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Comparison of Sustainability Concepts in China and the Czech Republic – Analysis of Determinants of Life Expectancy at Birth

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Comparison of Sustainability Concepts in China and the Czech Republic – Analysis of Determinants of Life Expectancy at Birth

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Objectives of thesis

The first objective of this dissertation is to determine and evaluate the sustainable development in China and the Czech Republic concerning environmental dimension, economic decision, social dimension. The author will compare the relevant indicators between these two countries to find out the strengths and weaknesses with respect to their performance.

Aa a significant synthetic indicator to assess the economic and social development in a nation or a region (Bilas, et al., 2014), it is vital to learn about what factor determines the life expectancy so that such improvements can be made. The second objective of this dissertation is to explore the determinants of life expectancy, both in China and the Czech Republic. Selected tested variables in four dimensions (environment, economic, social and technology) namely, CO2 emission, population using at least basic drinking services, GDP per capita, health expenditure per capita, unemployment rate, crude divorce rate, physicians, education attained and life expectancy at birth, have been examined in China and the Czech Republic in the period from 2000 to 2017. The data collected from the original public databases are analyzed by applying the regression analysis method.

The research will deal with the following questions:
• How is the current sustainable development in China and the Czech Republic?
• What are the variances concerning sustainable development between China and the Czech Republic?
• What are the relationships between life expectancy and its determinants in China and the Czech Republic?

Methodology

This thesis consists of two main parts: the theoretical part and the practical part. The first part is done through a literature review that is done based on several relevant works of literature, which include the concept of sustainability, sustainable development in China and the Czech Republic, determinants of life expectancy. Synthesis, extraction, and deduction are used during the literature review.

After gaining the theoretical knowledge of the selected topic, the practical part will be done in two main parts – The first part is done by a comparison of sustainable development in China and the Czech Republic. The second part is done through regression analysis. The data for analysis is collected from its original online databases of a given organization, such as the China Statistic Bureau, the World Bank Data, Eurostat. OLS regression analysis is used to examine the relationships between independent variables by life expectancy and the other nine dependent variables mentioned in the previous paragraph. The dataset covers 18 years from 2000 to 2017.

The proposed extent of the thesis

60 pages

Keywords

Sustainability, Sustainable development, Life expectancy at birth, China, Czech Republic

Recommended information sources

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Declaration

I declare that I have worked on my diploma thesis titled "Comparison of Sustainability Concepts in China and the Czech Republic – Analysis of Determinants of Life Expectancy at Birth" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the diploma thesis, I declare that the thesis does not break copyrights of any their person.

In Prague on 3.4.2020

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Comparison of Sustainability Concepts in China and the Czech Republic – Analysis of Determinants of Life Expectancy at Birth

Abstract

We are living in a globalized world, where all countries are collaborating from economics to human development. The relationship between China and the Czech Republic in recent years has entered the best period in history, which makes them a greater impact role on another one. Therefore, it is important to understand sustainable development in each of the two countries so that further partnerships could be made. The dissertation, first of all, compares the sustainable development in China and the Czech Republic. Several indicators namely SGD index score, CO_2 emission per capita, GDP growth, GDP per capita, the export of goods and service (% of GDP), unemployment rate, Aging Index, dependency ratio and life expectancy are compared, and further informative discussions are provided.

This study also explores the relationship between life expectancy and its determinants using OLS regression analysis in time-series data from 2000 – 2017 of China and the Czech Republic. To avoid spurious regression, the first difference method is used to make the time series stationary. The results reveal a significant negative correlation between the unemployment rate and life expectancy in both China and the Czech Republic. It also finds out GDP per capita has a significant positive impact on life expectancy, but the marginal effect is very small in both countries. CO2 emission per capita is found a significant negative relationship in the Czech Republic, but insignificant negative in China. A stronger correlation between health expenditure per capita is found in the upper-middle-income country, China, but not in the high-income country, the Czech Republic. However, physician density does influence the Czech Republic. Other variables, including basic drinking service and crude divorce rate, are also examined in the paper.

Keywords: Sustainability, Sustainable development, SGDs, Life expectancy, China, Czech Republic

Porovnání konceptů udržitelnosti mezi Čínou a Českou republikou – analýza determinantů střední délky života Střední od narození

Abstrakt

Žijeme v globalizovaném světě, kde všechny země spolupracují od ekonomiky až k lidskému rozvoji. Vztah mezi Čínou a Českou republikou je v posledních letech v tom nejlepšího období v historii, díky kterému se navzájem významněji podporují. Proto je důležité porozumět udržitelnému rozvoji v každé z těchto dvou zemí, aby bylo možné navázat partnerství. Diplomová práce nejprve porovnává udržitelný rozvoj v Číně a České republice. Porovnáno je několik ukazatelů, konkrétně index SGD, emise CO_2 na obyvatele, růst HDP, HDP na obyvatele, vývoz zboží a služeb (% HDP), míra nezaměstnanosti, index stárnutí, poměr závislosti a délky života, a jsou poskytnuty další informativní diskuse k tématu.

Tato studie také zkoumá vztah mezi střední délkou života a jeho určujícími faktory pomocí regresní analýzy OLS v datech časových řad z Číny a České republiky v letech 2000 - 2017. Aby se zabránilo falešné regresi, používá se metoda prvního řádu k stabilizaci časové řady. Výsledky ukazují na významnou negativní korelaci mezi mírou nezaměstnanosti a střední délkou života v Číně i České republice. Je také zjištěno, že HDP na obyvatele má významný pozitivní dopad na střední délku života, ale mezní účinek je v obou zemích velmi malý. Emise CO_2 na obyvatele jsou v České republice považovány za významný negativní vztah, ale v Číně nevýznamné. Silnější korelace mezi výdaji na zdravotnictví v přepočtu na obyvatele se nachází v zemi s vyššími středními příjmy v Číně, ale nikoli v zemi s vysokými příjmy jako je Česká republika. Avšak hustota lékařů ovlivňuje situaci v České republice. V diplomové práci jsou také zkoumány další proměnné jako například základní konzumace alkoholu a míra rozvodovosti.

Klíčová slova: Udržitelnost, udržitelný rozvoj, SDGs, střední délka života, Čína, Česká republika

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List of abbreviations

CIEL	Center for International Environmental Law
DSDG	Division for Sustainable Development Goals
EC	Economic Organization
EI	Education Index
EPI	Environmental Performance Index
EU	European Union
GDP	Gross Domestic Product
GHGs	Greenhouse Gases
GII	Gender Inequality Human Development Index
GNI	Gross National Income
HDI	Human Development Index
HDR	Human Development Report
IHDI	Inequality-adjusted Human Development Index
IHME	Health Metrics and Evaluation
II	Income Index
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for the Conservation of Natural Resources
KPSS	Kwiatowski-Phillips-Schmidt-Shin
LEI	Life Expectancy Index
MDG	Millennium Development Goals
MPI	Multidimensional Poverty Human Development Index
OLS	Ordinary least squares
SDSN	Sustainable Development Solutions Network
SGDs	Sustainable Development Goals
UN	United Nations
UNDP	United Nations Development Program
UNESCO	Food and Agriculture Organization, and the United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
WCED	World Commission on Environment Development

WITS	World Integrated Trade Solution
WSSD	World Summit on Sustainable Development
WWF	World Wildlife Fund

1 Introduction

The aim of this dissertation is, first of all, to compare the concepts of sustainability and sustainable development in China and the Czech Republic, and secondly to explore the relationship between life expectancy which is a critical factor to assess the economic and social development (Shaw, et al., 2005) with its determinants. This research is based on two notions: the significance of sustainable development to a nation, and the importance of improving the health conditions of its populations (Bilas, et al., 2014).

In September 2015, the United Nations General Assembly adopted a new development agenda: *Transforming our world: the 2030 agenda for sustainable development* (2030 Agenda), which is an action plan for people, planet, and prosperity. It consists of 17 Sustainability Development Goals (SDG) with 169 associated targets, covering and balancing all three pillars of Sustainability *concept* – the environment, economic and social. The 17 Goals are to address the challenges we as human-being are facing now, including the problems related to poverty, equality, justice, climate change, and so on with a 15-year plan. All United Nations (UN) members adopted the 17 Goals in 2015, including China and the Czech Republic. Sustainability or sustainable development is not a new subject, and it has a long history for decades. After this concept entering a global stage in 1992 – The Earth Summit, sustainable development has been adopted by many countries as their development guideline. Build on the principle of "leaving no one behind," the 2030 Agenda emphasizes the historical approach that everyone can achieve sustainable development. In the second analysis part, this paper focuses on the SDG3, which is to ensure health lived and promote well-being for all at ages, examining the determinants of life expectancy at birth, ntending to inform for future policymaking.

The 21st century has witnessed significant progress in living standard with a vast number of people around the world escape from hunger, disease and poverty. Global life expectancy at birth (life expectancy through the paper) in 1800 was about 30 years while it increased to 67 and 75 in rich countries in 2000 (Tracey & Anne, 2008). However, the difference in life expectancy between low and very high human development countries is still 19 years (Conceição, 2019). The level of life expectancy has essential significance for individual and human behavior (Shaw, et al., 2005). It has many impacts on fertility behavior, economic growth, human capital investment, intergenerational transfers and incentives for pension benefit claims.

There is no consensus in the literature showing the most critical factors that cause the improvement of health care (Taşkaya & Demirkiran, 2016) . However, the different variables can be grouped into the following dimensions: environmental, economic, social, and health-related issues (Sufian, 2013) The life expectancy and quality will not be improved solely with economic growth. For example, GDP still increases even when we are arguing with friends or family. Therefore, other determinants, such as safe water, education, employment, lifestyle should also be taken into consideration when talking about the topic.

As the ageing trends became a global issue, it can be expected that in the future, the active workforce will not be as enough as now (Bilas, et al., 2014). According to the recent UN report, *World Populations Prospects 2019* (UN, 2019), there is a 9% population over 65 years old, and by 2050, this number will be almost twice, reaching 16%. The proportion of the working-age population is falling around the world comparing to those over 65 years old. Therefore, one of the primary goals of every country's government is to improve life expectancy (Bilas, et al., 2014). In light of the World Bank Data, the population of 65 and above in China and the Czech Republic 10.92% and 19.42% in 2018, which ranks 11 and 19 respectively in the world (WorldBank, 2020).

We are living in a globalized world, where all countries are collaborating to build a community of destiny and becoming increasingly beyond the physical border, from economics to human development. In recent years, the relationships and cooperation between China and Central and Eastern European countries have been increasingly close. As a leader of the development of bilateral relations between China and Central and Eastern European countries, after a series of bilateral events, the Czech Republic has formed a "strategic partner" relationship with China in 2016. Afterward, there have been frequent senior leader 'visits, increasing economic and trade exchanges, and rapid development of cultural exchanges. It can be said that the relations between these two countries have entered the best period in history (赵倩楠, 2019). Therefore, the development of the two countries will have a more significant impact on another than ever before. It is important to understand sustainable development in each of the nations so that further partnerships could be made. However, due to the historical factors, different social systems, and ideology, there have been existing stereotypes between the two nations towards environment development, economic development, human development, and the balance among them. This fact was confirmed to some extent by the author's inter-cultural experience living in China and the

Czech Republic. Hence, one of the purposes of studying and compare these two countries in the present paper is to illustrate the facts based on real data. Accordingly, to guide the readers to understand China and the Czech Republic objectively and eliminate some misunderstandings.

Moreover, extensive reports and literature reviews revealed the importance of sustainable development for a nation. As one of the factors, life expectancy plays a significant role in reflecting people's health, which has been studied by many researchers. However, there is no consensus in the literature showing the most critical factors, and the difference between developed and developing countries exist (Taşkaya & Demirkiran, 2016). As comparing the developing country China and the developed country in the Czech Republic, the paper will also address the literature gap regarding the topic of life expectancy. Therefore, the reasons for undertaking this study can be summarized as the importance of sustainable development for nations, the greater interaction between China and the Czech Republic, personal interest, and addressing the literature gap.

This dissertation is divided into six chapters: Introduction, objectives and methodology, theoretical part, practical part, results and discussion, and conclusion. Chapter 2 introduces the main and partial objectives, and methodology used in this paper. Chapter 3 provides an overview of the context of sustainability, including its definition, history, dimensions, measurements, and relevant literature of life expectancy. Chapter 4 consists of two parts, which the first part compares several indicators reflecting sustainable development in China and the Czech Republic, and the second part examines the relationship of life expectancy in both countries. Chapter 5 reveals the findings and provides a series of discussions based on the results pointed out. Chapter 6 summarizes the paper and provides a conclusion of this dissertation.

2 Objectives and Methodology

2.1 Objectives

The first objective of this dissertation is to determine and evaluate the sustainable development in China and the Czech Republic concerning environmental dimension, economic decision, social dimension. The author will compare the relevant indicators between these two countries to find out the strengths and weaknesses with respect to their performance.

Aa a significant synthetic indicator to assess the economic and social development in a nation or a region (Bilas, et al., 2014), it is vital to learn about what factor determines the life expectancy so that such improvements can be made. The second objective of this dissertation is to explore the determinants of life expectancy, both in China and the Czech Republic. Selected tested variables in four dimensions (environment, economic, social and technology) namely, CO_2 emission, population using at least basic drinking services, GDP per capita, health expenditure per capita, unemployment rate, crude divorce rate, physicians, education attained and life expectancy at birth, have been examined in China and the Czech Republic in the period from 2000 to 2017. The data collected from the original public databases are analyzed by applying the regression analysis method.

The research will deal with the following questions:

- How is the current sustainable development in China and the Czech Republic?
- What are the variances concerning the sustainable development between China and the Czech Republic?
- What are the relationships between life expectancy and its determinants in China and the Czech Republic?

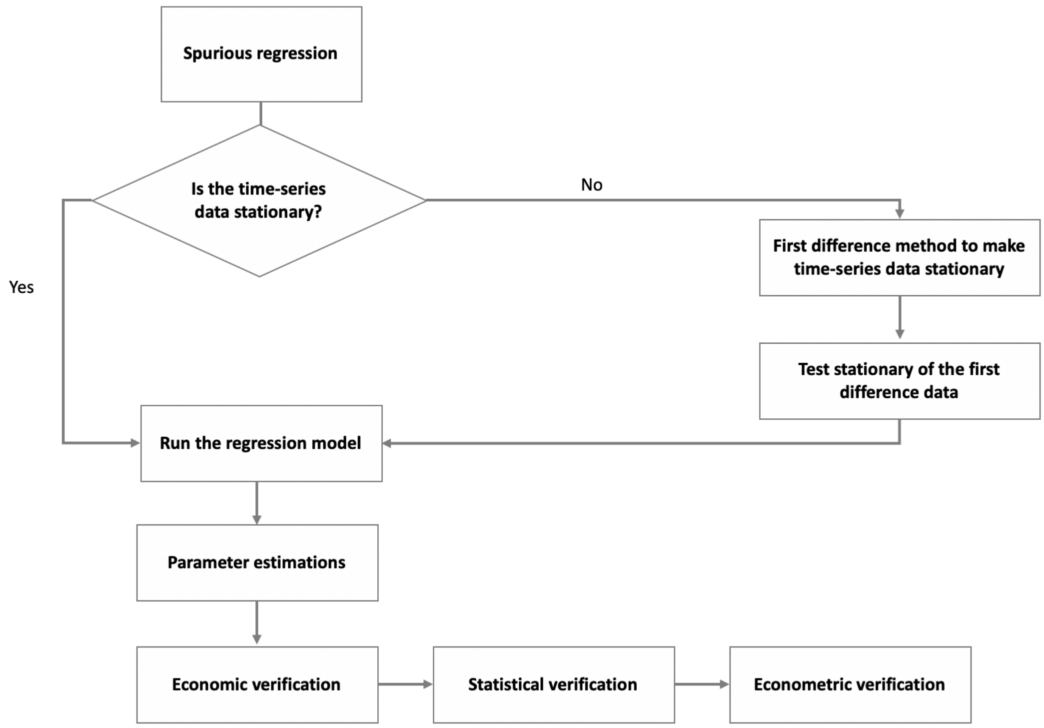
2.2 Methodology

This thesis consists of two main parts: the theoretical part and the practical part. The first part is done through a literature review that is done based on several relevant works of literature, which include the concept of sustainability, sustainable development in China and the Czech Republic, determinants of life expectancy. Synthesis, extraction, and deduction are used during the literature review.

After gaining the theoretical knowledge of the selected topic, the practical part will be done in two main parts – The first part is done by a comparison of sustainable development in China and the Czech Republic. The second part is done through regression analysis. The data for analysis is collected from its original online databases of a given organization, such as the China Statistic Bureau, the World Bank Data, Eurostat.

Ordinary least squares (OLS) regression analysis is used to examine the relationships between independent variables by life expectancy and the other eight dependent variables. The dataset covers 18 years from 2000 to 2017. OLS regression analysis is a type of linear least squares method, which is used to estimate the unknow parameters in a linear model. It is a powerful statistical method that can examine the relationships between two or more variables. A well-known issue connected with linear time-series model is so-called spurious regression, which the non-stationary data has the possibility to result in a spurious regression. To avoid this problem, the data collected will be differenced to be stationary. Figure 1 shows the scheme of methodology used in the present paper.

Figure 1 The methodology scheme



Source: Own computation

In terms of testing stationarity of time-series data, several techniques (Baumohl & Lyocsa, 2009) can be summarized in Table 1. Since the mixed results from different tests would bring more complexity and the main purpose of this dissertation is not about studying the methodology, it is up to author's choice to use and believe which test. In the present paper, KPSS test is used in Gretl.

Table 1 Overview of stationarity tests

Name	**Description**
Sargan – Bhargava (1983)	Based on Durbin – Waston statistic.
Dickey – Bell – Miller (1986)	Seasonal unit roots.
Dickey – Pantula (1987)	More than one-unit root is suspected.
Phillips – Perron (1988)	No IID assumption on disturbances and it allows autocorrelated residuals.
Perron (1989)	Structural change; known break point.
Hylleberg et al. (1990)	Cyclical movements at different frequencies.
Kwiatowski et al. (1992) [KPSS test]	Near unit root time series. It has higher power than ADF; transposition of the null hypothesis.
Zivot – Andrews (1992)	Structural change; break estimated at unknown point.
Elliott – Rothenberg – Stock (1996)	Higher power than ADF.

Source: Own computation, Baumohl, 2009

3 Theoretical Part

3.1 Definition of Sustainability

As for the concept of "Sustainability," meaning the ability to exit continuously, the definition is not as simple as it might seem. Therefore, it best illustrates the fact that there are over 200 different definitions (CircularEcology, 2019). Pirages (1977) pointed out in his research that sustainable growth represents economic growth that is supported by the social and physical environment. Goodland and Ledec (1987) described sustainable development as the transformation of economics that optimizes the economic and social benefit gained currently without compromising the future's development. Therefore, sustainable development can be explained as the process of economic development, helping to broaden human possibilities (Petkevičiūtė & Svirskaitė, 2001). The concept provided by Rradermacher (1999) was probably one of the broadest, suggesting that the definition of sustainability should take into consideration the following elements: globalization, a long-term period, external effects, environmental policy, and the approach from the cradle to the grave.

A general definition was provided by Pearce, et al. (1989) : establishing the social and economic systems to ensure support for the following goals: increase the real income and the improvement of education population's health and in the general quality of life. IUCN, UNEP, and WWF (1991) clarified that sustainable development, sustainable consumption and sustainable growth were used as equivalent concepts, which, however, are not the same in reality. The term sustainable growth is inherently contradictory that there is no physical unit can grow endlessly. Acknowledged by the representatives from these organizations, the term sustainable consumption should be used only in renewable resources.

The concept of sustainability can also be considered as an ethical ideal and normative ethical principle for future development. It means it not only speaks about the way it is but also how it should be, which projects the needs for criticism of lasting human relationships and action algorithms (Parker, 1993). According to HMSO (DoE, 1994b), majority of communities strive for economic growth to ensure a better living standard, as well as to protect the improve the environment for the present and future generations – sustainable development tries to combine these two tasks.

Considering the fact that there is no single definition of sustainability or sustainable development which can incorporate all concepts above-mentioned, it is thought appropriate to use the definition from *Our Common Future*, also know as *Brundtland Report*, which sustainability is defined as "meets the needs of the present without compromising the ability of future generation to meet their need." (Commision, 1987). This definition provides a broad understanding of this somewhat abstract concept. This definition is the most frequently cited one by many scholars and researchers, which is a fair distribution of natural resources among present and future generations, finding a consensus between the environmental, economic and social dimensions of the environment (Ciegis, et al., 2009, p. 30).

This concept is different from environmental protection or preservation of natural resources, even though it focused on the use and consumption of natural resources. Comparing with the traditional environment protection, sustainability is about proactive actions and long-term process, rather than dealing with a specific environment issue (Kent E. Portnet, 2015, p.4).

In the *Brundtland Report*, it said that "*Sustainable development is not a fixed state of harmony, but rather a process of change in which the exploitation of resources, the direction of investment, the orientation of technological development, and intuitional change are made consistent with future as well as present needs* (Commision, 1987). It should be noted that there is a specific turn-point from the previous dominating attitude "growth or environment" to a "growth and environment." This idea emphasizes not only quantity but also the quality of economic growth, which does not necessarily mean the degradation of the environment (Ciegis, et al., 2009).

Although some scholars have argued that the definition from the UN Commission seems to be controversial (Lélé, 1991) that it is always challenging to predict and determine what the needs of next generations are, which may differ from the needs of people today (Taylor, 2002), and the needs are different from developed countries and developing countries as well (Taylor, 2002). Nevertheless, most still believe that it is the most suitable and acceptable definition concerning its full practical applications (Dale, 2007). Although the definition from the UN has raised some disagreements, it is still clear revealed that the problem of environmental degradation is caused by economic growth, whose goal is to reduce poverty in society.

3.2 History of Sustainable Development

The history of Sustainability is a lesser extent about the emergence of a few new ideas but rather about new connections and realignments that have been established for a very long time. Sustainability is not a new subject in economic content (Kutay & Tektufekci, 2016). In 1972, the United Nations Conference on the Human Environment held in Stockholm was the first prominent international meeting that developed the first concept of sustainable development, which was called "ecological development" at the time.

In 1980, the International Union for the Conservation of Natural Resources (IUCN) introduced the term "sustainability" as an international issue with the report *The World Conservation Strategy,* in collaboration with the United Nations Environment Programmer and the World Wildlife Fund (WWF), the Food and Agriculture Organization, and the United Nations Educational, Scientific and Cultural Organization (UNESCO). Since that date, the term started to be used more frequently, and its environment, economic and social dimensions were debated as well as its importance in the search for a new form of development (Siche, et al., 2008).

The World Conservation Strategy, it defined conservation as "the management of human use of the biosphere so that it may yield the greatest sustainable benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations." (IUCN, U., 1980).

This concept was deeply discussed and popularized in the report *Our Common Future,* also named as the Brundtland Report, published by the World Commission on Environment Development (WCED) in 1987. In this report, it concludes that it is necessary to make a big change in the concept and approach of human development as all the ecological systems of the planet are suffering severe and irreversible damage (Siche, et al., 2008).

But sustainable development finally went to the global stage in June 1992. The *Rio Earth Summit* was held in Rio de Janeiro, and one significant agreement called *Agenda 21* was signed, which depicts the Sustainable Development move in the 21st century (Tracey & Anne, 2008). The definition of sustainable was extended in Agenda 21 on United Nations Conference on Environment and Development, which the declaration described sustainable development as*, "long-term continuous development of the society, which to satisfy the human's need at present and in the future via rational usage and replenishment of natural* *recourses, preserving the Earth for future generations*" (UNSD, 1992). Agenda 21 was the most significant achievement of the Earth Summit, which provided clear guidelines for policymakers on how to achieve sustainable development in the next century.

Another effort on global collaboration towards sustainable development was the international agreement named Kyoto Protocol which linked to the United Nations Framework Convention on Climate Change (UNFCCC). It is by setting a binding target on industrialized countries and the European communities to reduce their emissions of 6 greenhouse gases in order to prevent global warming. The main difference between the United Nations Framework Convention on Climate Change and Kyoto Protocol is that the former encourages industrialized countries to stabilize greenhouse gas emissions, but the latter commits them to do so.

The Kyoto Protocol was firstly adopted in December 1997, Tokyo, Japan but became valid in developed countries in 2005, in which three groups of parties are clarified: Annex I countries (industrialized countries), Annex II countries (developed countries) and developing countries. It requires industrialized countries to reduce their greenhouse to an average of five per cent against 1990 levels over the five years 2008 – 2012. Until May 2013, there are 191 countries and one regional economic organization (EC) have ratified the agreement. One of the ratifying countries – Canada withdrew the protocol in 2011.

In 2000, at UN headquarter in New York, The Millennium Development Goals (MDG) with a greater focus on developing countries and their poverty reduction targets were adopted. Two years later, in 2002, the World Summit on Sustainable Development (WSSD) was held in Johannesburg, South Africa. The Summit evaluated the progress and results achieved since the Earth Summit in 1992. The general discussion focused on health, biodiversity, ecosystems, agriculture, water, sanitation and energy.

A follow-up on the Kyoto Protocol was the Copenhagen Conference held in Denmark in December 2009. The meeting has been hailed as "the last chance to save humanity" as if the Copenhagen Protocol cannot be agreed and adopted, there will be no global document to restrict greenhouse gases emissions after the first commitment of Kyoto Protocol expires in 2012, which would cause a significant setback in human actions to curb global warming. However, the Summit failed to introduce a legally international binding agreement, remaining to people much confusion.

In 2012, The Rio+20 United Nations Summit on Sustainable Development took place in Rio de Janeiro, Brazil, in which the Member States examined the progress that has been made in the field of sustainable development over the last 20 years. A process to develop a set of Sustainable Development Goals (SDGs) will build upon the MDGs was also decided at the conference.

Eventually, in September 2015, the United Nations General Assembly adopted a new development agenda: *Transforming our world: the 2030 agenda for sustainable development* which is a 5P theoretical framework of being people cantered - people, planet, prosperity, peace and partnership. The SDGs are designed to be more realistic Seventeen sustainable goals were 169 specific targets were adopted, which makes a new stage in global development. Nowadays, the Division for Sustainable Development Goals (DSDG) plays a significant role in the evaluation of UN implementation of the 2030 Agenda and provides substantive support and capacity-building for the SDGs and their thematic issues.

The 2030 Agenda for sustainable development sets out the blueprint and vision for future global development and emphasizes each party's commitment to making our world a place without poverty, hunger, fear and violence, where human rights and the rule of law can be fully respected. The seventeen objectives, which are the core content in the 2030 Agenda, are summarized as below:

(1) SDG 1: To end poverty.
(2) SDG 2: To eliminate hunger and achieve food security.
(3) SDG 3: Ensure good health and promote well-being.
(4) SDG 4: Balanced and quality education.
(5) SDG 5: Ensure gender equality and empower women and girls.
(6) SDG 6: Ensure access to safe water and sanitization.
(7) SDG 7: Ensure access to clean and affordable energy.
(8) SDG 8: Promote decent work and economic growth.
(9) SDG 9: Build a resilient infrastructure and encourage innovation.
(10) SDG 10: Close the gap among countries.
(11) SDG 11: Make cities and communities intelligent.
(12) SDG 12: Promote responsible production and consumption.
(13) SDG 13: Take urgent actions on climate change.
(14) SDG 14: Protect underwater organisms.

(15) SDG 15: Protect the terrestrial ecosystem.

(16) SDG 16: Promote peaceful and inclusive societies; provide access to justice.

(17) SDG 17: Strengthen the implementation and global partnership.

Image 1 The Sustainable Development Goals

Source: Sustainable Development Goals Knowledge Platform

3.3 Relevant Dimensions

It is widely accepted that sustainability has three dimensions or three pillars, which are environment, economy, and society. Ghosh (2008) provides the concept of sustainability with a geometric shape, which is a triangle encompassing the three areas mentioned above.

According to the report of the UN’ World Commission on Environment and Development, Brundtland Commission, Sustainability has three elements that all start with letter “E” (in English), which are environment, economic and equity (Commision, 1987). The term “triple bottom line” introduced by Elkington (1994) reveals that sustainable development must consider the social, economic and environmental dimensions altogether. As shown in Image 2, these three dimensions cannot be considered alone, and of course, the interaction of them should also be taken into account. The overall goal of sustainable development is the long-term stability of the economy and environment; it only can be achieved through the integration and acknowledgement of economic, environmental, and social concerns throughout the decision-making process.

Image 2 Dimensions of Sustainability

Source: Own computation

3.3.1 Environment dimension

The environment affects the economic activities and psychosomatic conditions of people. Therefore, the protection of environment and efforts on reducing its degradation is of importance.

(1) Climate Change

Greenhouses gases occur naturally and are essential to the survival of humans as well as millions of other living things. However, after more than a century, the quantities of greenhouse gases (GHGs) in the atmosphere has risen to a record level that not seen in three million years (UN, 2020). In 2007, the climate scientists of the IPCC had suggested that at least 90% probability that atmospheric increase in CO_2 was human-related, mostly as a result of fossil fuel consumption. Scientists have also recognized that anthropogenic climate change represents a powerful driver of environmental degradation around the world, impacting natural, economic and social in all countries (Wendling, et al., 2018, p. 128). According to Centre for International Environmental Law (CIEL) (2019), with the rapid expansion of the plastic and petrochemical industries, the climate impacts of plastic will accelerate dramatically in the coming decade, which threatens the global community to keep global temperature rise below 1.5 Celsius degrees.

(2) Air Pollution

The quality of the environment which people are living has a great impact on someone's health. Being exposed to airborne pollution is the fourth leading cause of premature death (World Bank, 2016, p. 22). According to a study by the World Bank and the Institute for Health Metrics and Evaluation (IHME), about 5.5 million people die prematurely from air pollution (World Bank, 2016, p. 22). That means it contributes nearly 9% death globally. Air pollution can also harm the environment in many ways such as acid rain, eutrophication, ground-level ozone and haze and then ends to human's health. Unfortunately, there has been an increase of air pollution around the world because of human activities.

(3) Clean and Safe Water

Increasing urbanization has polluted clean water supply, and many countries still do not have access to clean, safe water (Clarke & King, 2004, pp. 20-21). Access to clean water has an influence on human's health without any doubt. Contaminated water is linked to transmission of disease such as diarrhea, cholera, dysentery, typhoid and so on. Some 829,000 people (WHO, 2019) are estimated to die from diarrhea due to unsafe drinking water.

3.3.2 Economic dimension

Sustainable economics represents a broad interpretation of ecological economics where environmental and ecological variables and issues are essential but part of a multidimensional perspective. It is much broader than the concept of sustained yield of welfare or profit margins. Conway and Barbier (2013, p. 37) pointed out that sustainability of economy is the ability to maintain productivity, whether of a field of a farm or a country in general. According to Solow's researches (Solow, 1986), the economic sustainability expand theory on capital convertibility and Hicks-Lindahl concept of maximum income, which can be obtained through saving essential wealth resources for the benefits of future generations. In this part, several economic indicators are provided.

The economic dimension is determined by two components, which are *the size of an economy, the productive structure of an economy* (Kondyli, 2010, p. 349).

(1) The size of an economy

Growth domestic product (GDP) and its growth rate represents the basic indicators when measuring an economy's total production such as economic growth. GDP per capita[1], which represents the value of all goods and services produced by a country in one year divided by its population, measures a country's economic prosperity. It naturally better reflects an economy's efficiency rather than GDP in absolute number (Kondyli, 2010, p. 349).

Moreover, it must be noted that GDP growth is not welfare and cannot solely represent the quality of life. Other aspects of human life, such as health, education, social security, should also be taken into consideration.

(2) The productive structure of an economy

The structure of an economy has a long-term effect on the country's dynamics and determines its ability to adapt to the changing circumstances**,** which indicates the competitiveness of an economy (Wong, 2002). The export sector plays a vital role in the development of an economy due to its inflow of money can create many positive results. Masurel (2001) points out in his paper that exports can not only increase the sales and efficiency, but also improve the quality so that it results in a competitive advantage. Therefore, the performance of an economy's export is essential to evaluate its growth. The common indicator reflecting this performance is export of goods and service (% of GDP).

There has been a close correlation between economic growth and environmental degradation, which as communities grow, the environment declines. In 2011, the International Resources Panel warned that by 2050 the human race could be devouring 140 billion tons of minerals, ores, fossil fuels and biomass per year (Wikipedia, 2019).

3.3.3 Social dimension

(1) Poverty

It has been widely acknowledged that poverty is one of the sources of environmental degradation, for instance, by Brundtland Commission report Our Common Future, MDGs and SDGs. Individuals living in poverty rely heavily on their local ecosystem as a source for basic needs, such as medicine, nutrition and general well-being (Beckley, 2010). The 21st

[1] GDP per capita = GDP / total population

century has witnessed significant progress in living standard with a massive number of people around the world escape from hunger and poverty. The global extreme poverty rate fell from 36% in 1990 to 9% in 2018 (Conceição, 2019, p. 33). To date, about 600 million people live on less than $1.90 a day, which is considerable progress in the fight against poverty over the past decades (Conceição, 2019, p. 67).

(2) Structure of population

The structure of population in an economy consists of two components: age composition of the population and economically active population (Kondyli, 2010, p. 350). An aging population can result in lack of labor force which will limit the economic and social development in an economy. A decrease in working population has a negative impact on flexibility and productivity of a society which causes the unbalance between demand and supply of labor. This mismatch will ultimately lead to an increase in unemployment. Therefore, evaluating the structure of population in an economy is essential to better understand its development. Aging index[2] and dependency ratio[3] are proper indicators to reflect whether the economy is active and productive.

(3) Employment

The unemployment rate[4] represents the share of the population that does not have a job but is available and actively seeking employment (Sachs, et al., 2019, p. 53). It is an indicator that reflects the inability of an economy to generate employment for those people who are willing to work but are not doing so. It is not only important on the national level but also plays a vital role in an individual's life. There is enough evidence on the relationship between unemployment and people's health. For instance, unemployment causes social deprivation, anxiety and thus may lead to health-threatening behavior such as suicide. It should also be noted that the employment status can affect the health condition but at the same time, its selection into and out can be determined by one's health status (Bartley, 1994).

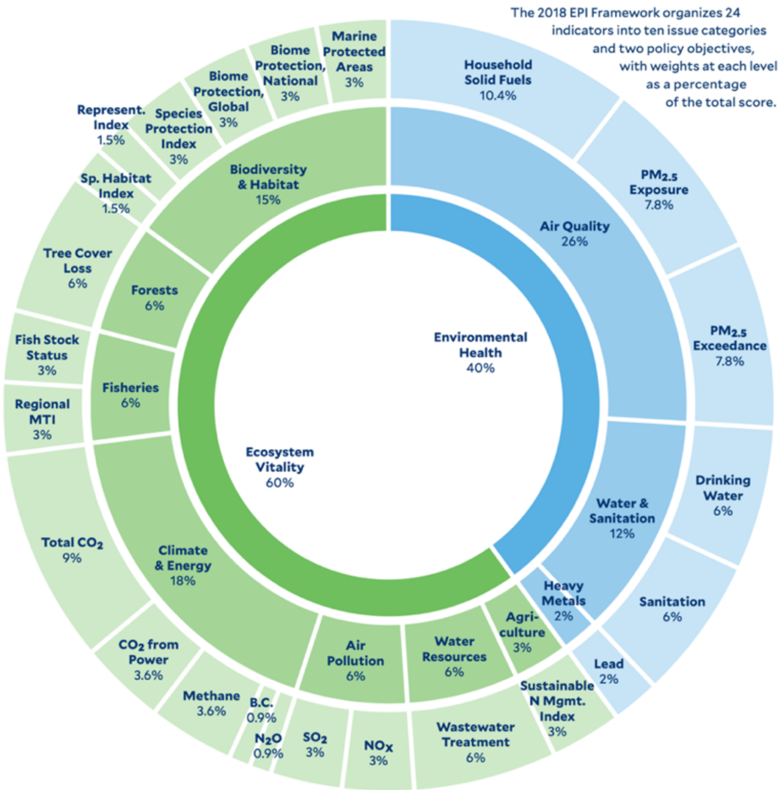
[2] Aging index = population aged over 65 / population aged 0 to 14
[3] Dependency ratio = [(population aged 0 to 14) + (population aged over 65) / population aged 15 to 64] *100
[4] Unemployment rate= unemployed population / total population

3.4 Measurement of Sustainable Development

According to Kates, et al. (2001), the purpose to assess sustainability is to provide an evaluation of global and local integrated natural-society systems both in short-term and long-term to policymakers, which assists them to decide what actions should be taken or not in order to make a sustainable society.

3.4.1 Environmental Performance Index (EPI)

Image 3 The 2018 EPI Framework



Source: Environmental Performance Index, 2018

The Environmental Performance Index (EPI) ranks 180 countries, using a hierarchical framework, which groups indicators into issue categories, issue categories into policy objectives, and lastly, policy objectives into overall objectives (see Image 3). These metrics provide a standard at a national scale of how close countries are to environmental goals. Thus, it provides a scores card that highlights leaders and laggards regarding environmental performance, giving insight on best practices. Meanwhile, it also provides guidance for countries that desire to be leaders in sustainability.

EPI has been long based on two policy objectives: (1) Environmental Health, which measures human health, containing three categories; (2) Ecosystem Vitality, which measures natural resources and ecosystem services, containing seven categories (Wendling, et al., 2018). 24 indicators are grouped within the following 10 issue categories (Wendling, et al., 2018, p. 5):

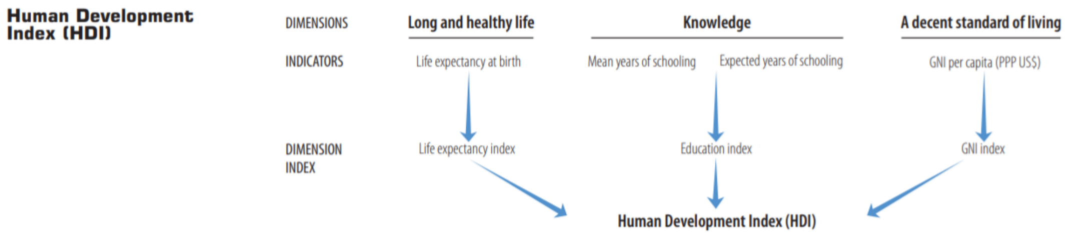
- Air quality
- Water & Sanitation
- Heavy Metals
- Biodiversity & Habits
- Forests
- Fisheries
- Climate & Energy
- Air Pollution
- Water Resources
- Agriculture

3.4.2 Human Development Index (HDI)

The Human Development Index (HDI) is one of the most commonly used measures of well-being, which was devised and launched by Pakistani economist Mahabub ul Hap, where the United Nations Development Programme (UNDP) published its first result in the first Human Development Report (HRD) in 1990. It is a statistic composite index of life expectancy, education, and per capita income indicators, which provides a summary measure of human development and able to describe both social and economic development. However, the weak point of HDI is that it does not consider environmental factors.

Before 2010, the HDI calculation combined three dimensions: Life Expectancy Index (LEI), Education Index (EI) and Income Index (II) with a simple mean. Later, in Human Development Report 2010, the UNDP began to use a new methodology to calculate HDI through a geometric mean of the same three dimensions (UNDP, 2010).

Figure 2 Human Development Index (HDI)

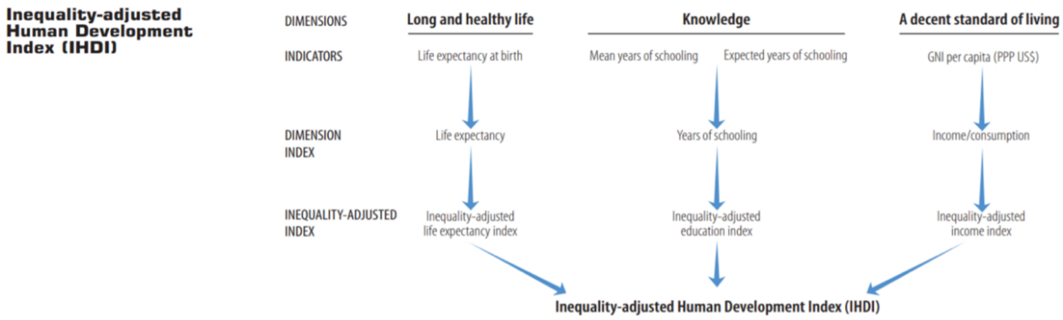


Source: Human Development Report, 2010

- **Health dimension**
  - Life expectancy Index
    - Represents a long and healthy life
    - Measured by life expectancy at birth
- **Education dimension**
  - Education Index
    - Represents the access to knowledge and education
    - Measured by mean years of schooling years aged 25 years and more and expected years of schooling for children of school entering age
- **Income dimension**
  - Income Index
    - Represents a decent standard of living
    - Measured by Gross National Income (GNI) per capita in Purchasing power arity (PPP) dollar

The 1990 Human Development Report recognized that the HDI only captures some people's choice but leaves out many values that more people may highly value. Therefore, three innovative measure of human development has been introduced in HDR 2010.

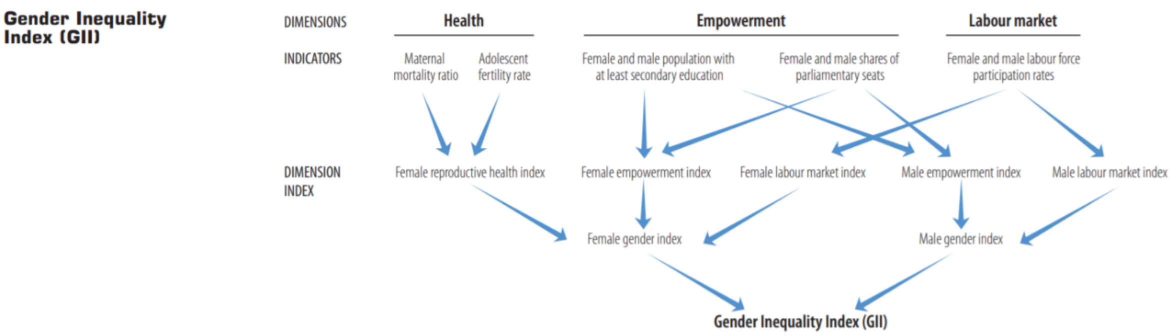
Figure 3 Inequality-adjusted Human Development Index (IHDI)



Source: Human Development Report, 2010

In Figure 3, Inequality-adjusted Human Development Index (IHDI) is shown. It considers not only the average human development in a country but also how it is distributed. In other words, IHDI accounts for inequalities in life expectancy, schooling years and income by "discounting" its average value according to its inequality level (UNDP, 2010, p. 87). The IHDI will be only equal to HDI when there is no inequality across people.

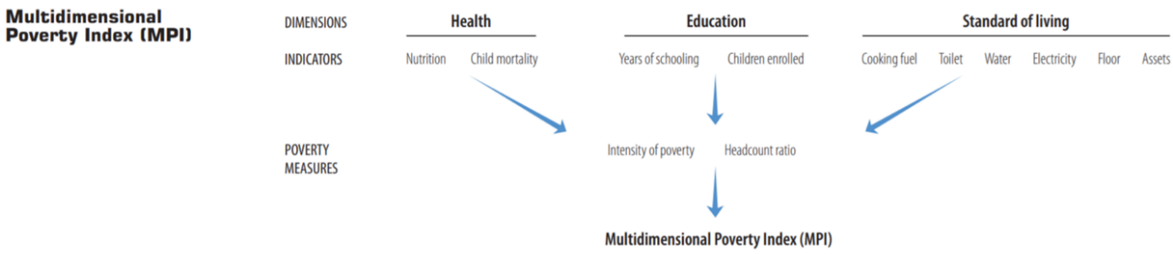
Figure 4 Gender Inequality Human Development Index (GDI)



Source: Human Development Report, 2010

Gender inequality remains a critical barrier to human development. Although women and girls have made significant strides since 1990, they have not yet gained gender equality (UNDP, 2010, p. 89). Gender Inequality Human Development Index (GII) is consistent with that for inequalities and only considers the inequalities between these two groups at the country level. The index calculation involves a more sophisticated methodology that involves three dimensions – health, empowerment and labor market, with five indicators.

Figure 5 Multidimensional Poverty Human Development Index (MPI)



Source: Human Development Report, 2010

The third innovative measure is Multidimensional Poverty Human Development Index (MPI). MPD identifies the overlapping deprivation across the same three dimensions as the HDI at the household level and shows the average number of poor people and deprivation which poor household content with (UNDP, 2010, p. 94).

3.4.3 Sustainable Development Goal Index

Sustainable Development Goal Index designed for all countries to evaluate their performance on the historic Agenda 2030 and the sustainable development, by providing a report card. It is provided in the Sustainable Development Report, which is prepared jointly by Bertelsmann Stiftung and the Sustainable Development Solutions Network (SDSN), presenting the SDG Index and Dashboards and frames the implementation of the SDGs in terms of six board transformations (Sachs, et al., 2019). According to the Sustainable Development report 2019 (Sachs, et al., 2019), SDG implementation can be operationalized through six dimensions:

(1) Education, gender and inequality
(2) Health, wellbeing and demography
(3) Energy decarbonization and sustainable industry
(4) Sustainable food, land, water, oceans
(5) Sustainable cities and communities
(6) Digital revolution for development

Image 4 Six SDG transformations of principle “Leave No One Behind”

Source: Sustainable Development Report, 2019

The SDG Index tracks the country’s performance on the 17 SDG goals that are equally weighted in the index. The score suggests a country’s position between the worst (0) and the best (100). Using historical data, the trend a country has been progressing towards to SDG is estimated. To avoid the problem that averaging all indicators may not reflect the real situation, the global SDG dashboards aggregate indicator ratings for each SDG by estimating the average of the two variables on which a country performed worst. Therefore, it highlights the strengths and weaknesses of each country on the 17 SDGs, so that particular attention will be prioritized for early actions (Sachs, et al., 2019).

3.5 Life Expectancy

Now let us shift the focus on the sections of life expectancy. The development and attention life expectancy started in the 20th century. Walker (2013) points out that the 20th century was the time of the most significant change in life expectancy in the history of humanity. As stated previously, it is a critical factor to assess the economic and social development in society and has a significant impact on individual and human behavior (Shaw, et al., 2005). It captures both fatal and non-fatal death outcomes in a summary level of population health (Sachs, et al., 2019).

3.5.1 Definition of Life Expectancy

3.5.1.1 Definition of Life Expectancy at Birth (e^0)

Life expectancy at birth is defined as the mean number of years a newborn infant still can live if the current patterns of mortality at the time of birth would be constant until the death (Nutbeam, 1998) which is a significant synthetic indicator to assess the economic and social development in a nation or a region (Bilas, et al., 2014). According to OECD (2020), life expectancy at birth is defined as, on average, how long a newborn can expect to live if the current death rates do not change. However, the actual age-specific death rate of any birth cohort cannot be known in advance. If the death rates are falling, actual life spans will be higher than life expectancy that calculated by current death rates.

The life expectancy at birth can be defined in two ways – cohort life expectancy and period life expectancy. Cohort life expectancy is the average life of a particular cohort, meaning a group of people born in a given year. In a word, when we track the group of people who were born in a particular year many decades ago and then observed the exact date of their death, we can calculate the cohort's life expectancy by simply calculating the average ages of all members when they died. However, as stated in the last paragraph, it is not possible to know this metric before all members of this cohort have died. Therefore, the statisticians usually track members of the cohort and predict the average age at death with a combination of observed mortality rates for past years and projections for future years.

Another alternative approach is what is known as period life expectancy (Forouzanfar, et al., 2016), which is the much more commonly used life expectancy metric. This approach estimates the average length of life for a hypothetical cohort assumed to be exposed to the mortality rates, which are observed at one particular period, usually a year. This definition is used by most international organizations, including the UN and the World Bank. To emphasize, the data analyzed later in section four is collected from the World Bank Database, which is period life expectancy.

3.5.1.2 Definition of Life Expectancy at 65

According to OECD (2020), life expectancy at 65 years old is defined as the average number of years that a person at that age can be expected to live, assuming that the actual age-specific motility levels stay same. However, the actual age-specific death rate of any particular birth cohort cannot be known in advance. The same as in the life expectancy at birth, if the death rate is falling, actual spans will be higher than the life expectancy that calculated by current death rates. This has been the case in OECD countries over the past decades (OECD, 2020). Commonly researchers use this indicator to examine longevity, which refers to the characteristics of the relatively long span of some members of a population.

3.5.2 Determinants of Life Expectancy

In this part, an overview of several previous studies on different dimensions of determinants on life expectancy at birth is given.

Several organizations and scholars have recognized the impact of air pollution on health (Tracey & Anne, 2008; Forouzanfar, et al., 2016; Cervantes, et al., 2020). They obtained similar results: the significance of environmental development was rising. For example, some researches (Samet, et al., 2000), have found out a relationship between short-term mortality rates and short-term pollution measures. However, whether this variation has a substantial effect on life expectancy was unclear. Therefore, in the paper of Ebenstein et al. (2015) , in which they focused on the long-run pollution exposure, showed that there is a consistently negative significant association between air pollution and life expectancy from 1991 to 2012, and the marginal detrimental effect of air pollution increased gradually. Besides, due to the severe status of air pollution in China, averagely, the northern Chinese residents have five years' life expectancy shorter than those in the south of China (Chen, et al., 2013). Except for air pollution, CO_2 emission, which has been seeing as the primary contributor to climate change accounts for 1/3 global greenhouse gas emissions (Nejat, et al., 2015). In the analysis of Ali & Ahmad (2014) , it is found that in the long-run CO_2 emission has an impact on life expectancy.

Economic circumstances also have an impact on life expectancy. For example, in China, there is a higher level of life expectancies in relatively developed regions, such as Beijing and Shanghai (Jiang, et al., 2018). This outcome may reflect factors such as income, lifestyle, as well as access to medical care.

Concerning to GDP per capita, several pieces of research have revealed that it is associated with better health status and greater longevity (Joumard, et al., 2010). Deton Augus (2006) points out that although GDP per capita of developing countries have not converged much closer to those developed countries, life expectancy in developing countries has improved to a comparable level with developed countries. Bilas, et al. (2014) reveal in their research that GDP per capita and education attained well-explained life expectancy at birth, in which there is a positive relationship between GDP per capita and expectancy and a negative correlation between education attained in European Union countries.

However, José A. Tapia Granados, Ana V. Diez Roux from the University of Michigan (Michigan, 2009) shows in their research that life expectancy increased during the Great Depression, recessions and depressions in general. The research points out that people tend to work hard during goof economic times, which puts them under more stress, exposures them to pollution and the likelihood of injury among other longevity-limiting factors.

An empirical study shows that health care plays a vital role in improving health status, which the health care spending, lifestyle factors such as smoking behavior, alcohol consumption, education, air pollution, and income are shown as the significant factors of increasing life expectancy (Joumard, et al., 2010) . Besides, it is also found that the health care expenditure per capita may have contributed to lengthening life expectancy at birth by about 1.25 years (Joumard, et al., 2010). Similarly, some other studies also reveal the higher education and people's health status may vary due to the influence of other variables (Bloom, 2007) .

Balan and Jaba (2011) have studied the factors that determine the life expectancy at birth in Romania. The significance of determinants on life expectancy was assessed using the regression analysis. Based on the data recorded, the authors identified the number of doctors, the beds in the hospital has a significant relationship with life expectancy.

The link between life expectancy and individual characteristics has been well-established and confirmed that there is a strong correlation between them. The development of education has been found in many studies that it has a significant influence on life expectancy. Some previous paper (Ling, et al., 2017) have revealed that education could contribute to life expectancy greatly, but the marginal enhancing effect was usually smaller than the development of economic. While some people may argue that the marginal enhancing effect is the most significant factor on life expectancy (Gulis, 2000) others have had the suggestive evidence of a non-significant effect of education on life expectancy (Liang-shu, 2008).

Across various ethnicity-race-sex groups, longer life expectancy was observed for individuals with higher levels of education and income, and for those who were married and employed (Lin, et al., 2003). It is also reported in Cockerham's (1997) research that poor lifestyle is a major social determinant of life expectancy in Russia.

4 Practical Part

4.1 Sustainable Development in China and the Czech Republic

4.1.1 Introduction of China and the Czech Republic

(1) China

The people's Republic of China, established on 1st October 1949, is a developing country located in East Asia with a population of 1.39 billion (China Statistical Yearbook 2019) in 2018, which accounts for roughly 20% of the total world population. It is the third-largest country by area with approximately 9,600 thousand square kilometers. The overwhelming majority population is found in eastern China, and with vast mountains and desert areas, fewer communities are in the west of the country (CIA, 2020). Since its establishment, China became very active in many international Organizations. The country officially became a UN member on 24th October 1945 and is one of the five permanent members of the UN Security Council.

In recent decades, China has experienced rapid economic development and became an essential entity in the world. However, fast economic growth and industrialization have brought much pressure on its environment and the severe environmental deterioration and pollution.

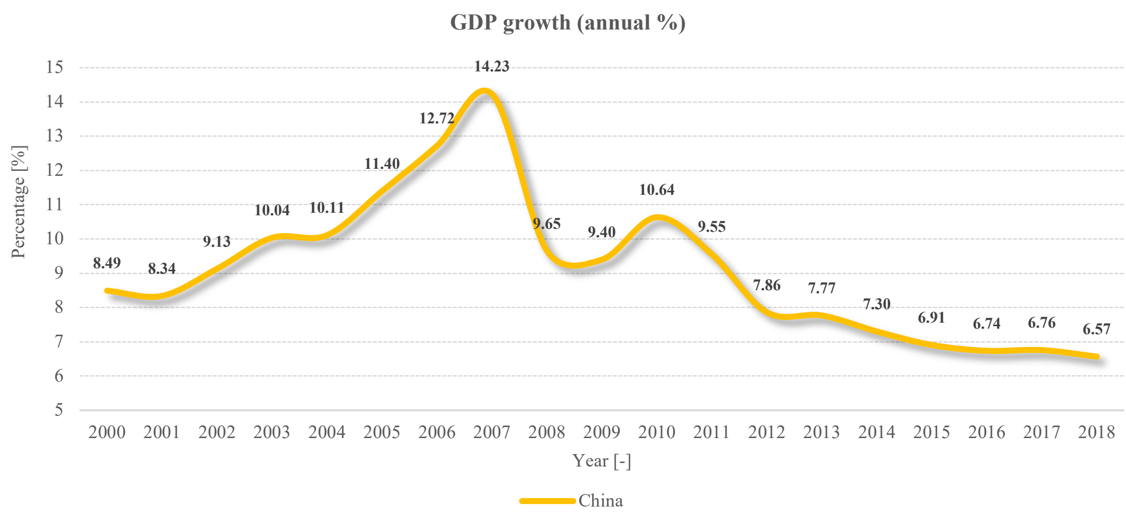
According to the 2018 Environmental Index, China was one of the laggards in air quality score 14.39 (Wendling, et al., 2018, p. 46) with rank 177th among 180 countries, followed by India, Bangladesh and Nepal. In China, 75% of the rural population continues to depend on solid fuels for cooking and heating (Pachauri, et al., 2012). Due to coal consumption for energy consumption, China faces significant challenges in addressing air pollution from SO_2 emissions. A 2015 study shows that the rapid industrialization of China has offset 40% of the improvement in air quality which was observed in the western United States between 2005 and 2010 (Verstraeten, et al., 2015).

As mentioned in the previous chapter, air pollution is the 4th leading reason causing premature death, which China is one of the most severe victims. Since 2005, premature deaths from air pollution in China has begun to stabilize. China has taken a few steps over the past years to reduce the number of deaths related to air pollution, which one policy is to restrict the traffic flows and construction activities during the periods with heavy pollution.

After the election of Donald Trump as president of the United States, China has seized the opportunities to reiterate its determination and support on sustainable development and climate change (Kuhn., 2018). To respond to the Agenda 2030, China developed an implantation plan in September 2016, to ensure its achievement by 2030. As the largest developing country in the world, China always highly valued the 2030 Agenda, and in March 2016, the Fourth Session of the 12th National People's Congress approved the outline of the 13th Five-Year Plan which links the Agenda 2030 with national mid-and-long term development strategies.

Since economic reform began in 1978, China's economy has developed into a highly diversified economy, and economic growth has been continuously above 6 per cent. Moreover, after decades of rapid growth, China overtook Japan to be the world's second-largest economy in terms of nominal GDP in 2010. Between 2010 and 2019, China's contribution to global GDP growth has been 25 per cent to 39 per cent (Desjardins, 2019). However, the World Bank estimates put forward that the potential growth which peaked at 14 per cent in 2007 will point to 6 per cent by fallen 8 per cent by 2020 (Zhao, et al., 2019). As of, China ranks behind over 70 countries with $18,236.61 in 2018 (WorldBank, 2020), making it an upper-middle-income country. Figure 6 shows the trend of GDP growth of China from 2000 to 2018.

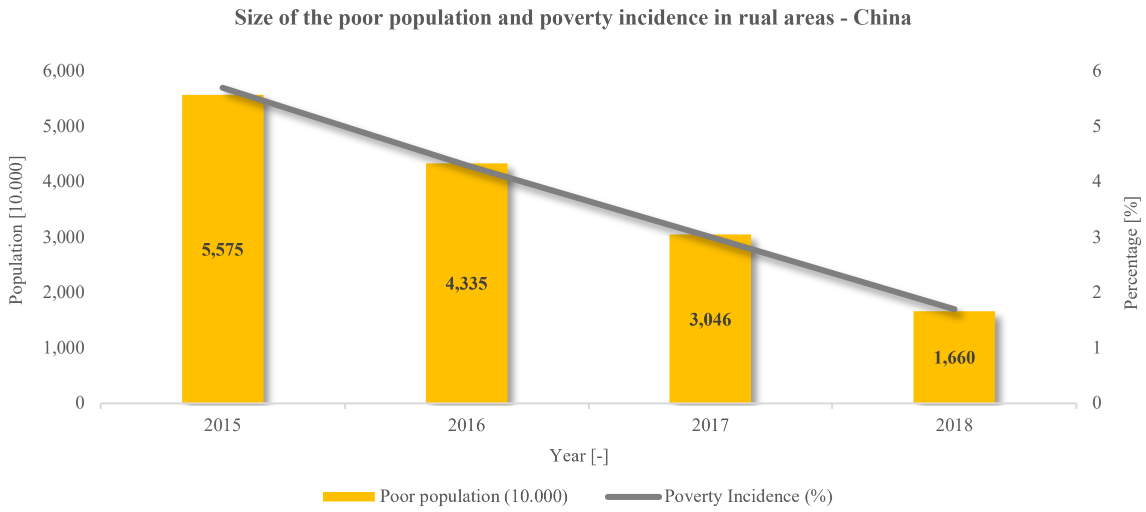
Figure 6 GDP growth (annual %) in China, 2000 – 2018



Source: Own computation, World Bank Database, 2020

China has achieved significant success in moving its large population out of the poverty line over the past 30 years. President Xi President vowed to live all poor rural residents out of poverty by 2020. By the end of 2018, the number of poor people in China had decreased to 16.6 million, which the incidence of poverty is 1.7% (MFA, 2019), as shown in Figure 7.

Figure 7 Size of the poor population and poverty incidence in rural areas – China



Source: Own computation, MFA, 2019

(2) Czech Republic

The Czech Republic, also known by its short-form name, Czechia, is a landlocked country in Central Europe boarded by Germany, Poland, Slovakia and Austria. It is a developed country with an advanced, high-income country with 10.649 million inhabitants in 2019 (Erostat, 2020). The country joined the European Union in 2004 but has not yet joined euro-zone.

The Czech economy is sensitive to global trends with particular interlinkages to Germany, which is its most prominent and long-term, trade partner. Strong economic growth between 2000 to 2008 has resulted from a considerable amount of foreign direct investment (FDI) which provided the market with capita, know-how and involvement in global value chains. Since 2005, in terms of GDP per capita, the Czech Republic has been converging to the EU average with a significant pause from 2010 to 2013. Since 2014, the new government has undertaken some reforms to reduce corruption and improve social welfare programs to improve the living conditions for Czechs. According to the World Bank (2020), Czech is a high-income economy with GDP per capita in PPP $39,743.6. Czech industry generates a proportion of GDP that is greater than the EU average, which accounts for about one-third of GDP, while in the EU this is about one fifth.

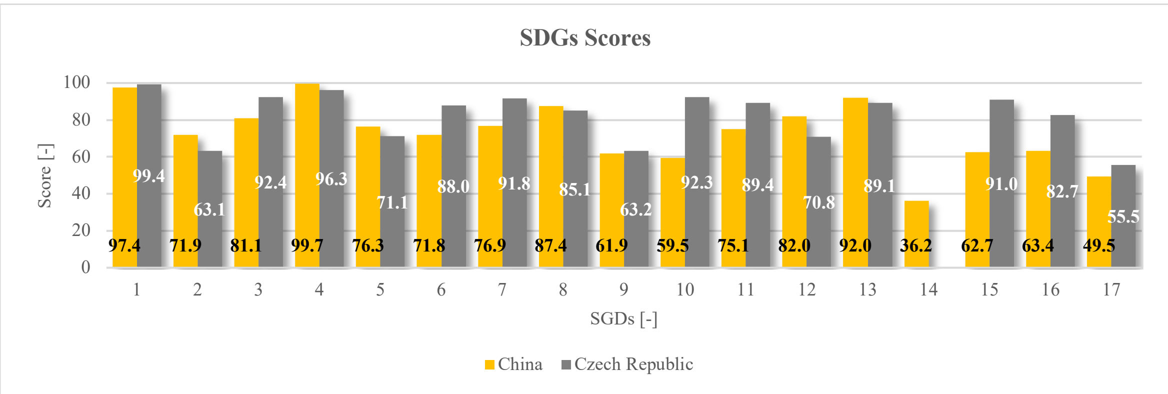
The concept of a sustainable economy is becoming increasingly significant for the Czech Republic. Over the past few decades, the living condition in the Czech Republic has undergone a critical change. Life expectancy at birth has shown steady growth; however, it remained lower in developed EU countries. Similarly, the impressive economic growth in the past two deceased has brought much pressure on the environment. The Czech Republic is one of the highest ratios of greenhouses gas emissions per unit in the OECD. The Czech Republic ranks 32th most environmentally country in the world in EPI 2018, with scores 67.68.

According to the National Report on Implementation of the 2030 Agenda for Sustainable Development (2017), the Czech Republic scores above the OECD average in ending poverty in all its forms everywhere. In 2015, the proportion of the population at risk of poverty or social exclusion was 14% which is much lower than the EU28 average, ranking the lowest score of the EU28. The SDGs target 1.1 and 1.b have been met, which means that the extreme poverty defined as living on less than 1.25 USD per day has been successfully eradicated.

4.1.2 Comparison

In this part, several indicators from environment, economic and social dimensions reflecting sustainable development are compared between China and the Czech Republic.

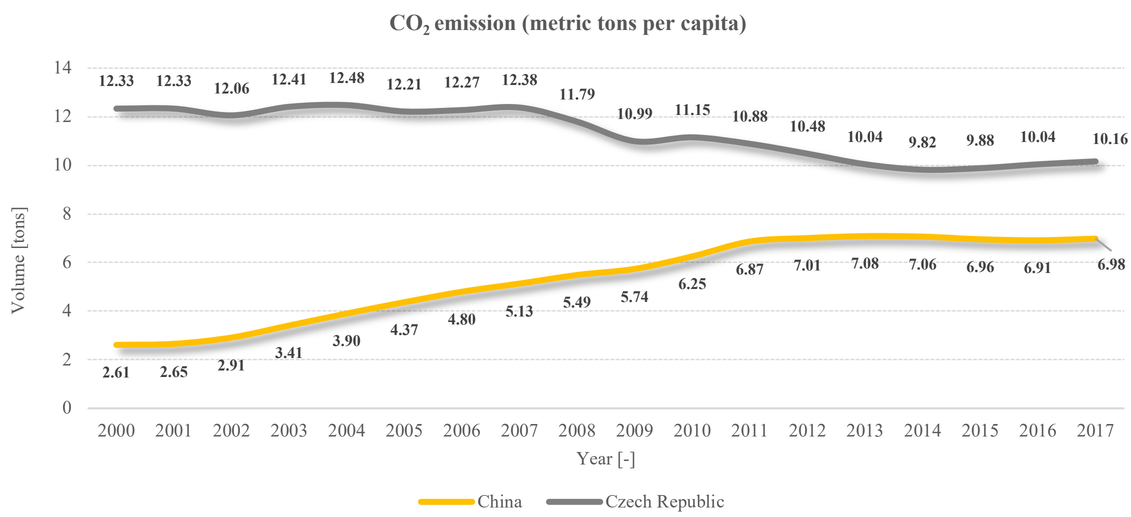
Figure 8 Country scores comparison by SDGs, China and the Czech Republic



Source: Own computation, SDSN, 2019

First of all, SDG index scores give us an overview of the country's performance towards the 17 SDGs. From Figure 8, it can be seen that the Czech Republic performs much better towards SDG3, SDG6, SDG7, SDG10, SDG11, SDG15, SDG16 and SDG17. Regarding SDG14 (life below water), since the Czech Republic is a landlocked country, there is no such data collected, and China only has 36.2 which is not a high score among all other countries. Both China and the Czech Republic did well in SDG1 (no poverty) and SDG4 (quality education), with 97.4, 99.4, 99.7 and 96.3, respectively. Toward to SGD15 (life on land) and SDG16 (peace, justice and strong institutions), China is way left behind the Czech Republic, which the difference is 28.3 and 19.3, respectively. Both countries have a poor performance on strengthening the means of implementation and revitalize the global partnership for sustainable development.

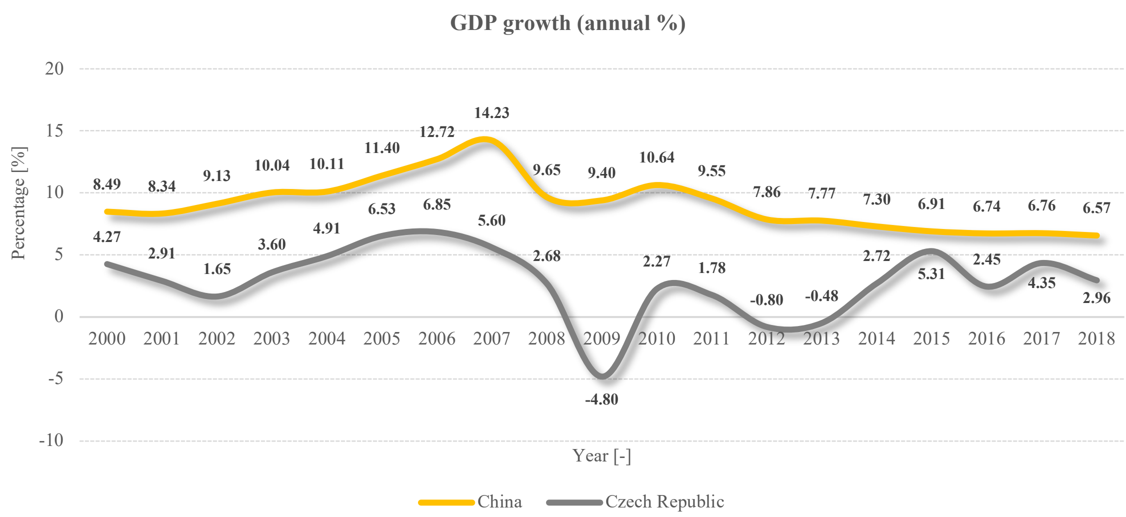
Figure 9 CO_2 emission, China and the Czech Republic, 2000 – 2017



Source: Author's computation; World Bank Data, 2020

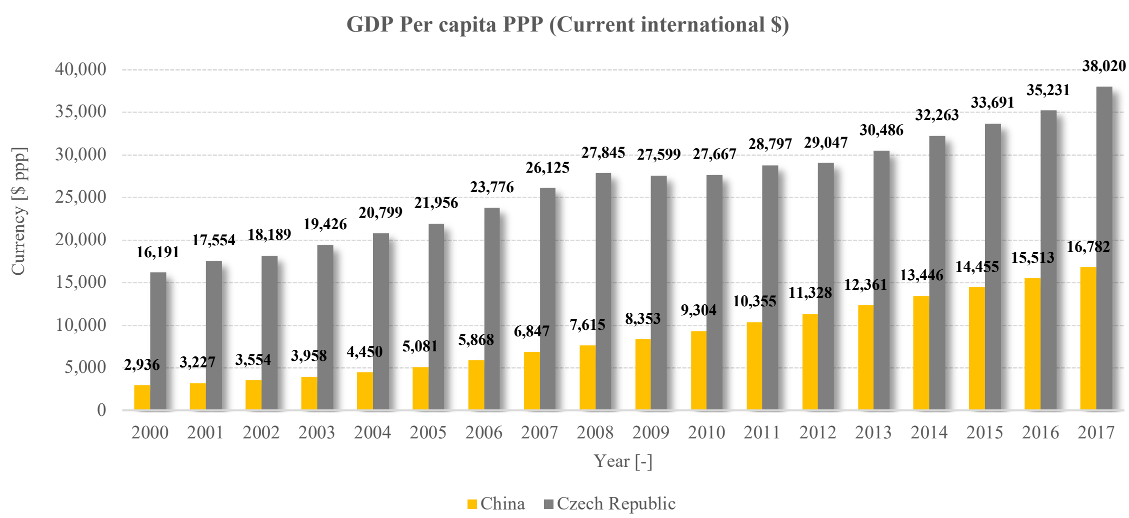
In the Czech Republic, the CO_2 emission per capita has a slight decline from 12.23 tons to 10.16 tons. While in China, due to its rapid economic growth and industrialization, the CO_2 emission per capita has increased from 2.61 tons in 2000 to 6.98 tons in 2017, which is almost three times more.

Figure 10 GDP Growth (annual %), China and the Czech Republic, 2000 – 2018



Source: Own computation; World Bank Data, 2020

Figure 11 GDP Per capita in PPP, China and the Czech Republic, 2000 – 2017

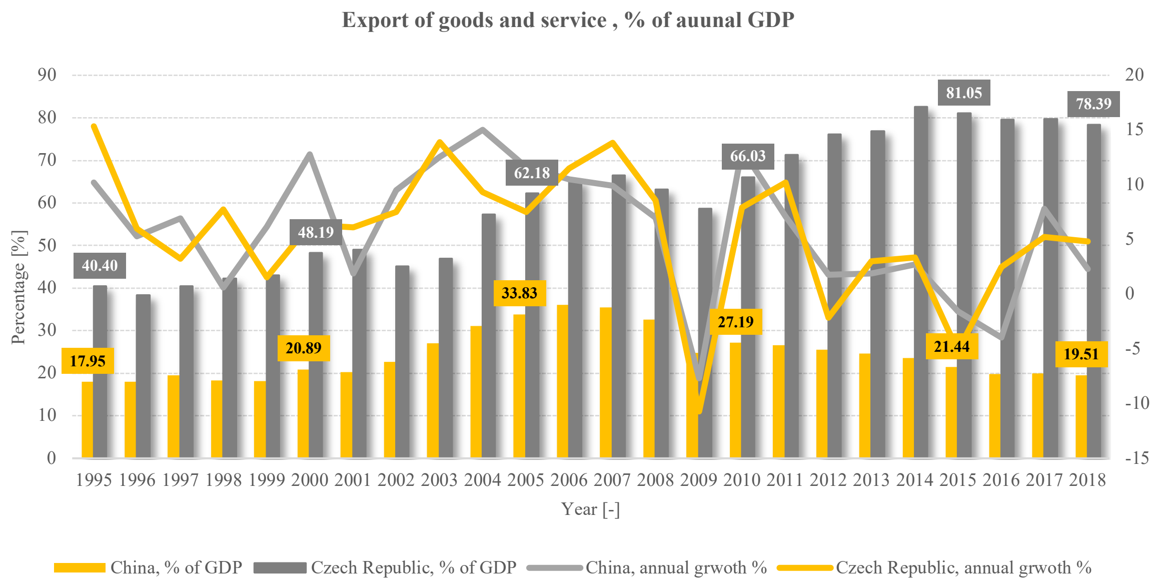


Source: Own computation, World Bank Data, 2020

As shown in Figure 10, China's GDP growth is higher than the Czech Republic, with a slowly declining since 2010. As we know, the Great Recession from 2007 to 2009 resulted in a great economic decline in the Czech Republic, as well as other developed countries, particularly in North America, South America and Europe. The data that GDP Growth with minus 4.8% in 2009 in the Czech Republic confirmed it. Many more developing economies suffered far less impact, including China. In most the recent year 2018, the GDP annual growth in China is 6.57% while 2.96% in the Czech Republic. From

Figure 11, it can be seen that GDP per capita in both countries have been increasing, over the last two decades, which in 2017 reached 38,020 and 16,782 international dollars, respectively.

Figure 12 Export of goods and service in China and the Czech Republic, 1995 – 2018

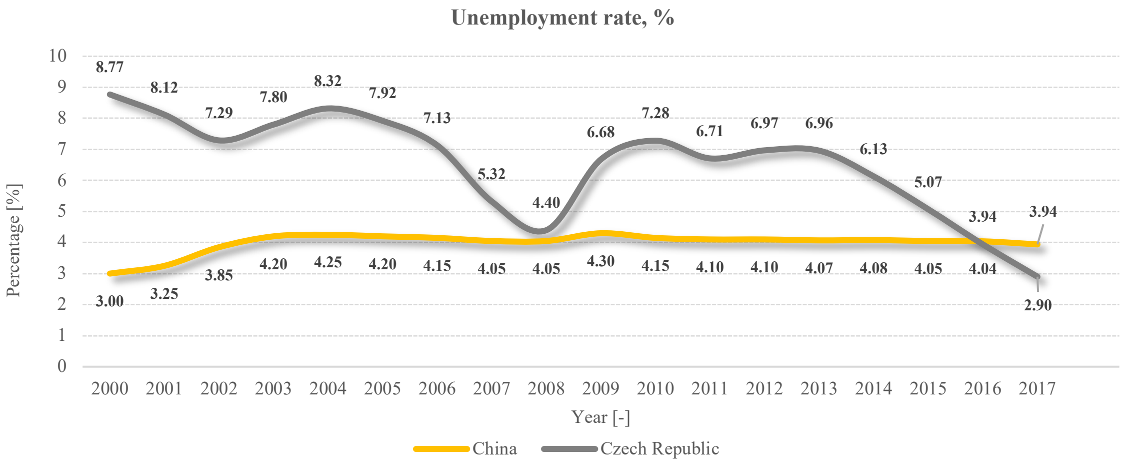


Source: Own computation; WITS, 2020

China has been the largest exporter in the world and its trade growth was 2.31% compared to world growth of 3.50% in 2018 (WITS, 2020). The total export of goods and services account for 19.51% of its GDP. Its most recent exports are broadcasting equipment, computers, office machines etc. The top destinations of its exports are United States, Hong Kong, Japan and Germany (OEC, 2020). In 2018, the Czech Republic exports accounted for 78.39% of its annual GDP. During the last past years, it has increased more than double times. The most recent exports are cars, vehicle parts and computers to the EU destinations including Germany, Slovakia, Poland, France etc. (OEC, 2020).

Regarding annual growth of exports, both China and the Czech Republic had a significant drop to negative growth in 2009 which were -7.63% and -10.72% respectively. After the Great Recession, the recovery of economy development has brought an increase on exports for both countries with a lower growth compared to previous years.

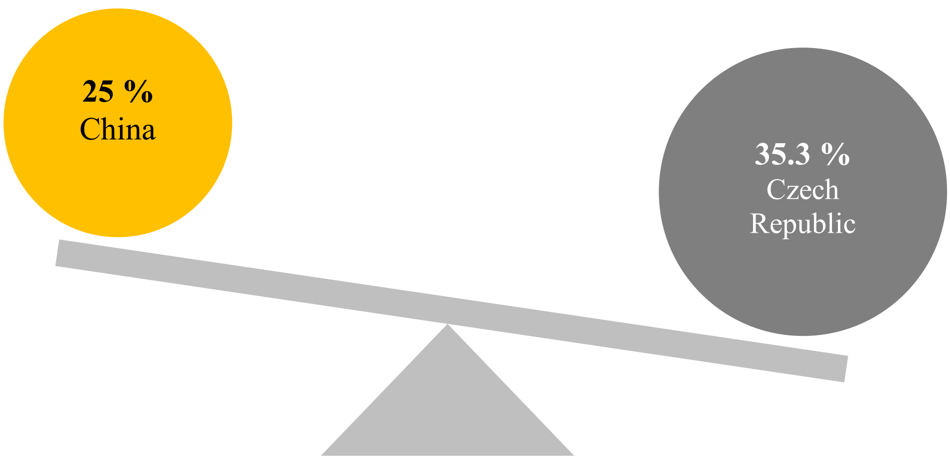
Figure 13 Unemployment rate in China and the Czech Republic, 2000 – 2017



Source: Own computation, World Bank Data, 2020

Apart from GDP growth, another commonly used indicator to measure the economic activities of a country is the unemployment rate. From Figure 13, the unemployment rate in China remains stable and constant at about 4% over the last two decades. In the Czech Republic, there are huger fluctuations which increased from 4.4% in 2009 to 7.28% in 2010. Eventually, there is a decline from 2013 to 2.90% in 2017.

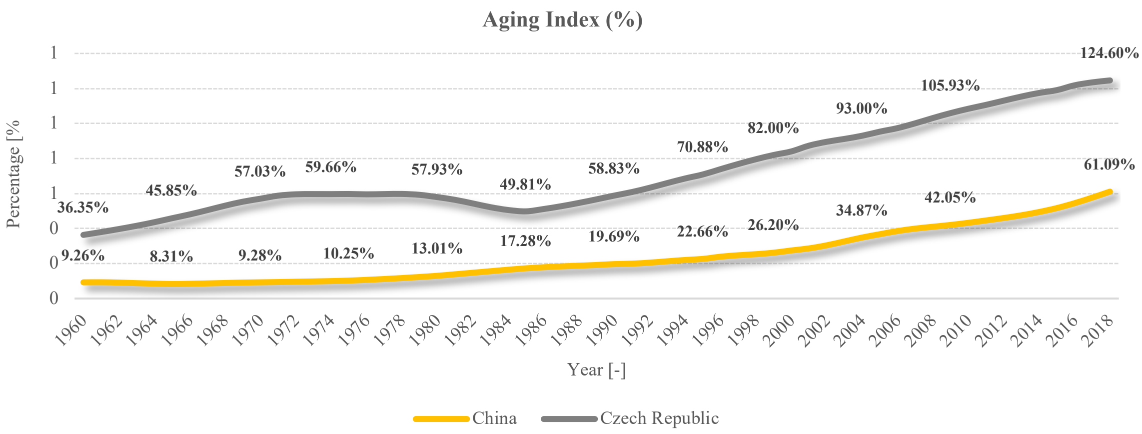
Figure 14 Dependency ratio, per 100 people ages 15-64, 2030 projection



Source: Own computation, UNDP, 2019

Figure 14 shows the old-age dependency ratio in China and the Czech Republic, which represents the population ages 65 and older to the population ages 15-64, expressed as the number of defendants per 100 people of working age (15-64). The data shows that by 2030, 3.5 people in the Czech Republic will depend on one person; and there will be 2.5 people depend on one person in China.

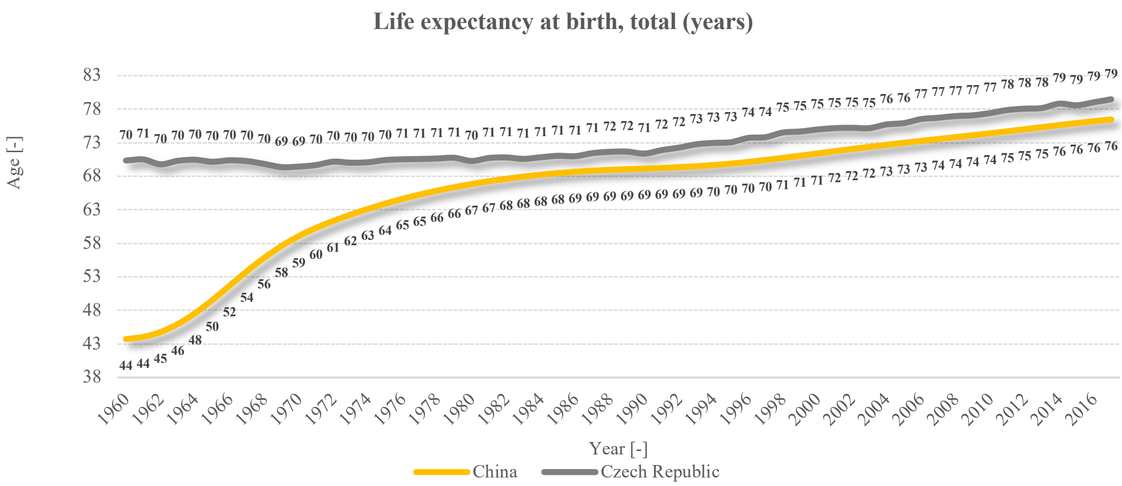
Figure 15 Aging Index in China and the Czech Republic, 1960 – 2018



Source: Own computation, World Bank Data, 2020

According to Figure 15, the Aging Index was reported in 2018 at 61.09% in China and 124.6% in the Czech Republic. The records have increased from almost six decades ago 9.26% and 36.35% respectively.

Figure 16 Life expectancy at birth in China and the Czech Republic, 1960 – 2017



Source: Own computation, World Bank Data, 2020

The last indicator comparison is life expectancy at birth. Figure 16 reveals that over the last past decades, the life expectancy at birth both have improved in China and the Czech Republic. The life expectancy at birth in the Czech Republic was about 70 years old and had been increasing nine years over the last 60 years. In contrast, there is a significant improvement in Chinese life expectancy, which has increased more than 30 years. As can be seen from the data, since the 1980s the life expectancy in China started to be close to the Czech Republic.

4.2 Analysis of Determinants of Life Expectancy

4.2.1 Methodology

In the second part of practical analysis, the association between life expectancy at birth and its determinants using OLS regression analysis is examined. To avoid a spurious regression, the data are differenced to be stationary. Appropriate tests will be performed to examine the robustness of the models.

4.2.2 Variables overview

After gaining the theoretical knowledge from previous chapters, in this practical part, a functional model will be run to examine the relationship between life expectancy at birth and its determinants in China and the Czech Republic. All data were collected from several public databases, including the World Bank Data, Eurostat, China Yearbook 2019, Global Economic Monitor (GEM) Database, CZSO Public Database, UNESCO Institutes and Statistics. Several missing data are solved by the mean value.

Table 2 Selected variables and interpretations

Symbol	Variables	Unit	Marking in Gretl
1. Dependent variable			
y1t	Life expectancy at birth	years	LEB
2. Independent variables			
x1t	Unit vector		
Environment			
x2t	CO2 emission per capita	metric tons	CO2pc
x3t	Access to safe water	percentage	DrinW
Economics			
x4t	GDP per capita	PPP $	GDPpc
x5t	Health expenditure per capita	PPP $	HEpc
x6t	Unemployment rate	percentage	UnemR
Social			
x7t	Crude divorce rate	percentage	DirR
x8t	Physicians density	Per 1,000 persons	PhyD
x9t	Education attainment	number	EdAt

3. Stochastic variable	
ut	Stochastic variable

Source: Own computation

The **environment dimension variables** used to examine the relationship with life expectancy at birth incorporates:

CO_2 emission per capita

CO_2. Emissions are those steaming from the burning of fossil fuels and the manufacture of cement, which including CO_2 produced during human activities, such as production and consumption of solid, liquid, and gas fuels. CO_2 emissions per capita (metric tons) are measured by the total amount of CO_2 emission divided by the total population.

Data source: The World Bank Data

Population using at least basic drinking water service

It represents the percentage of the population that use at least using drinking water from an improved source that the provided collection time is not more than 30 minutes for a round trip including queuing (Sachs, 2019).

Data source: The World Bank Data

The **economic dimension variables** used to examine the relationship with life expectancy at birth incorporates:

GDP per capita

GDP per capita in purchasing power parity (PPP) is gross domestic product converted to international dollars using purchasing power parity rates and are divided by the total population. When comparing two and more countries, GDP per capita (PPP based) is required.

Data source: The World Bank Data

Health expenditure per capita

Expenditure on health measures the final consumption of health goods and services, including the spending by both public and private sources on medical services and goods, public service and health prevention programs and administration. However, it excludes spending on the capital formation (investment). Health expenditure per capita is converted to international dollars using purchasing power parity rates when comparing the spending level between two countries (OECD, 2015).

Urbanization rate

It refers to the population shift from rural areas to urban areas which is the proportion of the total population living in the areas classed as urban.

Data source: The World Bank Data

Unemployment rate

It represents the share of the population that do not have a job but is available and actively seeking employment.

Data source: Global Economic Monitor (GEM) Database

The **social dimension variables** used to examine the relationship with life expectancy at birth incorporates:

Crude divorce rate

It refers to the annual number of divorces per 1,000 persons, which are the final legal dissolution of a marriage. The crude divorce rate can reflect the development of social harmony. In other words, we can say that this indicator can measure people's happiness to some extent.

Data source: China Statistical Yearbook 2019; CZSO Public Database; Eurostat

Physicians

The indicator used in this paper is physician's density (per 1,000 population), which represents the number of medical doctors or physicians, including generalist and specialist medical practitioners, per 1,000 persons.

Data source: The World Bank Data

Education attainment

In this paper, the author uses the number of enrollment in post-secondary non-tertiary education, both sexes as to reflect the country's educational attainment. After searching and comparing educational indicator from both China and the Czech Republic, the one as mentioned above is selected due to its nature and data completion.

Data source: UNESCO Institutes and Statistics

4.2.3 Hypotheses and Model

Based on the previous researches mentioned in this paper and economic point of view, the following nine hypotheses are made:

H1: There is a statistically significant ***negative (-)*** relationship between CO_2 emissions per capita and life expectancy at birth in both countries.

H2: There is a statistically significant ***positive (+)*** relationship between population using at least basic drinking water services and life expectancy at birth in both countries.

H3: There is a statistically significant ***positive (+)*** relationship between GDP per capita and life expectancy at birth in both countries.

H4: There is a statistically significant ***positive (+)*** relationship between health expenditure per capita and life expectancy at birth in both countries.

H5: There is a statistically significant ***negative (-)*** relationship between unemployment rate and life expectancy at birth in both countries.

H6: There is a statistically significant ***Positive (+)*** relationship between urbanization rate and life expectancy at birth in both countries.

H7: There is a statistically significant ***negative (-)*** relationship between crude divorce rate and life expectancy at birth in both countries.

H8: There is a statistically significant ***positive (+)*** relationship between physician density and life expectancy at birth in both countries.

H9: There is a statistically significant ***positive (+)*** relationship between education attainment and life expectancy at birth in both countries.

Economic model

$$LEB = f(UV, CO2pc, DrinW, GDPpc, HEpc, UnemR, DiR, PhyD, EdAt) \quad (1)$$

Econometric model

China

$$y_{1t} = \gamma_1 x_{1t} + \gamma_2 x_{2t} + \gamma_3 x_{3t} + \gamma_4 x_{4t} + \gamma_5 x_{5t} + \gamma_6 x_{6t} + \gamma_7 x_{7t} + \gamma_8 x_{8t} + \gamma_9 x_{9t} + \gamma_{10} x_{10t} + u_t \quad (2)$$

Czech Republic

$$y_{2t} = \gamma_{11} x_{1t} + \gamma_{12} x_{2t} + \gamma_{13} x_{3t} + \gamma_{14} x_{4t} + \gamma_{15} x_{5t} + \gamma_{16} x_{6t} + \gamma_{17} x_{7t} + \gamma_{18} x_{8t} + \gamma_{19} x_{19t} + \gamma_{20} x_{20t} u_t \quad (3)$$

4.2.4 Data Analysis

4.2.4.1 Correlation Matrix of Model (1)

Table 3 Correlation coefficient, using the observations 2000 – 2017, China

5% critical value (two-tailed) = 0.4683 for n = 18

LEB	CO2pc	DrinW	GDPpc	HEpc	
1.0000	0.9623	0.9971	0.9879	0.9686	LEB
	1.0000	0.9786	0.9240	0.8808	CO2pc
		1.0000	0.9769	0.9503	DrinW
			1.0000	0.9935	GDPpc
				1.0000	HEpc
UrbanR	**UnemR**	**DirR**	**PhyD**	**EdAt**	
0.9997	0.4567	0.7363	0.9295	0.2954	LEB
0.9666	0.5203	0.5906	0.8261	0.0723	CO2pc
0.9981	0.4824	0.6921	0.9067	0.2344	DrinW
0.9873	0.3274	0.7728	0.9730	0.4078	GDPpc
0.9664	0.2773	0.8079	0.9862	0.4943	HEpc
1.0000	0.4521	0.7263	0.9280	0.2829	UrbanR
	1.0000	0.2529	0.1416	-0.3339	UnemR
		1.0000	0.7881	0.5448	DirR
			1.0000	0.5562	PhyD
				1.0000	EdAt

Source: Own computation in Gretl

Multicollinearity elimination

Multicollinearity among the independent variables is a vital validity concern. Therefore, it is necessary to do a correlation matrix to determine whether there is multicollinearity among all the independent variables. When the correlation coefficients between the two independent variables are higher than 0.8, it suggests that there is multicollinearity between them.

Table 3 confirms that there is strong multicollinearity between the following independent variables:

x_3 DrinW and x_2 CO2pc;

x_4 GDPpc and x_2 CO2pc, x_3 DrinW;

x_5 HEpc and x_2 CO2pc, x_3 DrinW, x_4 GDPpc;

x_8 DirR and x_5 HEpc;

x_9 PhyD and x_2 CO2pc, x_3 DrinW, x_4 GDPpc, x_6 UrbanR;

To address this problem, the first difference method is used to replace x_2, x_3, x_4, x_5, x_7, x_8, x_{10}, which the new variables are shown as following. At the same time, two independent variables are removed from the model: x_6 UrbanR and x_9 PhyD (They cause bad singularity problem).

x_2 CO2pc	→	d_CO2pc
x_3 DrinW	→	d_ DrinW
x_4 GDPpc	→	d_ GDPpc
x_4 HEpc	→	d_HEpc
x_7 UnemR	→	d_ UnemR

New econometric model

$$y1t = \gamma_1 x_{1t} + \gamma_2 dx_{2t} + \gamma_3 dx_{3t} + \gamma_4 dx_{4t} + \gamma_5 dx_{5t} + \gamma_7 x_{7t} + \gamma_8 dx_{8t} + +\gamma_{10} x_{10t} + u_t \quad (4)$$

Table 4 New Correlation coefficients, using the observations 2001 – 2017, China

5% critical value (two-tailed) = 0.4821 for n = 17

d_CO2pc	d_DrinW	d_GDPpc	d_HEpc	d_UnemR	
1.0000	0.7057	-0.3204	-0.5250	-0.0079	d_CO2pc
	1.0000	-0.3758	-0.3831	0.2668	d_DrinW
		1.0000	0.7376	-0.7597	d_GDPpc
			1.0000	-0.3168	d_HEpc
				1.0000	d_UnemR
			DirR	**EdAt**	
			-0.7040	-0.6750	d_CO2pc
			-0.5880	-0.4463	d_DrinW
			0.4408	0.2237	d_GDPpc
			0.5631	0.2499	d_HEpc
			-0.0333	0.0157	d_UnemR
			1.0000	0.7747	DirR
				1.0000	EdAt

Source: Own computation in Gretl

In the new matrix Table 4, it can be seen that the multicollinearity problem disappears.

4.2.4.2 Stationary Test for Model (1)

$\mathbf{H_0 = 0}$, the time-series is stationary; $\mathbf{H_A \neq 0}$, the time-series is non-stationary

Table 5 KPSS test for stationarity in model (1)

KPSS test, 5% → Critical values: 0.150			
Critical values	d_CO2pc	0.135359	Not Reject
	d_DrinW	0.133431	Not Reject
	d_GDPpc	0.133791	Not Reject
	d_HEpc	0.112227	Not Reject
	d_UnemR	0.11529	Not Reject
	DirR	0.128578	Not Reject
	EdAt	0.179158	***Reject*** [5]

Source: Own computation in Gretl

[5] One of the disadvantage of KPSS test is that it has higher rate of Type I error and tends to reject null hypotheses. One way to double-check it is to run Augmented Dickey-Fuller (GLS) test for EdAt. The asymptotic p-value is 0.3987, greater than significant value 0.05. Therefore, the null hypotheses of Augmented Dickey-Fuller (GLS) test (non-stationarity) is rejected and EdAt is confirmed stationary.

4.2.4.3 Parameter's Estimation for Model (1)

Table 6 OLS, using observations 2001-2017 (T = 17), China

Dependent variable: LEB

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	69.5333	0.632593	109.9	<0.0001	***
d_CO2pc	−0.377323	0.547024	−0.6898	0.5077	
d_DrinW	0.549843	0.602858	0.9121	0.3855	
d_GDPpc	0.00236751	0.000575077	4.117	0.0026	***
d_HEpc	0.0214122	0.00525891	4.072	0.0028	***
d_UnemR	−1.12050	0.674652	−1.661	0.1311	
DirR	0.652893	0.265904	2.455	0.0364	**
EdAt	2.09072e-07	2.73985e-07	0.7631	0.4649	

Mean dependent var	74.13612	S.D. dependent var	1.490111
Sum squared resid	0.508360	S.E. of regression	0.237665
R-squared	0.985691	Adjusted R-squared	0.974561
F(7, 9)	88.56683	P-value(F)	1.41e-07
Log-likelihood	5.711166	Akaike criterion	4.577668
Schwarz criterion	11.24337	Hannan-Quinn	5.240252
rho	0.039993	Durbin-Watson	1.903664

Source: Own computation in Gretl

The final economics model:

$$y_{1t} = 69.5333 - 0.377323x_{2t} + 0.549843x_{3t} + 0.00236751x_{4t} + 0.0214122x_{5t} - 1.12050x_{7t} - 0.652893x_{8t} + 2.09072\mathrm{e} - 07x_{10t} + u_t \quad (5)$$

4.2.4.4 Model's Verification for Model (1)

Economic Verification

First of all, one of the essential parts of the regression analysis is economic verification. It is necessary to check if the results correspond to economic theory. The descriptions are shown in Table 7.

Table 7 Economic verification of model (1), China

Parameter	Value	Economic verification	Hypotheses
γ_1	69.5333	If all independent variables equal to zero, the expected value is 69.5333. However, the variables will never be zero.	
γ_2	−0.377323	If CO_2 emissions per capita increase by 1 unit, the life expectancy at birth will decrease by 0.377323unit.	***Negative*** ***Confirmed***
γ_3	0.549843	If the population using at least basic drinking service increases by 1 unit, the life expectancy at birth will increase by 0.549843unit.	***Positive*** ***Confirmed***
γ_4	0.00236751	If GDP per capita increases by 1 unit, the life expectancy at birth will increase by 0.00236751unit.	***Positive*** ***Confirmed***
γ_5	0.0214122	If Health expenditure per capita increases by 1 unit, the life expectancy at birth will increase by 0.0214122 unit.	***Positive*** ***Confirmed***
γ_7	−1.12050	If the unemployment rate increases by 1 unit, the life expectancy at birth will decrease by 1.12050 units.	***Negative*** ***Confirmed***
γ_8	0.652893	If the crude divorce rate increases by 1 unit, the life expectancy at birth will increase by 0.652893 unit.	***Positive*** ***Rejected***
γ_{10}	2.09072e-07	If the population of post-secondary but non-territory increases by 1 unit, the life expectancy at birth will increase by the 2.09072e-07 unit.	***Positive*** ***Confirmed***

Source: Own computation in Gretl

<u>Statistical Verification</u>

- Statistical significance of parameters $\alpha = 0.05$

$\mathbf{H_0 = 0}$, Significant

$\mathbf{H_A \neq 0}$, Insignificant

In this paper, the statistical significance of parameters $\alpha = 0.05$ is used. We should compare the P-value with the $\alpha = 0.05$. If P-value $< \alpha = 0.05$, we have to reject $\mathbf{H_0}$. otherwise, we have to accept $\mathbf{H_0}$.

From Table 6 we can see that only the P-value of γ_4 and γ_5 are less than $\alpha = 0.05$, even less than $\alpha = 0.01$. Thus, the variable d_GDPpc, d_HEpe are statistically significant at 1%

significant level. Another point to be mentioned is γ_8, whose P-value is 0.0364, greater than $\alpha = 0.01$ but less than $\alpha = 0.05$. That is to say, γ_8 is statistically significant at 5% level of significance.

- Coefficient of determinants - R^2 Goodness of fit

The R^2 in equation (1) is **0.985691**, which is to say **98.5691%** of the dependent variable life expectancy at birth can be explained as independent variables. This number is much more than 50% meaning the model is suitable. Meanwhile, Adj.R^2 is **0.974561**, 97.4561% that is also acceptable.

Econometric Verification

In this part, the appropriateness of the model will be checked, which no autocorrelation, no heteroscedasticity and normal distribution are the best.

- Autocorrelation $\alpha = 0.05$

To test the autocorrelation in the model, the Durbin-Watson (DW) Statistic test is used. The value of DW Statistic will always be between 0 and 4. A value equals 2, meaning there is no autocorrelation detected in the model. While values from 0 to 2 indicating a positive autocorrelation, and values from 2 to 4 suggesting negative autocorrelation. Gretl does this test.

$\mathbf{H_0 = 0}$, The is no autocorrelation in the model

$\mathbf{H_A \neq 0}$, There is autocorrelation in the model

Durbin-Watson statistic = 1.90366

p-value = 0.0974994

We can see in the model (1) the value of DW Statistic is 1.90366, which is closer to 2. Meanwhile, the p-value equals to 0.0974994 > $\alpha = 0.05$. Therefore, **H_0 is not rejected,** and we can say there is **no autocorrelation** in the model (1).

- Heteroscedasticity $\alpha = 0.05$

Heteroskedastic refers to the condition that the variances of residuals vary widely and is not constant over time. In this paper, the White's test for heteroskedasticity is used.

$\mathbf{H_0 = 0}$, The is no heteroscedasticity in the model

$\mathbf{H_A \neq 0}$, There is heteroscedasticity in the model

Table 8 White's test for heteroskedasticity for model (1)

OLS, using observations 2001-2017 (T = 17), Dependent variable: uhat^2

	coefficient	*std. error*	*t-ratio*	*p-value*
const	−2.35293	2.30830	−1.019	0.4153
d_CO2pc	−1.05624	1.70898	−0.6181	0.5995
d_DrinW	23.0866	27.3547	0.8440	0.4875
d_GDPpc	−0.00628270	0.00925562	−0.6788	0.5673
d_HEpc	−0.0147378	0.0151477	−0.9729	0.4332
d_UnemR	0.191864	0.215939	0.8885	0.4680
DirR	−1.65367	1.78584	−0.9260	0.4522
EdAt	7.74850e-08	1.79057e-07	0.4327	0.7074
sq_d_CO2pc	1.14474	1.89717	0.6034	0.6076
sq_d_DrinW	−16.8630	19.7557	−0.8536	0.4833
sq_d_GDPpc	3.30287e-06	4.97393e-06	0.6640	0.5750
sq_d_HEpc	7.76048e-05	0.000107430	0.7224	0.5451
sq_d_UnemR	−0.791906	1.22407	−0.6469	0.5840
sq_DirR	0.383733	0.370996	1.034	0.4097
sq_EdAt	−2.48488e-13	1.43616e-13	−1.730	0.2257

Source: Own computation in Gretl

- Unadjusted R-squared = 0.941362
- Test statistic: TR^2 = 16.003150
- with p-value = P(Chi-square(12) > 15.609549) = 0.313182

As the result shows in Table 8, the p-value = 0.313182 > $\alpha = 0.05$, **H₀ is not rejected.** That is to say there is **no heteroscedasticity** in the model (1).

- Normality test $\alpha = 0.05$

$\mathbf{H_0 = 0}$, u_t is normality distributed in the model

$\mathbf{H_A \neq 0}$, u_t is not normality distributed in the model

Table 9 Frequency distribution, model (1)

Frequency distribution for uhat42, obs 2-18; number of bins = 7, mean = -2.00624e-14, sd = 0.237665

interval	midpt	frequency	rel.	cum.	
< -0.18867	-0.24294	2	11.76%	11.76%	****
-0.18867 - -0.080121	-0.13440	4	23.53%	35.29%	********
-0.080121 - 0.028427	-0.025847	5	29.41%	64.71%	**********
0.028427 - 0.13698	0.082701	3	17.65%	82.35%	******
0.13698 - 0.24552	0.19125	1	5.88%	88.24%	**
0.24552 - 0.35407	0.29980	1	5.88%	94.12%	**
>= 0.35407	0.40835	1	5.88%	100.00%	**

Source: Own computation in Gretl

- Chi-square(2) = 2.853 with p-value 0.33246

As the result shows in Table 9, the p-value = 0.33246 > $\alpha = 0.05$, **H_0 is not rejected.** That is to say it is **normality distributed** in the model (1).

4.2.4.5 Correlation Matrix of Model (2)

Table 10 Correlation coefficient using the observations 2000–2017, Czech Republic

5% critical value (two-tailed) = 0.4683 for n = 18

LEB	CO2pc	DrinW	GDPpc	HEpc	
1.0000	-0.9226	0.9872	0.9857	0.8926	LEB
	1.0000	-0.9371	-0.8807	-0.9017	CO2pc
		1.0000	0.9715	0.9425	DrinW
			1.0000	0.8723	GDPpc
				1.0000	HEpc
UrbanR	**UnemR**	**DirR**	**PhyD**	**EdAt**	
-0.6205	-0.7605	-0.8515	0.6096	0.1719	LEB
0.5469	0.5805	0.8524	-0.5572	-0.3659	CO2pc
-0.6937	-0.6994	-0.8165	0.6023	0.1774	DrinW
-0.5958	-0.8339	-0.7972	0.6135	0.1701	GDPpc
-0.7500	-0.5644	-0.7223	0.6463	0.1841	HEpc
1.0000	0.2678	0.4251	-0.2981	0.3816	UrbanR
	1.0000	0.5918	-0.5392	-0.1830	UnemR
		1.0000	-0.4969	-0.0746	DirR
			1.0000	0.1970	PhyD
				1.0000	EdAt

Source: Own computation in Gretl

Multicollinearity elimination

Table 10 confirms that there is multicollinearity between the following independent variables:

x_3 DrinW and x_2 CO2pc;

x_4 GDPpc and x_2 CO2pc, x_3 DrinW;

x_5 HEpc and x_2 CO2pc, x_3 DrinW, x_4 GDPpc

x_8 DirR and x_2 CO2pc, x_3 DrinW;

To eliminate this problem, the first difference method is used to replace x_3, x_4, x_5, x_8, which the new variables are shown as following.

x3 DrinW	→	d_ DrinW
x4 GDPpc	→	d_ GDPpc
x5 HEpc	→	d_ HEpc
x8 DirR	→	d_ DirR

Table 11 New Correlation coefficient using the observations 2000–2017,Czech

5% critical value (two-tailed) = 0.4821 for n = 17

LEB	CO2pc	d_DrinW	d_GDPpc	d_HEpc	
1.0000	-0.9219	-0.3122	0.2415	-0.4161	LEB
	1.0000	0.3150	-0.0144	0.2531	CO2pc
		1.0000	-0.3608	0.5049	d_DrinW
			1.0000	-0.4039	d_GDPpc
				1.0000	d_HEpc
UrbanR	**UnemR**	**d_DirR**	**PhyD**	**EdAt**	
-0.5482	-0.7272	-0.2264	0.5617	0.2421	LEB
0.5048	0.5450	0.1196	-0.5219	-0.4191	CO2pc
-0.4464	0.4859	-0.1275	-0.3499	-0.4302	d_DrinW
0.3300	-0.5384	0.0502	0.0653	0.3052	d_GDPpc
-0.2078	0.5186	0.0619	-0.0124	-0.1185	d_HEpc
1.0000	0.1213	0.2684	-0.1757	0.3592	UrbanR
	1.0000	0.0608	-0.4842	-0.2514	UnemR
		1.0000	-0.1083	0.5236	d_DirR
			1.0000	0.2582	PhyD
				1.0000	EdAt

Source: Own computation in Gretl

Table 11 shows that the multicollinearity problem disappears. At the same time, x_6 UrbanR and x_{10} EdAt are omitted from the model due to the bad singularity problem.

4.2.4.6 Stationary Test for Model (2)

$\mathbf{H_0 = 0}$, the time-series is stationary; $\mathbf{H_A \neq 0}$, the time-series is non-stationary

Table 12 KPSS test for stationarity in model (2)

KPSS test, 5% → Critical values: 0.150			
Critical values	CO2pc	0.117405	Not Reject
	d_DrinW	0.162045	Reject [6]
	d_GDPpc	0.10803	Not Reject
	d_HEpc	0.128415	Not Reject
	UnemR	0.0769183	Not Reject
	d_DirR	0.113709	Not Reject
	PhyD	0.0937909	***Not Reject***

Source: Own computation in Gretl

4.2.4.7 Parameter's Estimation for Model (2)

Table 13 OLS, using observations 2001-2017 (T = 17), Czech Republic

	Coefficient	**Std. Error**	**t-ratio**	**p-value**	
const	86.2348	1.16021	74.33	<0.0001	***
CO2pc	−1.04701	0.0725910	−14.42	<0.0001	***
d_DrinW	96.6906	23.9422	4.038	0.0029	***
d_GDPpc	0.000232070	0.000120833	1.921	0.0870	*
d_HEpc	−0.000972796	0.000285270	−3.410	0.0077	***
UnemR	−0.166717	0.0404358	−4.123	0.0026	***
d_DirR	−0.462475	0.137651	−3.360	0.0084	***
PhyD	0.857905	0.203067	4.225	0.0022	***

Mean dependent var	77.17461	S.D. dependent var	1.413390
Sum squared resid	1.143635	S.E. of regression	0.356470
R-squared	0.964220	Adjusted R-squared	0.936391
F(7, 9)	127.0126	P-value(F)	2.87e-08
Log-likelihood	−1.180440	Akaike criterion	18.36088
Schwarz criterion	25.02659	Hannan-Quinn	19.02346
rho	0.203569	Durbin-Watson	1.565701

Source: Own computation in Gretl

[6] Augmented Dickey-Fuller (GLS) test for d_DrinW indicates that the asymptotic p-value 0.07367, greater than the significant level 0.05. Therefore, the null hypotheses of Augmented Dickey-Fuller (GLS) test (non-stationarity) is rejected and d_DrinW is confirmed stationary.

The final economic model:

$$y_{2t} = 86.2348 - 1.04701x_{2t} + 96.69061x_{3t} + 0.000232070x_{4t} - 0.00097296x_{5t} - 0{,}166717x_{7t} - 0.462475x_{8t} + 0.857905x_{9t} + u_t \quad (6)$$

4.2.4.8 Model's Verification for Model (2)

Economic Verification

Table 14 Economic verification of parameters, Czech Republic

	Value	Economic verification	Hypotheses
γ_{11}	86.2348	If all independent variables equal to zero, the expected value is 86.2348. However, the variables will never be zero.	
γ_{12}	−1.04701	If CO_2 emissions per capita increase by 1 unit, the life expectancy at birth will decrease by 1.04701unit.	***Negative*** ***Confirmed***
γ_{13}	96.6906	If the population using at least basic drinking service increases by 1 unit, the life expectancy at birth will increase by 96.6906 units.	***Positive*** ***Confirmed***
γ_{14}	0.000232070	If GDP per capita increases by 1 unit, the life expectancy at birth will increase by 0.000232070 units.	***Positive*** ***Confirmed***
γ_{15}	−0.000972796	If health expenditure per capita increases by 1 unit, the life expectancy at birth will decrease by 0.000972796 unit.	***Negative*** ***Rejected***
γ_{17}	−0.166717	If the unemployment rate increases by 1 unit, the life expectancy at birth will decrease by 0.166717unit.	***Negative*** ***Confirmed***
γ_{18}	−0.462475	If the crude divorce rate increases by 1 unit, the life expectancy at birth will decrease by 0.462475 unit.	***Negative*** ***Confirmed***
γ_{19}	0.857905	If the population of post-secondary but non-territory increases by 1 unit, the life expectancy at birth will increase by 0.857905 unit.	***Positive*** ***Confirmed***

Source: Own computation

As could be seen in Table 14, six out of seven estimated parameters are fulfilled the previous assumptions, which also correspond to economic theory. Unfortunately, γ_{13} failed to be to confirm.

Statistical Verification

- Statistical significance of parameters $\alpha = 0.05$

H$_0$ $= \mathbf{0}$, Significant

H$_A$ $\neq \mathbf{0}$, Insignificant

From Table 13 we can see that only the P-value of $\gamma_{12}, \gamma_{13}, , \gamma_{15}, \gamma_{17}, \gamma_{18}, \gamma_{19}$ are less than $\alpha = 0.05$, even less than $\alpha = 0.01$. Thus, the variable CO2pc, DrinW, d_HEpc, UnemR, d_DirR and PhyD are statistically significant at a 1% significant level.

- Coefficient of determinants - R^2 Goodness of fit

The R^2 in equation (2) is 0.964220, which is to say 96.42of the dependent variable life expectancy at birth can be explained as independent variables. This number is much more than 50% meaning the model is suitable. Meanwhile, Adj.R^2 is 0.936391, 93.6391% that is also acceptable.

Econometric Verification

- Autocorrelation $\alpha = 0.05$

H$_0$ $= \mathbf{0}$, The is no autocorrelation in the model

H$_A$ $\neq \mathbf{0}$, There is autocorrelation in the model

Durbin-Watson statistic = 1.5657

p-value = 0.018079

We can see in the model (2) the value of DW Statistic is 1.5657, which is less than 2. Meanwhile, the p-value equals to 0.018079 < $\alpha = 0.05$. Unfortunately, **H$_0$ is rejected,** and we can say there is **autocorrelation** in the model (2).

- Heteroscedasticity $\alpha = 0.05$

H$_0$ $= \mathbf{0}$, The is no heteroscedasticity in the model

H$_A$ $\neq \mathbf{0}$, There is heteroscedasticity in the model

Table 15 White's test for heteroskedasticity for model (2)

OLS, using observations 2001-2017 (T = 17), Dependent variable: uhat^2

	coefficient	*std. error*	*t-ratio*	*p-value*
const	85.3421	25.1867	0.0772	*
CO2pc	−6.01576	3.32201	−1.811	0.2119
d_DrinW	−482.285	551.542	0.4741	0.4875
d_GDPpc	0.000479593	0.000195171	2.457	0.1333
d_HEpc	−0.00122969	0.000441203	−2.787	0.1082
UnemR	2.23298	0.773575	2.887	0.1020
d_DirR	−0.250364	0.182259	−1.374	0.3033
PhyD	−31.3415	13.7374	−2.281	0.1500
sq_d_CO2pc	0.283718	0.155568	1.824	0.2098
sq_d_DrinW	92107.8	96776.7	0.9518	0.4417
sq_d_GDPpc	−4.06649e-07	1.49548e-07	−2.719	0.1128
sq_d_HEpc	4.42373e-06	1.56852e-06	2.820	0.1061
sq_UnemR	−0.196244	0.0684156	−2.868	0.1031
sq_d_DirR	−0.179974	0.362099	−0.4970	0.6684
sq_PhyD	4.09534	1.74636	2.345	0.1437

Source: Own computation in Gretl

- Unadjusted R-squared = 0.930244
- Test statistic: TR^2 = 15.814153,
- with p-value = P(Chi-square(14) > 15.814153) = 0.324855

As the result shows in Table 15, the p-value = 0.324588 > $\alpha = 0.05$, **H_0 is not rejected.** That is to say there is **no heteroscedasticity** in the model (2).

- Normality test $\alpha = 0.05$

H_0 $= \mathbf{0}$, u_t is normality distributed in the model

H_A $\neq \mathbf{0}$, u_t is not normality distributed in the model

Table 16 Frequency distribution, model (2)

interval	midpt	frequency	rel.	cum.	
< -0.68391	-0.78015	1	5.88%	5.88%	**
-0.68391 - -0.49143	-0.58767	0	0.00%	5.88%	
-0.49143 - -0.29895	-0.39519	0	0.00%	5.88%	
-0.29895 - -0.10647	-0.20271	4	23.53%	29.41%	********
-0.10647 - 0.086012.	-0.010228	6	35.29%	64.71%	************
0.086012 - 0.27849	0.18225	4	11.76%	88.24%	********
>= 0.27849	0.37473	2	11.76%	100.00%	****

Source: Own computation in Gretl

- Chi-square(2) = 2.853 with p-value 0.24018

As the result shows in Table 16, the p-value = 0.24018 > $\alpha = 0.05$, H0 is not rejected. That is to say it is normality distributed in the model (2).

5 Results and Discussion

In the first part of the analysis, several findings from three dimensions of sustainable development in China and the Czech Republic have been found.

High-income countries tend to have higher SGD index score. The Czech Republic, as a high-income developed country, ranks 7th with 80.7 among all 169 countries. However, even though it seems well from the score, but it is still significantly below the maximum score 100. However, its spillover score indicator is relatively low, which is to say it does not make significant progress on issues related to sustainable consumption and production. On the contrary, the lower-income country, China, with SDG index score 73.2 ranking 39th, has higher spillover score. Both countries have done well towards to SDG1 (end poverty), which is 2015 the proportion of the population in the Czech Republic at risk of poverty or social exclusion was 14% which is much lower than the EU28 average, ranking the lowest score of the EU28. China had deceased its poverty incidence in rural areas to 1.7% in 2018 from 5.7% in 2015. Towards to SDG15 (life on land) and SDG16 (peace, justice and strong institution), China is way behind the Czech Republic. Biodiversity loss, terrestrial ecosystem and forest management need more attention from the Chinese government, as well as its human. Other improvements such as public access to information and protect fundamental freedoms, reduction on corruption also need more attention. Both countries have low scores to strengthen the means of implementation and revitalize the global partnership, which requires them to put more efforts into mobilizing their multiple resources for developing countries.

The gradual transition to a low-carbon economy is still a challenging task in the Czech Republic, characterized by high CO_2 emission per capita. Although the study shows that the volume of CO_2 emission per capita is lower in China compared with the Czech Republic, it also needs to require some attention to the companies and government due to the more significant increasing signal. In 2017, the Czech government adopted an ambitious national Climate Protection Policy which aims at ensuring a gradual transition to a low-emission economy by 2050. On the other side, China also realized the problem and has expedited industrial transformation to promote the development of low-carbon industries such as information technology, high-end equipment manufacturing and new energy.

Economic growth in China is faster, but GDP per capita remains much lower than the Czech Republic, representing a lower living condition from the economic perspective. The

Great Recession has a more significant impact on the Czech Republic in 2009 that led to a minus 4.8% GDP growth, while as a developing country, China did not suffer too much. However, the slowdown of China's economy in recent years is many economist's concern. In recent years, the Czech economy could be influenced by external factors, such as trade war, deterioration of economics of main trade partners and Brexit (Štípek & Čížek, 2019). Concerning GDP per capita, both countries have made significant progress over the last two decades, and it is undoubtedly an outcome of ending poverty. Czechs have more than double times of GDP per capita than China, which was $38,020 and $16,782 international dollars, respectively in 2017.

Considering export performance, both countries had a negative growth in 2009 which is the result of great Recession. In 2018, the export growth of China was 2.31% and 4.84% of the Czech Republic, compared to the world growth of 3.50%. As a medium-sized, export-driven economy, the Czech Republic heavily rely on foreign demand, especially from EU states. In 2018, its export of goods and services accounted for 78.39% of GDP. On the contrary, export sector contributes much less to China's GDP compared with the Czech Republic, which accounts for 19.51% in 2018. The decrease of contribution of exports in annual GDP suggests that the Chinese economic growth strategy is switching from depending on foreign demand to stimulating domestic demand, which represents by expanding imports while remaining exports to promote a trade balance.

Another indicator commonly used to measure economic activities is the unemployment rate. From the statistic, the unemployment rate in China has been constant at about 4% over the last few years. It can be explained partially by its socialist heritage, full employment policy of the government. In the Czech Republic, there are huger fluctuations in which the unemployment rate increased from 4.4% in 2009 to 7.28% in 2010. Eventually, there is a decline from 2013 to 2.90% in 2017. In recent years, the unemployment rate in the Czech Republic is much lower than the average of the European Union. It is partially due to its relative easiness to create factory jobs thanks to government incentives that made the Czech Republic very attractive to Global Companies (Cnbiz, 2017).

The statistic shows that the life expectancy at birth in China has increased more than 30 years over the last 60 years, from 44 years old age in 1960, to 76.47 in 2017, which is excellent progress compared with the Czech Republic that improved from 70 in 1960 to 79.48 in 2017. It is a visible result of its improved health development. This result of the presented paper is constant with the previous research (Deaton, 2006) that pointed out the life expectancy in developing countries has improved to a comparable level with the developed country even though its GDP per capita has not converged much closer to those developed countries. It has to be noted that although the life expectancy in both countries have been increasing, Figure 10, Figure 14 and Figure 15 indicate that living longer does not directly lead to an economy growth. It is no secret that with better living conditions the population is growing older, however, the main problem of the growing population of aging people is that it requires higher health and social expenses.

In the second part of the analysis, the relationship between life expectancy and its determinants were examined, both in China and the Czech Republic. The OLS regression results clearly demonstrate that the majority of the independent variables incorporated in analysis appear to be significant either in the first or second model.

A well-known issue connected with the linear time-series model is the so-called spurious regression, in which the non-stationary data has the possibility to result in a spurious regression. To cure this problem, the first difference method was used to make time-series stationary. In the paper, the KPSS test results show that time series are non-stationary in their level but stationary on their first differences (i.e., CO_2 emission per capita). However, one of the disadvantages of the KPSS test is that it has a higher rate of Type I error and tends to reject null hypotheses (stationary). One way to double-check it is to run the Augmented Dickey-Fuller (GLS) test. The ADF-GLS results indicate that EdAt in the model (1) is stationary on its level, and d_DrinW in the model (2) is stationary on its first difference.

In the Chinese model, the coefficient of determination of the model is 0.985691, meaning that 98.5691% of the variance of life expectancy at birth is explained by the independent variables. This number is very acceptable. The results found that CO_2 emission per capita, population using at least basic drinking water service, GDP per capita, health expenditure per capita, unemployment rate and educational attainment has relationships with life expectancy at birth, which correspondents the economic theory. The most influencing factor in the model is the unemployment rate, which is the life expectancy will decrease 1.12050 years if the unemployment rate increase by 1%. It could be explained that the working pressure is relatively high compared with other countries and young people with higher education are difficult to find a job. This result is constant with the research by Wang (2015), which found out that in the long run, 1% of increasing unemployment would cause a 6.8% mortality increasing in China. Following it is population using at least a basic drinking service, which could be interpreted that if the population using at least basic drinking water service increase 1%, the life expectancy at birth in China will increase 0.549843 years. CO_2 emission plays an essential role as well. The results show that 1 ton of CO_2 emission per capita increasing will lead to 0.377323 years decreasing of life expectancy at birth. However, statistical significance was not confirmed for these three factors. That is to that these independent variables cannot reflect the characteristics of all populations.

The next one is health expenditure per capita and GDP per capita, which both have a significant positive relationship with life expectancy at birth in China. Respectively, if health expenditure per capita increases one international dollar, the life expectancy at birth will increase by 0.0214122 years; if GDP per capita increases one international dollar, the life expectancy at birth will increase by 0.00236751 years. From the result, we can see that economic growth and health improvement play a critical role in improving the life expectancy of Chinese, even with a small marginal gain. The development of healthcare directly ensures a reduction of death risks, leading to an increased life expectancy.

Moreover, educational attainment has an insignificant positive relationship with life expectancy. The impact of improved education on life expectancy has been proved in many pieces of research, but in this paper, the effect is minimal and statistically insignificant. The unbalanced education resources in China, in which the variable cannot explain the entire population.

The only indicator, crude divorce rate, failed to prove the relationship with life expectancy at birth, which shows a significant positive impact on life expectancy. Usually, we assume that social harmony can benefit life expectancy. Nevertheless, in this paper, the results show that in China, the divorce rate does not directly affect life expectancy. Other factors would have contributed to it as well.

In the Czech Republic model, the coefficient of determination of the model is 0.964220, which means that 96.4220% of the variance of life expectancy at birth is explained service, unemployment rate, crude divorce rate and physician density are found that have a statistically significant relationship with life expectancy at birth. The most influencing factor is population using at least basic drinking service, which 1% increasing will lead to 96.6906 years old at life expectancy at birth. Following it is the CO_2 emission per capita, which indicates 1 ton of CO_2 emission per capita increasing will lead to 1.04701 years decreasing of life expectancy at birth.

There exists a significant positive influence of physician density in the Czech Republic model, where increasing one physician among 1,000 population will lead to 0.867905 years increasing at life expectancy while health expenditure per capita failed to prove the assumption that its improvement has a positive relationship with life expectancy. When we look at this outcome with the Chinese model that has the contrast result, it corresponds to some researches that have showed that the health care development on life expectancy required more attention in developing countries as they could directly use advanced medical technologies from developed countries to improve their population health (Jiang, et al., 2018).

Different with the Chinese model, the crude divorce rate has a significant negative association with life expectancy at birth in the Czech Republic, which with 1% increasing crude divorce rate, the life expectancy at birth decreases by 0.462475 years. The data shows that family harmony plays an essential role in improving health condition and then indirectly contributes to life expectancy at birth.

While GDP per capita has an insignificant positive impact on life expectancy at birth, this outcome is constant with the study of Bilas et al. (2014). However, the marginal effect of this paper is 0.000232070. That is, a unit increase in GDP per capita increases life expectancy at birth by 0.023 per cent, which implies a very negligible influence of these variables.

Unemployment is also an influential factor that has a significant negative relationship with life expectancy in the Czech Republic. If the unemployment rate increases by 1%, the life expectancy at birth will decrease by 0.166717 years. Evidence from several countries has shown that even after allowing other factors, unemployed people suffer a substantially increased risk of premature death. Furthermore, job security does increase health (Wilkinson & Marmot, 2003).

6 Conclusion

The present paper firstly provided a theoretical background of sustainability, giving a base for practical analysis. After it, the paper examined sustainable development in developing country China and developed country the Czech Republic. The comparisons concerning several indicators were provided. Furthermore, the determinants of life expectancy were examined in the second part of the analysis in both countries. Following the part of the results and discussion with further explanations are provided..

All nations are putting lots of effort into sustainable development. The result of the research conducted in the first part indicates the performances toward sustainable development in China and the Czech Republic. To be precise, SDG index, CO_2 emission per capita, economic growth, GDP per capita, the export of goods and service, unemployment rate, Aging Index, dependency ratio, and life expectancy at birth were compared. The results suggest that as a developing country, China is making more considerable progress with higher spillover rate, but the overall performance is worse than the Czech Republic. Both countries are generating a severe amount of greenhouse gases, which the transition of the low-carbon economy is still a challenging task. However, the effort aiming at decreasing the emission of greenhouse gases to ensure low-carbon industries have been determined by both China and the Czech Republic. The export sector plays a vital role in both economies, but it contributes more to the GDP of the Czech Republic. The living standard of Chinese is left behind the Czechs, representing by lower GDP per capita, lack of fundamental freedoms, serious corruption. The aging problem exists in both countries, but with a higher Aging Index and projected dependency ratio in the Czech Republic. Again, strengthing the partnership to mobilize its resources for other developing countries need to draw more attention from both the Chinese and Czech governments.

The paper also tried to explore the environmental, economic, and social determinants of life expectancy of China and the Czech Republic, using a regression analysis model. The data analyzed in the paper was collected from several public databases. Eight frequently used variables have been used as independent variables to examine their significance in determining life expectancy at birth in China and the Czech Republic. The spurious regression problem was solved by using the first difference method to make time-series stationary. The results reveal that most of the variables turned to be significant either in China or the Czech Republic in constant with previous studies. Appropriate tests have been performed to examine the robustness of the two models used in the analysis. The goodness of fit tests confirmed the appropriateness of the regression analysis, and heteroscedasticity and non-normality were absent in the two models. Autocorrelation didn't exist in the first model, but unfortunately, it existed in the second model. Likewise, the marginal effects of some variables have been found negligible in the analysis. The limitation of the study is the short period of observations, not including some other variables due to the lack of available and comparable data.

Despite the limitations mentioned, the results have some implications for both China and the Czech Republic. In China, an increase in health expenditure per capita and GDP per capita is undoubtedly crucial for well-being and population health, as well as the life expectancy. Better access to healthy water, less CO_2 emission per capita, and lower unemployment are also crucial for human development but may not necessarily increase life expectancy. In line with previous researches, improved education attainment has a positive influence on life expectancy. On the other hand, except for the similarities with China, family harmony, which indicated by the crude divorce rate in this paper, is vital for human development and as well as life expectancy in the Czech Republic. Although health expenditure per capita did not show a relationship with life expectancy in the Czech Republic in the present study, it does not mean that health care is not important. The number of physicians shows the significance from another point of view, which its increasing can undoubtedly improve life expectancy.

7 Reference

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8 Appendix

Appendix A Data set of determinants of life expectancy, China and the Czech Republic, 2000 - 2017

Year	Life expectancy at birth, total (years)		Per capita CO2 emissions		Health expenditure per capita PPP (Current international $)		GDP Per capita PPP (Current international $)		Unemployment rate		Crude divorce rate %		Physicians (per 1,000 people)		Enrolment in post-secondary non-tertiary education, both sexes (number)		People using at least basic drinking water services (% of population)	
	CHINA	CZECH	CHINA	CZECH	CHINA	CZECH	CHINA	CZECH	CHINA	CZECH	CHINA	CZECH	CHINA	CZECH	CHINA	CZECH	CHINA	CZECH
2000	71.40	74.97	2.61	12.33	129.50	923.50	2936.288	16190.81	3.00	8.77	0.96	2.9	1.25	3.37	1E+06	49824	80.39	99.81
2001	71.73	75.17	2.65	12.33	134.39	1032.85	3227.419	17554.49	3.25	8.12	2.184	3.1	1.27	3.45	744923	36919	80.73	99.81
2002	72.06	75.22	2.91	12.06	152.82	1127.06	3553.924	18189.23	3.85	7.29	2.184	3.1	1.13	3.51	691812	48340	81.70	99.81
2003	72.38	75.17	3.41	12.41	172.24	1273.36	3958.472	19426.09	4.20	7.80	2.184	3.8	1.17	3.53	611786	73629	82.65	99.82
2004	72.69	75.72	3.90	12.48	188.11	1328.83	4449.562	20799.16	4.25	8.32	2.184	3.2	1.2	3.52	633582	21630	83.58	99.82
2005	72.99	75.92	4.37	12.21	210.17	1402.74	5081.049	21956.38	4.20	7.92	1.37	3.1	1.23	3.56	633582	21574	84.47	99.83
2006	73.27	76.52	4.80	12.27	229.24	1475.48	5867.797	23776.49	4.15	7.13	1.46	3.1	1.26	3.57	221270	21482	85.33	99.83
2007	73.55	76.72	5.13	12.38	248.92	1578.25	6847.070	26124.90	4.05	5.32	1.59	3.0	1.28	3.57	204524	20833	86.16	99.84
2008	73.84	76.98	5.49	11.79	292.06	1777.91	7615.030	27844.80	4.05	4.40	1.71	3.0	1.33	3.56	234692	20439	86.96	99.85
2009	74.12	77.08	5.74	10.99	357.18	2015.93	8352.690	27599.30	4.30	6.68	1.85	2.8	1.41	3.58	225178	20044	87.74	99.85
2010	74.41	77.42	6.25	11.15	384.20	1920.95	9303.734	27667.43	4.15	7.28	2	2.9	1.45	3.6	205547	19921	88.48	99.86
2011	74.71	77.87	6.87	10.88	438.56	2010.96	10355.496	28797.42	4.10	6.71	2.13	2.7	1.48	3.64	182866	19642	89.19	99.86
2012	75.01	78.08	7.01	10.48	507.79	2042.60	11328.282	29047.25	4.10	6.97	2.29	2.5	1.56	3.67	145052	17402	89.87	99.87
2013	75.32	78.18	7.08	10.04	573.48	2379.51	12361.398	30485.71	4.07	6.96	2.57	2.7	1.65	3.69	657935	58513	90.52	99.87
2014	75.63	78.82	7.06	9.82	632.76	2472.18	13446.402	32263.32	4.08	6.13	2.67	2.5	1.71	3.61	1E+06	61305	91.14	99.88
2015	75.93	78.58	6.96	9.88	703.50	2425.85	14454.998	33691.42	4.05	5.07	2.79	2.5	1.8	3.61	1E+06	65424	91.73	99.88
2016	76.21	79.03	6.91	10.04	761.49	2484.63	15513.273	35230.52	4.04	3.94	3.02	2.4	1.89	4.314	1E+06	58106	92.30	99.88
2017	76.47	79.48	6.98	10.16	359.79	1745.44	16782.208	38019.58	3.94	2.90	3.15	2.4	2.01	3.61	2E+06	52404	92.85	99.88

Note: The data highlighted in blue was used mean value as the missing data.