Spend Less, Get More? Explaining Health Spending and Outcome Differences Between Canada and Italy

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Abstract:

Canada spends more than Italy on health in per capita terms and as a share of GDP and yet Italy's two main health indicators as measured by life expectancy and infant mortality are better and have improved more than Canada's in recent years. Research at the national and international level has noted that more health spending does not always result in improved outcomes. Moreover, other social determinants have also been seen as important to health outcomes. Social spending relative to health spending has been tied to improvements in life expectancy and mortality rates. A key difference between Canada and Italy is that Italy spends relatively more on social transfers – particularly pensions. We find that more social spending and health spending in either Italy or Canada does not explain the differences in health outcomes. Moreover, once we consider more social spending in Italy, the Italian health care system may not be much more efficient than the Canadian system.

Introduction

Canada and Italy are both part of the G7 countries with publicly funded universal health care systems that afford their citizens high quality health care. Indeed, international rankings generally place Canada and Italy in top tiers when it comes to the performance of their health care systems. At the same time, these same rankings also reveal differences between the two countries that often place Italy ahead in terms of health outcomes, even though as both a percentage of GDP as well as per capita Canada devotes more resources to health. For example, the WHO 2010[1] rankings placed Italy second and Canada 30th in terms of health system performance, while a more recent study in the Lancet 2018[2] placed Italy ninth and Canada fourteenth. Meanwhile, in terms of spending as a share of GDP, a recent Fraser Institute report placed Canada third and Italy twenty fourth.[3]

Could the divergence in health care outcomes between Canada and Italy be due to the fact that Italy spends more on social transfers relative to Canada? Recent research at the national and international level has noted that more health spending does not always result in improved outcomes.[4] The literature suggests that other social determinants can also influence health outcomes. For example, Rowlingson (2011), Subramanian and Kawachi (2004) and Lynch et al., (2001), draw the link between income inequality and higher mortality rates as well as health and social problems. Dutton et al., (2018) for Canada note the importance of social spending at the provincial government level as a determinant of improved performance when it comes to improvements in life expectancy.

The conundrum is this. Italy has a lower per capita GDP than Canada and spends less on health care overall and yet does better on many international rankings of health care access and

[1] World Health Organization (2010).
[2] R. Lozano et al., (2018).
[3] Barua, B., S. Hasan and I. Timmermans (2017) Comparing Performance of Universal Health Care Countries, 2017. Fraser Institute.
[4] Ariste and Di Matteo (2017).

outcomes, and many of its health indicators are better than those in Canada. This research aims to compare health spending, health system parameters and outcomes in Canada and Italy in an effort to ascertain why Italy is apparently able to spend less on health care and yet obtain better outcomes as measured by life expectancy and infant mortality.

An important question is why compare the health care systems of Italy and Canada and not another pair of G7 countries? A key difference between Canada and Italy is that Italy devotes much more to redistributive schemes compared to Canada and we want to investigate if this difference might explain its better health outcomes. We also consider the differences in basic health care inputs and institutions that may account for these differences, and what can Canada learn, if anything, about how to structure its health care systems so as to increase its efficiency? The efficiency of the healthcare system is a pressing question in all advanced countries as they face an aging population that may put pressure on government budgets in the future.

The paper is divided as follows. First, we provide a brief overview of the size, structure and financing of the two health care systems. Second, we briefly review the health care literature with respect to value for money in health care spending. Third, we compare the aggregate health care spending in Canada and Italy, both in per capita terms as well as a share of GDP with OECD averages juxtaposed. Fourth, we compare health care status indicators and outcomes between Canada and Italy. Fifth, we compare the health care resource inputs in the two countries, such as physician, nurses, medical technology and hospital beds. Sixth, we compare assorted social expenditures and inequality and their differences across Canada and Italy. Finally, we carry out regression analysis to assess the determinants of health expenditures given the potential contribution of these differences in health expenditure and system differences to health indicator outcomes. Then we estimate the determinants of health outcomes – namely, life expectancy at birth and infant mortality. The paper concludes with a discussion as to what extent the differences in health outcome between Canada and Italy can

be ascribed to differences in lifestyle choice, the structure and performance of their health care, and the differences in social expenditures.

A Brief Health System Overview

Canada

In Canada, federal and provincial governments both finance public health spending but under the Canadian constitution the provincial governments deliver publicly funded health care to citizens, making for a decentralized health system with some variation in both expenditure levels and service provision.[5] Provincial and territorial government health expenditures are for insured health services and extended health care and are financed by own source revenues as well as federal government transfers to the provinces.

Health care in Canada is approximately 30 percent privately funded and 70 percent publicly funded, but the proportion varies from province to province, as well as within expenditure categories.[6] Private sector health care expenditures include those from health insurance firms, out-of-pocket expenditures of individuals, and patient service revenue paid by private insurers for items such as preferences for private hospital rooms or charges for services not deemed medically necessary. It also should be noted that in Canada public finance differs from public provision. For example, Canadian physician expenditures are nearly entirely publicly financed, but with physicians behaving mainly as private independent contractors rather than salaried employees.[7]

[5] As a result of its federal nature, Canadian public health care is not characterized as one public health care system, but actually 14 publicly funded systems, given that there are ten provinces and three territories along with a federal government with its own health obligations for indigenous peoples, the military and the RCMP.

[6] See: Canadian Institute for Health Information. National Health Expenditure Trends 2018, 1975 to 2017.

[7] For a discussion see Di Matteo (2014).

Federal transfers for provincial-territorial government health spending are made according to the legislation of the 1984 Canada Health Act, which specifies the criteria under which provinces and territories get federal health transfers. Provincial health systems must be publicly administered, be comprehensive in their coverage of insured services, must be universal in their coverage, must have portable benefits, and must provide for reasonable access to insured services. There is some variation across provincial systems in terms of what medical services and drugs are covered by provincial plans.

In 2018-2019, the total value of the Canada Health Transfer to the provincial and territorial governments according to the Federal Department of Finance is expected to be $CAD 38.584 billion dollars and is expected to increase to $CAD 40.373 billion by 2019-2020.[8] These federal transfers provide about 20 to 25 percent of provincial government health expenditures, though the growth rate of these transfers will decline after 2017 as the new replacement formula is based on the growth rate of real GDP, subject to a 3 percent floor as opposed to the previous Health Accord escalator, which saw annual 6 percent increases.

Italy

The OECD groups the Italian health care system in Group 6, along with those of Hungary, Ireland, New Zealand, Norway, Poland and the U.K. In this group, health care services are provided by a heavily regulated public centralized system, with spending limits imposed by a budget process[9]. Italy's publicly funded health care system (*Servizio Sanitario Nazionale-SSN*) was established in 1978, and is modelled on the National Health Service in Britain. It is a single payer system that includes universal coverage for all Italian citizens. However, the responsibility for the organization and delivery of health services resides with the 19 regions and two autonomous provinces.

[8] See: Department of Finance Canada. https://www.fin.gc.ca/fedprov/mtp-eng.asp
[9] OECD 2010, "Health care systems: Getting more value for money", OECD Economics Department Policy Notes, No. 2.

The central government in Rome controls the tax-financed health budget which defines the benefits that must be guaranteed to Italians and foreign residents. The regions are responsible for the organization, planning and the actual delivery of health services, through the local health authorities, Azienda Sanitaria Locale (*ASL*). The regions and the two autonomous provinces have substantial autonomy in how they structure their health care systems within the parameters established by the central government, including health care spending and delivery. However, it is the central government that allocates the bulk of the funds for healthcare, making it to some extent more centralized than the Canadian system. Still, the regions can raise their own additional resources, thus making for some significant regional differences in per-capita health care spending (Cicchetti and Gasbarrini, 2016).

The *SSN* has a strong focus on primary health care. All citizens are required to register with a general practitioner, who is given strong financial incentive to keep costs low by prescribing pharmaceuticals and refer patients to medical specialists only as appropriate. All citizens have access to primary care 24 hours a day, 7 days a week through not only their primary physician, but also out-of-hours service walk-in clinics (*guarda medica*). In recent years, general practitioners have been given financial incentives to form group medical practices, following a multi-professional and multi-disciplinary approach.

In an effort to improve efficiency through economies of scale, several regions since 2016 have merged local health authorities into larger entities. Despite the central government's commitment to a national standard of health care to all Italian citizens, there are concerns over regional differences in population health status and equal accessibility to quality health services.[10] Generally, northern and central regions have higher capacity, more advanced diagnostic machinery, and better patient perceived quality of health care compared to southern Italy. Thus, it is not surprising that a significant number of patients from southern Italy travel to northern regions to obtain care. According to the Ministry of Health, at least 30,000 patients a

[10] OECD, 2017

year from the regions of Campania, Calabria, and Sicily travel to northern regions seeking better health care.[11]

Health care in Italy is primarily publicly funded, only 24 percent of total expenditures are privately funded[12]. While the publicly funded health care share is higher than Canada, it still remains lower than France and England, where fully 93 and 90 percent of all health spending is publicly funded. Private health insurance plays a minor role in Italy, accounting for only about one percent of total health spending in 2014.

Total health care spending declined after the 2008 global financial crisis, and remained more or less flat for the following 5 years, but started to rise again in 2014. Containing the cost of health care spending has been a main concern for Italy given its relatively high public debt to GDP ratio. In 2016, the central government embarked on a deficit reduction plan for hospitals in an effort to balance their accounts. In fact, the number of acute care hospital beds has dropped significantly since 2000 in response to national targets to reduce all bed numbers. As is the case in many OECD countries, the Italian government is looking for efficiency gains from its national health care system.

Value for Money in Health Care: A Brief Review of the Literature

Efficiency is a core concept of economics. In a world of scarcity in which wants are unlimited but resources to satisfy those wants are limited, getting the most output for a unit of resource is paramount. As it relates to a health care system, getting the most out of inputs, such as diagnostic machinery, the number of doctors, and hospital beds, means extending the length as well as the quality of life. Inputs can be measured in either monetary terms, such as the per

[11] Ibid.
[12] OECD, 2015.

capita spending on health care, or in physical terms, such as the number of hospital beds and technical equipment.[13] Here, we investigate inputs in both monetary and physical terms.

The Canadian Institute for Health Information (CIHI) (2014) suggests another approach to measure the efficiency of a health care system: the reduction in potential years of life lost (PYLL) from treatable causes of death. According to their results, the reduction in PYLL in Canada from treatable causes of death could be anywhere between 18 and 35 percent, depending on the province, which translates to preventing between 12,600 and 24,500 premature deaths.[14] In a separate study,[15] the CIHI found that the PYLL for Italy for the year 2010 was lower than it was for Canada, pointing to a more efficient health care system.

Efficiency can be a relative term. This is the reason for comparing the health care systems in two OECD countries: Italy and Canada. Why does Italy appear to be getting more out of its spending and inputs compared to Canada on a number of important outcomes: namely, the expected length of life, and infant mortality?

1. Expenditures and Health Outcomes

A methodology often used to assess the efficiency of a health care system is to compare the length of expected life span and infant mortality rates with the amount spent on health care, either in terms of the per capita expenditure or as a percentage of GDP. Given measurement difficulties, different health care systems and differing country results, it is not surprising that consensus is lacking among those that have looked at the connection between expenditure on health and outcomes. Some OECD countries, such as Spain, have high life expectancy, but with spending on health care in the middle of the pack. Belgium and Denmark rank high in spending,

[13] There are recent studies of the efficiency of health care systems at the international level and particularly the EU. See Joumard, André and Nicq (2010), Asandului, Roman and Fatulescu (2014), and Medeiros and Schwierz (2015).
[14] CIHI (2014), p.2
[15] CIHI (2016)

but have only average health outcomes. Thus, we find in general a non-linear relationship between health spending and outcomes, at least among European OECD member countries[16].

Babazono and Hillman (1994) analyzed 1988 data for OECD countries, including Italy. Their result show that total health care spending and outpatient and inpatient utilization rates are not related to health outcomes. On the other hand, Anderson et. al (2000) look at health spending and outcomes for OECD countries for the 1960-1998 period and find a positive relationship between health care expenditures, particularly so with regards to the U.S.A.

Golinelli *et al*., found that mortality rates in Italy between 2011-14 increased because of government spending restraint, compared to the 1995 to 2010 period, implying that health expenditures do impact outcomes. However, they do point out, citing Stuckler et. al (2010), that health spending cannot be considered the only determinant of mortality rates. In fact, Vercelli *et. al.* find mortality rates in Italy dropping from the beginning of the 20th century, right up to 2008, and income did not rise at a constant rate throughout that period.

Anderson and Frogner (2008) find a tenuous relationship between health expenditures and health outcomes. They note that the U.S. had one of the highest per capita spending levels on health care in the world, yet it was equally likely to be at either the top or bottom of sixteen quality measures complied by the OECD.

Other studies have also found the impact of health care spending to be relatively small. Among these are Filmer and Pritchett (1999), and Nolte and McKee (2004). As well, Nixon and Ulman (2006) emphasize the complexity of associating health expenditures with outcomes, and found that for 15 European nations, including Italy, between 1980 and 1995, that increases in health care spending improved infant mortality, but had only a marginal impact on life expectancy.

[16] Madeiros and Schwierz (2015)

Cremieux et. al. (1999) analyzed Canadian provincial data for the period 1978-1992 and found that less spending on health care in Canada leads to an increase in infant mortality and life expectancy (LE). According to their results, a 10% reduction in health care spending increased infant mortality by 0.5% and decreased LE by 6 months for men and 3 months for women. Cremieux et. al. (2005a, b) more recently focused on the impact of spending on pharmaceuticals in Canada on health outcomes and found a strong positive relationship on the LE and infant mortality. On the other hand, Guindon and Contoyannis (2012) found no impact on health outcomes with increased spending on pharmaceuticals.

Finally, Joumard et.al. (2010) take a more comprehensive input-output approach in comparing OECD countries relative efficiency. They find both the Canadian and Italian system to be quite efficient, but the Italian health care systems has a lower mortality rate. On an efficiency basis, Medeiros and Schwierz (2015) find that the Italian health care system is one of the top performers in terms of the amount spent on health care and outcomes, placing second on its constructed efficiency scale, just behind France, which spends more on health care. Thus, Italy is not far from the "efficiency frontier," according to their analysis.

2. Social Spending and Health Outcomes

There is a burgeoning literature on "social spending" and health outcomes. Social spending is a large category that in the broadest sense is ultimately about income redistribution. It may include welfare payments to those in society that cannot work due to various physical or mental challenges, employment insurance programs, affordable housing programs, tax breaks for social purposes, particularly for families with low income, and direct in-kind provisions of goods and services. Social spending can be targeted to particular groups, such as the young or the elderly.

Bradley and Taylor (2013) found that social spending in OECD countries improves health outcomes for its citizens. They point out the stark example of the health care system in the U.S., one of the most expensive in the world, which ranks poorly on health outcomes. On a per

capita basis, the U.S. spends double the OECD average on health, but the outcomes are among the worst in the OECD. Their research show that social service spending in the U.S. was predictive of three key health outcomes: life expectancy, infant mortality, and maternal mortality.

Rubin et. al. (2016) make the same point with regards to social spending. In particular, they show that old-age spending appears to make a significant contribution to better health outcomes. They suggest that social protection may be more important to better health outcomes in societies in which inequality is high. For the U.S., they find that unemployment and income maintenance are strongly correlated with better health outcomes across U.S. states. Not surprisingly, they also found that social expenditures take time to translate into better health outcome.

Dutton et. al (2018) also find a causal relationship between inequality and health outcomes for Canada. Moreover, they find that increased social spending is associated with greater life expectancy, lower infant mortality, fewer potential years of life lost, lower prevalence of obesity, lower rates of myocardial infarction, and reduced absence from work due to mental health issues. The biggest gainers of the positive health outcomes are the poor.

Bradley et. al. (2011) using a pooled cross section of OECD countries in 2009 find that health expenditures were significantly associated with better health outcomes in only two of five health indicators while social services expenditures adjusted for GDP were significantly associated with better health outcomes in three of five indicators. The ratio of social expenditures to health expenditures was significantly associated with better outcomes in infant mortality, life expectancy and increased potential life years lost, after adjusting for the level of health expenditures and GDP.

Lynch et. al (2004) in a review of 98 peer reviewed studies on the role of inequality in health outcomes, concluded that in affluent countries, inequality is not associated with health differences, but income inequality appears to explain regional inequalities within countries,

particularly in the U.S.A. There is some evidence that income inequality is an indirect determinant of health outcomes. Their findings suggest that reducing income inequality of the most disadvantaged populations, will improve their health, and thus is an argument in favour of some degree of income redistribution.

Wilkinson and Pickett also find that reducing income inequality improves health outcomes but Snowden (2011) dissents and argues that health outcomes are the product of diverse influences that over time can impact life expectancy.

This paper contributes to the current literature by having a closer look at two of the G7 countries that devote different amounts to social spending, and to determine the effect on infant mortality and life expectancy.

A Comparison of Health Expenditure, Indicators and Outcomes, and System Trends

The data for the comparison of spending indicators and outcomes across Canada and Italy comes from 2018 OECD Health Statistics.[17] Figures A1 to A4 provide a comparison of several health expenditure variables while Figures A5 to A10 look at several key health indicators and outcomes. Finally, Figures A11 to A17 provide a comparison of health system characteristics including technological levels and health human resources. Figures are provided in Appendix 1.

Health Expenditure Comparison

Figures A1 to A4 (all figures are in the Appendix) show that there has been substantial growth in health spending over time in both Canada and Italy, no matter what variable is considered. Italian spending has more closely tracked the average for OECD countries. However, Canada spends more than Italy with respect to health whether we consider total spending, public spending, or health as a share of GDP. As a share of GDP, health spending in Canada in 1990

[17] http://www.oecd.org/els/health-systems/health-data.htm

was 8.4 percent while in Italy it was 7 percent. By 2017, the share of GDP devoted to health spending reached 10.4 percent in Canada and 8.9 in Italy. In 2017, Canada spent 38 percent more than Italy in total per capita health spending and 29 percent more in per capita public health spending.

Health Indicators and Outcomes Comparison

Figures A5 to A10 present basic health indicators in terms of both health outcomes as well as key correlates of some of those outcomes: namely, infant mortality rates, life expectancy at birth (both sexes), suicide rates, self-reported obesity rates, and alcohol and tobacco consumption. Both Canada and Italy have seen improvements in these basic health outcomes over time.

Between 1960 and 2014, infant mortality rates in Canada declined from 27.3 deaths per 1,000 to 4.7 – a reduction of 83 percent. Italy's reduction was steeper yet, falling from 43.9 in 1960 to 2.8 in 2014 – a reduction of 94 percent – and remaining at 2.8 in 2016. While Italy's infant mortality fell below the OECD average in 1979 and has remained below it, Canada actually rose above the OECD average for the first time in 2007.

Meanwhile, life expectancy at birth has grown over time in both countries. While both have life expectancy above the OECD average, life expectancy in Italy has risen faster and surpassed that of Canada in 1994. Between 1961 and 2015, life expectancy at birth in Canada rose from 72.3 to 81.9 years while Italy's rose from 69.8 to 82.6. Suicide rates (intentional self-harm) in both Canada and Italy are below the OECD average, and both have declined since the mid-1980s, but it should be noted that suicide rates in Italy are dramatically lower than in Canada. In 2013, deaths per 100,000 population for intentional self-harm were 6.3 for Italy compared to 11.1 for Canada and 12.2 for the OECD.

While obesity rates have been on the rise in both Canada and the OECD, they have been remarkably stable in Italy since 2005, after a period of increase dating from the early 1990s.

Alcohol consumption in Italy is now below the OECD average as well as below Canadian rates, with a period of dramatic decline starting in the mid-1970s to 2008. In 1970, Italy consumed 19.6 litres of alcohol per capita, compared to 10.4 for the OECD and 8.8 for Canada. By 2015, the OECD stood at 8.9 litres per capita compared to 7.1 for Italy and 8.1 for Canada. Tobacco consumption in Italy and Canada as well as the OECD has fallen dramatically since the 1960, but Italian consumption remains above both Canada and the OECD average.

Health System Comparison

Figures A11 to A17 round out the comparison of the Canadian and Italian health care systems by presenting indicators dealing with the deployment of resources in their respective systems. Figure A11 plots physician density in terms of total physicians per 1,000 population. Since the 1980s, the physician density in Canada has fallen substantially below the OECD average, and well below the Italian figures starting in 2000. By 2017, Canada had 2.6 physicians per 1,000 while Italy stood at 4 per 1,000.

Figure A12 shows that while the number of medical graduates[18] has fallen in Italy over time, it remains close to the OECD average, and is also well above the Canadian number in terms of graduates per 100,000 population. While the Italian health system appears more physician intensive than the Canadian one, the reverse is the case when nursing resources, as shown in Figure A13. While nurses per 1000 population has grown over time in both Canada and Italy, there are nearly twice as many nurses per 1000 population in Canada compared to Italy. Nurses in Canada may be a partial substitute for both physicians and hospital beds given that the number of hospital beds per 1000 in Canada is also below Italy's, as illustrated in Figure A14.

[18] Medical graduates is defined the number of students who have graduated from medical schools or similar institutions in a given year with dental, public health and epidemiology graduates excluded.

Figures A15 and A16 show that medical diagnostic technology in terms of MRI and CT scanners has grown since the 1990s in both Canada and Italy, but Italy has substantially more units per capita of both technologies. Again, Canada may be substituting intensity of labour utilization for capital when it comes to diagnostics relative to Italy because the available evidence in Figure A17 shows that there are more physician consultations per capita in Canada, despite lower stocks of diagnostic equipment as well as fewer physicians per capita.

To summarize, Canada spends more than Italy when it comes to health care, but Italy has surpassed Canada when it comes to basic health indicators such as longevity or infant mortality. At the same time, despite spending more both per capita and as a share of GDP on health, Canada has fewer physicians per capita, fewer hospital beds and less medical technology. However, Canada does have more nurses per capita and physician consultations per capita. Despite spending more, based on these indicators Canada appears to be getting less.

Social Expenditure & Inequality Comparison

Another area of importance to compare is the difference between Italy and Canada is expenditures on social programs, which we provide using aggregated data from the OECD.[19] We have already note that despite spending less per capita and as a share of GDP on health care relative to Canada, Italy has surpassed Canada when it comes to basic health indicators such as longevity or infant mortality. One possibility is that Italy has been able to achieve this because of greater spending on social program categories given the literature on the importance of social determinants with respect to health outcomes.

As a share of GDP, social expenditure has risen over time in both Italy and Canada, but Italy generally spends more (See figure A18). For example, in 1980 Canada spent 13.3 percent of

[19] OECD Stat. **https://stats.oecd.org/Index.aspx?datasetcode=SOCX_AGG**

GDP on social programs, compared to 17.4 percent for Italy. Over the last approximately 40 years that percentage has grown to 28.1 percent in Italy in 2017 but has remained stationary at 17.3 percent in Canada. Indeed, as Figure A18 shows, Canada saw an increase on social spending until the 1990s with a peak of 18.4 percent reached in 1995, but then it declined after the federal fiscal crisis of the 1990s, which saw transfer cuts to the provinces and associated declines in social expenditures as a share of GDP.

There are also differences in emphasis across social expenditures in the two systems. Public expenditures on old age and survivors cash benefits are greater in Italy, reflecting the more generous nature of the Italian social security system. In 1980 Canada spent 3.1 percent of its GDP on old-age related transfers, and this grew to 4.7 percent in 2015. In Italy, on the other hand, it already stood at 8.6 percent in 1980 and by 2015 it had almost doubled to 16.2 percent. To put this expenditure in an international perspective, the OECD average spending on old-age related transfers was 5.5 percent in 1980 and 7.5 percent in 2015.

As well, public expenditures on disability and sickness cash benefits are nearly double in Italy compared to Canada, coming in at 0.8 percent of GDP in Canada and 1.7 percent in Italy in 2015. Direct public expenditures on family (in cash and in kind) were 1.5 percent of GDP in Canada, and 2 percent of GDP in Italy in 2015. Also telling of the extent of the redistribution of income through social programs is the income of older people aged 65 and over, as a percent of the general population income. In 2014 those 65 years and older in Canada had 91.1 percent of the income of the general population, as compared with 98.8 for Italy, while the OECD average was 87.6 percent.

A final comparison between Canada and Italy is with respect to economic inequality given an extensive literature linking economic inequality to social and health outcomes. OECD Gini coefficients[20] for Canada and Italy with respect to income inequality with income defined as

[20] https://data.oecd.org/inequality/income-inequality.htm

household disposable income show that in 2016 Italy was slightly more unequal than Canada with a Gini of 0.33 when compared to 0.31 for Canada. However, if inequality is measured as the pre-tax income share of the top 1% of adult earners, then Canada appears to have greater income inequality than Italy[21]. Figure A19 plots the pre-tax income share of the top 1 % of adult earners for Canada and Italy using data from the World Inequality Database.[22] While income inequality as measured by this variable has grown in both countries over time, Canada appears to have greater income inequality than Italy before taxes and transfers are factored in. As we argue below, the income inequality data for Italy has to be treated with caution, given the relatively large size of its black-market economy compared to Canada. More will be said about this issue later in the paper.

Regression Analysis

In this section, we perform regression analysis on the drivers of both health care spending and basic health indicators to determine the responsiveness of both health spending and health indicators to common determinants across the two countries. There is an extensive international literature on the determinants of health spending – both public and private – with key expenditure drivers including population growth, physician numbers - given the gate keeping role of physicians,[23] population aging, income, inflation, and enrichment factors such as technological change as often proxied by time trend.[24] These studies have been carried out at the national, international and regional levels.

[21] In footnote 32 below, we note that Italy has a large shadow economy, thus the reported Gini coefficient may be off by a wide margin.
[22] https://wid.world/
[23] For a discussion see Di Matteo (2014).
[24] See Constant et al., (2011). For an excellent survey of the international health expenditure determinants literature, see Gerdtham and Jonsson (2000). The first generation of such determinants studies often used international data. See Leu (1986), Parkin et. al., (1987), and Gerdtham et al (1992). See also Hitiris and Posnett (1992), Barros (1998), Gerdtham et. al, (1998), Di Matteo and Di Matteo (1998), Ariste and Carr (2003) and Crivelli, Filippini and Mosca (2006). For some more recent papers, see Cantarero Prieto and Lago Penas (2010), Magazinno and Mele (2012), Di Matteo (2010, 2014) , Di Matteo and Emery (2014).

We focus on the determinants of health expenditure at the national level, even though both Canada and Italy are very regionalized countries. There are compelling reasons to focus attention on the national level. First, while Canadian health care is delivered by the provinces and there are regional differences in spending and services, health outcomes are consistently high across the country, even though per capita spending varies among provinces. Italy also has consistency in health outcomes across its regions, though there are regional differences in spending (Francese and Romanelli 2011)[25]. Second, the availability of regional level data across a long enough time span for both spending, service provision and outcomes is an issue. While sufficient and comparable time series going back to 1970 are either available or can be constructed at the national level, the issue becomes more problematic at the region/province level. For Canada, provincial level health expenditure data is available going back to the mid-1970s from the National Health Expenditure Database of the Canadian Institute for Health Information. For Italy, the data sets for regional spending go back to the 1990s.

Third, a high-level national comparison is probably better given that the concept of regions/provinces and the scope for health activities varies across Canada and Italy. Canadian provinces have considerably more autonomy in the areas of health and education spending than do Italian regions. In Canada, which is a highly decentralized federation, the provinces deliver and fund health care, whereas in Italy, while there is regional health care provision, there is much more centralization with respect to funding and provision. Thus, we determined it best to rely on national level data.

We model the determinants of health expenditure in Canada and Italy as:

$$(1)\ H_t = f(z_{1t}, z_{2t}, \ldots z_{nt})$$

[25] Generally, the southern part of Italy has lower per capita healthcare spending. The regional differences in healthcare spending is partly offset by southern Italians travelling north for health care services.

where H_t is real per capita government health expenditures and z_1 to z_n represent a vector of social, demographic, economic and policy variables at time *t* which are determinants of H_t. The national level data for these regressions covers the period 1970 to 2017, and comes from OECD Health Statistics 2018[26], supplemented by data from the World Bank, the OECD Social Health Expenditure Database[27], the IMF WEO Database[28], the World Inequality Database,[29] and FRED.[30] The key variables and sources are summarized in Appendix 2, the specification is log-linear, the estimation package is STATA 15.0, and the estimation technique is Robust Regression.[31] We conducted the Augmented Dickey-Fuller tests on the variables used in the regressions and found a high degree of stationarity across the variables in the dataset.[32]

In Table 1 we report our regression results for per capita public and per capita total health expenditures. The final reported specifications regress the health expenditure variables on GDP per capita in U.S. PPP dollars lagged one year (a measure of long term income impact), the first difference of GDP per capita in U.S. PPP dollars (a measure of short term income fluctuations), physicians per 1,000 population, nurses per 1,000 population, the number of MRI machines per one million population (a variable to represent the impact of diagnostic technology on health spending), and the percent of population aged 65 years and over using a quadratic specification to reflect the fact that while aging populations can drive up health spending, eventually steps will be taken to restrain it.

[26] http://www.oecd.org/els/health-systems/health-data.htm
[27] http://www.oecd.org/social/expenditure.htm
[28] https://www.imf.org/external/pubs/ft/weo/2018/02/weodata/index.aspx
[29] https://wid.world/
[30] FRED is the Federal Reserve Bank of St. Louis Database. See: https://fred.stlouisfed.org/
[31] It should be noted that while the data for these regressions is from 1970 to 2017, some of the variables did not have complete coverage and as a result gaps were filled using a regression that regressed the available data on time trend and the coefficients used to fit the data to the missing years.
[32] The ADF test was done employing no constant or trend and two lags. For most of the variables, the hypothesis of a unit root was rejected at the 5% and 10% level and occasionally at the 1% level.

We find that there are common drivers of per capita health spending across the two countries, but with differences in their impact given the differences in coefficient magnitudes. Lagged per capita GDP is a significant long-term driver of per capita Canadian health spending, but short-term fluctuations in GDP are not. We find the opposite response to these two variables for Italy. It is unclear why per capita health spending is less responsive to the level of GDP in Italy compared to Canada, but given the significance of the first difference of GDP per capita for Italy (but not for Canada) it may be that there is more opportunity for flexibility in Italian health expenditures in response to changing economic circumstances. While Italian health spending is more centralized than Canada, it means that changes if they occur can occur more rapidly across the entire system.[33]

With respect to GDP, it is also important to note that Italy's shadow economy is larger that Canada's. According to a study by the University of Tubingen in West Germany (IAW), as a percentage of GDP Italy's shadow economy was almost 20 percent (19.8%), second only to Greece, with the largest shadow economy at 21.5 percent. Canada's shadow economy in 2017 was half that of Italy, at 9.8 percent.[34] The relatively large shadow economy in Italy understates GDP and GDP per capita in Italy.

Physician numbers are drivers of spending in both Canada and Italy and the coefficient estimates suggest the response is somewhat less for Canada when it comes to total health spending, but greater for public health spending. We note that the larger response for public health expenditures to physician numbers in Canada may also be due to the fact that family physicians are paid on a capitation basis in Italy, whereas in Canada the fee-for-service

[33] GDP per capita has gone up a bit more in Canada compared to Italy since 1990. In 1990 GDP per capita in Italy was US$18.55K and in Canada US$20.25k. In 2016 it was 44.92k in Canada and 39.04 in Italy: https://data.oecd.org/gdp/gross-domestic-product-gdp.htm.

[34] Reported in Forbes, February 9, 2017, https://www.forbes.com/sites/niallmccarthy/2017/02/09/where-the-worlds-shadow-economies-are-firmly-established-infographic/#7459be0c742c

approach still dominates. What is more interesting is that nurses per 1,000 population is not a significant driver of Canadian health spending at either the total or public level, but it is for Italy. This is an intriguing result given that Italy has more physicians per capita than Canada but fewer nurses per capita. On the other hand, Canada has had more nurses per capita throughout the period under review, which may explain why relative to Italy, its expenditures on nurses have not risen as much.

New diagnostic technology has also had a differential impact on spending across the two countries. For Canada, increasing the number of MRI units is associated with a decrease in per capita health spending at both the total and public level. For Italy, the result has been positive though only significant for public health care spending and at the 10% level only. This suggests a potentially differential effect across Italy and Canada over time on per capita health spending from the introduction of new diagnostic technologies. Traditionally, technological change has been viewed as a cost-enriching decision as increased demand results from new procedures, but if new techniques generate less expensive health procedures, there could also be expenditure reductions.[35]

Finally, an aging population is a positive driver of health spending in both countries but larger and more significant in Canada than Italy, based on both coefficient sizes as well as t-statistics. In both countries, the proportion of population aged 65 and over is at first positive, but is eventually associated with a negative effect on per capita health spending. With respect to total per capita health spending, this negative impact occurs for Canada when the percent aged 65 and over reaches 14 percent of the population, and in Italy when those aged 65 years and over hits 8 percent of the population. This suggests that Italy may have moved earlier to deal with the costs of an aging population. However, it could also be a "statistical illusion" in that the over-65 population in Italy began to grow at an earlier period compared to Canada.

[35] For example, Cutler et al. (1998) report that the real quality-adjusted price of heart attack treatments declined at an annual rate of 1.1 percent between 1983 and 1994.

Another important aspect is the determinants of health outcomes, and in particular the efficacy of both health and social spending on life expectancy (LE) and infant mortality. Table 2 presents regression results of the log of life expectancy at birth and the log of infant mortality rates on the following key variables: lagged level of per capita GDP in U.S. PPP dollars, alcohol consumption per capita (litres), tobacco consumption, defined as the percent of population aged 15 years and over who smoke, the first difference of per capita total health expenditure in U.S. PPP$, the first difference of social expenditures per capita in U.S. PPP$ and the income share of the top 1 percent. Given the high level of economic development in both countries, per capita GDP rather than changes in GDP is the more likely determinant of changes in health status[36], As well, given the already high levels of health and social spending, it is changes rather than the overall level that at the margin are the more important determinants of health status. As in our first set of regressions, estimates were done using Robust Regression.

The regression results in Table 2 suggest that for both countries, the level of per capita GDP is a key determinant of increased life expectancy and falling infant mortality with high significance for both countries. Tobacco consumption significantly reduces life expectancy in both countries (but barely at the 10 percent level for Canada), while alcohol reduces life expectancy in Canada but not Italy. Alcohol consumption significantly increases infant mortality in Italy and Canada, while tobacco consumption increases infant mortality in Canada and Italy but is not statistically significant in either country. The health effects of tobacco consumption have been widely known for decades and there have been reduction in rates of consumption in both countries over time which may be a factor in the insignificance of the results.

The effect of marginal changes in health spending on health outcomes are insignificant drivers of life expectancy and infant mortality in both countries. Moreover, when it comes to social spending, changes at the margin are also insignificant contributors to life expectancy and infant mortality. Given the high level of social and economic development of both Canada and Italy, it

[36] Indeed, the health determinants literature focuses on level of income as a key determinant of health spending.

is perhaps not surprising that changes in health and social spending at the margin are not significant determinants of health status. Instead, the key drivers appear to be lifestyle variables such as tobacco and alcohol, as well as the long-term level of economic development as captured by per capita GDP.

As for income distribution and inequality, for Canada we find that an increase in the income share of the top 1% is significantly associated with a decrease in life expectancy and an increase in infant mortality. For Italy, an increase in income inequality is not a statistically significant determinant of either life expectancy or infant mortality. As already mentioned, the results for Italy should be taken with caution, since it has a relatively large shadow economy[37], making officially reported market income potentially unreliable when it comes to constructing inequality measures. There is also some reason to believe that income inequality may not be as important to health outcomes in advanced countries compared to relatively poorer countries. Thus, for Canada and Italy, both G7 countries, even if the top 1 percent become richer, the fact that the rest of the population still has a per capita income that is relatively high, it would insure a minimum level of health expenditure. Another possibility for the Italian results is the large proportion of social transfers devoted to income redistribution, especially for the elderly, which may also serve to weaken the effect of market income inequality.

Our results suggest a relatively consistent story when it comes to the determinants of health outcomes. It appears the key determinants in both countries of these health outcomes are more closely tied to per capita income as well as lifestyle choices such as drinking and smoking, rather than interventionist medical care or social spending. If inequality is considered a social determinant, then it matters for Canada but currently not for Italy, though that could be the result of data issues. The results partly buttress the case for the broader determinants of health status, with socio-economic factors such as lifestyle choices, per capita income and

[37] See Medina and Schneider, 2018 for a discussion.

income distribution as more significant determinants of health outcomes than interventionist health and social spending.[38]

A key result is that medical and social spending alone cannot explain health outcomes. In both Italy and Canada, changes in per capita health spending are not significant determinants of either life expectancy or infant mortality. Such results imply that lifestyle choices may be even more important to health outcomes than actual direct expenditures on health services while more health spending is not always effective and may be inefficient. In the case of social spending, Italy spends a much larger percent of its GDP on social expenditures relative to Canada and yet even this additional spending is not a significant determinant of either life expectancy or infant mortality. On the other hand, if income inequality is considered to be a social determinant of health status, it does appear to have an effect on health outcomes in Canada but not in Italy.

[38] For an overview of the social determinants of health, see Braveman, Egerter and Williams (2010).

Table 1: Health Expenditure Determinants Regression Results

Dependent Variable: Log of Per Capita Total Health Expenditure USPPP$

	Canada		Italy	
	Coefficient	**t-statistic**	**Coefficient**	**t-statistic**
GDP Per Capita in PPP Dollars Lagged One Year	0.000039	**4.06**	0.000004	0.33
First Difference of GDP Per Capita in PPP Dollars	0.000004	0.24	0.000039	***1.91***
Physicians per 1000 Population	0.498666	**3.83**	0.648925	**2.32**
Nurses per 1000 population	0.002573	0.10	1.187990	**9.88**
MRI Per Million population	-0.033041	***-1.90***	0.010492	1.25
Percent of population Aged 65 Years and Over	0.749569	**7.23**	0.234051	***1.89***
Percent of population Aged 65 Years and Over Squared	-0.026910	**-8.42**	-0.014850	**-3.81**
Constant	0.607742	1.00	0.903599	0.81
R-squared	0.9028		0.7639	
F-Statistic (7,39)	1349.63		854.35	

Dependent Variable: Log of Public Health Expenditure Per Capita USPPP$

	Canada		Italy	
	Coefficient	**t-statistic**	**Coefficient**	**t-statistic**
GDP Per Capita in PPP Dollars Lagged One Year	0.000043	**3.72**	0.000014	0.77
First Difference of GDP Per Capita in PPP Dollars	0.000001	0.08	0.000077	**2.43**
Physicians per 1000 Population	0.692374	**4.44**	0.545579	1.27
Nurses per 1000 population	0.000212	0.01	1.110165	**6.00**
MRI Per million population	-0.042219	**-2.03**	0.021116	***1.64***
Percent of population Aged 65 Years and Over	0.626672	**5.05**	0.249538	1.31
Percent of population Aged 65 Years and Over Squared	-0.023560	**-6.16**	-0.016379	**-2.73**
Constant	0.808397	1.12	1.137162	0.67
Adjusted R-squared	0.8962		0.8270	
F-Statistic (7,39)	869.39		321.66	

* **Bold** denotes significant at 5 percent level; ***Bold italics*** is significance at 10 percent level.

Table 2: Health Status Indicators Determinants Regression Results

Dependent Variable: Log of Life Expectancy at Birth in Years

	Canada		Italy	
	Coefficient	t-statistic	Coefficient	t-statistic
GDP Per Capita in PPP Dollars Lagged One Year	0.000002	**9.81**	0.000003	**6.80**
Alcohol Consumption (Litres per capita)	-0.002733	**-5.35**	-0.000003	0.00
Tobacco Consumption (% 15 years plus who smoke)	-0.000538	***-1.64***	-0.003852	**-4.62**
First Difference of Per Capita total Health Expenditure in PPP Dollars	0.000006	0.56	0.000000	0.03
First Difference of Social Expenditure Per Capita in PPP Dollars	-0.000002	-0.48	-0.000004	-0.49
Top 1% Income Share	-0.001271	**-2.43**	0.000151	0.10
Constant	4.353289	**325.94**	4.404139	**139.96**
R-squared	0.853000		0.875700	
F-Statistic (6,40)	1238.18		764.73	

Dependent Variable: Log of Infant Mortality (Deaths per 1000 Live Births)

	Canada		Italy	
	Coefficient	t-statistic	Coefficient	t-statistic
GDP Per Capita in PPP Dollars Lagged One Year	-0.000016	***-1.83***	-0.000048	**-8.15**
Alcohol Consumption (Lires per capita)	0.137729	**7.01**	0.027815	**2.59**
Tobacco Consumption (% 15 years plus who smoke)	0.013981	1.11	0.012768	0.97
First Difference of Per Capita total Health Expenditure in PPP Dollars	-0.000633	-1.60	-0.000047	-0.20
First Difference of Social Expenditure Per Capita in PPP Dollars	0.000015	0.08	-0.000102	-0.78
Top 1% Income Share	0.051073	**2.54**	-0.018311	-0.81
	0.241695	0.47	2.454694	**4.94**
R-squared	0.8109		0.8654	
F-Statistic (6,40)	100.02		769.09	

* **Bold** denotes significant at 5 percent level; ***Bold italics*** is significance at 10 percent level.

Discussion

While Canada and Italy both have publicly funded health care systems that provide a high level and quality of care, there are interesting differences in terms of the amounts spent, the health indicators and outcomes, as well as the services and structure of the health services provided. We need to acknowledge the challenges associated with measuring and comparing the efficiency two health care system. For example, we chose to emphasize infant mortality and the length of life as an indicator of the "output" of the healthcare system, but more difficult to measure and ascertain is the quality of extra years of life.

However, based on our regression results, there are several insights that can be distilled with respect to what drives health spending and health outcomes, and whether value for money is being generated in the provision of health care in Canada and Italy. The results suggest that there may be efficiencies to be gained in both systems, especially when it comes to health care spending, given the lack of effectiveness of such spending in promoting positive health outcomes.

With respect to income as a health spending driver, it is a significant long-term driver of per capita Canadian health spending, but short-term fluctuations in GDP are not, as opposed to Italy which seems to exhibit an opposite response to these variables. Our results suggest that the Canadian health system has a more long-term structural inertia with respect to increases in resources, while Italian health spending is more responsive to short term income fluctuations. The difference in response may be the result of institutional differences given that Canadian health care provision is decentralized with considerable autonomy across the provinces whereas Italy is much more centralized.

Physician numbers have similar effects on health spending in Canada and Italy, but the number of nurses does not. These results point to the role of physicians as gatekeepers to the system is the same in both countries, but in the Italian case, given that there are more physicians they have been able to better restrain physicians as a source of expenditure increases through the capitation as the remuneration system. There is however a difference in the role of nursing.

While, Italy has more physicians per capita, it has fewer nurses per capita relative to Canada, so at the margin an increase in nurses seems to contribute more to spending than in Canada. Again, the difference may be due to differences in aspects of health care provision such as the reliance on family to provide some of the hospital-based care in Italy – most likely an important factor given the relatively low number of nurses in Italy compared to Canada. Adding nurses substitutes positive amounts of spending for what essentially is being provided for free by family members. Moreover, given the low number of nurses in Italy, it would stand to reason that if more nurses were added, it would operate to increase health expenditures.

For Canada, increasing units of diagnostic technology per capita is associated with a decrease in per capita health spending at both the total and public level. For Italy, the result is positive, though only significant for public health care spending, and only at the 10% level. Yet, Italy also has many more MRI units per capita than Canada. It could be that the early diffusion of this technology helps reduce health care costs via more accurate and earlier diagnosis, but over time increases in the technology contribute more to costs than to benefits. The role of diagnostic imaging in affecting health costs is an area of some debate in the health economics literature and the results here do not resolve this debate.[39]

While Italy has a higher proportion of population aged 65 years and over, aging is a more significant driver of health spending in Canada than Italy. By 2017, the proportion of population aged 65 years and over was 17 percent in Canada and 23 percent in Italy. The results for Italy could be the fact that the percentage of the population over 65 began to grow at an earlier point in time, sparking health sector cost control measures that are more advanced than Canada. Or, it could reflect an institutional difference whereby the health needs of the elderly are more likely to be met outside the health care system in Italy relative to Canada as a result of families and personal care workers providing the care.

[39] For some literature in this area, see Beinfeld and Gazelle (2005), Sullivan (2014) and Marchildon and Di Matteo (2011).

In Italy, one-way health costs have been restrained in the elderly population is through the wide-spread hiring of foreign in-home elder care workers (the *badante*)[40]. The Italian government provides families with cash supplements to hire in-home elder care workers, thus what appears at first to be cost reducing measures in providing for the elderly, is in fact a bit of a mirage, in that resources spent for elderly care come from the social expenditure category.

In both Canada and Italy, health outcomes as measured by life expectancy at birth and infant mortality are more closely tied to income as well as lifestyle choices such as drinking and smoking rather than just interventionist medical care and social spending. This suggests that in both Canada and Italy, health care resources are not being as efficiently spent given that positive changes in spending do not have the anticipated effect on life expectancy and infant mortality. Moreover, higher social spending in Italy may also be quite inefficient in terms of leading to improvements in health care outcomes.

When it comes to public health and social spending, a key difference between Canada and Italy is that while Canada spends relatively more on health, Italy spends more on social transfers – particularly pensions. This is quite noticeable when one examines social spending. Overall, the key difference is in income transfers rather than the provision of public goods in health and education. These income transfers may have implications for health outcomes as some literature has shown that social spending can have important health effects on a population. For example, Dutton et al., (2018) examine the association between spending on health care and social programs and health outcomes in Canada using provincial data from 1981 to 2011 and find a 1-cent increase in social spending per dollar spent on health was associated with a 0.1% (95% confidence interval [CI] 0.04% to 0.16%) decrease in potentially avoidable mortality and a 0.01% (95% CI 0.01% to 0.02%) increase in life expectancy.

[40] See Gori, 2012

According to the OECD, education spending as a share of total government spending, Canada and Italy are comparable at 20 and 22 percent respectively. Public health spending levels are also not greatly out of sync as government health spending as a share of GDP is currently 7.2 percent in Canada and 6.5 percent in Italy, while per capita government health spending in USD is $3,262 in Canada and $2,470 in Italy. Yet, overall social spending in Italy is the 4th highest of the OECD countries at 28.9 percent of GDP versus 17.2 percent in Canada. The difference is driven by social benefits to households, which are 21 percent of GDP in Italy versus 10 percent in Canada, of which pensions is a significant proportion in Italy. Government spending on pensions in Canada is 4.5 percent of GDP compared to 16.3 percent of GDP in Italy, compared to an OECD average of 8.2 percent.

However, our results suggest that , greater social spending in Italy is not a significant determinant of either life expectancy or infant mortality. One might argue that the reason for the lesser significance of Italian health spending as a health outcome driver might be the result of a broader social determinants of health approach that emphasized social spending, in effect making social spending a substitute for health spending. Yet, our results show that social spending in Italy is not a significant health outcome driver. The insignificance of income inequality to health outcomes in the Italian case may reflect the bias of Italian social spending towards income transfers that serve to mitigate any effects of inequality on health outcomes even if total social spending changes per se are not significant.

Conclusion

Italy spends considerably less than Canada on health per capita and yet its health outcomes as measured by life expectancy and infant mortality have gradually surpassed those of Canada. The reasons for this difference may reflect a more efficient health care system in Italy with better value for money, but the evidence in this paper is not conclusive in this regard. If one defines the determinants of health as exclusively tied to health spending and medical intervention, then Italy does appear to be more efficient by spending less and getting more – so to speak. However, our results suggest that the most important determinants of health outcomes in both Canada and

Italy appear to be per capita income and lifestyle variables such as alcohol and tobacco consumption. Our results would give credence to Anderson et. al. (2000), Golinelli et.al (2018), and Cremieux et.al (1999) that health expenditures may have some positive impact on health outcomes, but also point to the complex forces determining health outcomes, including lifestyle. It may also be that once health spending has reached a certain level in high income countries, additional increments do not contribute much to health indicators such as life expectancy or infant mortality. That is, there are diminishing returns to additional expenditures.

As for the role of social spending being more important than health spending, our results suggest that while Italy does spend a larger share of its GDP than Canada on social spending, it does not appear to a significant influence on health outcomes. Social spending is also not a significant driver of health outcomes in Canada – which spends a smaller share of its GDP on social expenditures. The composition of social spending does not appear to be a direct factor in determining health outcomes given that much of the difference in social spending between Canada and Italy is accounted for by the more generous public pension system in Italy. Another possible explanation for these results is that for both Italy and Canada, diminishing returns have set in on its social spending.

We noted in the literature review that there is a significant consensus on the benefits of social spending, which implies a reduction in income inequality through redistributive programs, on health outcomes. Bradley and Taylor (2013) sing its praises, as does Rubin et. al., Dutton et. al. Bradley et.al (2011), Lynch et.al (2004), and Wilkinson and Pickett (2009). Our results point to a more complex role of social expenditures, at least in the Italian case. It could be that the higher emphasis on social expenditures in Italy relative to Canada have muted the impact of income inequality on Italian health outcomes relative to Canada, but if that is the case such a result is not being picked up by our results.

These are important findings for policy design in health care systems. It makes imminent sense that a reduction in inequality can improve health outcomes at least in Canada. If reducing income

inequality improves diet, reduces smoking, and allows greater access to health services, it follows that health outcome should improve. But the case of both Italy and Canada points to the economists' dictum that perhaps there can be "too much of a good thing," meaning there comes a point that the marginal costs are greater than the marginal benefits. It appears that both social and health expenditures run into a similar problem after a certain level of expenditure.

As Joumard et.al. (2010) point out, measuring the performance of health care systems remains a challenging task, especially where there are multiple objectives and different institutional framework. This study, which compares the health care system of two G7 countries, has highlighted some of the features that in each can be improved to increase efficiency, as measured by health outcomes. We noted that the are no absolutes in health care, and that spending more, including social programs, does not necessarily translates into better outcomes after a certain expenditure level.

We welcome future studies that continue our efforts to compare health care systems in countries at a similar level of GDP per capita and to measure their relative efficiencies given the resources put in, as well as the level of social spending.

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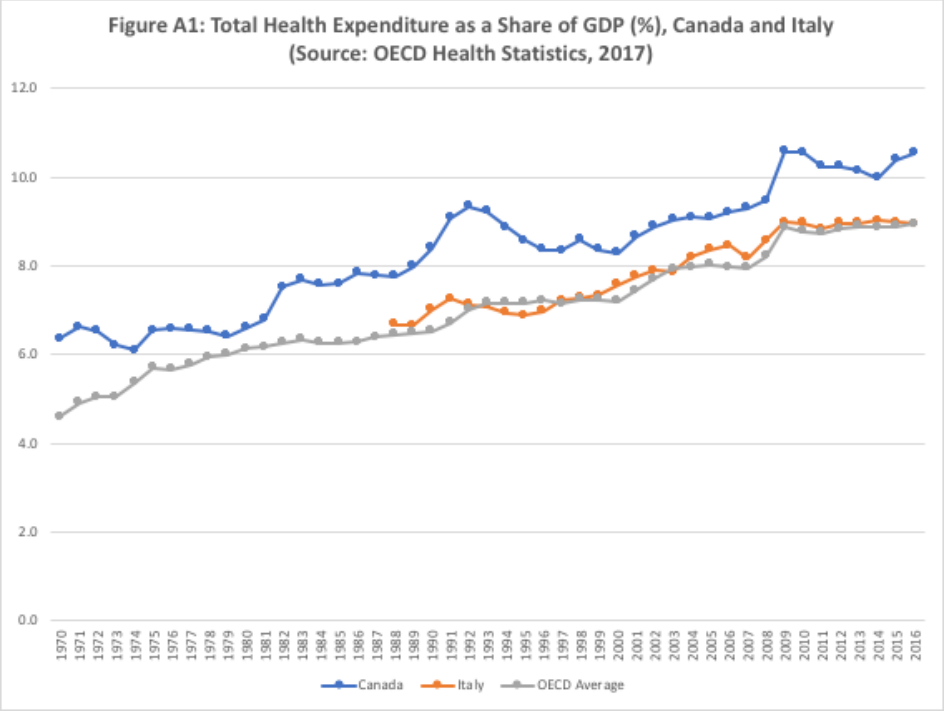
Appendix 1

Figures



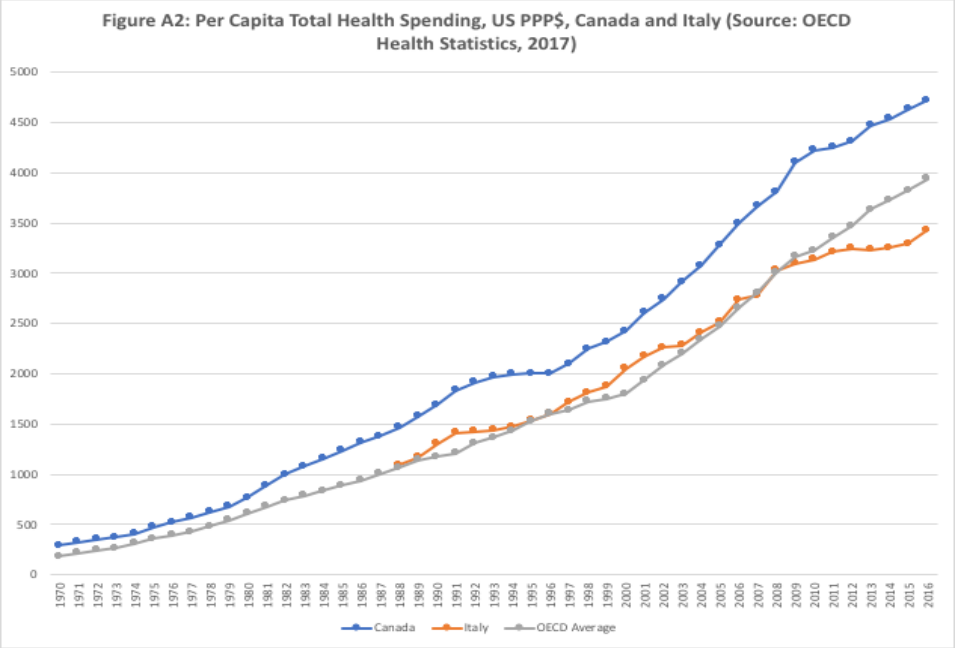


Figure A3: Per Capita Public Health Spending, US PPP$, Canada and Italy (Source: OECD Health Statistics, 2017)

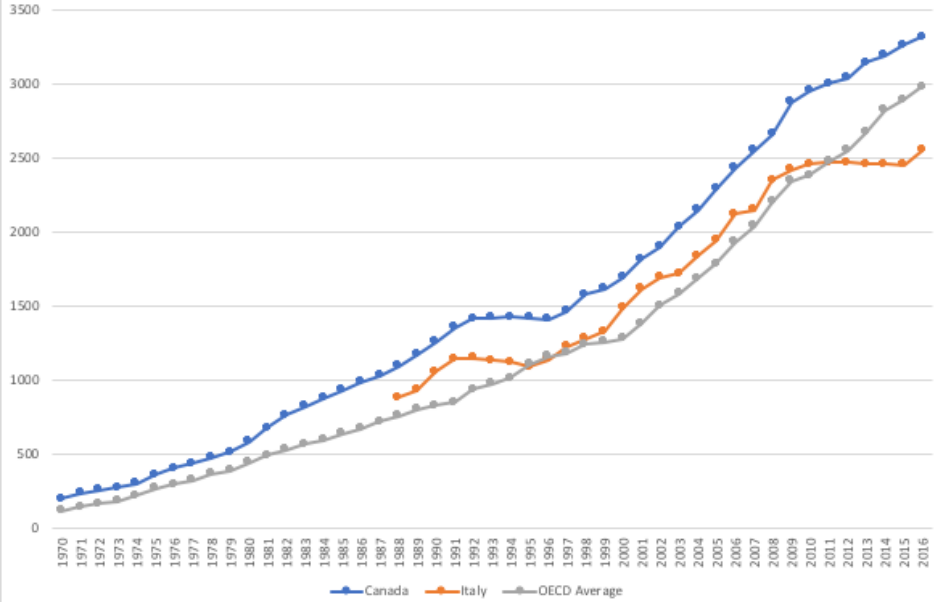


Figure A4: Per Capita Pharmaceutical Expenditure, US PPP$, Canada and Italy (Source: OECD Health Statistics, 2017)

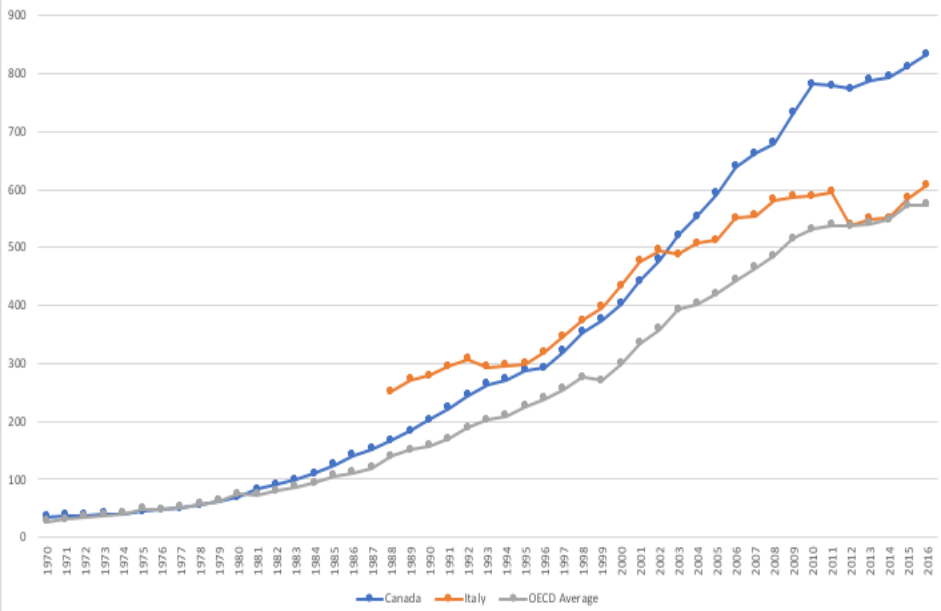


Figure A5: Infant mortality, Deaths Per 1,000 Live Births, Canada and Italy (Source: OECD Health Statistics 2017)

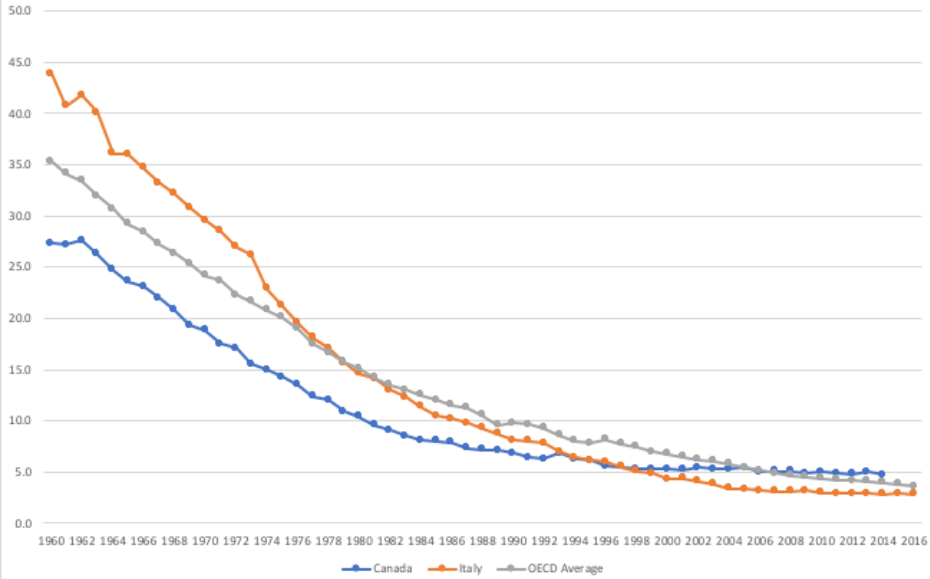


Figure A6: Life Expectancy at Birth, Total Population, Canada & Italy, 1960 to 2016

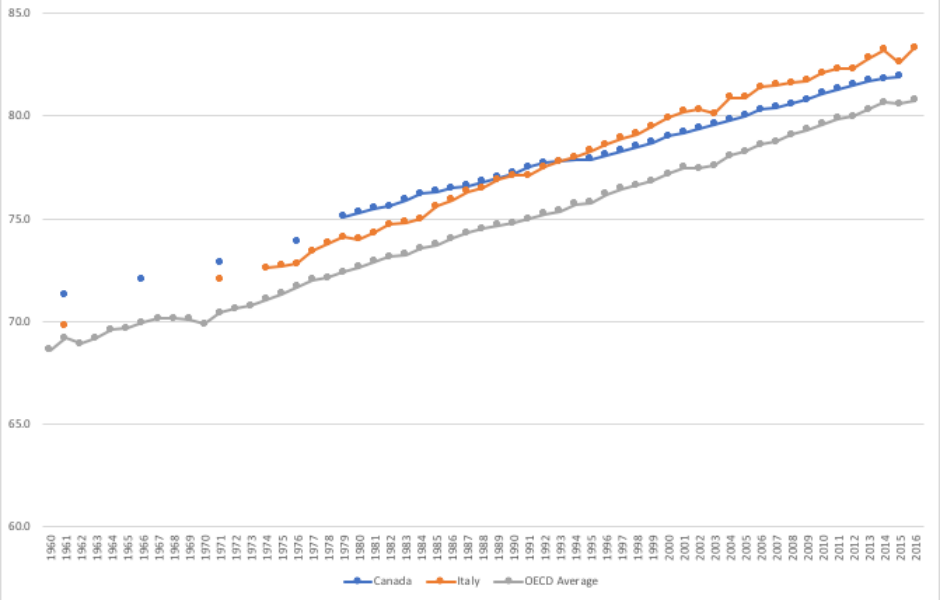


Figure A7: Suicide Rates, Deaths Per 100,000, Canada and Italy (Source: OECD Health Statistics 2017)

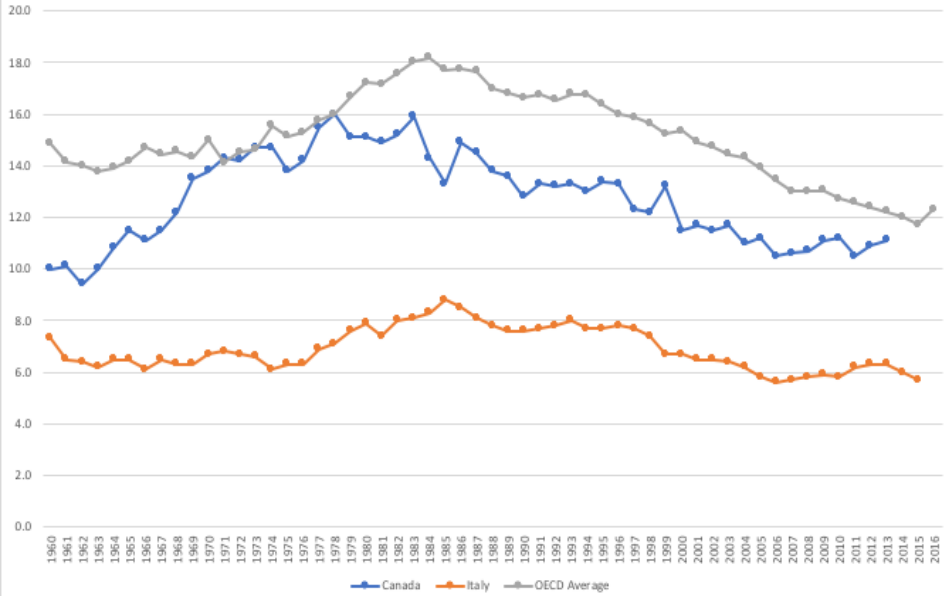
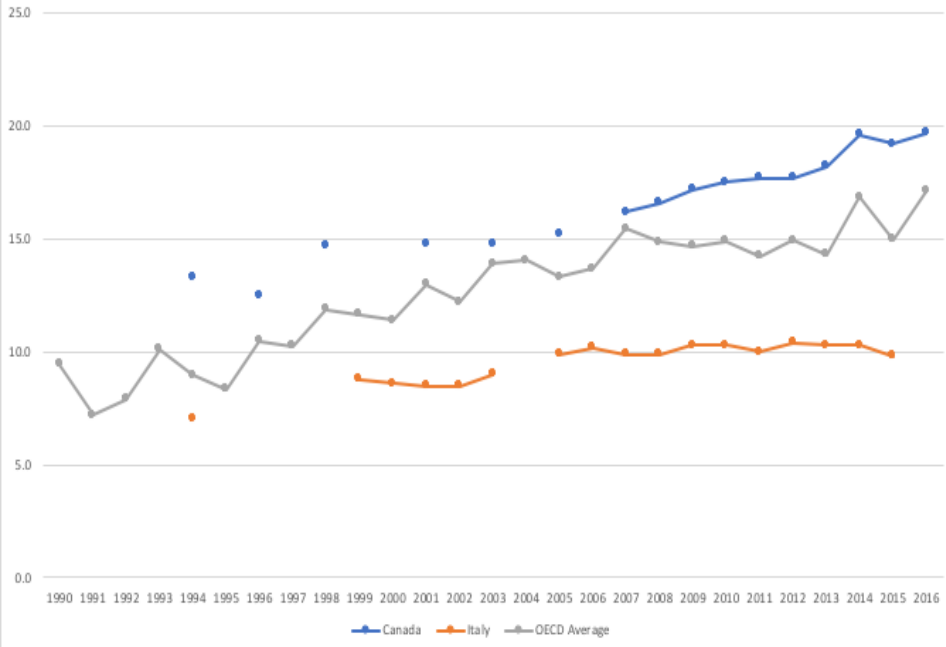


Figure A8: Self-Reported Obesity Rate as Percent of Total Population, Canada and Italy (Source: OECD Health Statistics 2017)



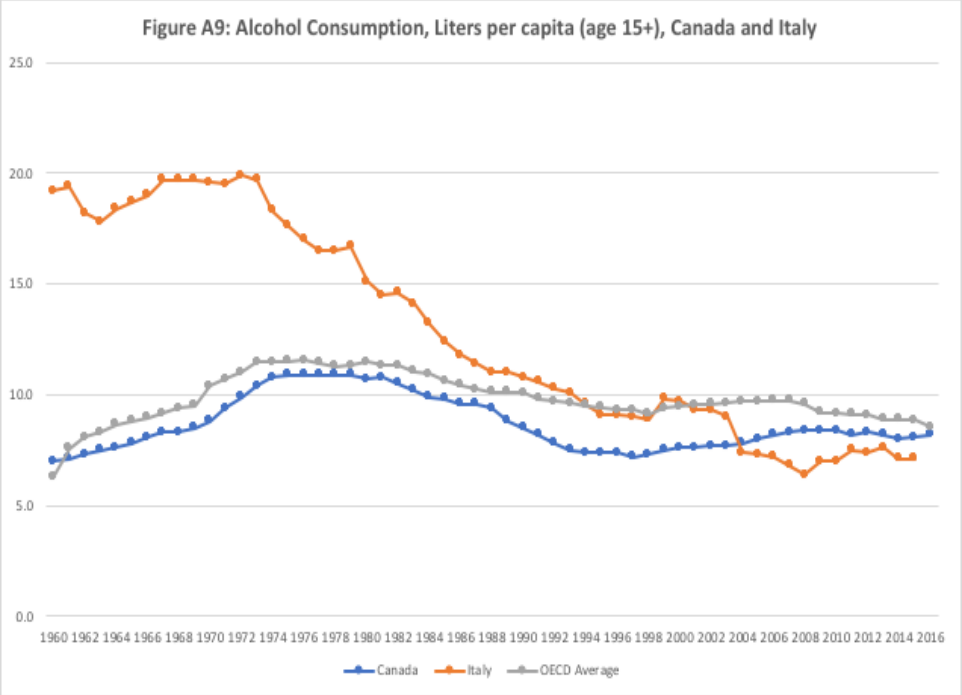


Figure A9: Alcohol Consumption, Liters per capita (age 15+), Canada and Italy
25.0
20.0
15.0
10.0
5.0
0.0
1960 1962 1964 1966 1968 1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016
Canada
Italy
OECD Average

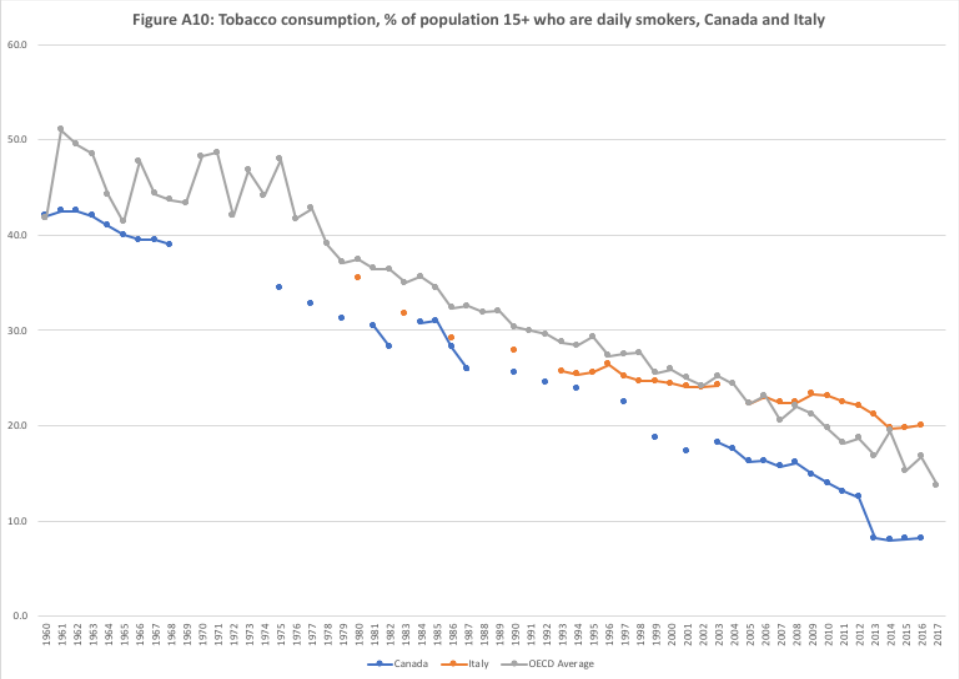


Figure A10: Tobacco consumption, % of population 15+ who are daily smokers, Canada and Italy
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Canada
Italy
OECD Average

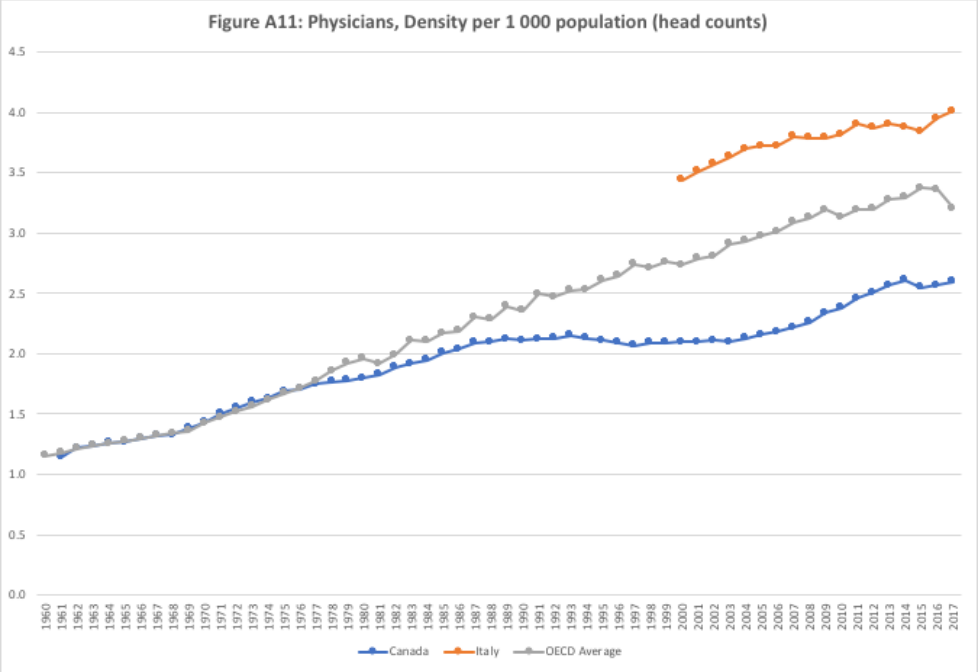


Figure A11: Physicians, Density per 1 000 population (head counts)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017
Canada
Italy
OECD Average

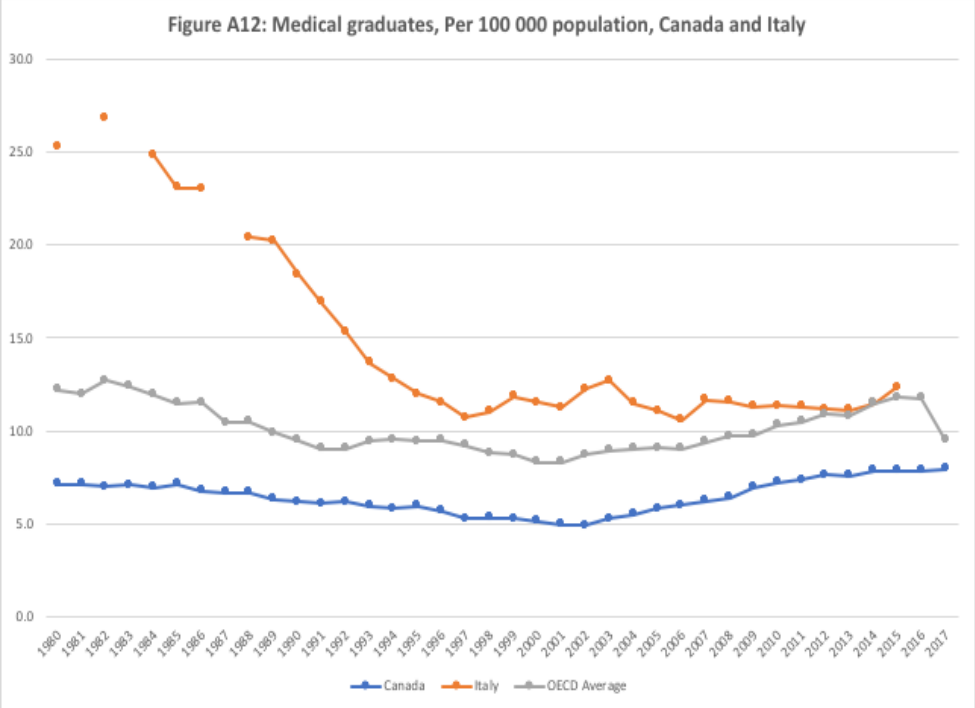


Figure A12: Medical graduates, Per 100 000 population, Canada and Italy
30.0
25.0
20.0
15.0
10.0
5.0
0.0
1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017
Canada
Italy
OECD Average

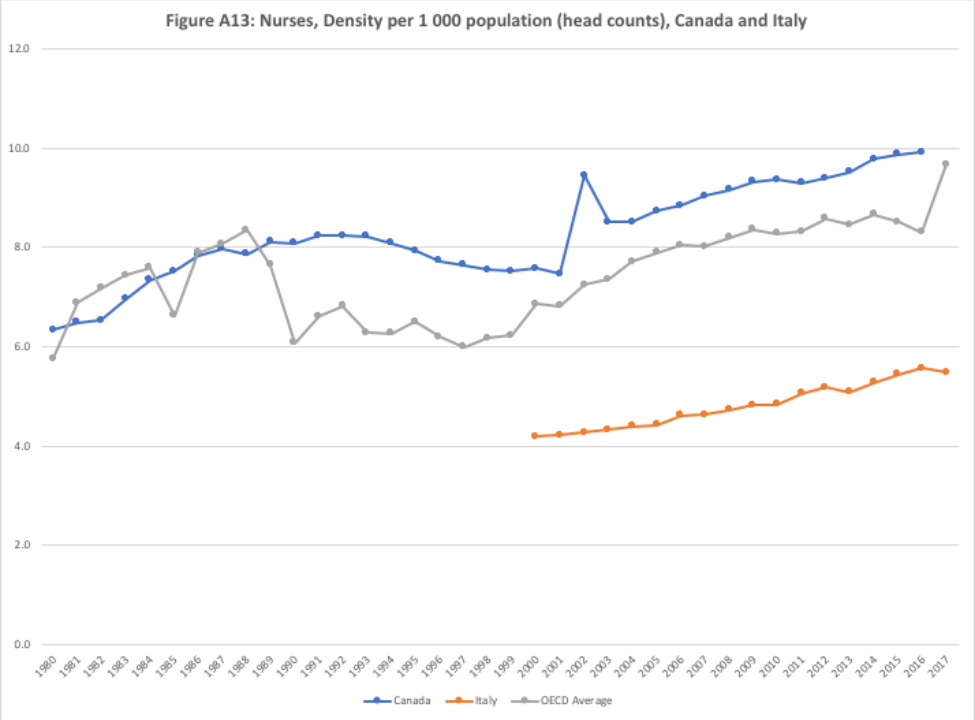


Figure A13: Nurses, Density per 1 000 population (head counts), Canada and Italy
12.0
10.0
8.0
6.0
4.0
2.0
0.0
1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017
Canada
Italy
OECD Average

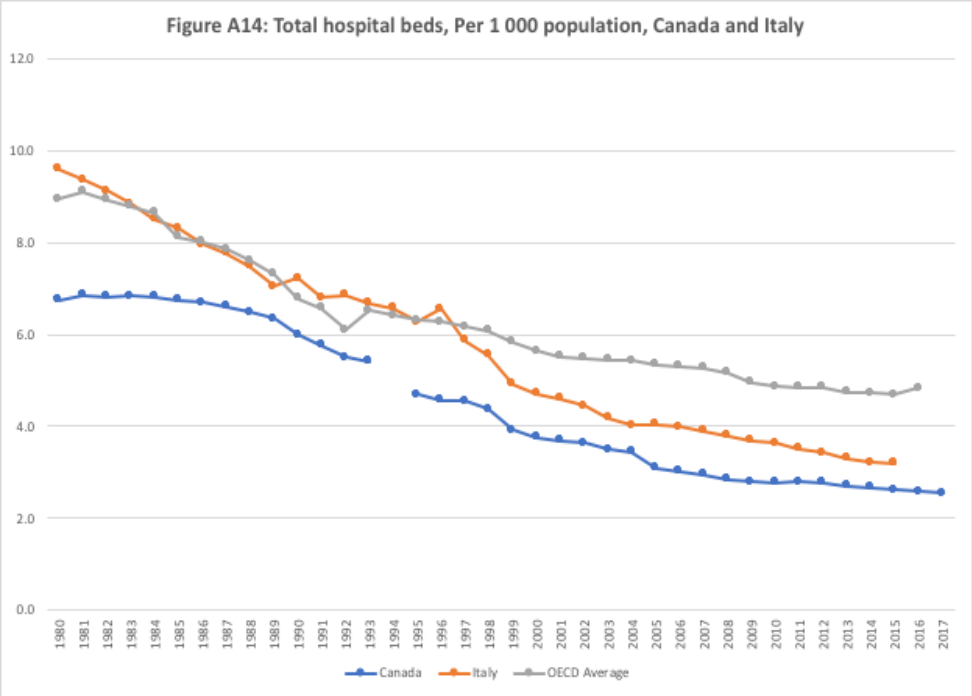


Figure A14: Total hospital beds, Per 1 000 population, Canada and Italy
12.0
10.0
8.0
6.0
4.0
2.0
0.0
1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017
Canada
Italy
OECD Average

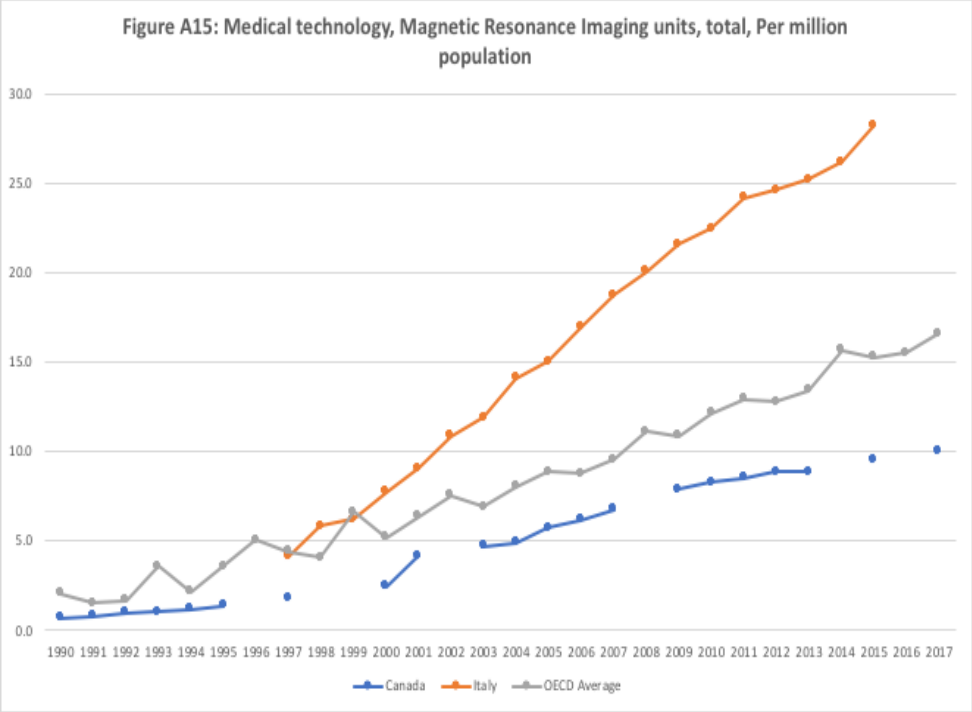


Figure A15: Medical technology, Magnetic Resonance Imaging units, total, Per million population
30.0
25.0
20.0
15.0
10.0
5.0
0.0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017
Canada
Italy
OECD Average

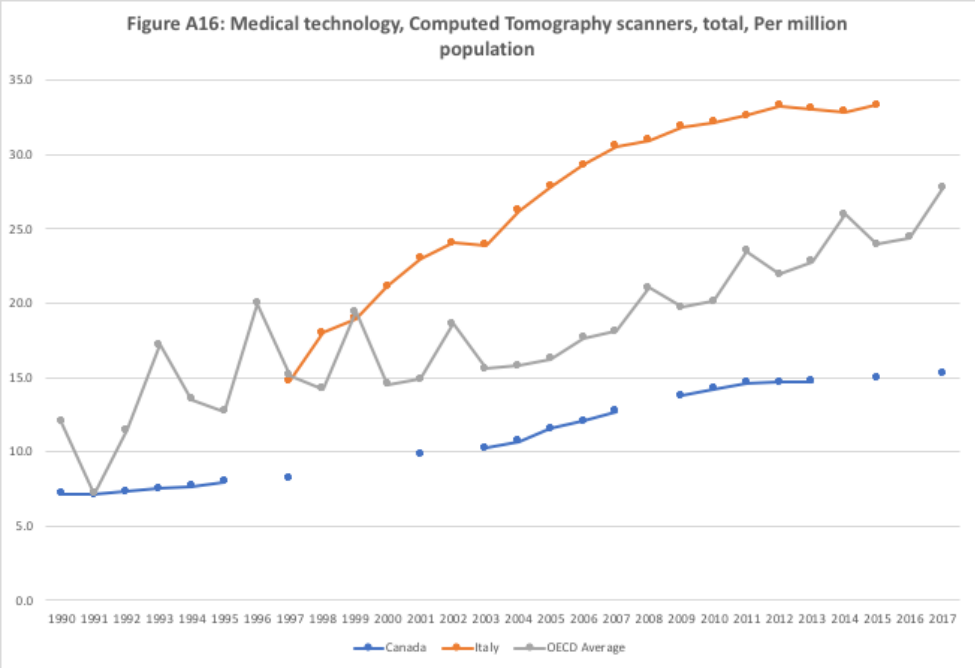


Figure A16: Medical technology, Computed Tomography scanners, total, Per million population
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017
Canada
Italy
OECD Average

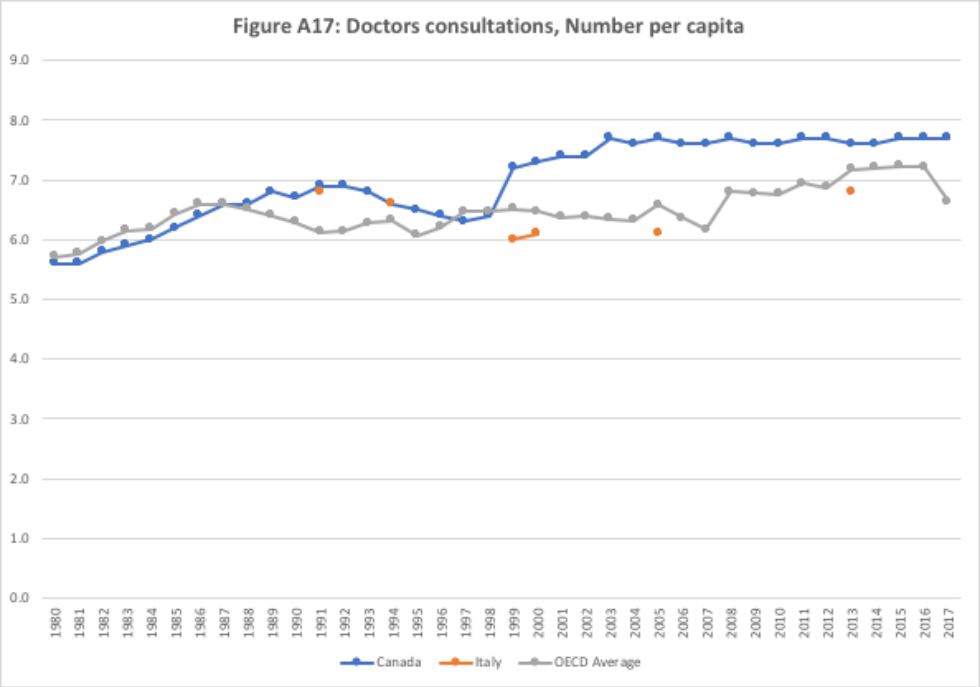


Figure A17: Doctors consultations, Number per capita
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017
Canada
Italy
OECD Average

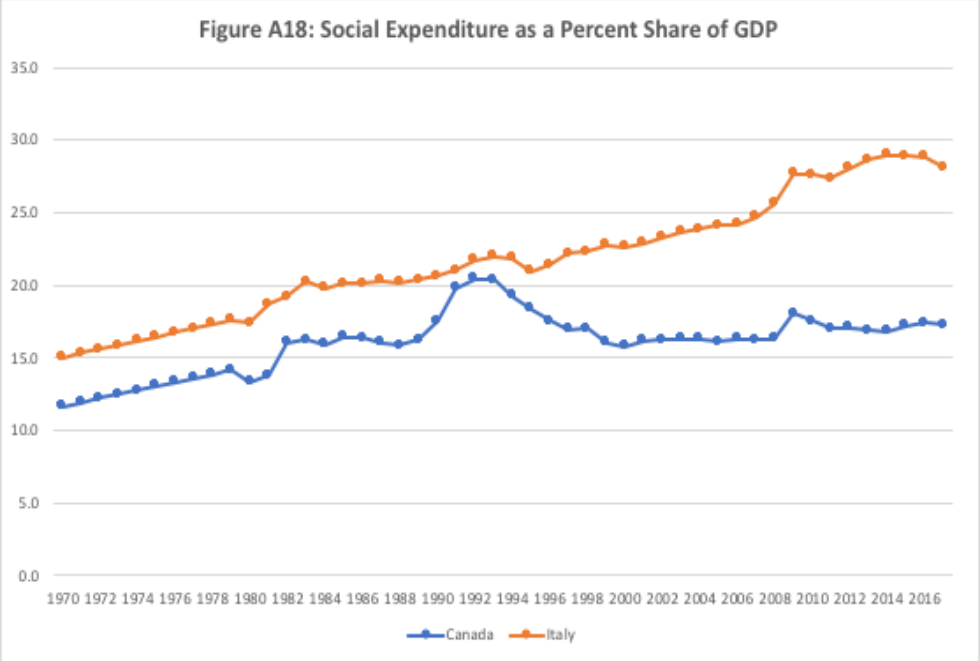


Figure A18: Social Expenditure as a Percent Share of GDP
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016
Canada
Italy

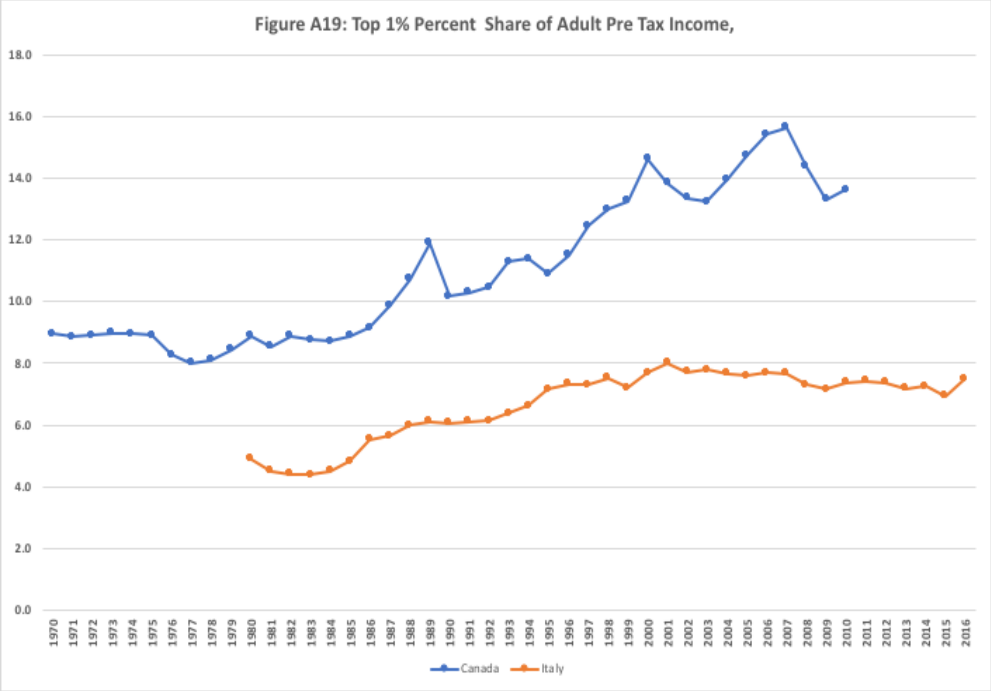


Figure A19: Top 1% Percent Share of Adult Pre Tax Income,
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016
Canada
Italy

Appendix 2

Regression Variables

Variable	Source
PPP GDP Per Capita Current Prices	1970-79 (FRED); 1980 to 2017 IMF WEO
GDP Per Capita in 2010 Constant USD	FRED
Population (millions)	FRED
Unemployment Rate (%)	IMF WEO Database 1980 to 2017 FRED, 1970 to 1979
Total Health Exp to GDP (%) HGDP	OECD Health Statistics 2018
Per Capita Total Health Expenditure USPPP$	OECD Health Statistics 2018
Public Health Exp Per Capita USPPP$	OECD Health Statistics 2018
Infant Mortality Deaths per 1000 live births	OECD Health Statistics 2018
Life Expectancy at Birth Years	OECD Health Statistics 2018
Self Harm (Suicides) Deaths per 1000	OECD Health Statistics 2018
Alcohol Consumption Litres Per Capita	OECD Health Statistics 2018
Tobacco Consumption. % pop 15+ who smoke	OECD Health Statistics 2018
Physicians per 1000 Population	OECD Health Statistics 2018
Medical Graduates Per 1000 Population	OECD Health Statistics 2018
Nurses per 1000 population	OECD Health Statistics 2018
Total Hospital Beds per 1000 population	OECD Health Statistics 2018
MRIs per one million people	OECD Health Statistics 2018
CTs per one million people	OECD Health Statistics 2018
Doctor consultations Per Capita	OECD Health Statistics 2018
Percent of population Aged 65 Years and Over	World Bank
Social Expenditure Share of GDP (%)	OECD Socexp Datbase https://stats.oecd.org/Index.aspx?datasetcode=SOCX_AGG
Social Expenditure Per Capita USPPP$	OECD Socexp Datbase & FRED
Top 1 Percent Pre-Tax Income Share	World Inequality Database https://wid.world/