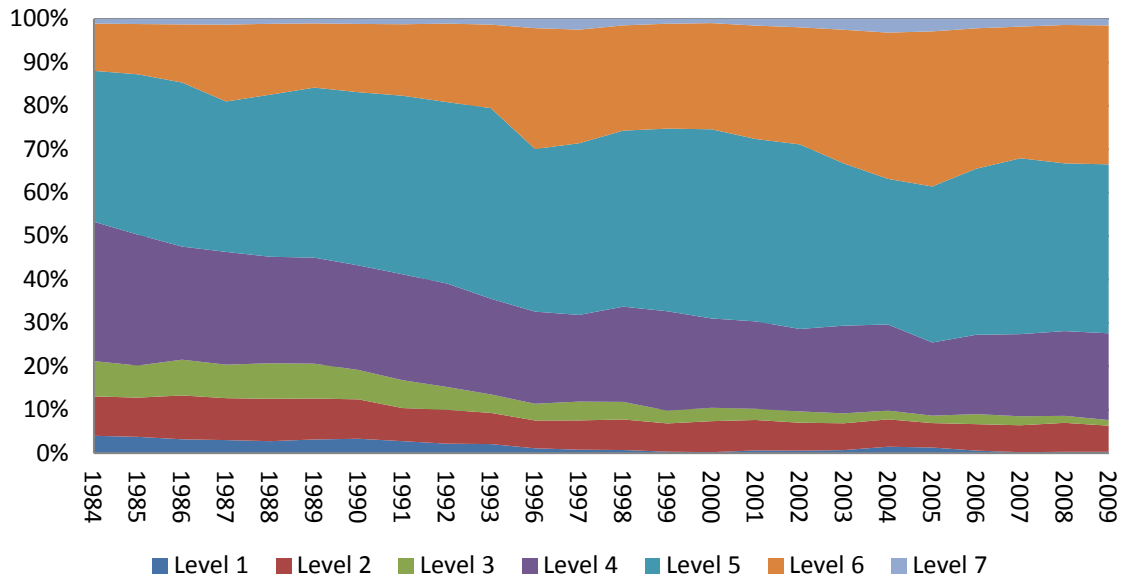
Figure 2. Output of rediential care facility sector
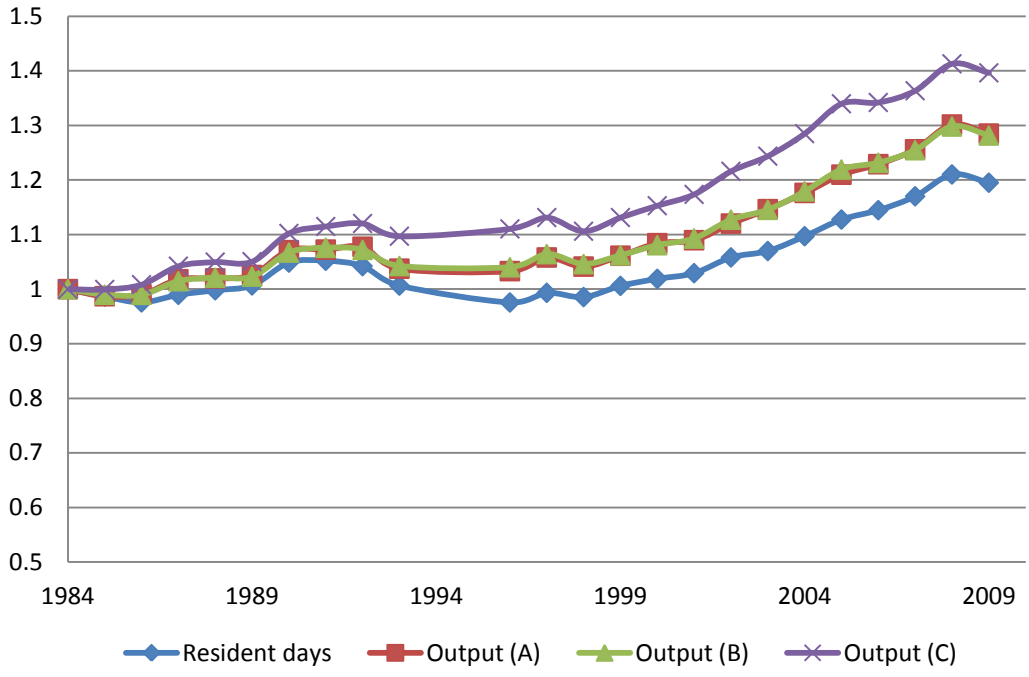
Figure 3. Total number of hours in the RCF sector in millions
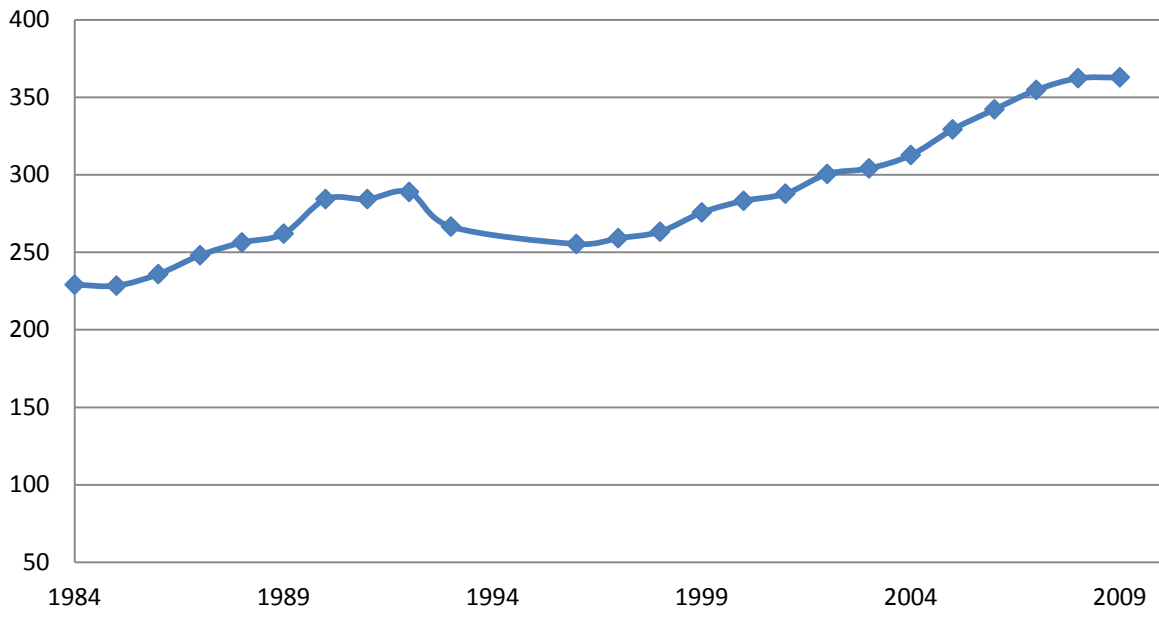
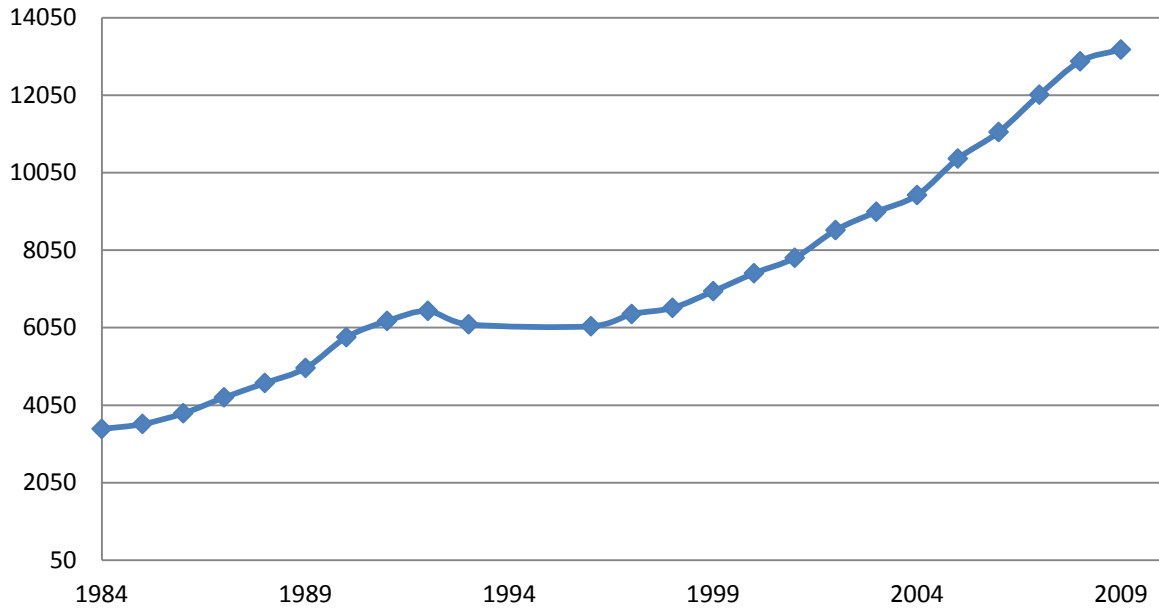**Figure 4. Total expendituires in the RCF sector in million dollars**
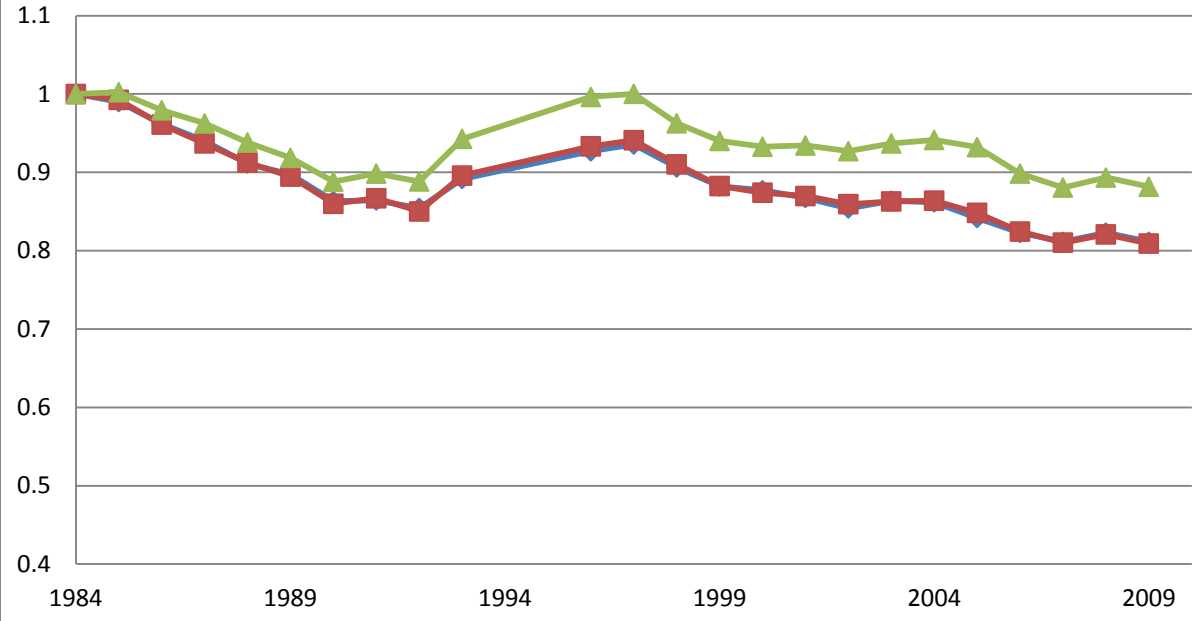
Figure 5. Labour productivity in the RCF sector

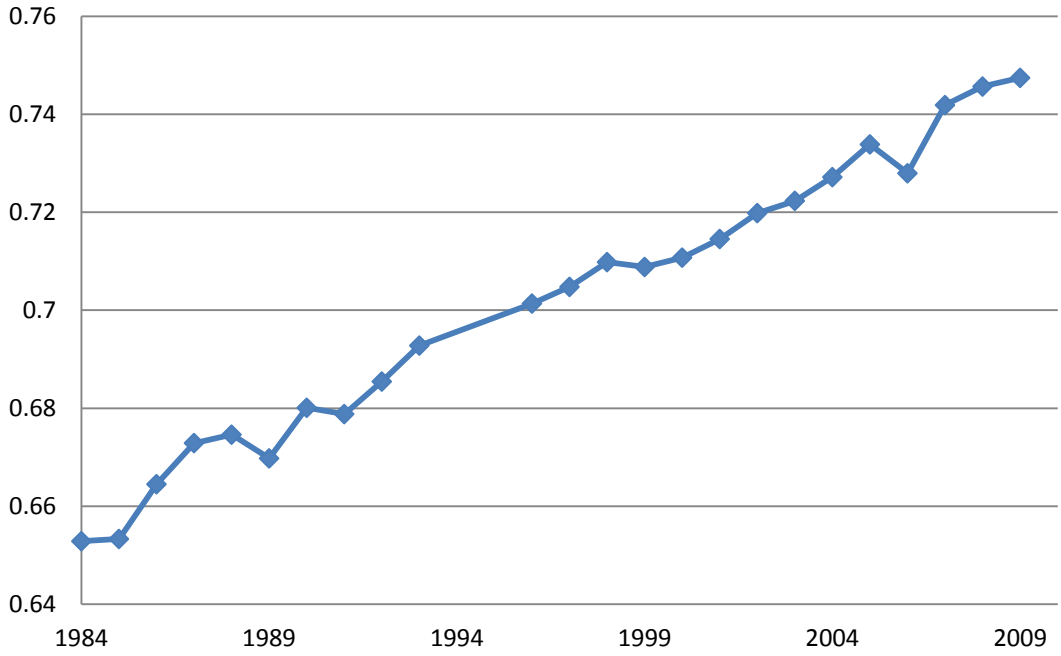Figure 6. Share of direct-care in total hours in the RCF (%)

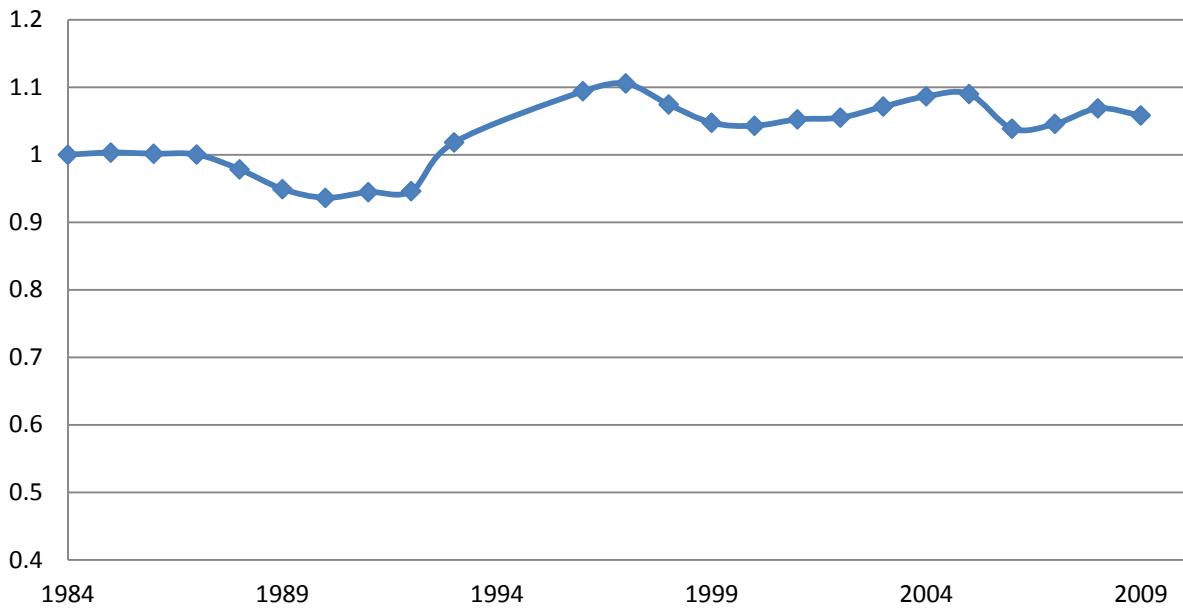**Figure 7. Labour productivity in the RCF sector with quality adjustment**
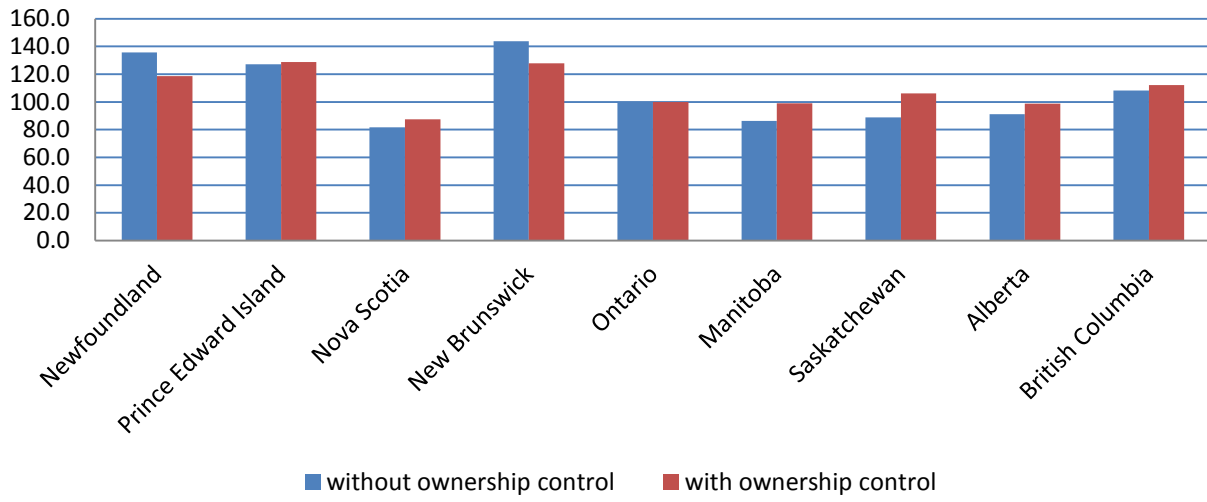
Figure 8. Level of labour productivity in Canadian provinces, (Ontario =100)

Appendix: Imputation (IMDB 3201 and internal documentation on the RCF)

Imputation for each facility in a total or partial non-response situation was done by imputing the predicted value of a multi-variate regression using the GLM procedure in SAS for total income, expenditures and hours worked. Independent variables are the characteristics of the facility as provided by the provincial department of health. These characteristics include type of service, type of property, region or province, level of care and rated-bed capacity. The other cells were imputed by assigning them a weight corresponding to their percentage of these totals in similar facilities. Great care was taken to ensure that incomplete answers given by facilities were not replaced by estimates and that the overall results remained consistent.

Quebec data come from administrative sources. Initially, the data had to be reformatted to establish conceptual equivalents to the cells of the questionnaire. In addition, Quebec facilities report financial data at the corporation level. A corporation may include various components, each with its own objectives. For example, a corporation whose primary objective is residential care may include facilities whose activities relate to outpatient or hospital care. This means that financial data from this type of corporation may include a significant number of activities unrelated to residential care. The inclusion of these activities in the accounts of residential care facilities could artificially inflate them. To reduce this bias, an attempt was made to differentiate, in administrative documents, activities purely attributable to residential care facilities from other activities and to report only the former in the accounts. Weighting was performed on common activities, as well as those that could not be differentiated (such as administrative activities or research). In this sense, Quebec data from 1996 are an estimate of residential care activities. *This adjustment was not made for historical data prior to 1994/1995.* Hence, those data refer to complete data for corporations deemed to be residential care facilities regardless of the division of activities within the corporations. They may therefore include a significant portion of activities that are outside the scope of residential care.

For the period for which the adjustments were applied, the estimates for "Homes for the Aged" are satisfactory. However, because of the small number of facilities for "Persons with mental disorders" and especially of facilities in the category "Other", estimates may still include some external activities

In 2004, many residential-care facilities in Quebec became part of a newly created Centre de santé et de services sociaux (CSSS). Since many of these CSSS likely included a variety of other services, such as hospital out-patient services and social services facilities, estimation and imputation methods had to be changed from that used in the previous year. Hence*, data for Quebec and Canada for 2004/2005 and subsequent years are not comparable with data for previous years.*

Appendix Table 1

Type of employees in the RCF survey

Direct Care to Residents Expenses

    1   Registered nurses
    2   Registered qualified nursing assistants/licensed practical nurses
    3   Physiotherapists/occupational therapists
    4   Other therapists (specify)
    5   Activity/recreation staff
    6   Other direct care staff not included above (specify)

General Services Expenses

    7   Administration (include all employee benefits in the middle box)
    8   Dietary (i.e., kitchen/food services)
    9   Housekeeping/laundry
   10   Plant operation, maintenance and security (i.e., janitorial services)
   11   Other (specify)

Appendix Table 2

Estimation results from the regression of unit costs on the share of residents by level of care

Variable	Coefficients	Std error
Share of residents in level 2	79.9	1.7
Share of residents in level 3	52.1	1.7
Share of residents in level 4	57.0	1.7
Share of residents in level 5	82.7	1.7
Share of residents in level 6	115.2	1.8
Share of residents in level 7	133.1	3.6
Constant	19.2	1.6

The excluded variable is the share of residents in level 1. The sample used for estimation includes all residential care facilities.