Drivers of Government Spending on Health: Effect of National Income

National Income is a significant driver of health spending

The PBO has found that a 1% change in national income, drives a change in government spending on health by 0.7%.

In the medium term, it is estimated that national income growth will drive health spending upwards by an average of 3% each year.

Key Messages

• Government spending on health in Ireland has been rising substantially in recent years. Examining the drivers of health expenditure can help in understanding the reason behind these increases.

• A previous PBO publication1 found that demographic changes are one driver of government health spending in Ireland but do not explain the majority of the increases in spending.

• Many studies have found that changes in national income is the largest driver of government spending on health internationally.2 Other drivers include inflation, technological advances, pressure on wages, structural reforms and demographic changes.

• By analysing different measures of national income in Ireland, over a long time horizon, the PBO has found that a 1% annual change in the national income alone, drives Government spending on health to change by between 0.6% to 0.8% in the following year. This effect holds, controlling for other drivers of health spending such as demographics, inflation and technology. This relationship is relatively stable over 25 years, despite the time including the period of the financial crisis.

• On the basis of these estimates, from 2016 to 2019, national income drove an average increase of 5% annually to Government spending on health. In this time period, public health expenditure has increased an average of 7% annually, meaning that the vast majority of this increase has been driven by rises in national income.

• Due to the COVID-19 pandemic, it is difficult to predict future changes in public health expenditure, particularly in the short term. However, in the more medium term, this analysis predicts that national income will continue to contribute to the upward pressure on government health spending, adding an estimated 3% to the health budget annually from 2023 to 2025.

2 OECD (2020) Health Spending Projections to 2030
Introduction

Government spending on health has risen substantially in the last number of decades (approximately 250% in the last 20 years). Changes in health spending are driven by several factors which can be broken into two broad categories: demographic and non-demographic.

- **Demographic factors** refer to how the changing size and age structure of the population impacts on public expenditure. A note published by the PBO in 2019 explored the demographic drivers of public health spending in Ireland and compared different estimates of how much spending will change due to changing demographics. It was found that approximately one third of increases in health expenditure has been due to demographic changes in Ireland in the last 5 years.

- **Non-demographic factors** refer to all other drivers, other than changing population age and structure, that cause changes to health spending. This includes factors such as policy changes, changes to wages and institutional factors. In particular, rising national incomes have been found to be a significant driver of health expenditure internationally.

This note will explore the relationship between national income and government spending on health in Ireland. In recent years, statistical measurements of national income have been distorted by the activities of multinational corporations. As a result, we estimate the elasticity of government health spending to income employing a range of different measures of national income: Gross Domestic Product (GDP), Gross National Income (GNI), (Modified Gross National Income (GNI*)) and Gross National Product (GNP). Using the results of the analysis, we will forecast changes in government health spending going forward due to projected growth rates in national income.

How do incomes changes affect health spending?

The amount of goods and services an individual purchases usually changes when personal income changes. When incomes rise, the amount of goods purchased normally increases and when incomes fall, the amount of goods purchased also tends to decrease.

For the majority of goods, when income increases the consumption of that good increases. In economics, these are called ‘normal’ goods. For example, the amount spent on clothes, food and socialising is likely to increase when your income increases, but not at the same rate as your income increases. An example of this could be people choosing more expensive food items or clothing as their income increases. For some goods, consumption increases by a proportionally large amount when income increases by a relatively small amount. This could be seen as disposable income rises, and core necessities are covered. These goods are referred to as ‘luxury’ goods. For example, if your income rises by 50%, your consumption of designer clothes, jewellery or luxury cars might increase by much larger than 50%. The relationship between income increases and consumption increases is called income elasticity.

Healthcare is similar to many other goods. When incomes increase, expenditure on healthcare tends to increase. However, how much healthcare expenditure increases by has been debated over the years with studies finding different results. Some studies have found that healthcare is a normal good, meaning when incomes rise by 1%, expenditure on healthcare increases by less than or equal to 1% (income elasticity of less than or equal to 1). However, other studies have found that healthcare is a luxury good, meaning when income rises by 1%, spending increases by greater than 1% (income elasticity of greater than 1).

Studies into the income elasticity of healthcare expenditure have analysed differences between the results when countries are grouped by national income (high-income, middle-income and low-income countries), and the difference between public and private healthcare.

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3 PBO calculations using Department of Public Expenditure and Reform Data. The Department of Children and Youth Affairs (DCYA) was part of the Department of Health until 2011. To extract DCYA expenditure from health expenditure, it is assumed that the proportion of DCYA expenditure in 2011 to Health expenditure in 2011, remained the same in the previous years.

4 Parliamentary Budget Office (2019) ibid

5 OECD (2019) Health Spending Projections to 2030

6 Ibid.

7 Mehrara et al. (2010) The Relationship Between Health Expenditure and GDP in OECD Countries Using PSTR
consumption. Largely, recent studies have found that high-income countries (like Ireland) treat public healthcare like a 'normal' good, meaning that a 1% increase in national income results in a less than 1% increase in government spending on health. Government expenditure on healthcare is found to act more like a normal good than private expenditure on healthcare. Studies have found that individual consumption of private healthcare is a luxury good meaning that if income increases by 1%, expenditure on private healthcare increases by greater than 1%.

**Income Elasticity of Health Spending in Ireland**

Understanding the relationship between national income and government health spending is fundamental to predict health spending trends in the future. This allows for effective management of public resources and the efficient allocation of these resources.

One difficulty in analysing the relationship between income and health spending in Ireland is that many measures of national income are distorted due to the transactions of large multinational companies operating in Ireland. For this reason, the PBO have analysed the relationship between health spending and a number of measures of national income, including gross domestic product (GDP), gross national income (GNI), modified gross national income (GNI*) and gross national product (GNP).

Figure 2 shows the historical trend in government health spending alongside the trend in different measures of national income in Ireland from 1995 to 2019. All measures of national income have largely increased over time with exceptions seen during the recession from 2008 to 2013. Health spending has been increasing for the majority of this time period, with a notable exception seen in the recession period from 2010 to 2015.

A number of factors were likely driving the increases in health spending in this time period, including demographic changes and structural changes in the health system. For example, health spending growth accelerated after 2000, which coincides with the publication of a new strategy on national health policy outlining expansions for primary care, acute care and continuing care services. A further increase in health expenditure growth is seen after the formation of the Health Service Executive (HSE) in 2005.

Source: Health expenditure data is sourced from PBO calculations on Department of Public Expenditure and Reform data. National income data is sourced from the CSO.
Note: Health expenditure included expenditure on Children & Youth Affairs (CYA) until 2011. CYA expenditure was equal to 1.5% of total Health and CYA expenditure in 2011.

8 Bustamante & Shimoga (2018) **Comparing the Income Elasticity of Health Spending in Middle-Income and High-Income Countries**

9 Farag et al. (2012) **The income elasticity of health care spending in developing and developed countries**

Kahn & Mahmud (2015) **Is healthcare a ‘Necessity’ or ‘Luxury’? an empirical evidence from public and private sector analyses of South-East Asian countries?**

10 Department of Health (2001) **Quality and fairness: A health system for you**
The analysis presented in the next section will look at the relationship between national income and health spending by controlling for other factors which might drive government spending on health. It should be noted that the relationship between public health expenditure and national income is complex and multi-directional. Increases in national income can lead to increases in health spending, but investment in health can also impact the economy as increased spending on health can lead to a healthier, and therefore more productive, nation. The analysis presented here looks specifically at the effect national income changes have on health expenditure.

**Findings**

The PBO analysed past data from 1995 to 2018 on national income and government health spending to understand this relationship and estimate how changes in national income affect health spending. We then estimate how much public spending on healthcare is expected to rise in coming years due to developments in national income.

Regression models are constructed using time series data from 1995 to 2018. These models largely follow the methodology used by the OECD but make Irish specific changes to the data used. More information regarding the methodology used can be found in Annex 1.

The growth rate of public health spending is analysed against the growth rate of national income in the previous year, as it is assumed that decisions regarding health expenditure are largely determined in the year before the expenditure occurs (this is consistent with how the Budget process is carried out) and therefore are informed by the national income growth in the previous year. The trend in health expenditure more closely follows the trend in national income in the previous year, which further supports this theory.

A number of other variables which control for factors that also drive changes in health spending are also included in the analysis. To capture the effect of demographic drivers, the number of people in the country aged 65 and over is included in the analysis. The annual changes in average national wages and total factor productivity growth (TFP) are included in the analysis to control for changes in health expenditure caused by wage growth in the wider economy or technological advances. A dummy variable is also included to control for the establishment of the HSE in 2005.

Table 1 presents the income elasticities or the expected percentage increase in public health expenditure caused by a 1% increase each of the national income measures. The results show that an increase in national income of 1% will lead to between a 0.6% to 0.8% increase in health expenditure, depending on the measure of national income analysed.

Across all measures of national income, we find that public healthcare is a ‘normal’ good meaning that when national income increases by 1%, spending on healthcare increases by less than 1%. Including control variables only cause marginal changes to the results and no differences are seen once figures are rounded up.

Applying these elasticities to percentage changes in national income for the years 2015 to 2018, it’s been found that since 2016, income drivers have contributed an average of 5% annually to public health expenditure. This is more than double the estimated increase due to demographic factors, which was found to be just under 2% annually.

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11 OECD (2019) [Health Spending Projections to 2030](#).
12 We use log-differenced data to deal with unit roots in health spending and national income data in levels.
13 This method also corrects for the potential causal effect that changing health expenditure has on national income.
14 We find that health spending growth is also more correlated to lagged income growth.
15 TFP is a measure of productivity calculated by dividing economy-wide total production by the weighted average of inputs.
Table 1. Regression results for income elasticities from 1995 to 2018

<table>
<thead>
<tr>
<th></th>
<th>No Controls Included</th>
<th>Controls Included</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>0.6 *** (0.17)</td>
<td>0.6 *** (0.14)</td>
</tr>
<tr>
<td>GNP</td>
<td>0.7 *** (0.18)</td>
<td>0.7 *** (0.15)</td>
</tr>
<tr>
<td>GNI</td>
<td>0.7 *** (0.18)</td>
<td>0.7 *** (0.15)</td>
</tr>
<tr>
<td>GNI*</td>
<td>0.8 *** (0.16)</td>
<td>0.8 *** (0.13)</td>
</tr>
<tr>
<td>National Income (Average Effect)</td>
<td>0.7</td>
<td>0.7</td>
</tr>
</tbody>
</table>

Source: Results from PBO analysis
Note: Standard errors are presented in brackets. Stars represent the level of statistical significance. * denotes significance at the 0.1 level, ** at the 0.5 level and *** at the 0.01 level.

Health Spending Projections Due to Income Changes

Using these elasticities, we can estimate how public health expenditure will change due to national income changes in the coming years. However, the current COVID-19 pandemic makes this exercise significantly more complex and greatly increases the uncertainty around these estimations.

The COVID-19 pandemic and the current restrictions in place to prevent the spread of the disease are having a significant negative effect on the Irish economy. The extent of the effect depends on the length of time that restrictions are in place and the speed of economic recovery. As these factors are unknown, any projections of economic activity in the short or medium term are associated with a high level of uncertainty.

There is also uncertainty surrounding the relationship between national income and public health expenditure, specifically, whether the historical relationship will continue in the future. Our analysis has found that only a small percentage of the increase in health expenditure in recent years was due to factors outside of demographics and income. However, due to the Covid-19 outbreak, we can assume that in 2020 (and potentially 2021), a larger proportion of health expenditure increase will be due to factors other than income and demographics. For this reason, changes in national income is likely to be less useful in predicting changes to health expenditure in the short term. There is also the possibility that this pandemic will lead to a reprioritisation of health spending, causing a change in the relationship between national income and health spending.

However, there is reason to assume that even if a breakdown of this relationship occurs in the period immediately following the crisis, the historic relationship between public health expenditure and national income can be expected to resume in the medium term. These historic elasticities were found by analysing 25 years of data, which is a relatively long period of time. When analysing the relationship prior to the financial crisis in 2007 and the period post financial crisis from 2010 onwards, little fluctuation in these elasticities is observed. This shows that while the relationship may have broken during the years of the financial crisis, the relationship reverted to trend once the economy began to recover. Therefore, it is assumed that the elasticies found in this analysis will hold in the medium term.

By applying elasticities to macroeconomic projections of national income, the percentage change in health expenditure due to changes in national income are produced. Figure 3 shows these results when elasticities are applied to both pre-COVID national income projections and the projections that were released by the Department of Finance in April 2020, when COVID restrictions were in place.
It is estimated that the COVID-19 pandemic will have a large negative impact on the economy in 2020. **If elasticities hold, this fall in national income should cause a fall in the income effect driving health expenditure down in 2021.** However, due to other factors driving health spending (demographics and COVID related expenditure in particular), the change in overall public health spending may still be positive.

The most recent official economic projections assume that economic recovery in Ireland will start in Q3 of 2020 and national income growth will return to the pre-COVID projection in 2021. If these assumptions hold then **we expect national income to be a positive driver of public health expenditure from 2022 onwards, adding an additional average of 3% to the health budget annually.**

**Conclusion**

Two of the main drivers of health expenditure internationally have been found to be demographic changes and changes to national income. A previous PBO paper estimated that an additional **2% annual increase in the health budget will be needed to meet demographic pressures in Ireland** in the coming years.

This paper has found that there is a **strong relationship between changes in health expenditure and changes in the national income in Ireland.** For every 1% rise or fall in national income, public health expenditure has tended to change by between 0.6% and 0.8% in response.

Due to the COVID-19 pandemic, it is expected that all measures of national income growth will turn negative in 2020. There is a large amount of uncertainty around the speed of economic recovery and the short term effect on the relationship between income and health spending. It is therefore difficult to predict the effect that a fall in national income will have on health spending in the short term.

However, in the more medium term, we expect that **rising national incomes will lead to an additional 3% annual increase in public health expenditure from 2023 to 2025.**

With government spending on health increasing steadily and expectations that it will continue to rise, understanding what drives these increases becomes more important to ensure efficient use of public resources and to address future challenges. While increased spending may lead to positive outcomes in terms of patient care or the functioning of our health system, these expenditure decisions need to be analysed to ensure sustainability of our public finances.
Annex 1: Model Specification & Methodology

As we are interested in the income elasticity of health expenditure, we transform the variables using their natural logs to estimate the percentage change in one as a result of a percentage change in the other.

Testing for Stationarity

This statistical model requires stationary variables. Using the Dickey Fuller test, we found no evidence of stationarity for health expenditure or any of the national income measures. To correct for this, we continued the analysis using the first difference of the logs of public health expenditure and national income. This is consistent with methods used in previous research.\(^\text{16}\) The basic model took the following form:

\[
\Delta\ln PHE_t = \beta_0 + \beta_1 \Delta\ln Income_{t-1} + \varepsilon_t
\]

Where PHE is the measure of public health expenditure and Income (lagged) is the measure of national income. This basic model was run four times for the four different measures of national income analysed.

Control Variables

Different control variables were considered for inclusion in the model. After analysing the data, the full model took the following form:

\[
\Delta\ln PHE_t = \beta_0 + \beta_1 \Delta\ln Income_{t-1} + \beta_2 \Delta\ln Demographics_t + \beta_3 \Delta\ln Wages_t + \beta_4 \Delta\ln Technology_t + \beta_5 \text{dumHSE} + \varepsilon_t
\]

To control for demographic factors, absolute numbers and the population share of different age groups were analysed. The absolute number of people aged 65 and over was found to have the most explanatory power and therefore this is the measure included in the final model. Other measures such as share of population aged over 65, did not have a significant impact on coefficient of the income variable.

To control for technological growth, total factor productivity (TFP) is included. The OECD method includes a measure of expenditure on research & development, but from analysing this variable in relation to health expenditure using Irish sources, the data did not appear reliable\(^\text{17}\) and was not included.

A measure of wages in the economy is also included to capture the effect that wage growth in general, has on wage growth in the health sector. Theory suggests that wage growth will occur in the health sector driven by wage growth in the general economy.\(^\text{18}\) Data on sector specific wages was not available over the time period analysed, nor was a consistent measure of total average wages from administrative or survey data. In lieu of this, we included a measure of average wages calculated using aggregated national figures from national accounts.\(^\text{19}\)

We found no evidence of stationarity in the control variables and therefore calculated the log changes in these variables for the full model. The only exception is the demographics variable where it was necessary to take the second order difference to achieve stationarity.

A dummy for 2015 was included in some of the models as some national income measures (GDP particularly) were significantly distorted in this year. A dummy was also included for the year 2005 to control for the establishment of the HSE. Dummy variables for the years 2008 and 2009 were also considered to capture the period of the financial crisis but did not

\(^{16}\) Baltagi & Moscone (2010) *Health Care Expenditure and Income in the OECD*  
\(^{17}\) This variable was deemed unreliable as it showed a counter cyclical trend which is contrary to what you would expect. These was also a drastic decrease in expenditure in 2005 which may indicate that the variable is inconsistent when looking at pre and post HSE establishment.  
\(^{18}\) This is referred to as the Baumol effect. It is when wage increases occur when no increases in productivity have occurred, motivated by wage increases in other sectors when productivity gains have been made.  
\(^{19}\) Data sourced from *OECD*
have a significant impact on the coefficient for national income and were ultimately left out of the final model.

**Results**

Full results of the regression models are found in Table 2.

**Table 2. Full regression results**

<table>
<thead>
<tr>
<th></th>
<th>GDP</th>
<th>GNP</th>
<th>GNI</th>
<th>GNI*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Income</strong></td>
<td>0.58 ***</td>
<td>0.69 ***</td>
<td>0.69 ***</td>
<td>0.79 ***</td>
</tr>
<tr>
<td></td>
<td>(0.2)</td>
<td>(0.2)</td>
<td>(0.2)</td>
<td>(0.1)</td>
</tr>
<tr>
<td><strong>Demographics</strong></td>
<td>2.09</td>
<td>1.78</td>
<td>1.97</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td>(2.8)</td>
<td>(2.5)</td>
<td>(2.5)</td>
<td>(2.2)</td>
</tr>
<tr>
<td><strong>Wages</strong></td>
<td>0.97 *</td>
<td>0.96 *</td>
<td>0.94 *</td>
<td>0.76</td>
</tr>
<tr>
<td></td>
<td>(0.5)</td>
<td>(0.5)</td>
<td>(0.5)</td>
<td>(0.4)</td>
</tr>
<tr>
<td><strong>Technology</strong></td>
<td>-0.18</td>
<td>-0.28</td>
<td>-0.28</td>
<td>-0.39 *</td>
</tr>
<tr>
<td></td>
<td>(0.3)</td>
<td>(0.2)</td>
<td>(0.4)</td>
<td>(0.2)</td>
</tr>
<tr>
<td><strong>HSE</strong></td>
<td>0.06</td>
<td>0.06</td>
<td>0.06</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>(0.1)</td>
<td>(0.1)</td>
<td>(0.1)</td>
<td>(0.0)</td>
</tr>
<tr>
<td><strong>Constant</strong></td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>(0.0)</td>
<td>(0.0)</td>
<td>(0.0)</td>
<td>(0.0)</td>
</tr>
<tr>
<td><strong>R²</strong></td>
<td>0.59</td>
<td>0.65</td>
<td>0.65</td>
<td>0.74</td>
</tr>
</tbody>
</table>

Source: PBO analysis

Note: Standard errors are demoted in brackets and stars refer to level of significance. * denotes significance at the 0.1 level, ** at the 0.5 level and *** at the 0.01 level.

Interestingly, the demographics variable is not found to be significant in any of the regressions, indicating that increases in the number of those aged 65 or over has not had a significant impact on health expenditure. There may be a few different reasons for this. The time series analysed is relatively short and contains two unique periods: the establishment of the HSE and the financial crisis. In these periods it's likely that demographic change was a less important driver of health expenditure. It might also be the case that demographic changes have not been an important driver of expenditure in the past because Ireland is a relatively young country. However, it is expected that this will change in the coming years.