

A Statistical Analysis of Greece's Recovery From The 2008 Financial Crisis and Their Progress in SDG Goal 8

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ABSTRACT

The 2008 Financial Crisis heavily impacted the Greek economy due to economic mismanagement, poor bailout measures, structural weaknesses already present in the economic system of the Greek economy, and government failing to accurately report debt levels in the country. This resulted in a large amount of poverty following 2009, and a large recession in the country. However, in 2015 Greece also committed to achieving the Sustainable Development Goals by 2030, which was set by the United Nations, and Goal 8 was achieving Decent Work and Economic Growth. Utilising the 10 sub-goals set by the United Nations, it was found that Greece was on track to achieve 7 of the goals, however still needed to do more action regarding 3 of the goals, for them to be met.

Keywords: Mathematics; Probability and Statistics; Economics; Finance; Greece

Introduction

Over the last few years, Greece's economy and job market has been a great stain on a country rich in history, philosophy, and mathematics. To understand why and how this has occurred and why achieving their 8th Sustainable Development Goal of Decent Work and Economic Growth may be difficult, it is important to re-establish how and why they got themselves into this troubling position, The Global Financial Crisis.

The Global Financial Crisis in 2008 ravaged Greece's economy, as Greece already had a large amount of debt at this time that was already higher than its calculated GDP (gross domestic product), with the debt to GDP ratio being a staggering 109.4% in 2008¹. For reference, the average debt to GDP ratio now is only 67.1%², however this difference is further exacerbated by the fact that the COVID-19 pandemic made this average rise dramatically, meaning that in 2008, Greece was even further behind other countries.

The GFC caused a decline in Greece's GDP due to the decrease in tourism and shipping, and over the course of 2008, the Athens Stock Exchange (ATHEX) dropped 65%. If this wasn't enough, in 2009 it was revealed that the Greek government had covered up the true budget deficit of the country, which wasn't at 6.7 %, but was at 15.4%. Interest and borrowing costs in the country skyrocket, and the country is in a state of economic turmoil.

On May the 2nd, 2010, Greece, with a debt to GDP now at 127%, the International Monetary Fund and the European Union decide to bailout Greece by lending them 110 billion euros (168 billion aud), and their plan was to pay out creditors and ensure that they pay off debt and decrease spending, which would pave a way for Greece to make a surplus and recover. However, these austerity measures only make things worse, and Greece now had a debt to GDP ratio of 172% in 2011, 63% higher than in 2008.

On February the 21st, 2012 the IMF and EU lends Greece another 130 billion euros (200 million aud), further increasing taxes and cutting spending. This largely works, as the Greek economy is now stabilizing and recorded a surplus in 2014. However, the Greek citizens are suffering due to these reforms. Unemployment in Greece sat at 25%, and citizens weren't happy with the high tax rates and lower wages.

In 2015 a snap election occurs, and a government is put into power which increases spending dramatically. This results in a liquidity crisis, and the country defaults on its debt in 2015, plummeting its credit score. The stock exchange and banks close, and on July the 26th 2015, the government takes another bailout for 86 billion euros (131 billion AUD), much to the opposition of Greek citizens, which meant further taxes and wage cuts. This works, and the Greek economy stabilizes.

Altogether, the Greek GDP shrunk 25% because of the crisis, and the debt to GDP ratio now sits at 199%³, with 1/3 Greeks being at risk of living in poverty. Due to the crisis the Greek economy is now in a bad state, with the unemployment rate in Greece standing at 16.9% currently, with the average being 6.5% in the world.

The 8th SDG (Decent Work and Economic Growth) has 10 sub-goals which, when achieved, will constitute as the country achieving the goal. With Greece currently in a precarious position, it will be interesting to see whether they are projected to achieve these 10 sub-goals.

Indicators

In each SDG goal, there are targets within them that define whether the overarching goal has been completed. For Decent Work and Economic Growth, there are 10 sub-goals, which are;

8.1: Sustain per capita economic growth in accordance with national circumstances and, in particular, at least 7 per cent gross domestic product growth per annum in the least developed countries

8.2: Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors

8.3: Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services

8.4: Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-Year Framework of Programmes on Sustainable Consumption and Production, with developed countries taking the lead

8.5: By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value

8.6: By 2020, substantially reduce the proportion of youth not in employment, education or training

8.7: Take immediate and effective measures to eradicate forced labour, end modern slavery and human trafficking and secure the prohibition and elimination of the worst forms of child labour, including recruitment and use of child soldiers, and by 2025 end child labour in all its forms

8.8: Protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment

8.9: By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products

8.10: Strengthen the capacity of domestic financial institutions to encourage and expand access to banking, insurance, and financial services for all

When all these sub-goals are defined as being “completed”, the overarching goal can be defined as being achieved. However, many goals do not set a specific value as being completed.

Due to this, a “completion” value will need to be set before it is possible to determine whether Greece is projected to complete the goal. As this entire report mainly goes back to the financial crisis Greece.

faced, the majority of goals will be suited so that when the SDGs are projected to be completed in 2030, that Greece returns to its (so far) peak economic state in 2008.

The research here done is necessary as it is hard to measure financial recovery; this paper seeks to measure it as best as possible and determine whether a country of more than 10 million citizens is on the right pathway to recovery. The goal of this paper is to determine how likely it is that Greece will complete SDG Goal 8 through the usage of statistical analysis using data provided by the UN. Whilst literature has been published regarding the Greek crisis, none have analysed it in the manner of relating it to the 8th SDG.

Results & Discussion

SDG Goal 8.1

While a specific value for growth is given (7%), this only pertains to the least developed countries, which Greece is certainly not a part of. Therefore, it was decided that a fair enough goal in this regard would be to have a GDP per capita growth, which, when achieved would bring Greece back to their GDP per capita level in 2008, which stood at 31,997 USD. From their current GDP per capita of 20,277 USD, and with the SDG goals planning to be achieved by 2030, we can use the equation $31997 = 20277(x)^8$ and find out the annual growth rate required. Using this equation gives us a value of $x=1.059$, meaning that the target value for Greece's completion in this goal would be to sustain an annual growth rate of 5.9% regarding their gross domestic product per capita.

Now that the required value has been given, we can now estimate whether Greece is on track to achieve this goal. By simply looking at the indicator produced by the United Nations which is the annual growth rate of real GDP per capita and finding their average growth rate over the last 7 years (SDGs were established in 2015) it is possible to garner an accurate and reasonable idea as to whether the goal will be achieved.

Table 1

Year	Annual growth rate of real GDP per capita (%)
2015	0.5
2016	-0.1
2017	1.3
2018	1.9
2019	1.9
2020	-8.8
2021	8.7

Average rate of growth = 0.78%

Growth goal = 5.9%

Average < Goal, therefore the estimate is that goal 8.1 will not be completed by 2030.

SDG Goal 8.2

It's hard to measure the success of this sector, however an indicator has been provided, with it being the annual growth rate of real GDP per employed person. To identify their goal, the data from the indicator from the years 2000-2008 has been averaged, which gives a value of 3.5%. This was the average annual growth rate from before the financial crisis. Looking at the growth rate since 2015 gives us the estimation, but also exemplifies just how devastating the impact of the current economic crisis has had on the country.

Table 2

Year	Annual growth rate of real GDP per employed person (%)
2015	0.2
2016	-0.1
2017	1.5
2018	2.1
2019	2.3
2020	-8.6
2021	8.7

Although the average growth for these values comes out to 0.87%, which is far lower than 3.5%, the goal was to establish whether a growth rate could be maintained at previous 2008 levels. Although the growth rate currently is lower than pre-2008, we can see that some figures are reasonably close to 3.5 and could easily grow to that stage, with the period from 2017-2019 being evidence of that. Dueto this, if we exclude 2020 & 2021 (due to the COVID recession and comeback) and find the average growth in the percentage between 2015 and 2019 and multiply it by 8 to project the rate in 2030, this will give us a far more accurate insight as to whether 8.2 will be achieved.

Average growth in percentage between 2015-2019 = 0.525%

$0.525\% \times 8 = 4.2$

Goal = 3.5%

Average > Goal, therefore the estimate is that goal 8.2 will be completed by 2030.

SDG Goal 8.3

In this goal, the indicator is the proportion of informal employment in total employment. Informal employment is when an individual is employed by somebody, however taxes are not involved. Unfortunately, even though a lot of research was done, no statistics on this indicator could be found, however a different set of statistics were found, which was the size of the undeclared economy proportional to the GDP. According to a report done by the International Labour Organisation⁴ in 2013, the undeclared economy remained, surprisingly, relatively unchanged by the financial crisis.

Table 3

Year	Undeclared economy proportional to the GDP in Greece (%)
2008	24.3
2009	25
2010	25.4
2011	24.3
2012	24
2013	23.6

Although these figures are out of date, these are the only figures available, so an estimation had to be made with only these statistics. Since the figure in 2013 is better than the one in 2008, an estimation unrelated to the financial crisis must be made. Looking at a report made by Professor Colin C. Williams from the University of Sheffield, the average size of the undeclared economy proportional to the GDP in Europe stood at 18.4% [5]. Normally, adjustment of the figure for 2022 would be needed, however due to the COVID-19 pandemic, this would remove all the progress needed for all countries, so a figure of 18.4% would be a suitable aim. Due to COVID, it is believed that the undeclared economy would skyrocket, so the estimated 2022 figure would be around 25%, a bit higher than the era around the financial crisis.

To make an estimate, only the years 2010-2013 will be considered, as in 2010 the first bailout occurs. If we calculate the average change in GDP throughout this period, it comes out to -0.6%. Therefore, to get the estimated statistic, the equation $25 - 0.6(8)$ was done, which comes out to 20.2%.

Goal Estimation, therefore the estimate is that goal 8.3 will not be completed by 2030.

SDG Goal 4

In this goal, there are 2 indicators. One is the material footprint per GDP, and the other is the domestic material consumption per GDP. Unfortunately, for the first indicator there is no statistics available, however a report from the European Environmental Agency from 2019 stated that Greece had reduced its material footprint by more than 30% since 2010 [6], so it can be estimated that Greece satisfies and completes the first indicator. As for the second indicator, using the Eurostat values (numbers produced by the European Union) there is a table showing the Domestic Material Consumption per capita in Greece since 2010 [7]:

Table 4

Year	Domestic material consumption per capita in Greece
2010	16.752
2011	15.279
2012	14.151
2013	13.284
2014	13.949
2015	13.379
2016	12.707
2017	12.544
2018	12.179
2019	11.586
2020	9.85
2021	9.819

The outstanding statistic in this sector is that the average DMC per capita value in the European Union in 2021 was 14.135, meaning that Greece is 44% better than the rest of the European Union. The fact that Greece is outperforming and showing such great progress in this goal means that Greece is on course to complete goal 8.4 by 2030.

SDG Goal 8.5

As for this goal, there are two indicators as well. One is the average hourly earnings of female and male employees, and the other is the unemployment rate by sex. Since goal 8.5 is about equal pay and opportunity, the goal is clear; to make the gap between these indicators to be 0 at 2030.

Unfortunately, it was unable to find any information regarding indicator one, however there is data for the second indicator.

Table 5

Year	Male (Unemployment rate) %	Female (Unemployment rate) %
2015	21	28
2017	17	25
2020	13.75	20

Although the main goal for this indicator is to reduce the inequality between genders, it is still very interesting to note the extremely high rates of job unemployment in Greece caused by the financial crisis. The average unemployment rate in the world is 6.5%, showing that Greece is still far, far away from reaching the average.

In 2008, the unemployment rate for females was 13%, and for males it was 5%. Without doing any calculations, it is clear from the statistics that the unemployment rate in plunging as new economic laws is being passed, and that Greece has remained relatively stable in 2022. If the unemployment rate continues to drop, so will the gap between the genders. Due to this, it is estimated that goal 8.5 will be completed by 2030.

SDG Goal 8.6

As for this goal, the indicator is the proportion of youth not in education, employment or training. In this context, the UN has defined “youth” as being between the ages of 15-24. Surprisingly, statistics show that this statistic was left relatively unchanged throughout the financial crisis, but the real difference came during the failed bailout by the European Union in 2010.

Table 6

Year	The proportion of youth (15-24) not in education, employment or training. (%)
2008	11.4
2009	12.4
2010	14.8
2011	17.4
2012	20.2
2013	20.4
2014	19.1
2015	17.2
2016	15.8
2017	15.3
2018	14.1
2019	12.5
2020	13.2

Amazingly, Greece is far ahead of the world in this statistic. According to a report made by the International Labour Organisation, the average youth NEET rate was 22.4% in 2020 [8], and according to a report by the European Union, the average youth NEET rate in Europe in 2021 was 13.2% [9]. This means that Greece is actually one of the world's leading nations when it comes to a solution to the growing NEET problem. Due to this reason, it is estimated that goal 8.6 will be completed by 2030.

SDG Goal 8.7

In this goal there is one indicator, with that being the proportion and number of children aged 5-17 years being engaged in child labour. Unfortunately, no direct information is available regarding this indicator on Greece, however an alternative was found, which was to look at the proportion of primary-school children which were out of school, assuming that they all worked. Furthermore, no information regarding 15-17 year olds could be found, so it was assumed that the proportion in this age would be the same. The goal for this indicator will be to get the rate as close to 0% as possible.

Table 7

Year	Proportion of children aged 5-17 years being engaged in child labour
2011	2.78
2012	2.27
2013	2.07
2014	2.96
2015	2.18
2016	1.52
2017	1.25
2018	1.43
2019	0.89

Looking at the table provided, it is clear that Greece is well on its way to achieving this goal, as the statistics keeps on dropping. This is further extenuated by the fact that more children not be working during COVID, as demand for child labour would decrease during this time. Due to these reasons, it is estimated that goal 8.7 will be completed by 2030.

SDG Goal 8.8

For this goal, there are two indicators. One is the non-fatal occupational injures per 100,000 workers, and the other is the level of national compliance with labour rights. Obviously this cannot be measured by statistics, so it was determined that this indicator would be measured by the International Labour Organisation on a scale from 0-10, with 0 being the best possible score

(most compliant).

For the first indicator, the goal will be to reduce the statistic by 80% from the 2008 level. The reasoning for this is that in 2008 many Greeks chose to enter any job they could find due to the scarcity, resulting in unsafe workplaces. The reason the percentage was chosen to be 80% is because it was determined to be a significant enough decrease.

Table 8

Year	Non-fatal occupational injuries per 100,000 workers
2008	475.8
2009	440.9
2010	352.3
2011	329.8
2012	294.5
2013	275.4
2014	96.4
2015	159.6
2016	108.5

80% of 475.8 equates to 95.16, and this has already nearly been achieved in the year 2014. Coupled with the fact that less people are in the workforce due to COVID and that there were less jobs outdoors, it is fair to say that this indicator was regarded as being completed by Greece.

Regarding the second indicator, the International Labour Organisation has released scores for Greece from 2015-2020. The goal for this indicator will be to achieve a score of 1.59, as this was the average score for the developed countries of the world.

Table 9

Year	Level of national compliance with labour rights (0 being the best)
2015	1.02
2016	1.02
2017	1.02
2018	0.85
2019	0.85
2020	0.85

These results are absolutely staggering, with Greece actually having one of the most compliant scores in the entire world, with their score being far better than the average of the developed nations. This is miraculous for a country, who is still reeling from the effects of a financial and job market crisis. This indicator is regarded as being completed.

Due to the fact that both indicators were estimated as being completed, it is estimated that goal 8.8 will be completed by 2030.

SDG Goal 8.9

As for this goal, the indicator is the tourism direct GDP as a proportion of total GDP. This essentially means the proportion of the GDP caused by tourism. The goal for this goal will not be to make it as high as possible, as if it were high there would be an overreliance on this one sector, and if there was another global shutdown, Greece would pretty much collapse. Therefore, it was decided that the goal of this would be to bring Greece back to their 2019 level, as of course the COVID-19 pandemic sought to ruin the economic stability for all nations in the world from 2020 till now, especially in the tourism sector. **The 2019 statistic for Greece was that tourism was responsible for 28% of the GDP**, so that will be our target. Unfortunately, there will only be the statistics from 2020 and 2021 available to make the estimation, so further digging will be required.

Table 10

Year	The tourism direct GDP as a proportion of total GDP
2020	10.49
2021	16.4

Although these statistics gives little to go on, it shows that Greece at the very least is making a recovery. However, these statistics do not show the full story; Greece is actually a world leader in recovery from the pandemic in terms of the tourism sector. According to greekreporter.com [10], Greece in 2022 has reached 90% of their pre-pandemic 2019 levels in terms of tourism revenue. The reasoning for this is that 6 Greek cities are in the top 10 tourist bookings in Europe for summer, which is the holiday season and is when tourists are most likely to spend exorbitant amounts of money.

Furthermore, Greece is the only country in Europe on the road to full post-COVID-19 recovery of its total and direct air connectivity, according to the Airport Industry Connectivity Report for 2022 released recently by ACI Europe, the trade association of Europe's airports. Lastly, Athens International Airport only recorded a drop of 6.8% comparing 2022 June to 2019 June.

The reason as to why Greece recovered so well is because the country opened up non-essential travel far earlier than most European countries, and that there are no COVID-19 restrictions to travel there. There is no vaccine mandate for visitors as well. Due to the handling of the situation, it seems that the Greek government has put the economy over the wellbeing of the nation. Despite this being an interesting observation, this is irrelevant when answering the main question.

Due to these reasons, it is estimated that goal 8.9 will be completed by 2030.

SDG Goal 8.10

For this goal, there are actually three indicators. One is the amount of commercial bank branches per 100,000 adults, the second is the amount of ATMS per 100,000 adults, and the last is the proportion of adults (14<) with a bank account.

For the first indicator, the goal will be different to what initially thought. For this goal, it isn't good to have a high amount of bank branches, as they becoming more out-of-date when compared to the new form of banking, which is in the digital format. For example, the rate of bank branches per 100,000 people in OECD countries (a collection of wealthy nations) has declined since 2007. Therefore, to say that a high bank branch rate is successful is not correct. However, due to the financial crisis less and less Greeks trust their own countries' banks. This further extenuates the fact that this statistic actually has little to no relevance to high-income countries, and is situational. As already discussed, the higher the rate doesn't necessarily mean better. However, it also wouldn't cause much effect in Greece due to their population's distrust of the banking system. Due to these reasons, it was actually decided to not count this indicator as being an aspect of success.

For the second indicator, it is pretty simple to say that the more ATMs the better, especially in Greece where more people have been inclined to use cash instead of credit cards and other means of paying. The goal for this sector will be to have the same amount as in 2008, which was 80.43.

Table 11

Year	Amount of ATMS per 100,000 adults
2015	58.68
2016	59.28
2017	61.56
2018	62.28
2019	63.37
2020	63.88

Using this information, we can deduct an average in the growth each year, which equates to 1.04. If we multiply 1.04 by 10 it equates to 10.4, meaning that the estimated 2030 number comes out to 74.28, which is obviously less than 80.43. The estimation that Greece will not meet this goal is further backed up by the fact that COVID would've affected the rate at which ATMS could be constructed.

Therefore, it is estimated that the second indicator will not be completed.

As for the third indicator, the goal will be to see a high level of growth, to the point where it can be reasonably estimated that 99% of the 14+ population will have a bank account in 2030.

Table 12

Year	Proportion of adults (14+) with a bank account
2011	77.94
2014	87.52
2017	85.47
2021	94.88

Looking at these results and especially the growth from 2017-2021, it can be comfortably estimated that more than 99 percent of the population in Greece 15 and older will have a bank account. This is further supported by the fact that more people are having bank accounts due to the digitalization of the world economy after COVID.

The classification for this goal has been defined as not being complete. The reason for this is that to define a goal as being “complete” is to finish everything contained inside it, and this is simply not true due to the fact that the second indicator has been classified as not being projected to finish.

Therefore, it is estimated that goal 8.10 will not be completed by 2030.

Conclusion

Overall, out of the 10 indicators in SDG goal 8 for Greece, it has been estimated that 3 will not be completed and 7 will be completed by 2030.

For Greece, this is tremendous. Greece has suffered from horrible governments, poor investing and a dismal reputation for the last few years, however this research essay shows that Greece is recovering very well, if not already has recovered.

There are still some areas for growth, however. Economic growth, aspects of the job market and financial institute access must be improved in order to meet their goals by 2030.

In conclusion, this report has shown that Greece is well on its way to complete SDG goal 8, if some more little effort is made. Greece has recovered tremendously from the financial crisis, and the government and population must be commended for their efforts since 2015 to complete the

relevant goals.

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