Integrating Artificial Intelligence into Life Expectancy Model: An Analysis of OECD Countries

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Abstract

The study attempted to incorporate Artificial Intelligence into the life expectancy model utilizing the Grossman model and data of OECD nations with significant AI investment. In contrast to conventional methods that concentrate on traditional health determinants only, the current study presents a new model that looks at how AI investments affect health outcomes. The empirical examination of AI investment and its interaction with government effectiveness and internet usage in the healthcare industry, which has not yet been covered in the literature, makes this study distinctive. RGS is used for mapping comparing 2012 with 2022 in terms of AI investment. The Generalized Methods of Moment (GMM) is used for data analysis. GMM is a flexible approach for modelling economic relationships handling heteroscedasticity, endogeneity, and leveraging moment conditions for reliable and accurate results. This study found that while out-of-pocket expenditures and GDP per capita have a positive but non-significant effect, AI investment initially negatively impacts longevity due to transitional costs. However, life expectancy significantly increases when investment in AI is combined with governance and internet usage, implying the need for robust governance. Findings highlight the importance of policies promoting digital inclusion and innovation in the health sector. Digital adaptation and a strong bond between investment in AI and the use of the internet will ultimately lengthen life expectancy. Policymakers have to focus on privacy, and data security and adopt regulatory frameworks to promote digital innovation in the health sector. Government should adopt strategies for the promotion of digital health innovation by funding AI, to enhance internet accessibility and better institutional efficacy.

Keywords: Artificial Intelligence, Life Expectancy Model, OECD Countries.

Introduction

In any nation, enhanced human capital is seen as essential to attain targeted economic growth and development. The neoclassical growth model states that improvements in health and education levels over time have a beneficial impact on per capita income. According to Bloom and Canning (2000, 2003) and Bloom et al. (2004) there are four ways that healthier individuals support the national economy: (i) In the workplace, healthy people are more high-yielding and thus make more cash; (ii) they can work extensive and retire later because of their general health; (iii) they lay out money on their education and training, which raises productiveness; and (iv) they are more likely

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to save and invest more in anticipation of living longer. Consequently, a country's primary development objective should always be to improve its health since it is a crucial component of sustainable development. A sense of empowerment that elevates human existence is another benefit of excellent health, which also guarantees financial security for individuals and their families.

Research shows that health payout has a positive economic influence on life expectancy. Longer life is a key indicator of a country's general health, happiness, and socioeconomic status. This reflects evolution in technology and healthcare as well as the complex interplay of several socioeconomic causes. For example, for every 10% rise in the life expectancy at birth, the economic growth rate rose by 0.35% yearly (WHO, 2001). Similarly, poor health is considered a huge financial burden and is responsible for half of the growth variation between developing and developed countries. Since 2000 the average global increase in life expectancy has been 10 years, which is a corroboration of the concerted efforts made to augment healthier societies (WHO, 2020). Also, the World Bank (2019) reports that every dollar invested in health returns a significant $4 return in economic growth highlighting the positive relation between economic growth and health.

Even with admirable advancements, life expectancy both inside and between nations continues to vary significantly. With an average life expectancy of nearly 80 years at birth, the Organization for Economic Co-operation and Development (OECD) highlights the noteworthy progress achieved by its member countries (OECD, 2020). However, the results presented by Foreman et al. (2018) show that there are notable differences in life expectancy within OECD countries, with values ranging from 78.5 to 83.9 years. These variations demonstrate how complicated life expectancy is and how important it is to have a thorough understanding of all the contributing elements. Research studies have looked closely at several elements that affect life expectancy, such as technological advancements, healthcare facilities, and economic indicators. Research performed, for example, by Cutler et al. (2006), Bloom et al. (2011), and Acemoglu and Johnson (2007) has shed light on the complex relationship that exists between changes in healthcare spending, economic growth, and life expectancy. Furthermore, the WHO's support for spending on healthcare along with initiatives to reduce poverty and to make use of advanced technology (WHO, 2019).

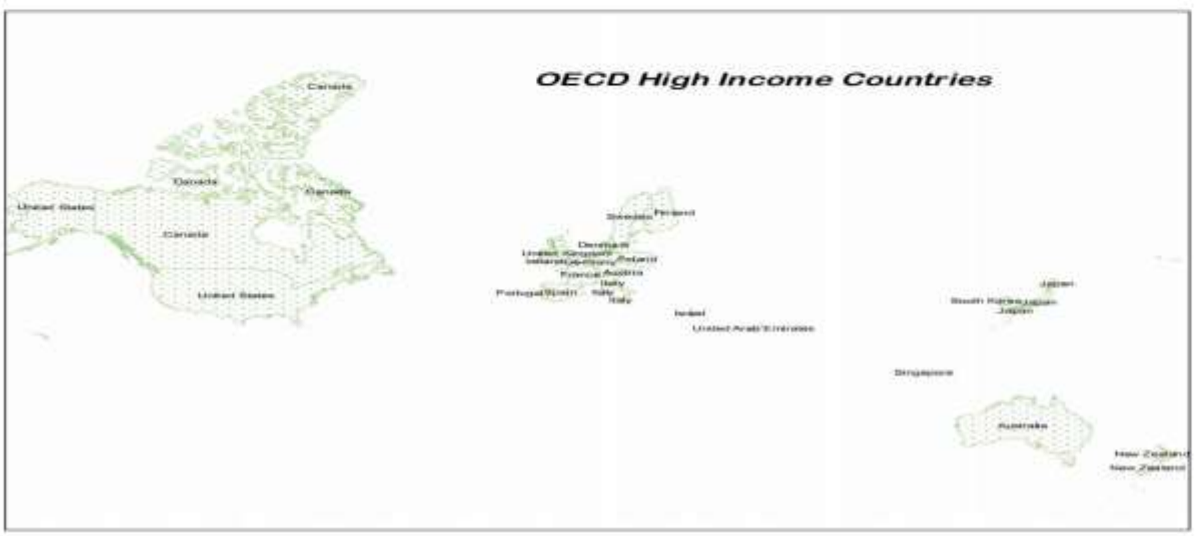
Health outcome is represented by life expectancy at birth and used by many researchers to show the importance of life expectancy at birth on a country’s development and growth as a result of enhanced human capital for instance elaborated by Balkhi et al. (2021), Onofrei et al. (2021), Hilaire (2016). Similarly, the OECD report also highlighted the importance of health status in the development of a nation (OECD, 2020). While measuring health status researchers have used various variables like GDP per capita for income. Developed nations spend more on health relative to underdeveloped nations. Many studies highlighted the importance of education, economic growth, basic sanitation, environment, and many other variables in the life expectancy model. In 2012, the United States, Canada, the United Kingdom, and Israel emerged as dominant investors in AI. These countries have invested more than 100 million. Therefore, the current study has included some variables based on their importance in the literature. The contribution of the study is to check the impact of investment in AI and to check the combined effect of digital literacy and investment in AI the combined effect of government effectiveness, individuals using the internet, and investment in AI.

The purpose of this study is to contribute to the existing literature to inquire about the macroeconomic determinants of life expectancy at birth in the selected OECD nations with a special focus on analysing the role of AI. The present study expands upon the Grossman model by integrating a new element the investment in artificial intelligence (AI) in the life expectancy model, which aligns with the needs of the contemporary world. In contrast to typical methods that concentrate on traditional health variables only, our study presents a new model that looks at how AI investments affect health outcomes. The empirical examination of AI investment and its interaction with government effectiveness and internet usage in the healthcare industry, which has not yet been covered in the literature, makes this study distinctive. We intend to examine the consequences of AI on health by focusing on 25 OECD nations that have made large investments in AI. The study aims to assess how investments in AI have affected OECD countries' life expectancy at birth. It is also aimed to analyse the role of interaction in terms of internet usage, AI investment, and government effectiveness as well as of internet use and AI investment in the life expectancy model. In addition, the effect of GDP per capita and out-of-pocket health expenditures on life expectancy at birth in OECD countries will also be analysed. In the end, the discussion and conclusion of the study will lead to some policy recommendations. The aim is realized by employing Generalized Methods of Moment for data analysis of 25 OECD countries throughout 2012-2022.

Study Area

The map in Figure 1, indicates a geographic visualization of our selected countries from the group of OECD nations to analyze the impact of AI on the health status of the population. The selected countries in the map are all high income countries having high GDP and quality infrastructure. These countries are considered economic centers and hubs for innovation, and technology. Further, the map consists of diverse geographical locations from America, Europe and Asia, for a comprehensive study.

Figure 1: OECD high-income countries



Source: Authors' elaboration.

Literature Review

This section provides a review of literature on health outcomes. Health outcomes are important indicators to measure how healthcare procedures, policies, and interventions affect people's individual and community well-being. They give decision-makers useful information to raise the general health of the population and improve the efficiency of healthcare systems. Previous work on health outcomes provide us important insight to understand factors and policies that contribute to society. Different researchers studied the relationship between literacy rate, GINI coefficient, GDP per capita, population growth and health outcomes for specific countries like Pakistan, Africa, India, Oman and others. In addition, to get a wide coverage some researchers utilized panel data analysis to reveal the complex interplay of these variables in European Union, SAARC-ASEAN, Middle East & North Africa and OECD regions.

Reddy et al. (2020) present a governance model to highlight ethical and regulatory issues arising from AI incorporation in healthcare, emphasizing potential negative consequences such as safety and liability issues algorithmic biases, privacy and concerns. Similarly, Sarker et al. (2021) the systematic review range over the integration of AI and robotics in controlling the COVID-19 pandemic, focuses on AI's exceptional accuracy in diagnosing of virus, trend predictions in epidemic, prognostic assessment, and discovery of drugs, which enlarge healthcare efficiency and bring down human viral vulnerability. Jiang et al. (2017) review the current and future potential of AI implementations in healthcare, noting its benefit in neurology, cancer and cardiology especially in prognosis, treatment, and result prediction, while highlighting data privacy and ethical concerns. Shaheen (2021) emphasizes AI's life changing impact on present-day healthcare, including improvements in drug discovery, genetic code analysis, robotic surgery, and clinical trial automation. Ronmi et al. (2023) inquired AI and data science procedures to forecast longevity in 193 countries, disclose that AI can provide penetrative analysis and actual predicts, and assist decision-makers in health maintenance and potentially enhancing life longevity outcomes worldwide. Collectively, these studies call attention to AI's notable future to improve healthcare conveyance, efficacy, and outcomes, while also emphasis the need to address along with ethical, regulatory, and privacy provocations.

Multiple studies have explored the impact of health expenditure on health outcomes across different regions, revealing diverse and nuanced findings. Balkhi et al. (2021) examined the Middle East and North Africa (MENA) region from 1995 to 2015, finding a significant positive correlation between life expectancy and per capita health expenditure. However, they noted that higher spending did not always equate to better health outcomes, as some nations with greater healthcare expenditures had lower life expectancies. Hlafa et al. (2019) analyzed South Africa from 2002 to 2016 using panel data estimation techniques, including fixed and random effects models, and concluded that a 1% increase in health spending led to a 0.3% decrease in child mortality and a 0.9% rise in life expectancy. They also found a significant positive relationship between life expectancy and provincial GDP, but the ratio of doctors to the population and the prevalence of HIV/AIDS had little impact on these outcomes. Onofrei et al. (2021) organized a comparative inquiry among EU developing nations from 2000 to 2019 utilizing factor and regression analysis. They found that socioeconomic susceptibility, healthcare expenditure, and government efficiency significantly affect public health outcomes. A 1% rise in public health expenditure resulted in a 0.64% cutback in the infant mortality, and there was a positive relation between GDP and longevity, suggesting that as a nation’s income increases, so does its spending on healthcare facilities, leading to better health outcomes. Mohanty and Behera (2020) inspected health status in Indian states from 2005 to 2016 utilizing a panel fixed effect model across 28 states. They found that a 10% raise in per capita public health spending resulted in a 0.18% reduction in under five mortality and an increase of 1.85 years in life expectancy. Public health expenditure also had a negative impact on malaria cases and neonatal mortality, with significant contrast observed between states with different performance levels. States with higher per capita gross state domestic product and better health framework showed improvements that are more noticeable in health outcomes. Lastly, Railaite and Ciutiene (2020) analyzed ingredient of human capital across 28 EU member states from 2000 to 2017 utilizing panel data models with fixed, random, and ordinary least squares effects. Their study give demonstration of a 1% increase in public health spending led to a 0.027% increase in longevity. They also found that higher education levels positively affected life expectancy, while lower education levels had a negative impact. Additionally, there was a strong positive relation between GDP per capita growth, old age dependency, and life expectancy, whereas alcohol intake and the GINI coefficient negatively affected life expectancy. Urbanization levels also had a favorable, albeit weaker, influence on health outcomes. These comprehensive findings underscore the complex relationship between health expenditure, socioeconomic factors, and health outcomes across different regions and time periods.

Ullah et al. (2021) worked on health outcomes in Pakistan from 1995 to 2017, applying the (QARDL) model. Their findings determined that public health expenditure importantly improved health status in both the short and long run by reducing neonatal mortality and death rates while raising life expectancy. Al-Azri et al. (2020) centered on Oman from 1990 to 2016, exhibit that raising in health spending led to larger life expectancy and reduced neonatal and under five mortality. Despite these enhancements, public health spending did not significantly affect deaths from non-communicable diseases. They also headlining the crucial role of secure drinking water and sanitation facilities in reducing death rates, GDP per capita positively affecting these outcomes.

Health outcomes have been estimated by many researchers. Numerous researchers have explored the concept of health outcomes and its determinants. However, the existing literature has considerably examined individual determinants of population health such as economic growth, health expenditure, per capita income, education spending, Health care system, Socioeconomic factors, Household food availability, Childcare practices, Health status, Education level, Occupation, environmental factors, wealth status, Urban-Rural status, and No of physician. All the above-mentioned variables are discussed in the literature but there is a variable, which is not discussed in the literature that is Investment in AI. So, in this study Investment in AI is included as new variable. Moreover there is also a gap in literature regarding analyzing the interaction term of government effectiveness, Investment in AI and individuals using internet to know, the combine effect of these three variables in life expectancy model. Similarly, the combined effect of Investment in AI and individual using internet through the interaction term is analyzed for the first time in the life expectancy model. These additions will help in better understanding the health outcomes and life expectancy.

Theoretical Framework and Model Specification

This section outlines the theoretical framework, data sources, and methodology used in the study. It begins by presenting the key theories that support the research, followed by a description of the data collection process and the criteria for selecting data. The methodology section details the analytical approaches employed to address the research questions, ensuring a coherent and systematic investigation.

Theoretical Framework

This section aims to formulate a theoretical framework. A population that is well educated and in good health contributes significantly to a nation's human capital, which in turn fosters growth and development. Human capital is the most important driver of country's development due to this every nation wants to improve their health status to contribute more to the growth of nation. However, the question of interest is to model the health status. The current study follows Grossman (1972) model or Health production function in order to develop life expectancy model. Grossman studied health status on micro level and developed a model for health status based on different health inputs. According to Grossman health is the function of different inputs like leisure, income, diet, exercise and many other micro variables on individual base due to that health can be improved or worsen.

$$H = H\ (I, X, \varepsilon) \qquad (1)$$

Where H represents health status, I represents exogenous (external) health inputs, such as medical care, X represents endogenous (individual) health inputs, such as exercise, diet, etc. and ε represents environmental factors that affect health.

Investment in health improve health status and the opposite can happen if investment in health is delayed or ignored. An analogy can be drawn between investment in health and investment in a machine, if proper investment is made and proper steps are taken to take care of the machine then it will work well and will last for longer time. Similarly investment in health leads to regular improvements, efficiency and longer lives. This study follows Grossman model on macro level as it is followed by different studies like Majeed and Ozturk (2020), Fayissa and Gutema (2005), Ali and Ahmad (2014). These studies included environmental variable, socioeconomic variable, health supply and health demand to examine how factors affect health status. The current study is contributing to literature by incorporating investment in AI in this model. This study follows health production function by adding new variables to formulate new hybrid model.

$$H = f\ (E, T, G) \qquad (2)$$

Where E refers to socioeconomic variable, T refers to Variable of Technology and G refers to variable of governance. The variable of socioeconomics is limited to GDP Per Capita and out of pocket health expenditures. The variable of Technology comprises investment in AI and individuals using internet and finally variable of governance represents Government effectiveness.

Model Specification

The purpose of the empirical model is to investigate the relationship between the selected independent variables and life expectancy at birth (LEB). A lag dependent variable is added to the model. In order to account for the dynamic character of the panel data and eliminate any endogeneity biases, this study uses the Generalized Method of Moments(GMM) to produce credible estimates of the relationships between life expectancy at birth and the selected independent variables.

$$LEB_{it} = \alpha + \beta_1 LEB_{t-1} + \beta_2 GDPK_{it} + \beta_3 INAI_{it} + \beta_4 OPHE_{it} + \beta_5 GII_{it} + \beta_6 NAI_{it} + u_i + \varepsilon_{it} \qquad (3)$$

Where

- LEB $_{it}$ is the life expectancy at birth for country *i* at time *t*.
- LEB $_{it-1}$ is the lag of independent Variable.
- GDPK is GDP Per Capita.
- INAI is investment in Artificial Intelligence.
- OPHE is Out of Pocket Health Expenditure.
- GII is the Combination of Government Effectiveness, Investment in AI and Individuals Using Internet.

- NAI is the Combination of Investment in AI and Individuals Using Internet.
- *Ui* represents the unobserved country-specific effects.
- ϵ_{it} is the error term.

Data Sources

The OECD AI Policy Observatory and the World Development Indicators (WDI) are the two main sources of data used in this study. The World Bank's WDI offers comprehensive data on a range of socioeconomic indicators, including metrics relating to health, in numerous nations. The OECD Policy Observatory provides in-depth analysis of policy initiatives and their effects, particularly those pertaining to health and technology. It is ensured that the information used for the study is correct and up to date. Panel data for 25 upper income OECD countries covering an 11-year period (2012–2022) compose the dataset. This study excluded other OECD countries due to the non-availability of data on the selected variable Investment in AI. The following countries are part of the analysis.

List of Countries

The following table contain list of selected Upper Income OECD countries classified according to World Bank’s classification.

Table 1: List of Selected OECD Countries

Germany	Poland	Switzerland	South Korea
Portugal	Australia	United Arab Emirates	New Zealand
Belgium	Austria	Netherlands	Sweden
Ireland	Israel	United States	Finland
Singapore	Italy	France	Luxembourg
Japan	Canada	Denmark	United Kingdom
Spain			

Variables and Units

Variables and their units along with time are in the table below:

Table 2: Variable and units

Variables	Units	Time
Lag dependent variable	Year	2012-2022
GDP Per Capita	Constant 2015 US$	2012-2022
Investment in AI	US$ Million	2012-2022
Out of Pocket Health	Percentage of Current health	2012-2022
Government Effectiveness	Estimate	2012-2022
Individual Using Internet	Percentage of Population	2012-2022

Source: World Development Indicators (WDI) & The OECD AI Policy Observatory.

Methodology

Acknowledging multiple problems with the data made us to switch to the Generalized Method of Moments (GMM) estimation. More specifically, endogeneity, measurement errors, and possible bias from missing variables were among the issues in our data. In both FE and RE models, these issues may result in skewed and inconsistent estimations.
Several benefits of the GMM approach effectively handle these issues. To account for endogeneity, GMM employs instruments. Variables that have a correlation with the endogenous regressors but not with the error term are called instruments. GMM produces reliable and objective estimates by employing the lag values of the explanatory variables as instruments. Internal instruments allow GMM to adjust for measurement errors. By doing this, the bias brought on by mistakes in the explanatory variable measurements is decreased. GMM works especially effectively in models of dynamic panel data in which the dependent variable is reliant on historical values. GMM is resilient to autocorrelation and heteroscedasticity in the error terms, which are frequent problems with panel data. Because of this, the GMM estimations have more reliability than the conventional FE and RE models. By addressing possible heteroscedasticity and autocorrelation problems in the panel data, the GMM approach helped us ensure the accuracy and robustness of our results.

Empirical Results and Discussion

This section details the empirical findings of the study and examines their significance. It starts by presenting the results derived from the data analysis, followed by a discussion that connects these findings to the theoretical framework and relevant literature. The section also reports the implications of the results.

Descriptive Statistics and Correlation Matrix

The descriptive statistics are summarized table 3 below. These statistics helps to quickly overview the variable of interest and to have idea about their mean values, standard deviation and minimum and maximum values. Mean value of life expectancy at birth shows that on average the selected countries of our study have life expectancy of 81.6 years, representing a fairly high average. The total observations for all the variables are 275 except LEB (t-1) which has 250 and it’s the lag of dependent variable.

Table 3: Descriptive Statistics

Variables	Observation	Mean	Std. Dev.	Min	Max
LEB	275	81.657	1.615	75.602	84.812
LEB (t -1)	250	81.616	1.578	75.602	84.56
GDPK	275	46571.95	19642.37	11466.42	110425.89
INAI	275	6247.44	34172.63	0	372290
OPHE	275	17.551	6.51	8.453	37.654
GOE	275	1.464	0.416	0.255	2.285
IUI	275	86.899	8.982	55.638	100.96

The correlation matrix is presented by table 4.

Table 4: Matrix of Correlation

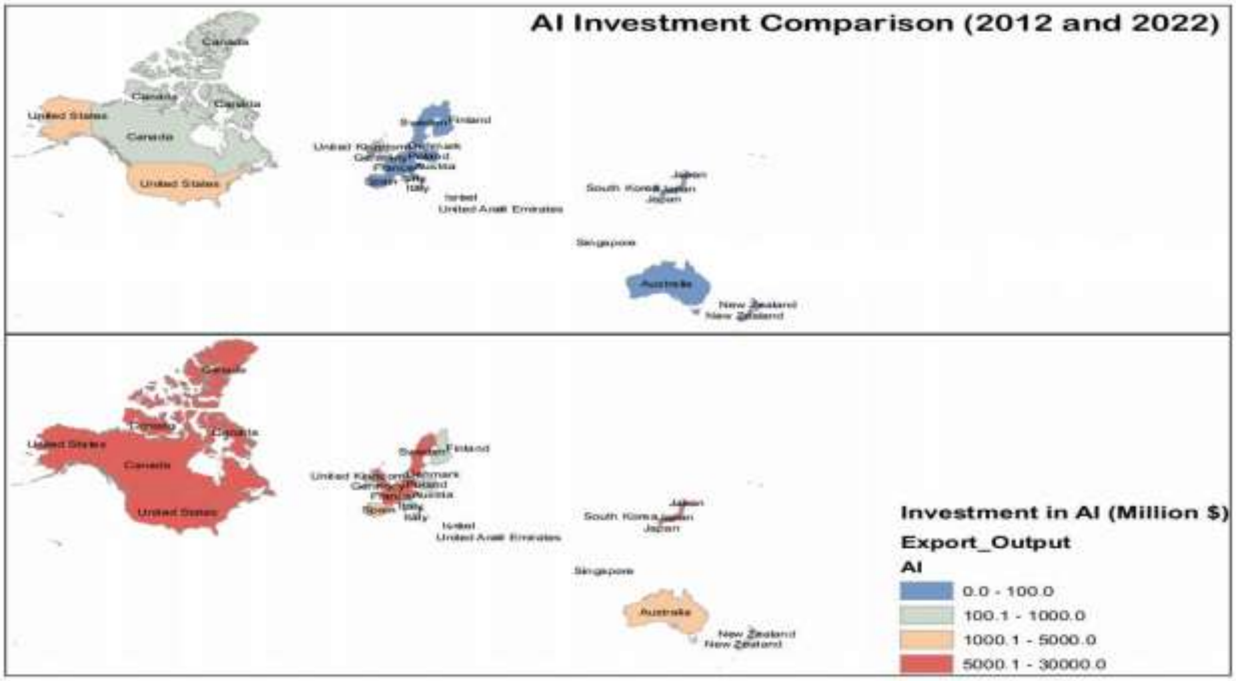
Variables	LEB	LEB (-1)	GDPK	INAI	OPHE	GOE	IUI
LEB	1.000						
LEB(-1)	0.967	1.000					
GDPK	0.238	0.237	1.000				
INAI	-0.387	-0.370	0.102	1.000			
OPHE	0.143	0.116	-0.320	-0.167	1.000		
GOE	0.305	0.292	0.570	-0.045	-0.215	1.000	
IUI	0.139	0.146	0.485	0.081	-0.389	0.509	1.000

Comparison of AI Investment (2012 and 2022)

In Figure 2, we have visualized a comparative investment across the selected OECD high-income countries for year 2012 and 2022. These maps highlight the trends and geographical variations in AI investment. In 2012, United States, Canada, the United Kingdom, and Israel emerged as a dominant investor in AI. These countries have invested more than 100 million as represented by the gray and orange colors. While the remaining countries invested less than 100 million in 2012 as represented by the blue color. These countries also recognize the importance of AI but have not invested as much as the leading countries have invested.

After a decade, this investment trend remained the same for leading countries like the United States, Canada, and, the United Kingdom. These countries have sustained their investment in AI reflecting a long-term investment with a strong commitment to AI development and deployment. Due to this commitment, these countries became the leading forces in AI technologies. Some countries that were low in investment in 2012, invest more than 5000 million dollars in AI development and deployment. These emerging leaders are Japan, Sweden, Denmark, Poland, Germany, and France as indicated by the red color. Two countries Spain and Australia jumped into the range of more than 1000-million-dollar investment represented by the orange color. Surprisingly, in year 2022 no individual countries are there in the range of 100 million dollars in investment reflecting the importance of AI. The remaining countries are in the range of 100 to 1000 million dollars in investment.

Figure 2: Comparison of AI Investment (2012 and 2022)



Source: Authors' elaboration

Pre-Estimation Diagnostic Tests

Durbin Wu-Hausman Test for Endogeneity

This study employed the Durbin & Wu-Hausman test to examine the endogeneity issue. There is an endogeneity issue with one variable, the lag of the dependent variable i-e LEB (-1). The probability values of the Durbin Wu-Hausman test indicate that our independent variables GDPK, INAI, OPHE, GII & NAI do not exhibit endogeneity issues. Using the probability values from the Durbin and Wu-Hausman tests, it is possible to reject the null hypothesis for the dependent variable's lag. This suggests that the lag dependent variable is the only reason for the endogeneity issue in our model.

Table 5: Durbin Wu-Hausman Test For Endogeneity

Variable	Durbin test (Probability)	Wu-Hausman test (Probability)
lag dependent variable	0.0000	0.0000
GDPK	0.8121	0.8156
INAI	0.6306	0.6104
OPHE	0.3820	0.3908
GII	0.8813	0.8835
NAI	0.6647	0.6766

Arellano and Bond Autocorrelation Test

The serial autocorrelation of the first order and second order is examined by using the Arellano and Bond test of AR (1) and AR (2), which is applied to the differenced residuals. The probability value of AR (1) is 0.001, which is less than 0.05 and supports the null hypothesis that the errors term is first-order correlated at the 5 percent significance level but not at the 1 percent level. Since

AR (2) has a probability value of 0.120, which is higher than 0.05, the absence of second-order serial correlation in the residuals is confirmed.

Table 6: Arellano and Bond Autocorrelation Test

	Probability value
AR (1)	0.001
AR (2)	0.120

Hansen Test of Overidentification

Roodman (2009) provides a comprehensive discussion on the diagnostics for GMM estimation, particularly focusing on the potential issues arising from overidentification test like the Hansen test. A high p-value of 0.832 in the Hansen test, indicating failure to reject the null hypothesis, suggests that the instruments are valid and not correlated with the error term. David Roodman highlights that the Hansen test is robust to heteroskedasticity and more reliable. Therefore, we conclude that the instruments in our GMM model are valid.

Table 7: Hensen Test of overidentification

Value	Probability
Hansen test	0.832

GMM Results

GMM results shows us the relationship between Life expectancy at birth and GDP per Capita, Out of Pocket Health Expenditures, Investment in AI, combine effect of Government Effectiveness, Investment in AI, and Individuals Using Internet and the combine effect of Investment in AI and Individual Using Internet.

From the table 8 we can conclude that for OECD nations, GDP per capita has a positive, but not statistically significant impact on life expectancy at birth. This may indicate that, in comparison to lower-income nations, the marginal increases in life expectancy from economic expansion are less significant inside OECD nations, which typically have high GDP per capita. The amount spent on medical expenses out of pocket is positively correlated but not statistically significant. This shows that while people are spending more money on healthcare, higher out-of-pocket costs may be linked to improved health outcomes. The absence of statistical significance, however, suggests that this association is not robust or constant throughout OECD nations. Essential medical care is provided by general health coverage or public insurance in many OECD nations. Elective procedures, non-essential treatments, or co-payments are frequently associated with out-of-pocket expenses. Compared to primary and emergency healthcare services, which are usually sponsored by the government, these may have less of an impact on life expectancy overall, even though they can improve quality of life.

Table 8: GMM Results

LEB	Coefficient	S.E	t-value	p-value
LEB (-1)	0.7897739	0.080665	9.79	0.000
GDPK	6.58e-06	4.44e-06	1.48	0.138
OPHE	0.0142748	0.010494	1.36	0.174
INAI	-0.0001545	0.0000197	-7.86	0.000
GII	4.12e-07	1.16e-07	3.54	0.000
NAI	1.07e-06	1.40e-07	7.66	0.000
Constant	16.74353	6.563298	2.55	0.011
Mean dependent variable	81.722	**SD dependent variable**	1.624	
Number of obs	250	**Chi-square**	6548175.146	
****** p<.01, ** p<.05, * p<.1***				

Life expectancy is negatively impacted by AI investment in a statistically meaningful way. It may sound strange, but this could reflect transitory costs or a misallocation of resources in the early stages of implementing AI. It might also mean that, in the context of OECD nations, life expectancy gains from AI investments take time to materialize. The interaction term indicates that life expectancy is greatly increased when government effectiveness, AI investment, and internet usage are combined. It is positive and highly significant. This suggests that strong governance can enhance the positive effects of AI investments and extensive internet usage on health outcomes in OECD nations. The combination of AI investment and internet usage has a positive and highly significant effect on life expectancy. This emphasizes how critical it is for the health sector to promote digital inclusion and technological innovation in health sector.

Discussion

From high-income nations, our results point to an interesting relationship between technology innovation and economic variables that affect life expectancy at birth. Financial resources alone may not ensure improved health outcomes, as suggested by the negligible impact they have on life expectancy. However, the strong correlation between GDP per capita and out-of-pocket health expenditures reveals a baseline level of financial capacity for healthcare access.

The negative correlation between life expectancy and AI investment is an important deviation from conventional wisdom. This could be due to potential disruptions caused by the use of AI in healthcare systems, like job displacement or moral dilemmas with algorithmic decision-making (Topol, 2019). The positive and significant interactions between internet usage, government effectiveness, and AI investment, however, demonstrate that the combination of good governance, technological advancement, and digital connectivity has important implications for public health. The main reason for the early negative relationship of AI investment alone may be the challenges of adopting new technology in the absence of adequate legislative frameworks, high-speed internet connectivity, or data privacy regulations. Our research indicates that AI on its own has a limited impact on health, but when paired with internet accessibility and strong government performance, it can yield positive results. As technological advancements continue and Without adequate support systems, AI may lead to inefficiencies or even adverse outcomes. However, when integrated with robust internet infrastructure and effective governance, AI becomes a powerful tool for enhancing health services and outcomes. This highlights the importance of adopting a comprehensive approach to AI implementation one that includes technological support and regulatory oversight to fully unlock its benefits legal frameworks evolve, we can expect increasingly significant and beneficial returns from AI investments in the healthcare sector. This study emphasizes that, in order to fully realize AI's promise for enhancing public health outcomes, a comprehensive approach to its application is required.

The relationships that are positive between interaction terms highlight the significance of complete approaches to healthcare, in which internet use and artificial intelligence (AI) complement rather than replace conventional methods of providing treatment. This is similar to the idea of "digital health ecosystems," in which linked technology enhance human capacity to provide effective and individualized healthcare services (Stephanie & Sharma, 2020). Our findings suggest that the OECD nations that most closely match the results we obtained are those with strong government performance, significant investments in artificial intelligence, and high internet penetration rates, along with increases in life expectancy at birth. In terms of technical innovation and government efficacy, nations like Norway, Sweden, Denmark, and Finland frequently score highly, which may have a good impact on health outcomes. The people of these nations also have high rates of internet usage and digital literacy, which increases the potential advantages of integrating AI into public health and healthcare programs.

Conclusion

This study explores the unique role of technological factors, specifically artificial intelligence (AI), in this scenario, while also looking into the determinants of health status using life expectancy at birth as a proxy of health status. Life expectancy, which measures health, is a key metric for assessing the general well-being and socioeconomic development of a society. Health improvements have historically been attributed to variables like GDP per capita and out-of-pocket medical expenses. The current research introduced artificial intelligence (AI) into the model and the related interaction terms. The OECD Policy Observatory and the World Development Indicators (WDI) are two of our main sources of data. The Generalized Method of Moments (GMM) is used for empirical analysis.

The findings demonstrate that, although positively correlated with health status, GDP per capita and out-of-pocket medical expenses had no statistically significant effect. This implies that major improvements in health outcomes might not be achieved by merely raising financial resources or per-person health spending and also because the countries of analysis are advanced economies and their GDP and out of pocket expenditures have achieved certain high levels. However, a negative and substantial correlation is shown between an investment in AI and their health status. This detrimental effect is in line with the body of research that highlights the possible dangers and difficulties of implementing AI in its early stages. AI has a very favorable influence on health status when it is combined with extensive internet use, good government policy, and both. This suggests that an environment with strong governance and a strong technology infrastructure maximizes the potential benefits of AI. According to the positive interaction effect, internet use and sensible government regulations can increase the positive effects of artificial intelligence (AI) by reducing its initial negative effects and promoting its beneficial contributions to health outcomes.

Furthermore, the comparatively small coefficients in our findings suggest that the impact of AI is still developing. This shows that although AI hasn't yet yielded significant returns, as the technology develops and integrates more with auxiliary systems, its benefits are starting to show. Future studies should keep an eye on how AI affects health in the long run and look at other variables that might affect how effective it is. This study shows that a mix of conventional economic considerations and innovative technical inputs may significantly enhance health status, as assessed by life expectancy at birth. The future of public health appears to be greatly enhanced by the successful integration of AI, supported by strong governance and technology infrastructure. The research adds significantly to the understanding of how new technologies may be used to enhance health outcomes by highlighting the need of implementing AI with a comprehensive and well-regulated strategy. Researchers and policymakers can more effectively utilize AI's potential to make significant advancements in global health by pursuing the exploration and enhancement of these links.

Policy Recommendations

The current study highlights the importance of policies promoting digital inclusion and innovation in the health sector. Digital adaptation, investment in AI and enhancement in use of internet will ultimately lengthen life expectancy. Digital literacy is the need of today's modern world and every individual should equip him/herself of digital education and its use for health improvement. Those who are digitally literate can effectively use telemedicine services to get essential health information and to take preventive action for health care. Main goal of policy makers and government should be to encourage an atmosphere for the promotion and implementation of use of AI in health sector. The significant improvements in government effectiveness, internet usage and AI investment can bring improvements in life expectancy. So policy makers and government need to focus on this. They can play their role by providing financial aids to private sectors to adopt new technologies to boost the confidence of public in digital health solutions, to focus on privacy and data security and to adopt regulatory frameworks to promote digital innovation. Accountability, transparency and governance in health spending can improve the efficiency of government in the use of technology can directly leads to improved health and lengthen life expectancy.

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