

**Mendel University in Brno**  
**Faculty of Business and Economics**



***Stability of rate of inflation and economic growth***

Bachelor thesis

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I would like to thank sincerely to the supervisor of my bachelor thesis, Ing. Marcel Ševela for his expert guidance, consultations, comments and support while writing the entire thesis.

## **Declaration**

Herewith I declare that I have written my final thesis “Stability of rate of inflation and economic growth” by myself and all sources and data used are quoted in the list of references. I agree that my work will be published in accordance with Section 47b of Act No. 111/1998 Sb. On Higher Education as amended thereafter and in accordance with the Guidelines on the Publishing of University Student Theses.

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## **Abstract**

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The aim of this thesis is to describe and empirically test the influence of the financial stability approximated by the rate of inflation on economic growth in the long run.

The purpose of the overview of the literature is to identify the main theoretical aspects that explain the role of the inflation rate on consumer behavior and their propensity to save.

The empirical part will focus on the analysis of time series describing economic growth and the inflation rate to discover patterns and common trends. It will be studied a sample of five countries developed in recent decades to determine the long-term trends and the hypothesized relationships.

The discussion and conclusions will focus on critical evaluation of the results, especially in relation to equality of other assumed conditions and the heterogeneity of countries determined by significant differences in their institutional framework.

## **Keywords**

Economic growth, saving rate, accumulation of capital, technological progress, inflation rate, expectations of savers.

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## 1 Introduction

By a historical view of the data, we know that the fluctuations of many economic variables are often very unstable in the short term, particularly in the last few decades in which the world economy has witnessed a progressive and imposing globalization of markets; this phenomenon increases even more the vulnerability and instability of many economic variables as these are influenced by other factors, belonging to other markets and other territories (even very distant geographically). This interdependence between the markets has increased exponentially in the last century. It is therefore difficult to establish if, for example, a country has a low or high rate of inflation or employment in the course of 25 or 50 years since, as we have said before, these phenomena are susceptible of large variations in the short term. However, this does not exclude that the economic systems can tend toward stably low values rather than high or vice versa in relation to some economic phenomena, (e.g. countries that tend to have a high inflation over 5 decades, although these countries pass through short periods of low inflation). In this thesis we will go therefore to analyze the data on inflation and economic growth of the main economic systems and then apply practically some of the theories most important in the field and finally we are going to look for a possible relationship between stability/instability of the inflation rate and the level of economic growth in the long term. This thought derives from the fact that, as highlighted by the model of Solow, an higher saving rate, and therefore a greater accumulation of capital, positively affects the economic growth in the long term. The Stability / instability inflation and any policies of the credibility of the central bank, directly affect the amount and level and the savings rate (due to variations of uncertainty) and indirectly the economic growth in the long term.



## 2 Aim and Methodology

The objective of this thesis is to analyze the possible relationship between inflation and economic growth as regards to the main economic systems. This indirect relationship will be analyzed by studying the following intermediate steps random:

- the stability or instability of the inflation influences consumers in consumer choices and savings;
- according to the analysis of Solow, the savings rate positively influences the accumulation of capital in the long term;
- always according to the analysis of Solow, capital accumulation determines the level of economic growth in the long term;
- then on equal terms and considering a situation of equilibrium between saving and investment, nations with a higher rate of savings will reach in the long term a level of product per capita higher compared to the nations with a lower rate of savings.

The methodology used will be analytical and comparative, whose assumptions are based mainly on the Solow model and the new growth theories. We are then analyzed the data on a sample of nations; later these data will be processed in order to study a possible relationship between the phenomena through the simple linear regression model. The report that you want to study requires the study of some intermediate steps. We will take as a reference some countries belonging to the OECD and then we will proceed with the collection of data on the savings rate, inflation rate, GDP growth rate and growth rate of GDP. In analyzing the results, we will study, using the linear regression model, the following possible relationships:

- inflation rate and savings rate;
- savings rate and growth rate of GDP;
- inflation rate and growth rate of GDP.

These models will be created for each country studied in the chapter on the empirical analysis. These nations are Italy, Germany, USA, Britain and Japan.

Whereas, as we shall see in the course of the argument, the relationships between these variables show their dependence in the long run (and not immediately), in the chapter devoted to the empirical analysis we will consider the annual average of these variables in intervals of ten and fifteen years, so as to take into account the time required for such aggregate variables perform their effects over time. These time intervals will be considered:

- 80's (years from 1980 to 1989);

- 90's (years from 1990 to 1991);
- 2000-2015 (years from 2000 to 2015).

The critical analysis of these results will be made taking into account the heterogeneity between these intervals of time taken into account (in terms of significant economic and social events for the variables studied in this thesis) and between Nations object of this study (in terms structural and institutional diversity of the analyzed economic systems).

In conclusion, the objective of this work is that of finding a relationship between the two phenomena in order to demonstrate how the average level of inflation in an economic system can influence economic growth in the long term.

The main body of this thesis is divided into three parts:

- in the first part we will talk about economic growth in the long run on a group of countries (mainly OECD countries), emphasized the role that the savings rate in the level of economic growth in the long run;
- the second part will be referred to the causes and effect related to inflation, in order to study how the financial instability in the economy will affect the savings of investors choices.
- the third part will be obtained and will discuss the results of the thesis.

The reference to economic literature is quite extensive.

In the first part, we will refer mainly to the Solow model that emphasizes the importance of the savings rate for capital accumulation and economic growth in the long run. However, this analysis is a limit: according to Solow, economies grow to the point of steady state and cannot go further. Whereas the convergence hypothesis of countries posed by the analysis of Solow does not seem to have found fully reflected in the historical data, we will test the limit, and we'll refer to new theories of growth, which introduce the technology endogenous process and crucial for economic growth : such theories give an explanation of why in recent decades has not verified the convergence process suggested by Solow.

In the second part, we will refer to the Keynesian theory to analyze the economic equilibrium conditions necessary for the theories at the basis of this thesis can find a scientific confirmation. In addition, it will refer to the Philips Curve and its subsequent amendments to analyze inflationary periods of the nations in recent decades, and then make a reference to the Lucas critique in order to test it with the data and assess the impact of monetary policies on the behavior of workers, businesses, investors and consumers.

In the third part, the empirical analysis will focus on a sample of five countries, all OECD. The main sources to analyze the phenomena in this sample will be the OECD data: we will

use in large part the data of the OECD database in order to ensure the homogeneity of the data and the correct comparison between nations.

### 3 Savings and economic growth: comparison between countries

#### 3.1 Economic growth in the long term

Economic growth in terms of constant increase in production aggregated over time, is not directly affected by fluctuations in the short term (such as for example a recession or a period of expansion). However, situations tendentially stable or unstable in a temporal arc very large can influence the trend of the determinants of economic growth in the long term, such as capital accumulation and technological progress. Physical capital and human capital are real investments made by companies and the State. By observing the data on economic growth in the last century, the State plays a fundamental role as regards investment, both from a qualitative point of view and from the point of view of quantity.

An economic system in macroeconomic balance, understood as the balance between aggregate demand and aggregate supply, also implies a balance between saving and investment (Keynes, Tea theory...). And it is precisely the savings rate the crucial question of this thesis: This parameter is complementary to the consumption and this means that an increase of the propensity to save indicates a loss of consumer confidence and this can lead to a reduction of the production in the short term (this mechanism is also known as the trap of savings or of the liquidity trap). However, the savings rate is positively correlated to an increase in investment (thanks to the reduction of the rate of interest and thus to a reduction in the cost of the investment) and this reflects positively on the accumulation of capital, since the latter represents an investment on the part of enterprises. In fact, if we indicate with the level of investment and with  $S$  the level of savings, we obtain the following relation:

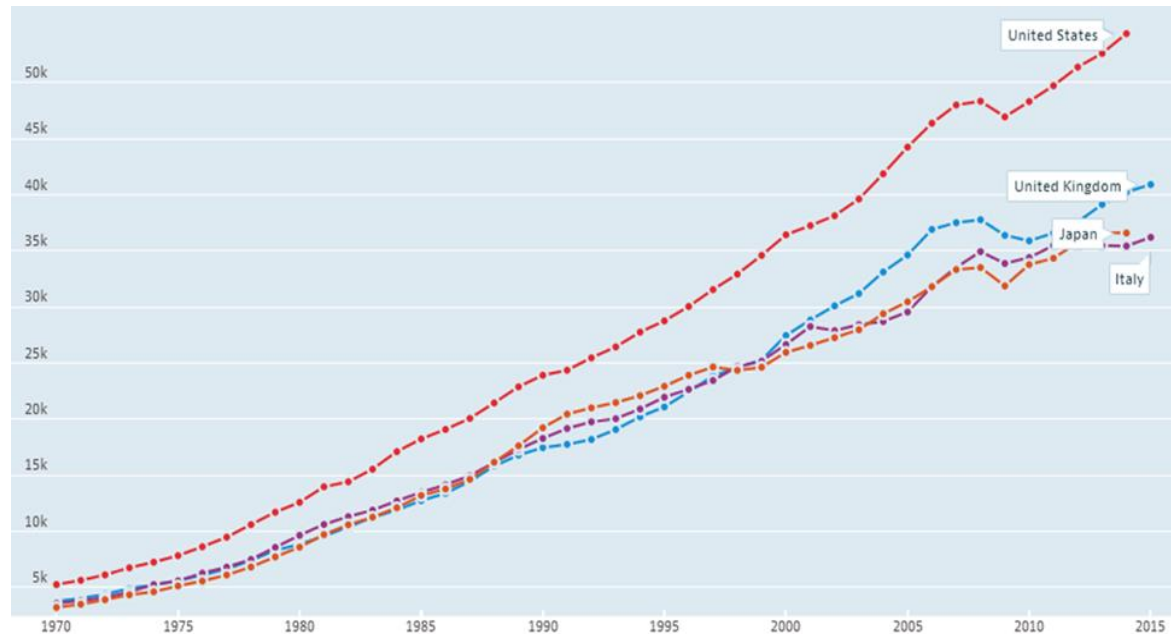
$$I=S$$

The level of savings is determined by the level of income and from the savings rate so it is possible to rewrite the equation as follows

$$I = sY$$

Where  $s$  is the marginal propensity to save and  $Y$  is the level of aggregate production.

Therefore it is evident that the savings rate affects the level of investment and therefore of the accumulation of capital in the economy and therefore economic growth in the long term.

**Figure 1:** Real GDP per capita in Italy, U.K., U.S. and Japan (PPP adjusted), since 1970

Source: <https://data.oecd.org/>

From the graph of Figure 1 it is possible to observe the trend of per capita GDP from 1970 to 2015 in United States, United Kingdom, Japan and Italy. Since 1970, the per capita GDP in the nations taken into consideration is increased as follows:

- 10,14 times in Italy;
- 10.36 times in the USA;
- 11.42 times in Japan;
- 10.97 times in the United Kingdom.

These data highlight the so-called force of compounding (compound interest, i.e. interests that produce interest) and are extremely significant because they reflect economic growth versus the population in a time span of only 45 years. In addition the USA to have a similar growth before 1970, we have used well 170 years. In addition, if we consider the period between the year 1000 and 1800, the growth is only increased by about three times. Address similar also applies to the other three countries taken into consideration, which have also been the subject of a strong economic growth in the period after the Second World War.

These data therefore concern between some of the greatest economic forces in the world of the last century and it is possible to observe a similar trend in other countries too.

Moreover, from the observed data showed a trend toward convergence in levels of per capita production in the course of time: the levels of product per capita were much more similar in 2015 than they were in the post-war imminent. In fact, since 1950, Italy, Japan

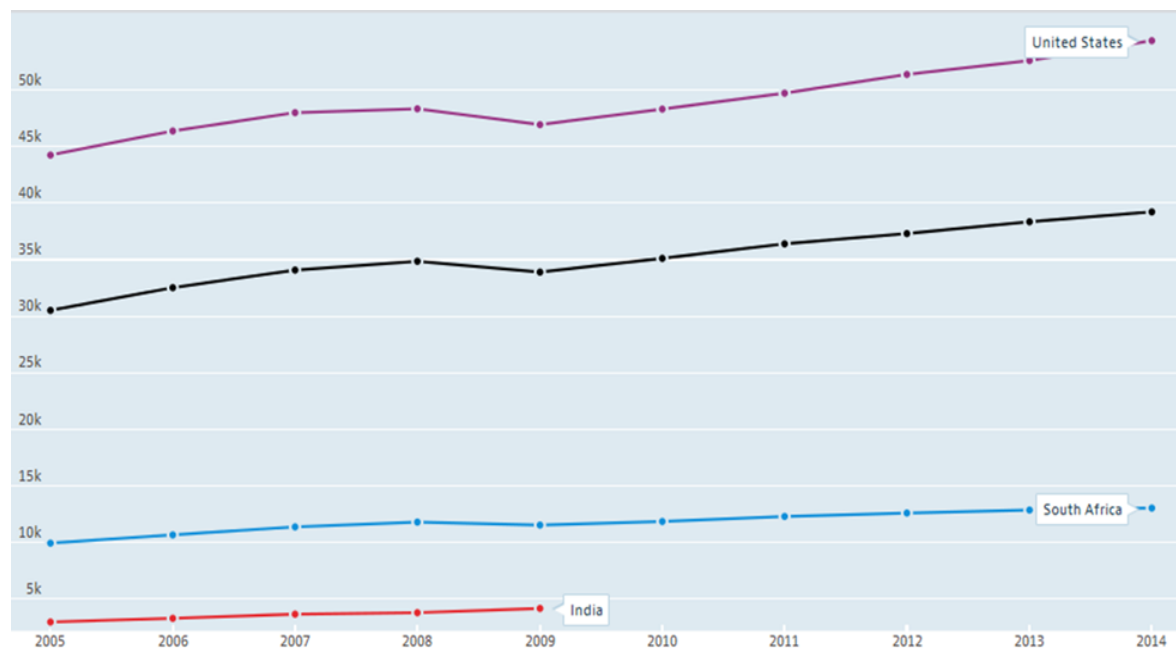
and Great Britain (countries "tardy") grew at a rate higher than the USA (in absolute terms the largest force in the world of the twentieth century), thus reducing considerably the gap.

This convergence of per capita production also extends to other OECD countries.

Different speech is for countries characterized by low value of GDP per capita: although they too have grown at a faster rate in the course of the last century with respect to previous centuries, this growth was not parallel to the one of the most industrialized countries and therefore has not occurred the convergence process assumed by Solow. The reasons can be different, such as political and social problems, low availability of valuable natural resources, adverse weather conditions, high distance between social classes, poor distribution of the wealth generated.

For example, the very poor countries like India and South Africa have certainly experienced higher growth in the last century with respect to economic growth observed in previous 800 years, but are very far from converge to the average level of the countries belonging to the OECD. To observe more in detail this great divergence, look at the next graph.

**Figure 2:** Real GDP per capita in the U.S., South Africa, India and OECD countries (PPP adjusted), since 1970



Fonte: <https://data.oecd.org/>

The graph of Figure 2 shows the trend of per capita GDP in the last ten years of the USA, South Africa, India (whose data are available only up to 2009) and the average of the countries belonging to the OECD. In 2008, the GDP per capita in India was equal to 10.85% of that of the OECD countries and only to 7.82% with respect to the GDP per capita of the USA. While the per capita GDP of South Africa represented in the same year

the 33,83 % and 39 % compared to the OECD countries and the USA. In this case, the cause of low growth observed in India and South Africa is not due certainly at a low rate of savings, but at a level of production constantly very low which implies, regardless of the savings rate, levels of saving and investment also very low.

### 3.2 Analysis of Solow and accumulation of physical capital

Physical capital is represented by investments in material resources (e.g. machinery, buildings, computers and the like) which can be used in the production process and the use of which extends for more than a year. The accumulation of this factor in time is therefore a necessary condition so that you can check an economic growth and is positively influenced by the savings rate. In fact, we know that in a situation of equilibrium decisions of savers are compatible with those of the investors (Evsey Domar, 1939). Must therefore be satisfied the following

$$S_t = I_t$$

Where  $S_t$  è is the level of save of year  $t$  and  $I_t$  is the level of investment in year  $t$ .

As seen previously, we know that the following equation applies:

$$S_t = sY_t$$

Where  $s$  is the marginal propensity to save and  $Y$  and the level of production.

Then we can rewrite the previous equation as follows:

$$I_t = sY_t$$

Investments represent amounts of resources, which, from period to period, are to be added to the stock of capital goods that already exist. It is therefore obvious how the savings rate is decisive for investment and thus in the long term for the accumulation of capital. According to the analysis of Solow, capital not depreciates at an annual rate constant: in other words, each year a constant portion of the stock of existing capital becomes unusable. So that you can generate an intensification of capital, i.e. an increase of the capital-labor ratio, the capital investments in the year  $t$  must be greater than the depreciation of capital which occurred in the same year, in order to cover that part of the capital which becomes unusable and add new capital to the stock of existing capital remained intact.

### 3.3 New Theories of Economic Growth and accumulation of Human Capital

The new theories of growth considers, unlike the model of Solow, technical progress as an endogenous variable (i.e. explained within the model) and is tightly linked to the enhancement of human capital meaning with the latter set of knowledge, skills and capacities possessed by workers in a given economic system. The human capital depends on the level of education, training and professional experience acquired by individuals.

As we will see in the course of this paragraph, even the human capital, as the physical capital, is determined by the level of energy present in an economic system.

A nation in which there are many highly skilled workers will surely be more productive of a nation in which the level of qualification on the part of workers is relatively low.

Toward 1800, in the current Member States belonging to the OECD, 70% of the population was illiterate. Today the illiteracy rate in OECD countries is slightly higher than the 4%, thanks to the laws that make compulsory primary education.

The human capital accumulated by an undertaking, unlike the physical capital, produces knowledge and such knowledge generate positive externalities. In fact, qualified workers can give input innovative and creative unlike physical capital. In addition the knowledge acquired from an undertaking which, for example, invests in research and development, can be acquired easily also by other undertakings despite laws designed to protect the know-how. Thus, part of the knowledge generated by the innovator will sooner or later be inevitably at the disposal of the other undertakings, and this undoubtedly represents an advantage for consumers. The knowledge acquired by a firm which invests in research and development, not exhausting its effects within the undertaking in which it is generated, can be likened to a public good not rival and non-excludable which produces positive effects for the whole community.

The production of each undertaking may not therefore depends only by physical capital and labor employed, but also depends on the investments in research and development, by training programs for workers and from the knowledge gained thanks to the positive externalities of knowledge. Then the aggregate production in an economic system depends positively by physical capital, from work (understood in the traditional sense, as labor) and by human capital.

The accumulation of human capital is similar to that of physical capital since the investment in human capital represents an economic cost, evaluated by firms with future benefits connected thereto, from which we expect a value greater than the costs.



It is appropriate to make a reference to the theory of growth proposed by Lucas, according to which the production function of human capital has a marginal productivity growing because individuals with a wealth of human capital greater need less time to achieve the same growth rate in terms of human capital.

In addition the human capital, unlike the physical capital, not depreciates much more slowly because the capacity, in addition to deteriorate more slowly (e.g. aging of a worker), often improves over time as more are applied and may be transmitted with ease from individual to individual.

As we said before, an important factor that determines the human capital is the savings rate.

In nations where there is a level of savings higher, businesses can make greater investment in research and development and the Government can invest in education (for example by improving the effectiveness of schools and universities and providing subsidies for students in order to increase the number of people educated within the Nation). The countries that save more and/or who spend more in education can reach higher levels of product per capita in steady state.

**Table 1:** Human Capital Index 2015 detailed rankings (the first 35 countries)

Country	Overall index		Under 15 Age Group		15–24 Age Group		25–54 Age Group		55–64 Age Group		65 and Over Age Group	
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
Finland	85.78	1	97.67	1	85.04	2	81.49	1	83.72	6	73.06	7
Norway	83.84	2	93.16	12	83.87	3	79.48	4	85.14	3	74.59	2
Switzerland	83.58	3	92.78	16	83.08	5	80.03	2	83.45	8	73.28	6
Canada	82.88	4	93.00	15	88.70	1	75.84	14	84.15	5	72.97	8
Japan	82.74	5	94.76	5	76.26	21	78.61	5	85.24	2	75.39	1
Sweden	82.73	6	91.88	21	81.23	11	79.62	3	84.40	4	70.42	17
Denmark	82.47	7	91.61	25	82.31	9	78.15	6	83.66	7	74.12	4
Netherlands	82.30	8	93.41	9	83.81	4	77.55	7	80.63	14	69.53	18
New Zealand	81.84	9	95.07	4	81.83	10	74.15	21	85.72	1	74.19	3
Belgium	81.12	10	93.86	7	78.62	16	77.24	9	77.87	25	68.39	22
Austria	81.02	11	92.24	18	82.70	8	75.42	15	79.01	21	72.09	10
Ireland	80.59	12	96.05	2	75.68	27	75.94	13	77.65	28	67.58	26
Australia	80.22	13	89.98	29	82.87	6	74.26	19	82.64	10	71.23	14
France	80.15	14	93.05	14	75.89	23	76.98	10	77.24	30	66.53	29
Slovenia	79.95	15	93.20	11	78.66	15	74.43	18	76.75	32	71.40	13
Estonia	79.88	16	93.20	10	77.09	18	73.59	23	82.59	11	71.69	11
United States	79.64	17	88.09	40	82.86	7	74.64	17	80.61	15	70.44	16
Lithuania	79.33	18	92.58	17	75.65	28	74.24	20	80.89	13	68.34	25
United Kingdom	79.07	19	91.70	23	74.77	31	76.42	12	78.73	22	61.12	47
Iceland	78.86	20	92.23	19	78.97	14	75.06	16	74.15	45	60.07	50
Luxembourg	78.79	21	90.83	26	72.68	42	76.69	11	75.36	37	66.85	27
Germany	78.55	22	79.56	75	79.87	12	77.55	8	82.67	9	73.47	5
Latvia	78.39	23	89.39	31	75.89	24	73.30	24	80.52	16	71.56	12
Singapore	78.15	24	95.47	3	75.96	22	74.12	22	71.35	53	54.76	66
Czech Republic	77.60	25	88.52	36	76.69	19	72.85	26	77.69	27	68.35	24
Russian Federation	77.54	26	86.81	44	79.13	13	71.77	29	80.45	17	70.69	15
Cyprus	77.33	27	93.57	8	70.59	53	72.92	25	74.86	39	63.78	36
Poland	77.06	28	90.10	28	74.57	32	72.38	27	75.46	35	65.65	32
Israel	77.03	29	89.16	32	75.88	25	71.40	31	79.10	20	66.78	28
Korea, Rep.	76.84	30	91.91	20	75.81	26	70.36	34	78.42	24	61.73	43
Ukraine	76.21	31	90.48	27	77.51	17	66.75	41	79.19	19	72.40	9
Hungary	75.82	32	85.24	50	73.38	38	71.86	28	77.13	31	69.14	20
Malta	75.77	33	88.59	35	73.52	36	71.65	30	72.88	49	63.13	39
Slovak Republic	75.48	34	87.81	41	71.89	48	70.86	33	76.26	34	65.66	31
Italy	75.44	35	91.68	24	72.07	47	68.99	39	75.23	38	62.93	40

Source: <http://reports.weforum.org/human-capital-report-2015/results-and-analysis/>

In the table 1, we find the ranking of the 35 countries that are positioned in the highest places as regards the measure of human capital. This measure is carried out with econometric methods.

The Scandinavian nations are positioned to the first places in the standings thanks to policies of social security, which ensure a high level of education, and training in countries. Finland (1) is the best-performing country in the world when it comes to building and leveraging its human capital potential, taking the top spot on the Under 15 and 25-54 age group pillars and scoring in the top ten for the remaining age groups. Norway (2) and Switzerland (3) follow closely behind with a strong performance across all age groups, although they do not make it to the top 10 in the Under 15 age group pillar.

Canada (4) is the only North American country in the top 10, being the overall leader for the 15-24 age group pillar. Japan (5) performs strongly in the 55-64 and 65 and Over Age

Group pillars, boosted by the longevity and education of its older population, but held back by relatively low labor force participation in the first working age group, in particular due to the gender gap.

Sweden (6) slightly outperforms Denmark (7) although both have strong results across all age groups. New Zealand (9), the only other country from the Asia and the Pacific region, places in the top ten for all age group pillars except for the 25-54 age group pillar, two in particular to a comparatively lower economic complexity and labor force participation rate.

**Table 2:** Human Capital Index 2015 detailed rankings (last 35 countries)

Country	Overall index		Under 15 Age Group		15–24 Age Group		25–54 Age Group		55–64 Age Group		65 and Over Age Group	
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
Cameroon	60.75	89	69.23	102	60.36	88	58.40	76	60.72	86	46.43	86
Nicaragua	60.65	90	69.26	101	56.22	101	55.60	88	69.27	60	58.20	55
Venezuela	60.51	91	79.13	77	65.05	74	53.04	100	53.95	102	36.58	108
South Africa	60.50	92	75.32	88	54.44	108	58.24	78	61.96	82	35.24	111
Kuwait	59.31	93	85.20	51	47.83	116	51.15	105	57.40	91	42.62	96
Namibia	59.09	94	70.99	97	52.81	109	54.55	93	61.19	84	54.22	67
Morocco	59.04	95	76.37	84	56.07	103	52.97	101	58.56	89	40.69	102
Honduras	58.93	96	68.39	103	61.22	86	53.55	98	60.68	87	49.35	77
Cambodia	58.55	97	67.21	106	56.02	104	55.48	89	60.78	85	49.00	79
Tunisia	58.21	98	81.05	71	59.05	93	49.81	107	48.72	113	35.97	110
Bangladesh	57.62	99	74.98	89	59.28	91	48.35	111	57.22	92	45.87	87
India	57.62	100	82.03	67	57.50	98	49.34	109	46.42	115	33.47	114
Kenya	57.54	101	71.58	96	51.54	111	54.55	92	56.76	95	40.71	101
Uganda	57.34	102	63.84	109	60.36	89	55.17	90	59.65	88	39.16	104
Tanzania	56.56	103	61.44	114	60.05	90	53.72	96	57.74	90	47.10	84
Madagascar	56.25	104	62.89	111	55.69	105	54.51	94	56.65	97	44.59	91
Lao PDR	56.16	105	74.47	92	59.06	92	49.78	108	49.02	111	31.64	117
Nepal	55.77	106	76.56	83	61.62	84	47.55	114	44.62	119	30.93	118
Lesotho	54.74	107	67.82	104	51.31	112	53.07	99	49.67	109	33.74	112
Rwanda	54.17	108	69.48	100	58.66	94	48.15	112	47.71	114	33.55	113
Mozambique	54.04	109	61.70	113	52.21	110	52.08	102	52.48	106	44.81	89
Malawi	53.49	110	59.24	117	54.72	106	51.33	104	55.41	100	41.59	98
Senegal	53.04	111	63.78	110	47.32	118	49.82	106	52.87	105	46.54	85
Myanmar	52.97	112	59.12	118	63.91	75	47.00	116	54.74	101	39.76	103
Pakistan	52.63	113	60.52	115	50.85	113	51.37	103	50.96	108	39.15	105
Algeria	52.14	114	74.64	90	54.67	107	44.93	119	43.93	120	20.29	123
Ethiopia	50.25	115	52.37	123	58.37	97	47.37	115	48.90	112	43.19	94
Burkina Faso	49.22	116	57.05	120	46.34	120	48.54	110	45.93	116	36.94	107
Côte d'Ivoire	49.02	117	65.05	107	47.43	117	45.18	118	41.37	121	28.54	119
Mali	48.51	118	59.27	116	49.50	115	44.52	120	44.80	118	36.20	109
Guinea	48.25	119	56.86	121	41.00	123	47.59	113	49.07	110	37.74	106
Nigeria	47.43	120	53.01	122	50.16	114	46.25	117	45.43	117	32.42	116
Burundi	46.76	121	64.10	108	47.28	119	37.54	122	56.07	99	26.93	121
Mauritania	42.29	122	57.85	119	42.57	121	37.46	123	34.73	123	24.43	122
Chad	41.10	123	50.50	124	40.41	124	38.83	121	37.31	122	27.93	120
Yemen	40.72	124	62.70	112	42.00	122	34.06	124	25.54	124	17.54	124

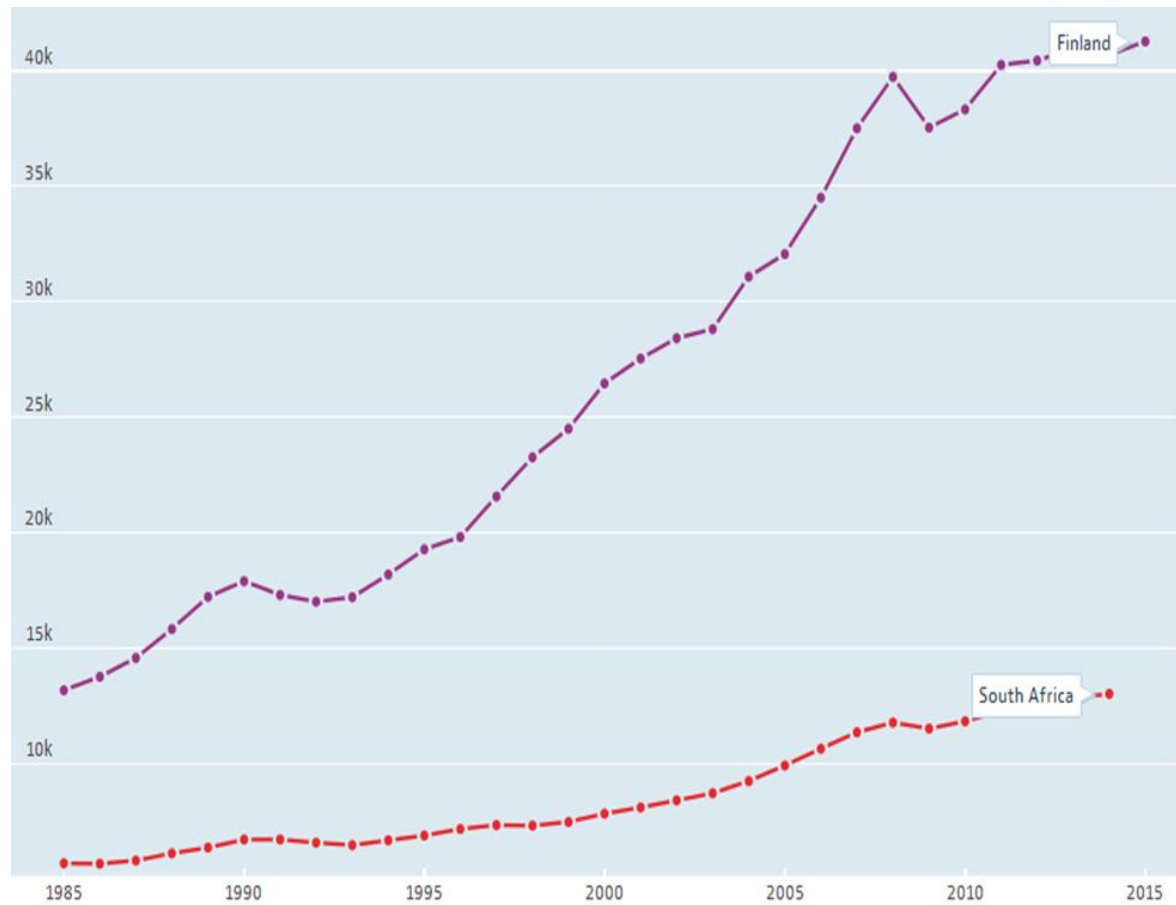
**Source:** <http://reports.weforum.org/human-capital-report-2015/results-and-analysis/>

In the table 2, are represented the 35 nations that were classified at a lower level than this ranking conducted by the World Economic Forum.

This ranking reflects the trend of the last few decades and then we can highlight how these nations recognized for their low productivity, have not had an economic progress also due

to the very low rate of Human Capital Index. This can be one of the reasons why these countries, although far from their steady state, they find it difficult to grow economically.

**Figure 3:** Comparison between Finland and South Africa in terms of GDP per capita in the last 30 years



Source: <https://data.oecd.org/>

In Figure 3, we can observe and compare the trend of per capita GDP in the last 30 years between Finland, who arrived in the first place in the standings in the ranking of the Human Capital Index of 2015, and South Africa, which is reached between the last of the rankings.

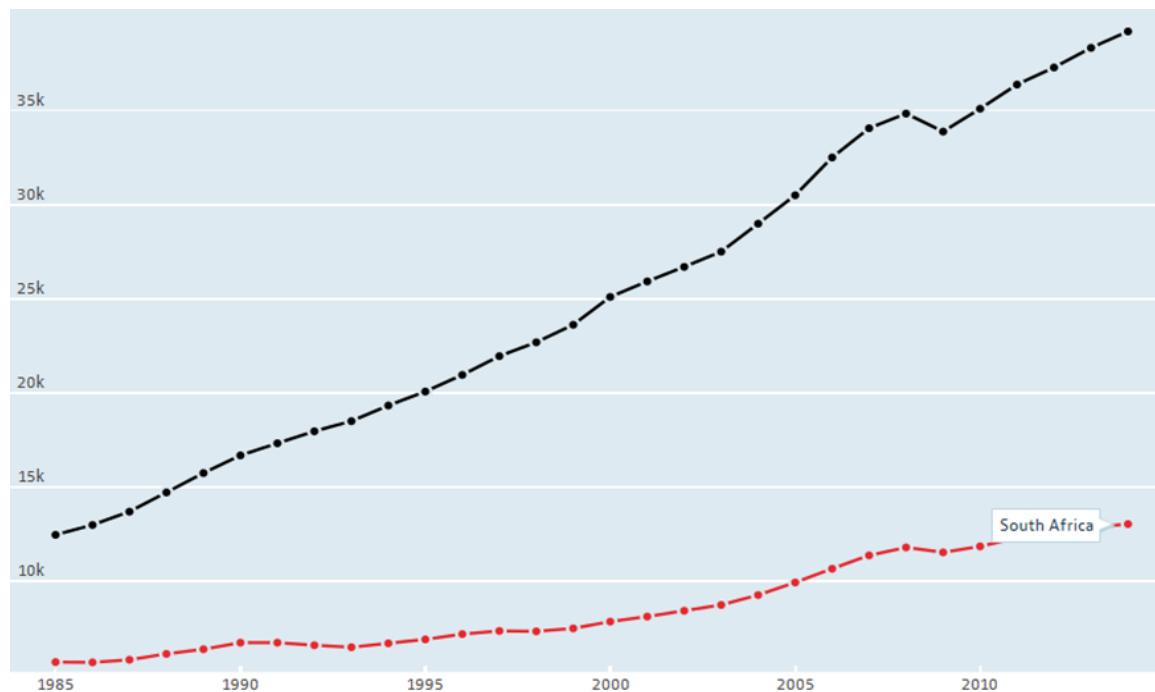
As we have said before, this ranking reflects the trend of the level of human capital in recent decades and the detected deviations in 2015 are not as excessive. We can then proceed with the comparison.

- Finland in 1985 was already at a good level of per capita income (considering the trend of nations in that period) with a per capita income equal to 13.186 USD per capita per year. The per capita income per annum detected in 2015 is equal to 41.266 USD. In this nation, the increase in the GDP per capita in percentage terms over the last 30 years was of 3.13%.
- Let us now analyze the evolution of South Africa. In 1985 showed a level of per capita income per year equal to 5.699 USD while in 2015 this level was equal to 13.032 USD (more low per capita income that had the Finland in 1985). The increase in the GDP per

capita in the course of the last 30 years amounted to only 2.28%; an increase very low considering the following factors:

I. The growth rate is much higher in the countries belonging to the OECD. In the figure below, we can see the difference between the average per capita income of the countries belonging to the OECD and the per capita income of South Africa in the past 30 years.

**Figure 4:** Comparison between OECD countries and South Africa in terms of GDP per capita in the last 30 years



Source: <https://data.oecd.org/>

In fact, there is a huge difference. The countries belonging to the OECD, already very developed since the eighties, grew much more quickly than in the South Africa (although this is the most advanced country in Africa): in fact the line that represents the growth of GDP per capita of the countries belonging to the OECD is much more inclined with respect to the line that represents the growth of South Africa.

II. According to the model of Solow, the poorest countries (then the economies with capital levels and low income) should grow faster than countries with a per capita income higher. In the long term we should therefore observe a certain tendency to convergence in levels of per capita income of the various countries, i.e. it should be noted that the poorest countries "run after" richer countries and this implies that the poorest countries should grow faster than countries that have a stock of wealth higher.

Ultimately we can conclude by saying that the growth human capital is crucial for economic growth: this means that are decisive for economic growth also all other factors that influence the growth of human capital, such as the initial stock of human capital, investment in human capital and the savings and therefore also all the factors that affect positively the savings rate, such as for example a period of inflation is not accompanied by a recession which tend to create instability and therefore an increase in the savings rate without causing an excessive fall in aggregate production.

### **3.4 Technological progress**

Technological progress is a determinant factor for sustained economic growth and is closely linked to the accumulation of human capital because it is the fruit of knowledge that evolves in time. The technological progress, as the accumulation of physical and human capital, depends positively by the investments (first among all investments in research and development), and therefore depends positively by the savings because, as we know, in a situation of economic equilibrium saving is equal to investment. The technological progress generates important results for economic growth, some of which are listed as follows:

- greater productivity;
- economies of scale;
- production of innovative products
- improving the quality of existing products.

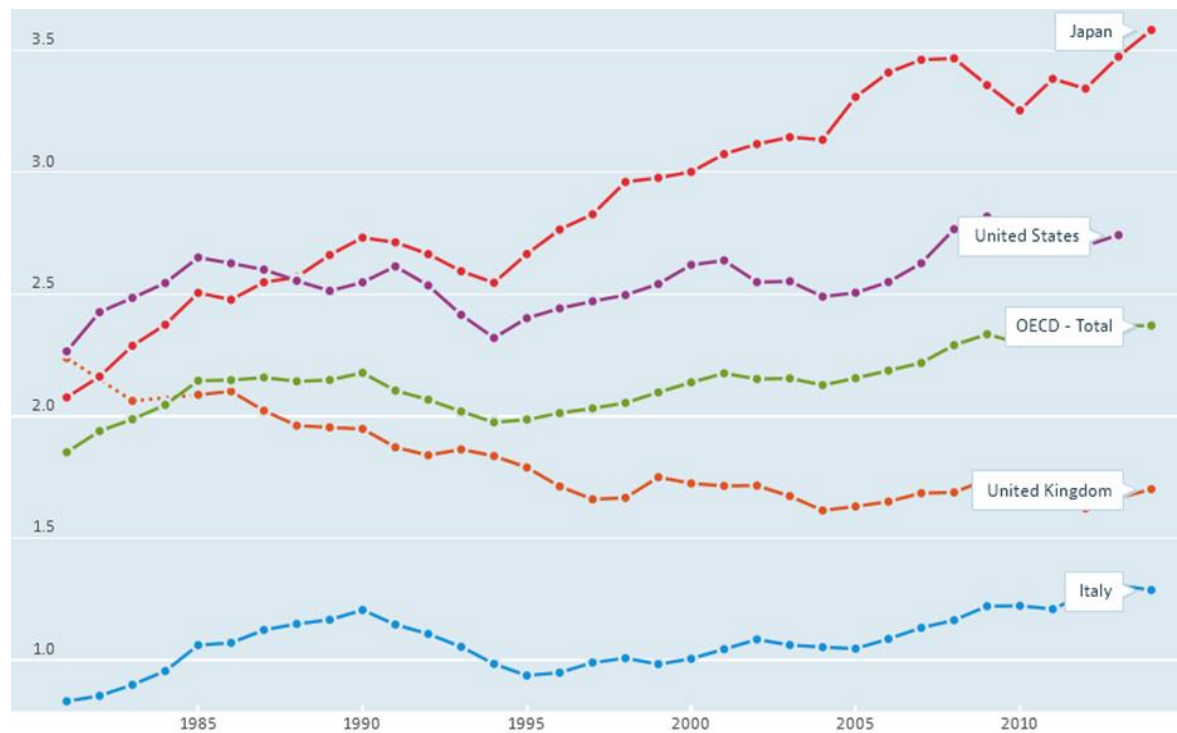
These results are reflected immediately in a greater surplus of wellness for consumers, which are to be able to choose a wider range of products of superior quality compared to previous; often everything also translates into greater competition, which encourages businesses to fix a mark-up less costs.

New theories of growth, unlike the approach proposed by Solow, consider the technological progress as an endogenous factor and no longer as external factor that grows constantly. The technological progress, being linked to the valorization of capital as a result of the externalities created by the manufacturing process can then be influenced by economic policy and by the choices of business investment.

The countries that save and invest more in knowledge can grow faster even in the steady state since the marginal productivity of knowledge is not decreasing but remains constant and therefore the accumulation of this factor may increase ever since there are no grounds to curb the accumulation of such a productive factor. According to the new theory of

growth, the technological process is a process endogenous to the saving activities and therefore the growth of steady state is endogenous. Then rises the importance of the role of energy and economic policies aimed at increasing the savings and investment in research and development and in education in order to valorize the human capital. Consequently, the level of such investment is affected indirectly by all those factors that influence the propensity to save.

**Figure 5:** % of GDP spending on R&D, 1981 – 2014



Source: <https://data.oecd.org/>

The figure 5 shows the spending on research and development compared to GDP, and nations taken into consideration are: Japan, United States, United Kingdom, Italy and the average of the countries belonging to the OECD (the green line in the graph). It includes R&D funded from abroad, but excludes domestic funds for R&D performed outside the domestic economy.

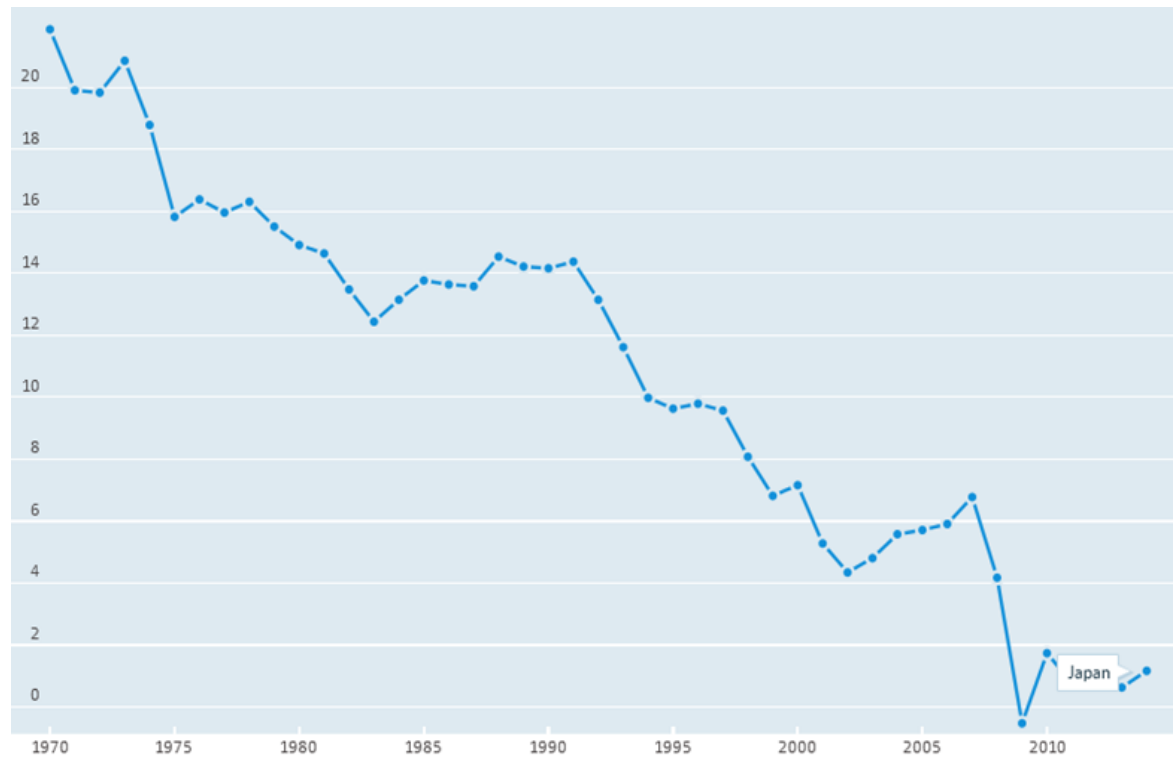
Let us analyze in detail the nations taken into consideration:

- Japan: the nation that since 1988 retains primacy in this league. In 2014 the spending on research and development recorded in Japan was equal to 159.220.000.000 USD, i.e. 3,4 % of GDP. From 1980 to today, investments in research and development in the Japanese nation have grown by about 70%. This is in harmony with the propensity to save historically high in Japan: such a high level of savings has allowed to Japan to make huge



investments in the course of the years and a large proportion of these investments consists of spending on research and development. From the graph below it is possible to analyze the savings rate recorded in Japan since 1970.

**Figure 6:** Saving rate in Japan (% of GDP, 1970 - 2014)



Source: <https://data.oecd.org/>

In 1970 the savings rate recorded in Japan was equal to 22%, a value high. In the course of the years the savings rate in Japan is gradually decreased, but remained however at very high levels until the mid-1990s. This has led to the government and to the Japanese firms to carry out in time huge vestment in research and development.

- USA: Around 1987 the United States have been overcome by Japan as regards expenditure compared to GDP in research and development. However have maintained a very high level of investment in research and development, and you are constantly above the average in the OECD member countries.



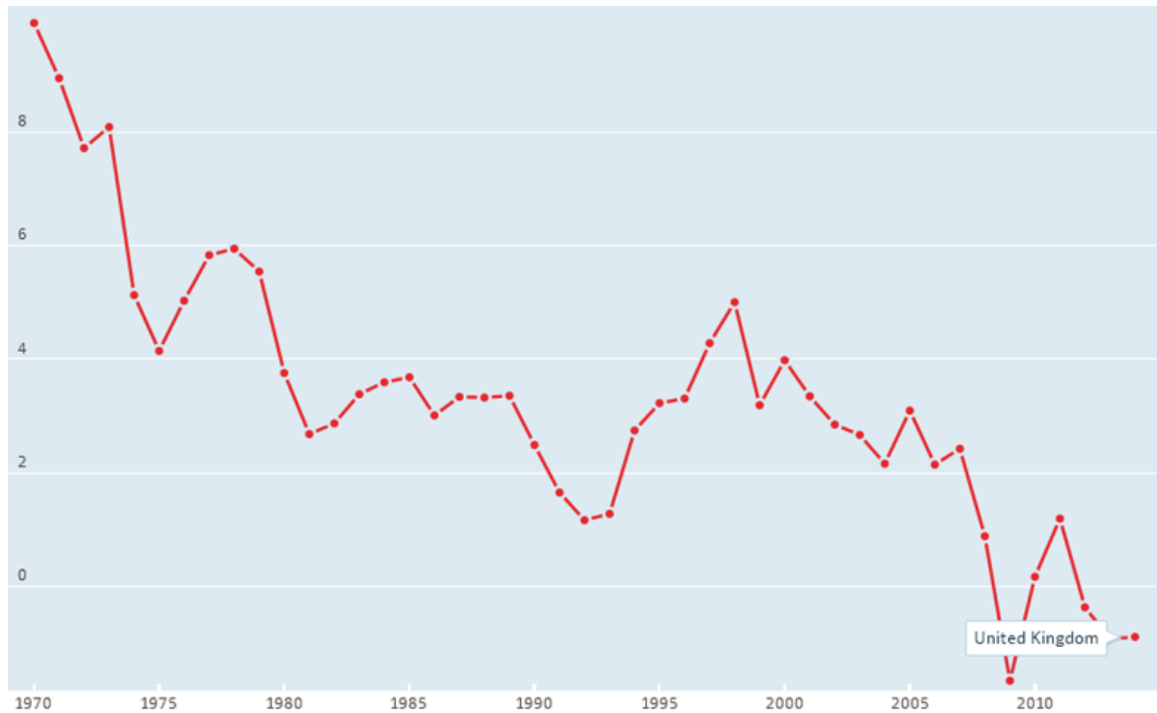
**Figure 7:** Saving rate in USA (% of GDP, 1970 - 2014)

Source: <https://data.oecd.org/>

As shows us the graph, in 1973 the savings rate in the USA amounting to 11% of GDP and this represents the highest peak of the period taken into consideration. This value is gradually decreasing during the time taken into consideration, in which however you are recorded considerable fluctuations. This graph is in tune with the consumerism typical of the USA.

However the high rate of technological progress is no doubt due to the great economic strength of the USA that the post-war driving the world economy. This has allowed with extreme ease for the US to find foreign financing at low cost, thanks to the great confidence on the part of foreign investors.

- United Kingdom: the spending on research and development by the United Kingdom was above the average of the countries belonging to the OECD until 1984. This value is tendentially decreased over time: over the last thirty years, the spending on research and development by the United Kingdom is kept constantly below the average of the countries belonging to the OECD.

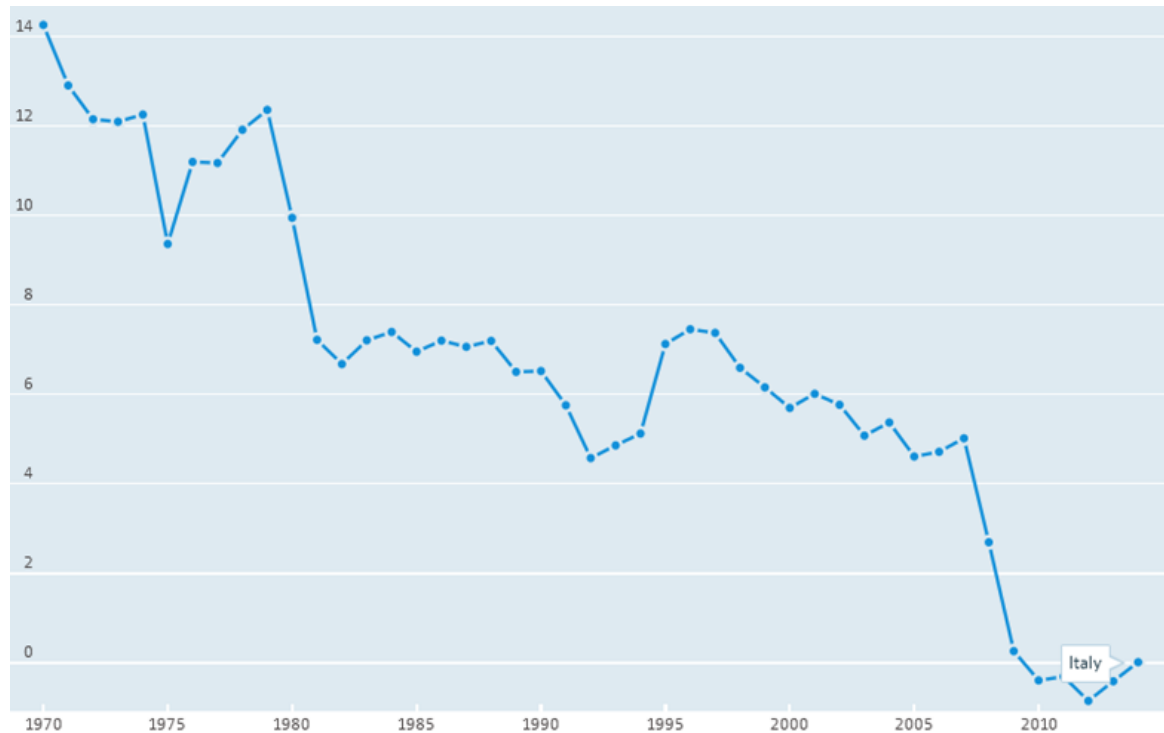
**Figure 8:** Saving rate in U.K. (% of GDP, 1970 - 2014)

Source: <https://data.oecd.org/>

The trend of expenditure on research and development in the course of the years by the United Kingdom is not totally at odds with the assumption of this argument, namely to give a central role to the saving and the phenomena that affect the savings to explain the economic growth in the long period of economic systems.

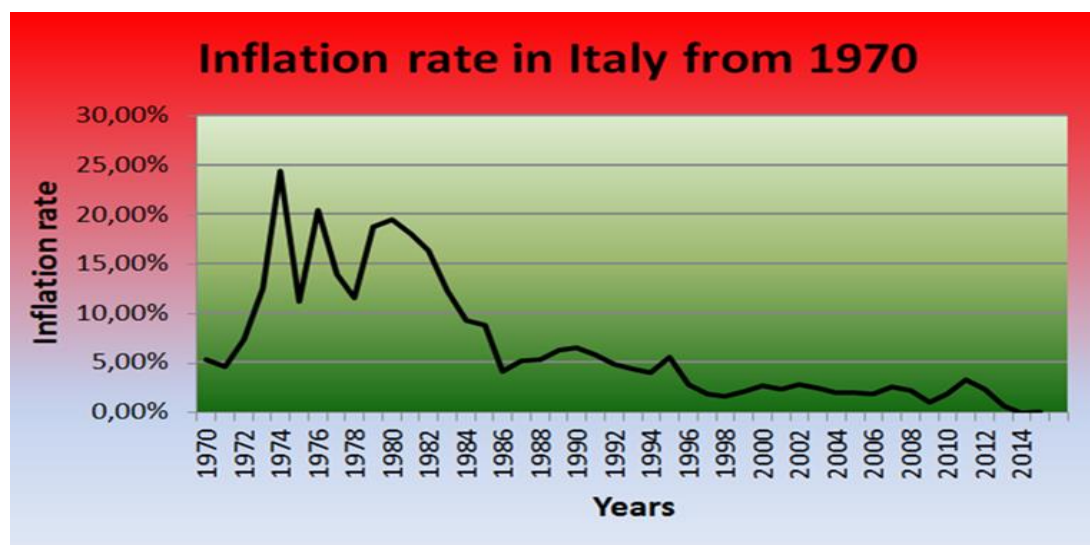
In fact, as you can see from the graph, the decreasing trend of the savings rate in the United Kingdom also reflects the trend tendentially decreases in the course of the last few decades of investments in research and development.

- Italy: in comparison to other countries considered, Italy has investments in research and development is relatively low and constantly below the average of the OECD countries over the last 40 years despite the fact that, since 1995, has tentative signs of recovery. This relatively low level compared to other industrialized nations, is even more abnormal if we consider (as shown by the graph below) that Italy has historically been a propensity to save very high, second only to Japan among the countries analyzed in this paragraph.

**Figure 9:** Saving rate in Italy (% of GDP, 1970 - 2014)

Source: <https://data.oecd.org/>

In fact, as shown in the figure, the savings rate in the course of the last 45 years has always been relatively high, with very high values in 1970 (14.3% of GDP) and in 1979 (12.4% of GDP). In the seventies, this value has been greatly influenced by two of the energy crisis and by the high inflation recorded in those years. In the course of the years the savings rate is gradually decreasing as decreased inflation: in fact, as shown by the graph, the inflation rate has had a trend similar to that of the savings rate.

**Figure 10:** Saving rate in Italy (% of GDP, 1970 - 2014)

Source: ISTAT

Returning to the speech of before, these savings rates relatively high are not translated into a high level of investment in research and development, unlike other countries taken into consideration. The reasons for this limit may be two:

1. Italian firms are historically composed almost entirely from small and medium-sized enterprises, which are still struggling to make large investments in research and development because of their limited size.
2. The investments made by the Italian government are generally not been projected toward a long-term economic growth since it is preferred to use the financial resources in the short-term activities.

## **4 Inflation and instability in the main economic systems**

### **4.1 Inflation: causes and effects**

Inflation has been one of the main topics of study by many economists. Inflation can be defined as the prolonged increase of average level general prices for goods and services in an economic system for a given period of time. The recent economic history teaches us that prolonged periods of inflation or deflation more or less high can lead to negative consequences in the economic system, as can be simply the negative effects caused by diseases of variables aggregated economic-financial institutions. High rates of inflation causes an uneven distribution of the level of income and uncertainty on the part of economic agents while an inflation rate of negative (deflation) may be a symptom of serious economic problems and slowing down of production (falling demand).

From an analysis of the inflationary periods that have struck several cheap, we can list the main causes that have provoked an increase in inflation:

- Increase in employment: during the period 1900-1960, in the United States a high level of employment was generally associated with a high rate of inflation; vice versa a low level of employment was typically associated with a low inflation or negative (deflation). This report was proposed by Paul Samuelson and Robert Solow that scholarship applied as A.W. Philips had observed in the United Kingdom already for some years before. In fact, this theory has been reflected in the USA. The main reason for this phenomenon is that an employment leads to a higher nominal wages; such a greater salary entails a higher cost for companies, which are forced to increase their prices in order to maintain unchanged the marginal revenue: the level of prices and then increases. This increase in prices causes a request from a nominal wages higher by workers in order to maintain unchanged the real wages; this higher level of nominal wages encourages businesses to increase prices again and the mechanism continues until you encounter other factors (such as for example an increase of unemployment). This mechanism is known as a wage-price spiral.
- Increase in the money supply: As is known from the theory Keynesian, a monetary policy broadly by the Central Bank leads to an increase in production in the short term. However in the medium term the production level returns to its natural level. If then the increase in the money supply is higher than the increase of the production, it stimulates the demand for goods and services and investment in the absence of a corresponding increase of the offer: in the economic system occurs then a price increase in order to get the economy back into balance. In the medium term the rate of inflation will then be equal to the rate of growth of

money; in fact according to the American economist Milton Friedman, inflation is always and everywhere a monetary phenomenon.

Increase in the cost of raw materials: the increase in the cost of raw material obliges companies to increase prices in order to keep unchanged the marginal revenue or otherwise decrease slightly. From the historical analysis of the data, it is possible to notice how strong increases in the price of oil and energy we have caused inflationary periods in different economic systems. As we will see in the course of this argument, of the energy crisis of the Seventies he has caused a significant rise in prices and everything is translated into an increase in inflation and a lack of confidence of consumers in various economic systems in the west.

Although several scholars have made major contributions in order to explain the causes (in addition to the effects of the variations in the level of prices, it is not yet possible to draw a unanimous conclusion that agree all scholars.

Are however known some of the main direct and indirect effects caused by a level of prices relatively high lasted for a significant period of time such as the economic instability, the formation of expectations about future inflation, the lack of confidence on the part of consumers and therefore an increase in the marginal propensity to save.

## **4.2 Inflation performance in recent decades**

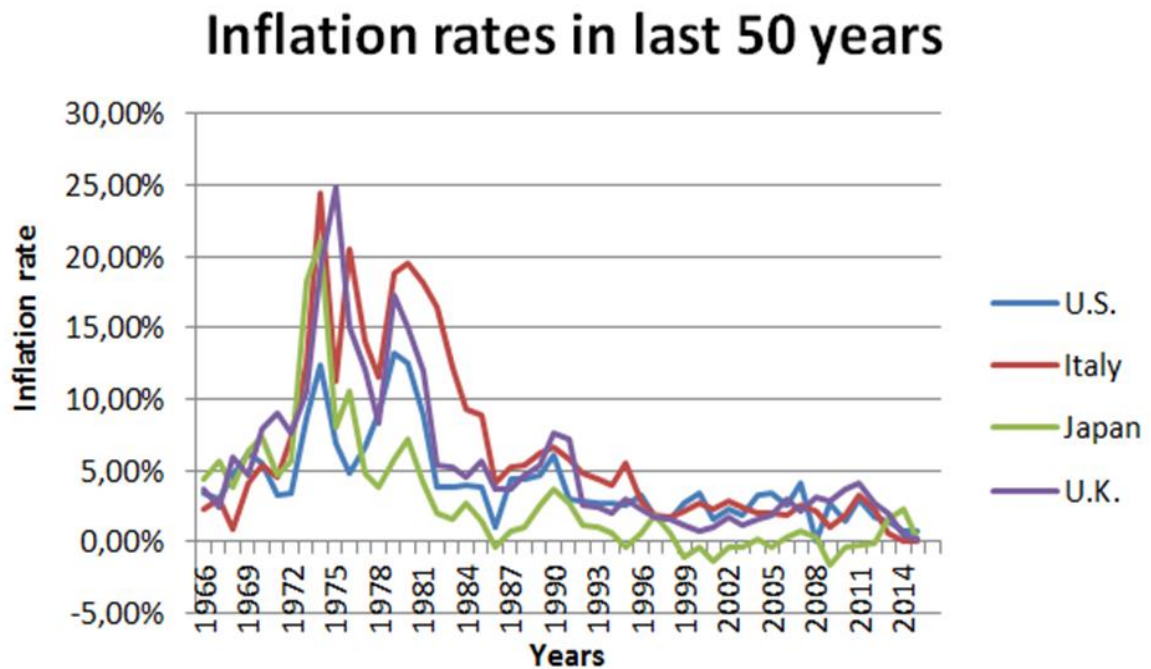
As we said in the previous paragraphs, the main objective of this thesis is to find a relationship between inflation and economic growth. The latter, as is well known, is meant in the economic literature as economic growth in the long term. For a long period is a period of time of about 50 years: in this time period are manifested the effects on the accumulation of capital which determines the economic growth in the long term, taking into account the state of technological advancement from which an economy.

In the course of the last 50 years there have been many changes that have affected the economic systems of the world: in particular the economic and monetary union in the European Union and monetary policies by central banks have been increasingly addressed in the course of the last few decades toward a policy of price stability, thus containing the growth of inflation. A stable inflation arouses greater safety against consumers, which, under equal conditions, are more inclined to devote to consume a greater part of their income: in this sense it is reasonable to think that a greater price stability is reflected in a lower marginal propensity to save. As we will see later, economic growth in the long term is positively influenced by the accumulation of capital; the latter in turn is positively

influenced by the level of savings and therefore in a situation of sustainable balance between savings and investments, the capital is positively influenced by the real investments made in a time span rather long.

It is therefore necessary to study firstly inflation trends observed in some of the most industrialized countries in the last fifty years.

**Figure 11:** Inflation performance in the last 50 years observed in U.S.A., Italy, Japan and Great Britain.



**Source:** Elaboration of *International Monetary Fund* data

The nations examined were chosen both based on the importance of the role covered in the world economy over the period considered and both based on geographical location.

Although starting from the most recent years Italy is subject to the monetary policy of the ECB, for most of the period taken into consideration it has enjoyed a their monetary sovereignty and the consequential effects of the level of energy present in the national economy have influenced the accumulation of capital and thus long-term economic growth in the latest decades.

As can be seen from the figure 11, if we consider a coarse analysis, inflation rates among nations taken into consideration are grown and declined over the years even though with different intensity. In particular, in the years seventy the entire world economy has suffered heavily the effects of the oil crisis and political tensions at international level. In fact, the rate of inflation has risen sharply between 1973 and 1974 in Great Britain, Italy and Japan. While the USA, from the point of view of inflationary, have suffered a rise in prices is less

steep with respect to the aforesaid nations: however the level of inflation in the USA grew in 1973 by 5.3% compared to the previous year. A similar situation, albeit with an impact slightly lower, it is repeated in the early Eighties following the second oil crisis. It should be noted that at the time despite the globalization of markets had not yet given beginning at the boom of the interaction between international markets, economic systems throughout the world were already deeply disturbed by the shock of the macroeconomic variables of other nations (this is because, for example, the energy market had already assumed a worldwide dimension).

Since the 1990s, it is possible to note how the inflation in these countries tent down, even with cases of persistent deflation in Japan because of the speculative bubble formed starting from 1986 and broke out in 1991 (Shigenori Shiratsuka, asset price bubble in Japan in the 1980s: Lessons for financial and macroeconomic stability).

The continuous growth of the economies of the industrialized countries and the growing rules aiming to liberalize the markets, have allowed enterprises to grow and competition has always increasing, also thanks to the boom of globalization began after the end of the Cold War (Clark, Ian: Globalization and fragmentation: international relations in the twentieth century, Oxford University Press, New York, 1997). All this has given rise to a large supply of goods and services whose prices are therefore remained low despite the question was always increasing until it is arrived to the economic-financial crisis of 2007. This crisis has caused a heavy fall in demand; in 2008 inflation in the USA decreased by 3.99%. A reduction of inflation is then propagated also in other nations remaining average very low until you get to the last years, despite the fact that there have been some timid increases. According to the Eurostat data, in 2015 the inflation in the Eurozone skimming the 0%. Inflation also in the USA has touched the 0% in 2015. A very similar situation was also registered in Japan.

### **4.3 Repercussions on consumption and saving**

The salary/wage of workers has three possible destinations:

- taxes;
- consumption;
- savings.

We can define the net income  $R_n$  the income net of taxes.

Now introduce two fundamental parameters: the marginal propensity to consume and marginal propensity to save. The first indicates how much of the net income will be



intended for consumption (also called as consumer confidence index) while the second indicates how much of the net income will be allocated to savings. Both values are then compared with the total net worth.

Therefore, the following relation applies:

$$I-c=s$$

Where the parameter  $c$  represents the marginal propensity to consume and  $s$  represents the marginal propensity to save.

If we reasonably assume that the marginal propensity to consume  $c$  and the marginal propensity to save  $s$  are different from zero, we can build the following equation:

$$R_n=cR_n+sR_n$$

Where  $c+s=1$

Rearranging the terms, we can rewrite the equation as follows:

$$R_n=R_n(c+s)$$

At the base of this reasoning is the assumption that individuals do not consume and not save more than earn: savings already existing therefore remain unchanged.

Our attention focuses on the parameters  $c$  and  $s$ , which respectively indicate the marginal propensity to consume and marginal propensity to save.

When in an economic system there is stability and optimism about the future forecasts, the marginal propensity to consume grows. Vice versa, if in an economic system there is uncertainty and instability, consumption declines and individuals prefer to save a larger slice of their income because they are not optimistic for the future and then act in this way in order to cope in the future for any emergency situations (e.g. loss of work, price increase).

Therefore, if a persistent high inflation in time creates uncertainty and instability, it influence indirectly also the marginal propensity to save of individuals. Obviously, a marginal propensity to save more high does not automatically translates in a level of accumulated saving higher: everything depends on the level of production and therefore the level of income. We make a numerical example:

We analyze two nations, A and B and assume for both that the analysis is carried out in a time period of one year and, for convenience, we assume that in both nations that fees are equal to zero.

The total level of income generated in the economy A is equal to 90 and the marginal propensity to save is equal to 30%. We will then have a total level of savings equal to  $90*0.30=27$

The total level of income generated in the economy B is equal to 60 and the marginal propensity to save is equal to 40%. We will then have a total level of savings equal to  $60 \cdot 0.4 = 24$

In spite of the fact that there is a marginal propensity to save more low with respect to the economy B, in the economy has reached a level of power higher than that of the economy B.

Therefore, it is important to remember that the level of savings does not depend only on the marginal propensity to save, but it also depends on the income.

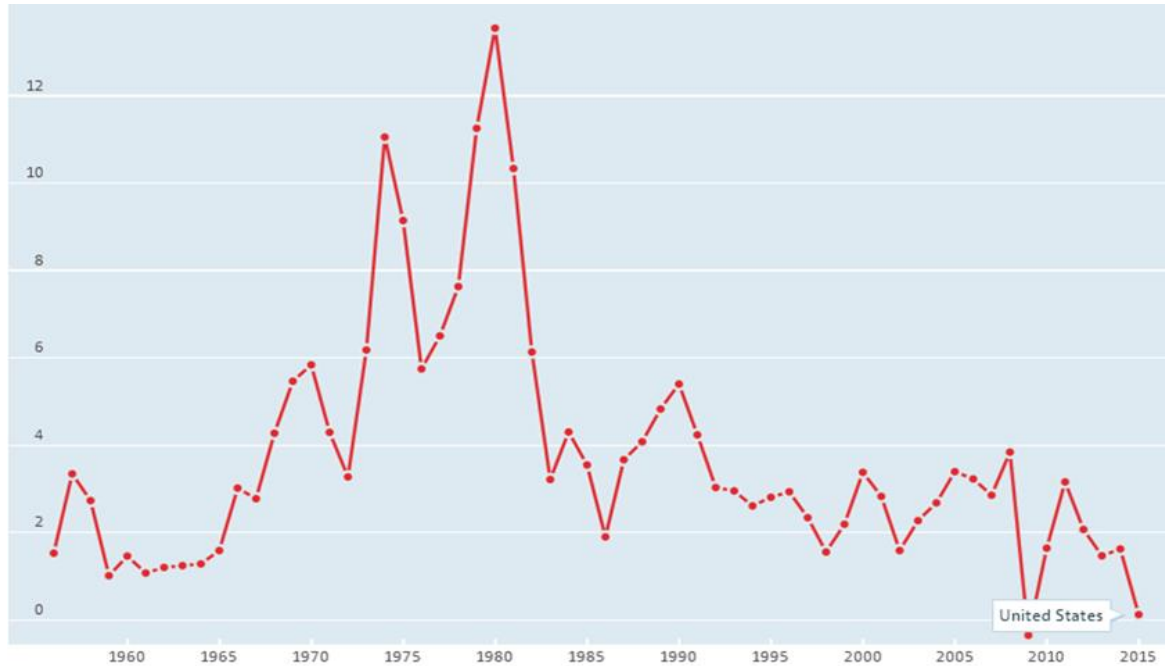
However, under equal conditions, an economy where the marginal propensity to save is greater, there will also be a level higher savings.

If, as we have said before, a high inflation creates instability and insecurity among consumers, it is reasonable to think that they will tend to save more. Furthermore, though a high inflation in a persistent manner can be synonymous with serious problems and can cause adverse effects cannot be excluded either that it might be caused not only by pathologies economic, but may be an effect created by a high demand. In fact, as is known from the Philips curve, the inflation rate increases with the increase of employment, thanks to the mechanism triggered by the wage-price spiral.

**Figure 12:** savings rate in the USA in the last 50 years



Source: <http://www.tradingeconomics.com/>

**Figure 13:** Trends in inflation in the U.S.A. in the last 50 years

Source: <https://data.oecd.org/>

In Figure 12, we note the trend in the savings rate in the USA related to the last 50 years, whereas in Figure 13, always for the same period, it is possible to observe the behavior of inflation in the USA over the last 50 years.

As you can see, the inflation of the mid-seventies due to oil crisis has caused a drastic reduction of consumption and therefore an increase in the marginal propensity to save, which exceeded the 15%. This is even more significant if we take into account that the USA was already in those years a nation whose families were characterized by a tendency to exceed consumption. In the course of the last few decades, when inflation gradually is stabilized toward lower values, even the savings rate gradually decreased then climb sharply between 2007 and 2008 in response to the crisis.

#### 4.4 Formations of the expectations and implications on savings

Workers and companies have "learned", over the years, to form their expectations on future inflation based on inflation data observed in previous years: in this way, they fit wages and, consequently, the prices (spiral wage-price).

An indirect effect on inflation expectations of the future can also be reflected on consumption and savings choices: if consumers expect that in the following years the price level will increase, it is reasonable to think that they will save a larger share of their income in order to be able to cope in the future the price increases. In fact, one of the major points on which this thesis is based about is that financial instability affects consumer behavior in

consumption choices and savings; this influence also extends to the government and businesses in investment decisions and, in the long term, this can affect the economic growth, under equal conditions. This influence can be better explained through the following steps:

- financial instability (or the forecast of a financial instability in the years immediately following) creates a climate of uncertainty around economic operators, including consumers who reasonably will be more likely to save a higher portion of their income;
- if the economy does not experience a prolonged recession (which may be due to the monetary policies of disinflation), a higher savings rate can result in a higher level of savings in the whole national economic system;
- in a situation of balance between investments and savings, higher levels of savings imply more investment from the government and firms;
- major investments positively affect economic growth in the long run.

In the '60s, in the US there was an inverse relationship between inflation and unemployment (note as of Philips Curve): an increase in employment caused a rise in inflation, and vice-versa: in other words, inflation was a direct result of an increase in production beyond its natural level (except in cases where the inflation was due to the increase in oil prices), while deflation was a consequence of a slowing economy.

However, considering that many categories of workers (and retirees) do not receive wages indexed to inflation or do not have the power to renegotiate their wages, high and persistent inflation cause severe market distortions and inequalities and accentuates the difference between the social classes.

In 1979, the inflation rate in the US was around 13%. To curb the high level of inflation, the Federal Reserve had available the following monetary policy alternatives;

- Making an abrupt restrictive monetary policy: in this way, the prices should come down quickly but at the cost of a sharp rise in unemployment (high cost of disinflation).
- Make a restrictive monetary policy in a more "soft" way, gradually raising the interest rate: thus, the cost of disinflation (i.e. rising unemployment) would be smaller but inflation would remain high for several more years.
- Credibility policies by the Central Bank (Lucas Critique): according to the economist Lucas, if the Fed Reserve had committed to make believe to economic operators that it intended to carry out a tight monetary policy, those fixed prices would be expected a lower inflation in the future; thus inflation could be lower because of the expectations

formed by economic agents, without actually making a restrictive monetary policy and therefore without causing a recession.

As mentioned above serves to emphasize the importance of the formation of inflation expectations by economic operators:

- when inflation expectations are changing , workers and firms vary the wage bargaining;
- consumers and investors vary their choices of consumption and savings when inflation expectations are changing.

In the 70s, in which inflation expectations were kept very high, the savings rate in the USA has come to exceed 10%, then declined over the years along with the decline in the inflation rate and increase again as a result of 'rise in inflation in 1979.

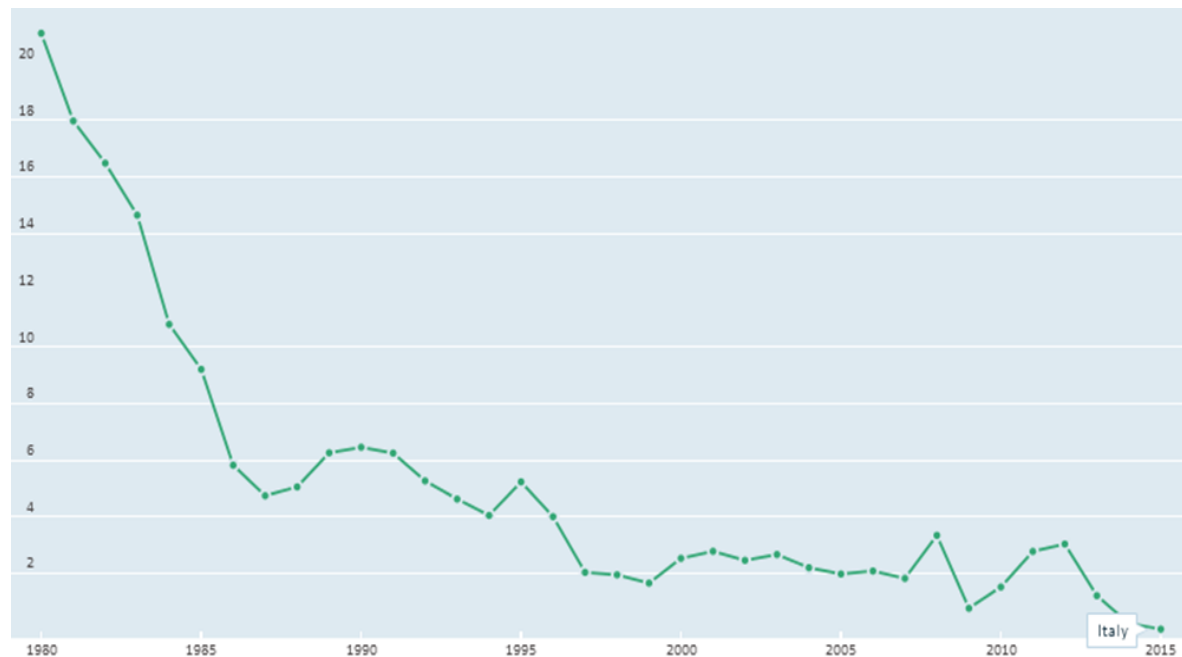
It is therefore appropriate to analyze the influence of inflation expectations not only from the perspective of workers, businesses and wage-price, but also from the point of view of consumer-savings-investment and economic growth. Albeit on two different tracks and at different time intervals, such prospects are traveling in parallel.

## 5 Results

In this paragraph we are going to carry out an empirical analysis on a sample of 5 nations in order to assess the validity of the hypotheses bases of this thesis is to demonstrate a report (albeit indirect) between the stability of inflation and economic growth in the long term. Then we will analyze historical series about the data of inflation, savings rate and economic growth in the period of time that goes from 1980 to 2015. The effects influenced by values tend to be stable or unstable variables macroeconomic aggregated result in consequences on growth after a certain number of years: in fact from the model overview Solow, in conjunction with the Keynesian theory, we can say that a greater savings rate causes a decrease in consumption and therefore a decrease in production in the short term (Keynes, the liquidity trap) but in the long term, a levels tend to be highest in the savings rate cause a higher economic growth over a long period with respect to the nations with savings rates more bass, on equal terms (Theory Of Solow). In the following paragraphs, we will analyze the trend of inflation, savings rate and economic growth from 1980 to 2015 in Italy, Germany, USA, UK and Japan in order to study possible common trends of three macroeconomic variables object of this study. The data that we will use in the following paragraphs will be taken all from the same database of data in order to guarantee the homogeneity of the analysis of the countries. Then we will go to study these relationships for each country using the linear regression model.

## 5.1 The case of Italy

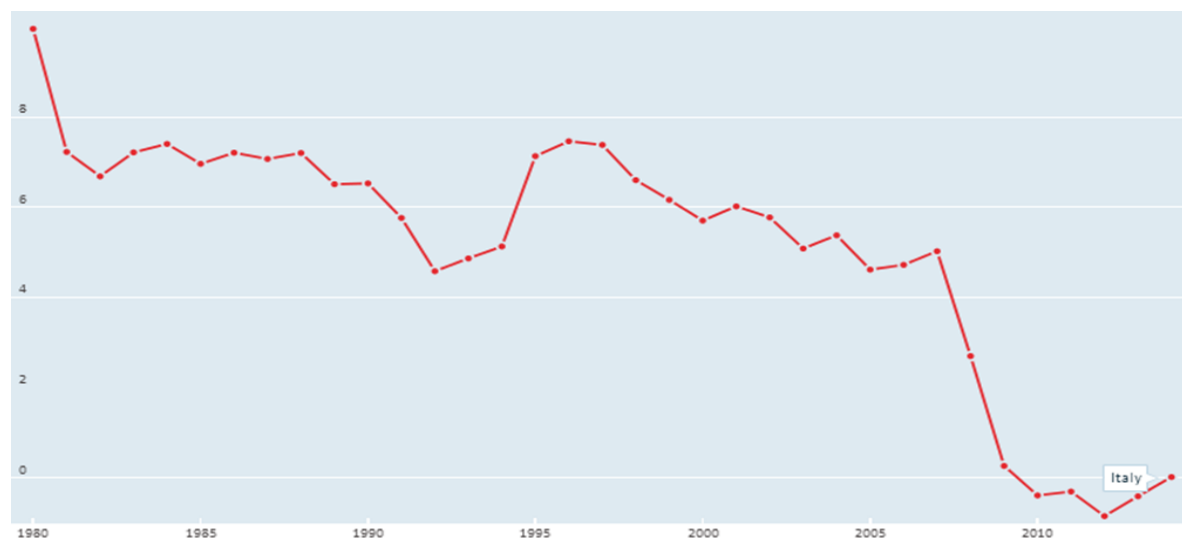
**Figure 14:** Inflation rate in Italy (1980-2015)



Source: <https://data.oecd.org/>

In Figure 14, you can monitor the progress of the rate of inflation in Italy from 1980 to 2015. By a ten-year perspective, the rate of inflation, relatively high in the years 80, went always decreasing remained stable in the last decade values of around 2%. Given that the current currency in Italy is the Euro, it is subject to the monetary policy of the ECB; in fact the low inflation in recent years is due to the choices of the monetary policy of the ECB that are based on the principles that have founded the internal market (namely to contain inflation within the 2%). In the next figure, we are going to analyze the trend in the savings rate of Italian consumers in the same period for the previous graphic.

**Figure 15:** Saving rate in Italy (% of GDP, 1980 - 2014)



Source: <https://data.oecd.org/>

In the Figure 15, we can notice the trend in the savings rate by consumers in Italy from 1980 to 2015. Our task now is to see if in the period of time considered the behavior of consumers was influenced by inflation. Whereas in general the consumers do not react immediately to changes in prices as regards the choices annual savings (unless there are enormous shock), it is useful to analyze their tendency to savings from the point of view of the Decennial, so as to be able to make a better comparison with the trend in recent decades of inflation. For this purpose, it is useful to compare, to simplify data management, the arithmetic average decennial of inflation rate with the arithmetic mean the tenth anniversary of the savings rate, starting from 1980. In this way, we can see if the variations of the average inflation are reflected in the same decade in variations of the same sign of the average of the savings rate. It is possible to study this report in the following table:

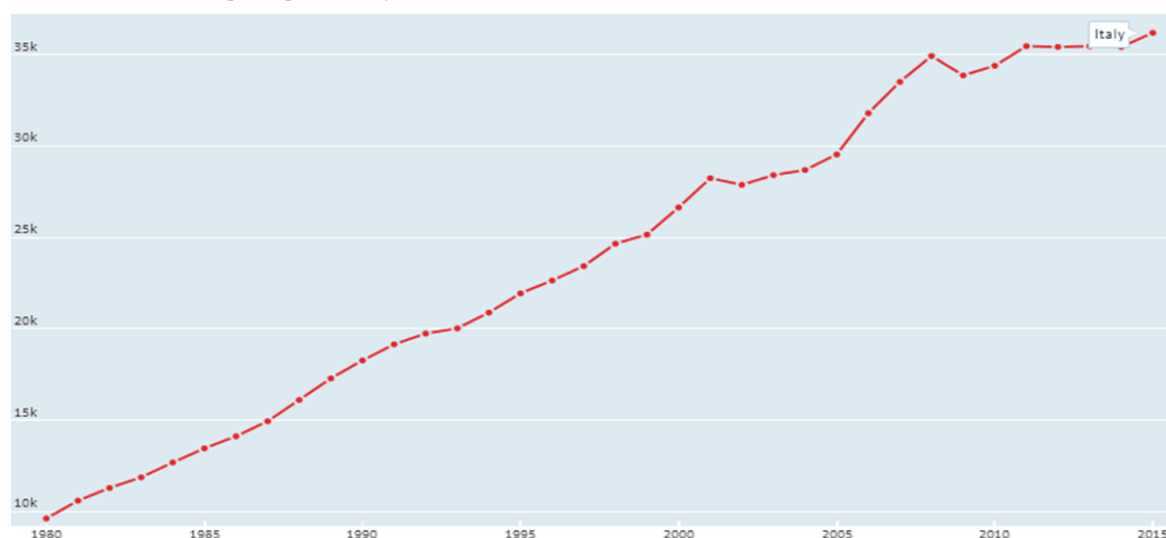
**Table 3:** annual average of inflation rate and savings rate in Italy since 1980 (grouped in classes of 10 and 15 years)

Italy		
	Average inflation rate	Average saving rate
<b>80's</b>	12,45%	8,16%
<b>90's</b>	4,63%	6,85%
<b>2000-2015</b>	2,09%	3,09%

Source: OECD data elaboration

From the Table 3 it is possible to highlight how the decrease of the average rate of inflation and the consequent greater financial stability has led to greater confidence in consumers: everything was then translated into an increase in consumption and a reduction in the savings rate. These results are in line with the hypotheses put to the bases of this thesis.

**Figure 16:** Real GDP per capita in Italy (1980-2015)



Source: <https://data.oecd.org/>



According to the analysis of Solow on economic growth of countries (which endogenous considers the savings rate and the accumulation of capital while exogenous considers the growth of the labor force, the role of the technological progress and human capital) the savings rate and the accumulation of capital positively determine the level of economic growth in the long term. This process is therefore not immediate: for long period shall mean decades. These empirical results found on Italy are in line with the model of Solow: a high average rate of savings in the Eighties has generated a sustained economic growth in the subsequent decades, despite the savings rate in recent decades is significantly reduced. This point is therefore in keeping with the hypothesis that lie at the base of this thesis and with the analysis of Solow.

But why then, in situations where the savings rate remains on average lower than the previous decades, the economic systems are still projected to a continuous growth without converges at the point of steady state assumed by Solow? The answer we find in the new theories of growth, i.e. those who consider the technological progress and human capital as endogenous factor and no longer exogenous. The consideration of such factors as endogenous allow to overcome the limitations of the model of Solow: as we have seen in the previous paragraphs, what allows to the nations to continue to grow is the technological progress and the accumulation of human capital (closely linked between them). This is a reason for which, as it is possible to highlight from the data of the paragraph on the accumulation of human capital, it has not found the process of convergence between rich and poor countries, as assumed by Solow.

However, whereas the physical capital not depreciates from year to year, the savings rate and the new investment in capital still play a fundamental role in the process of growth: these factors, when combined with technological progress and to the accumulation of human capital, can have a significant impact in the growth process of countries. In fact it is advisable to consider the analysis of Solow and new theories of growth as complementary models and not as models that are mutually exclusive.

However, it is important to analyze not only the level of growth of GDP, but also its growth rate. Since the effects of the savings rate and inflation have an impact on economic growth over the years, in the following table you can see the average annual GDP growth rate of the eighties, the nineties and in the years since 2000 2015

**Table 4:** annual average of growth rate of GDP in Italy since 1980 (grouped in classes of 10 and 15 years)

<b>80's</b>	2,5%
<b>90's</b>	1,49%
<b>2000-2015</b>	0,17%

Source: *OECD* data elaboration

Now we have all the data to study the possible relationship between the values observed over the years in each country considered in this chapter. We will go then to observe, through the linear regression model, the following relationships:

- inflation rate and savings rate;
- savings rate and growth rate of GDP;
- inflation rate and growth rate of GDP.

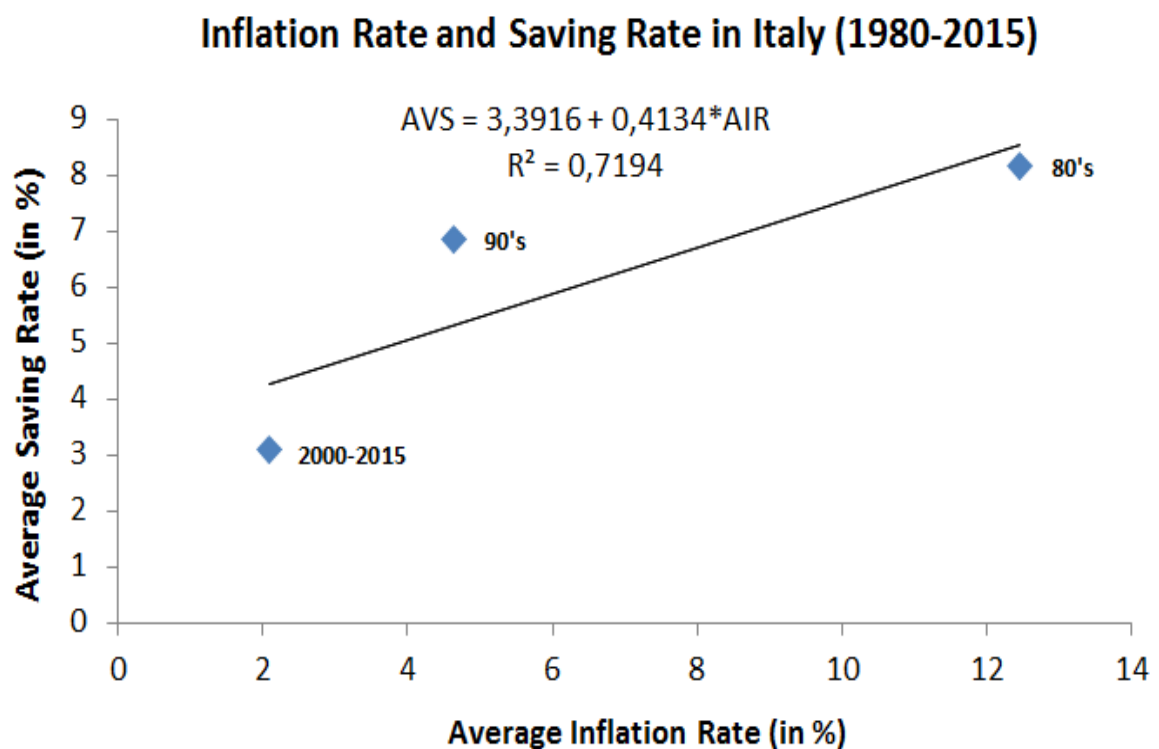
Consideration will be given three time intervals, which are:

- 80's (years from 1980 to 1989);
- 90's (years from 1990 to 1991);
- 2000-2015 (years from 2000 to 2015).

The values are calculated on an annual average in the time intervals considered, so we can make a long-term oriented to the analysis.

The  $R^2$  indicator will show us how strong the relationship between the two variables is.

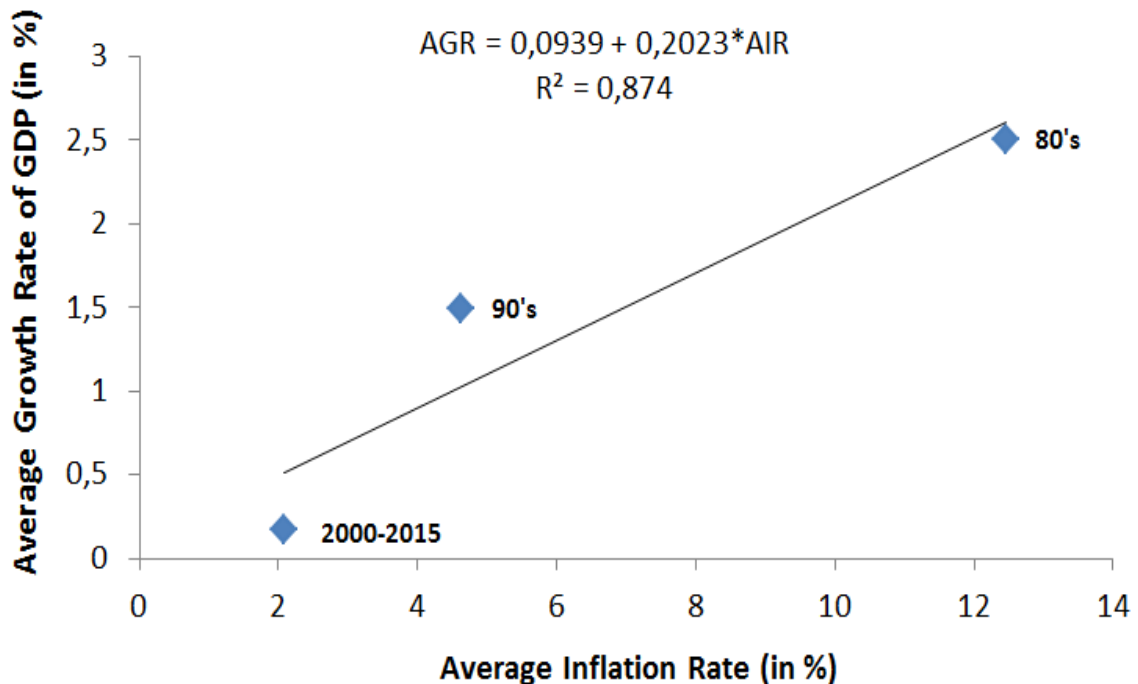
In this section, we analyze the relationships between variables observed in Italy.



### Saving Rate and Growth Rate of GDP in Italy (1980-2015)



### Inflation Rate and Growth Rate of GDP in Italy (1980-2015)



In all three observed relationships, the  $R^2$  index is rather high, in particular as regards the relationship between saving rate and growth rate of GDP, in which the  $R^2$  index is nearly 100%. This means that, over the decades, these relationships are not coincidences but are definitely concordant with the assumptions underlying in fundamentals of this thesis.

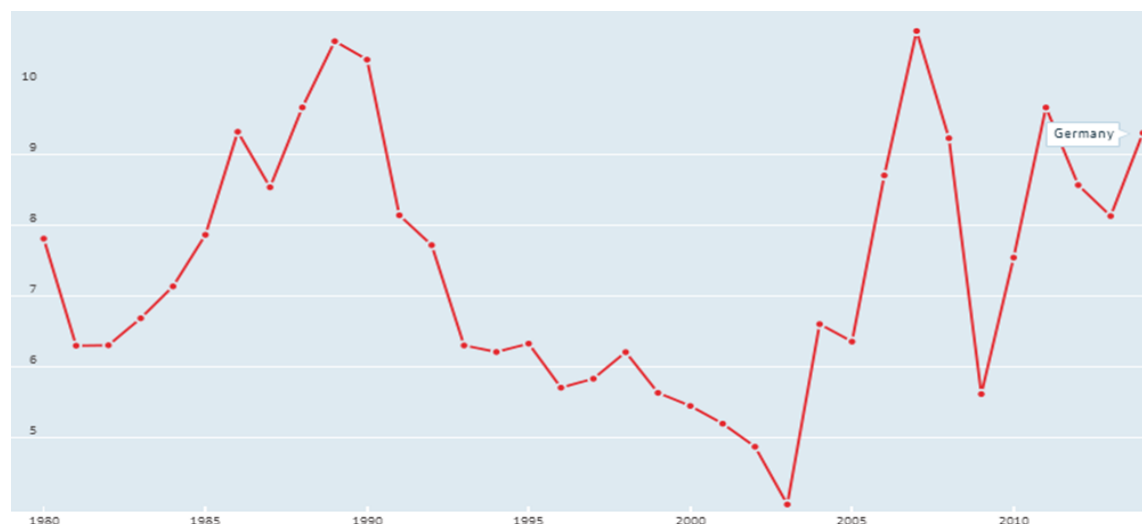
## 4.2 The case of Germany

Figure 17: Inflation rate in Germany



Source: <https://data.oecd.org/>

At the beginning of 1980, the annual rate of inflation in Germany was around 6%, to then decrease sharply in subsequent years until you get to a short period of negative inflation in 1986. This trend is very erratic recorded in the 1980s it is then loosened. In fact inflation trends in the 1990s it has much more regular and without sudden spikes (apart from the soaring recorded in 1991). In fact in the second part of the nineties inflation moved between 1.9% and 0.6%. Situation more stable in the last fifteen years, in line with the monetary policy of the ECB to which Germany is subject: in this period inflation is always kept below 2.1%, apart from the 2007 and 2008 in which it is grown slightly more than usual, arriving in any case to an annual maximum of 2.6%.

**Figure 18:** Saving rate in Germany (% of GDP, 1980 - 2014)

Source: <https://data.oecd.org/>

From Figure 18 it is possible to note how the savings rate in Germany over the last 35 years has touched the highest levels in 1989 and 2007, i.e. in the periods in which the social uncertainty and economic was rather high: in the first case there was the big social uncertainty due to the cold war and in the second case it was in the face of the financial crisis that broke out in the USA.

**Table 5:** annual average of inflation rate and savings rate in Germany since 1980 (grouped in classes of 10 and 15 years)

Germany		
	Average inflation rate	Average saving rate
<b>80's</b>	3,20%	8,9%
<b>90's</b>	2,83%	7,57%
<b>2000-2015</b>	1,47%	7,30%

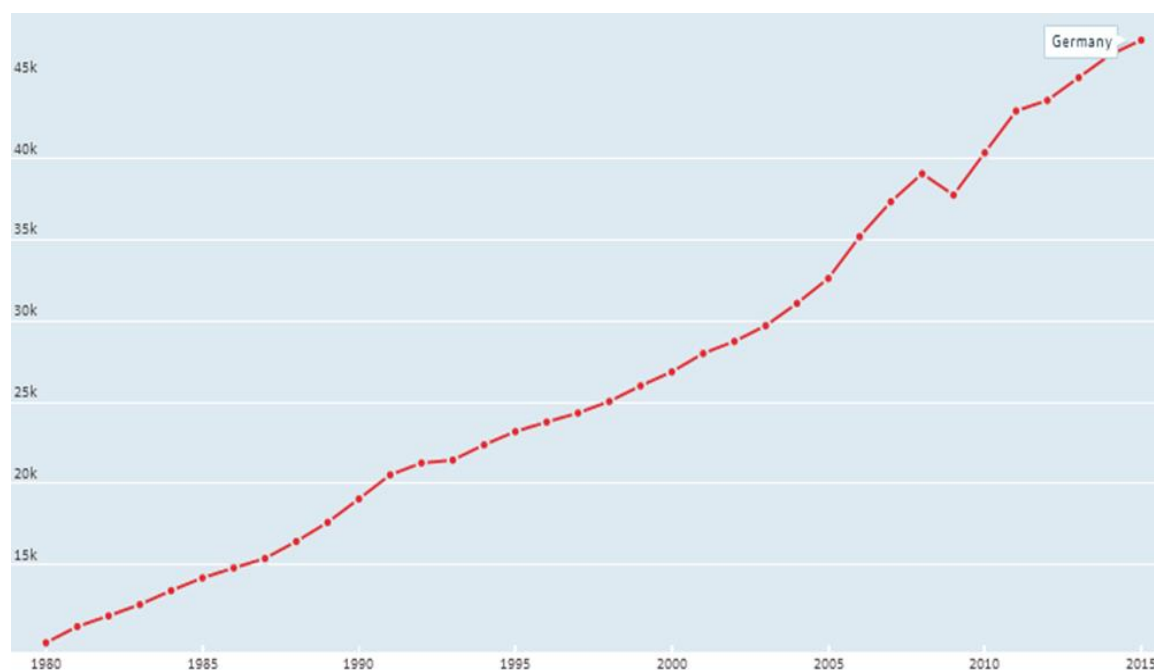
Source: *OECD* data elaboration

As in the previous paragraph, here we have grouped into ten-year class the eighties and the nineties and in class fifteen-years the years ranging from 2000 to 2015, by calculating the arithmetic average of the inflation and the savings rate for each period.

Although the average inflation rate is always kept low enough, it is however decreased over the years and of equal pitch is also reduced the average rate of savings, remaining however in recent years around a medium-to-high values (0.72% in more than in Italy in the 1990s and even the 4.21% in more than in Italy in the last 15 years).

It is therefore clear how in Germany there is historically a tendency to have to save a significant slice of their income.

**Figure 19:** Real GDP per capita in Germany (1980-2015)



Source: <https://data.oecd.org/>

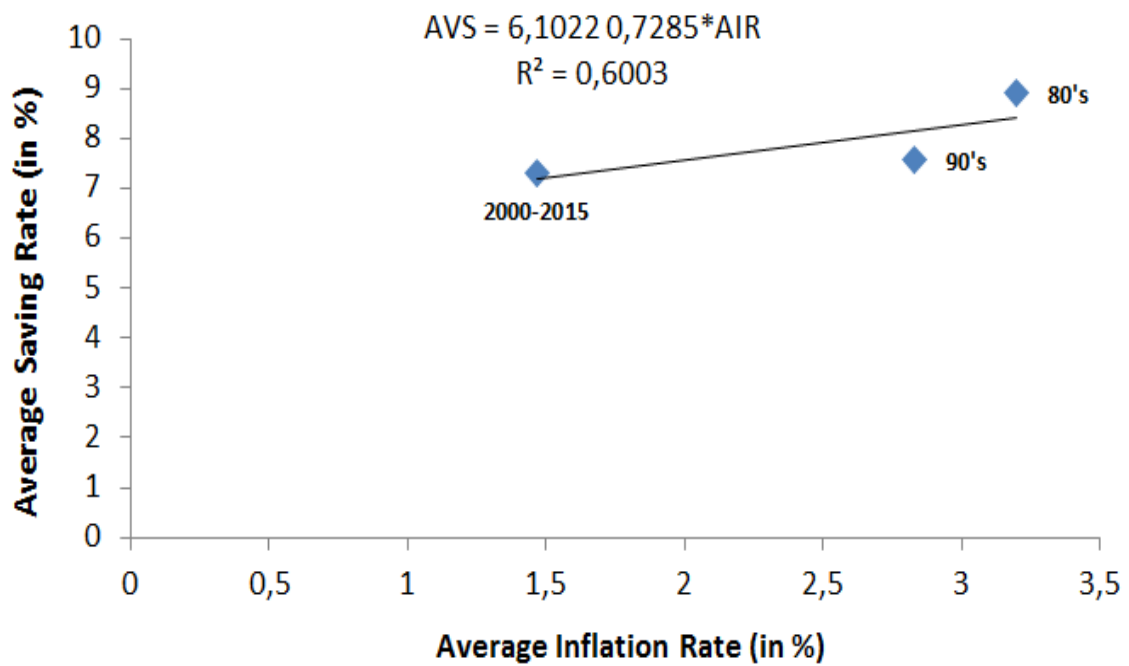
The values tend to be higher in the savings rate recorded in Germany have favored an important economic growth of the nation who brought to guide the European economy in recent decades. The per capita GDP registered in 2015 is of 23.49% higher than that recorded in Italy.

**Table 6:** annual average of growth rate of GDP in Germany since 1980 (grouped in classes of 10 and 15 years)

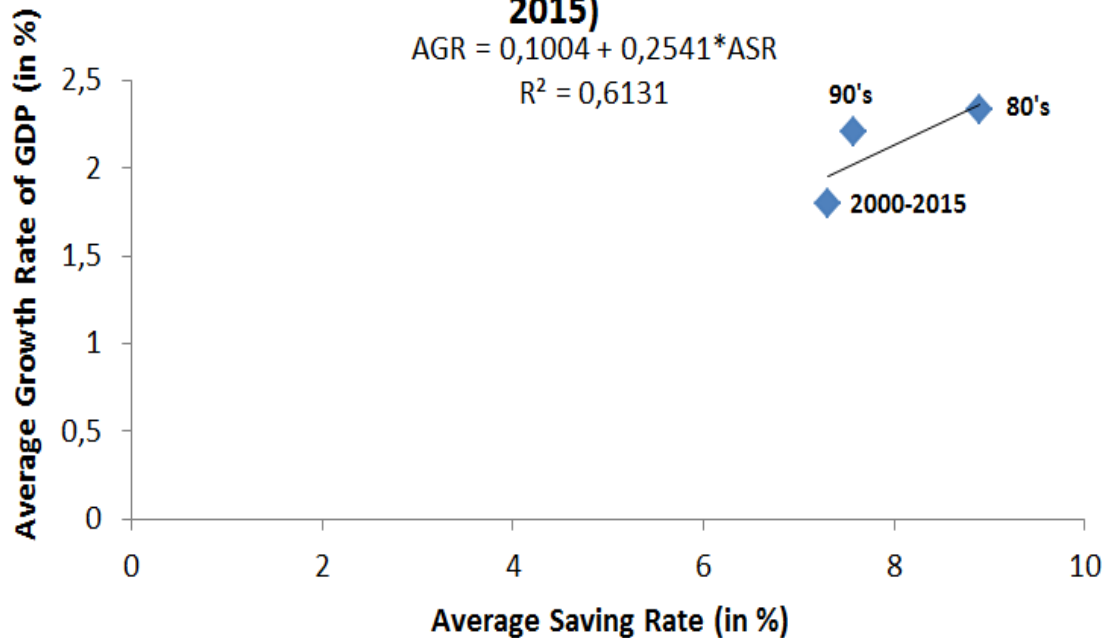
<b>80's</b>	2,33%
<b>90's</b>	2,21%
<b>2000-2015</b>	1,8%

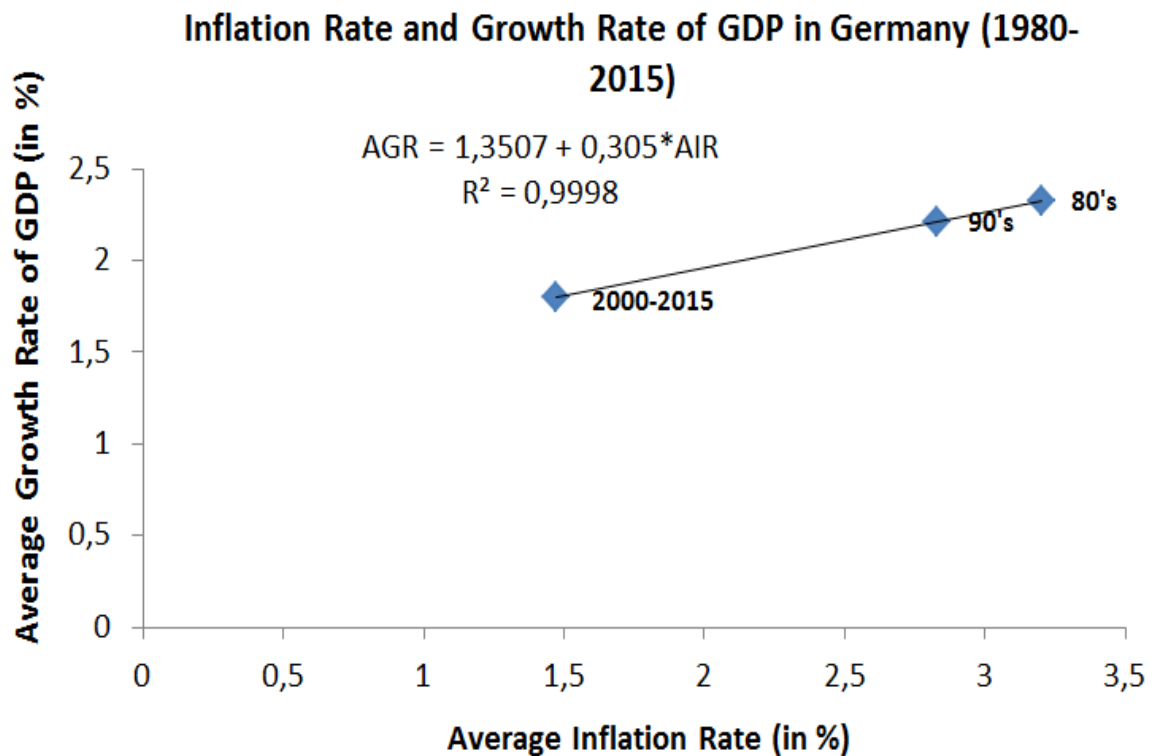
Source: *OECD* data elaboration

### Inflation Rate and Saving Rate in Germany (1980-2015)



### Saving Rate and Growth Rate of GDP in Germany (1980-2015)



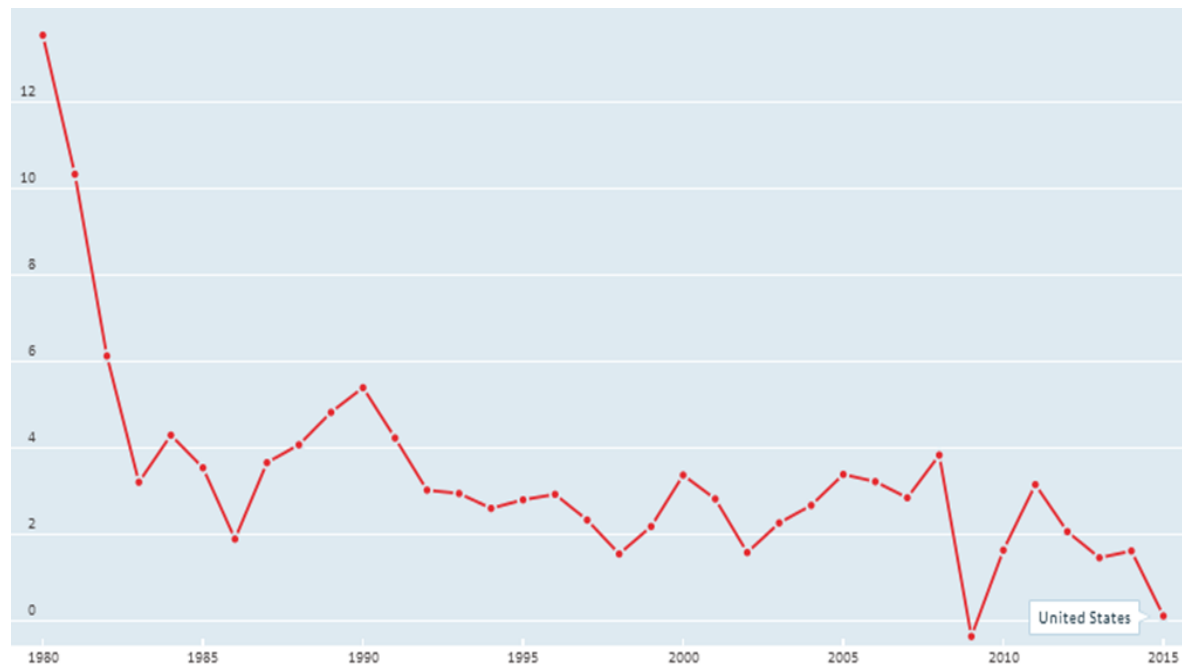


In the case of Germany, the index  $R^2$  is less, compared to Italy, in the relationships between the rate of inflation-savings rate and between the GDP growth-rate savings rate. Still hold these relationships highlighted from the 1980. Finally, as we can see from the last linear regression graph, the relationship between the inflation rate and the growth rate of GDP in Germany is very strong: inflation in Germany, which since the 80s was basically lower than the other countries considered, has been slowly decreasing and this trend has been accompanied by a growth rate of GDP slowly decreasing, without suffering significant decreases (apart from in 2009 due to the global economic and financial crisis).



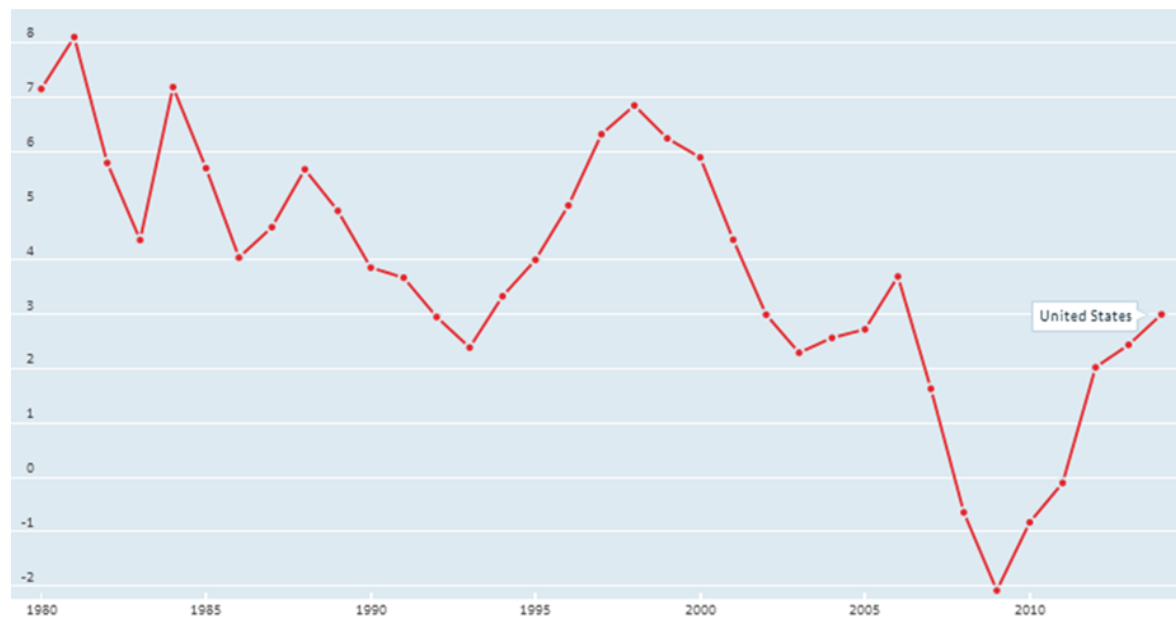
### 5.3 The case of USA

**Figure 20:** Inflation rate in USA (1980-2015)



Source: <https://data.oecd.org/>

The level of inflation in the USA, after the peak reached in 1980 (up 13.5%) fell significantly in the course of the years, remaining with the highest peak reached in 1990 with an inflation rate of 5.4%. The trend in recent years is less similar with respect to the countries of the euro area: the central bank of the USA (the Federal Reserve) has used a monetary policy that is more expansionary, leaving a wider margin of inflation to be able to use as a lever to solve some problems in an economic system so vast and varied. The devaluation of the dollar after the financial crisis that broke out in the US between 2007 and 2008 has certainly helped the US economy to recover from the crisis, bringing the USA to an immediate and substantial increase in production from 2010. Let us now look at how inflation trends of the last 35 years has influenced the behavior of consumers/savers.

**Figure 21:** Saving rate in the USA (% of GDP, 1980 - 2014)

Source: <https://data.oecd.org/>

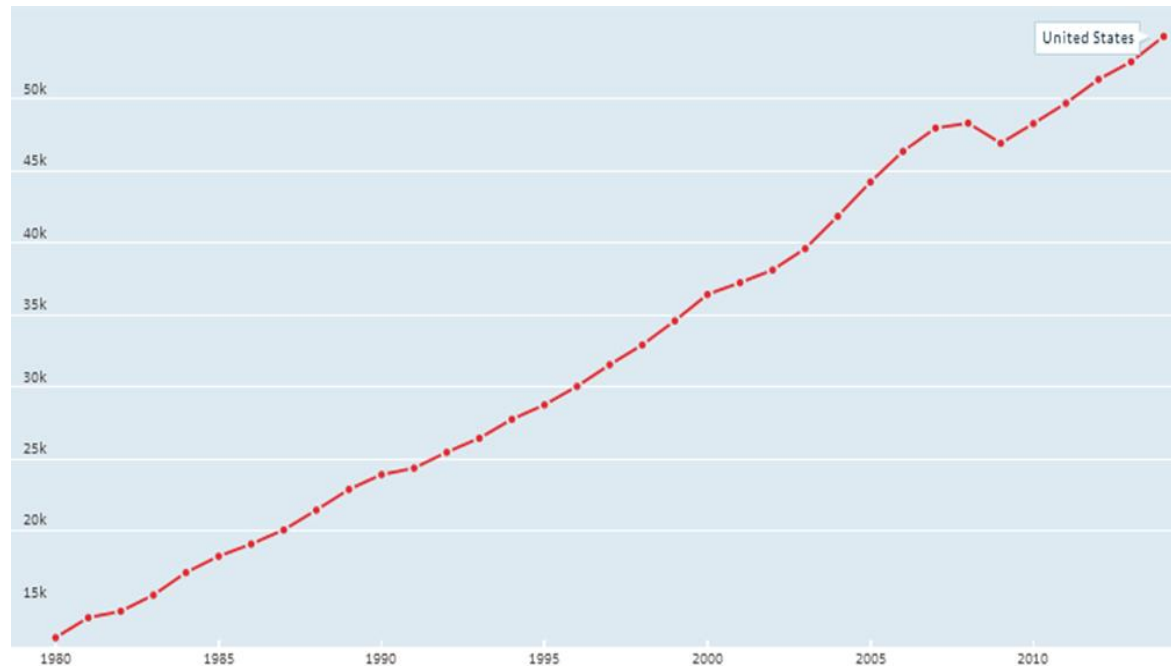
The consumers in the USA, famous for their high propensity to consumption, have maintained their savings rate tendentially low; this is thanks to the great trust in the US economy which in the last century has undoubtedly enjoyed the fame of the leader of the world economy (in particular in the second world war). This also translated into a great confidence of foreign investors, which have allowed us to obtain substantial financial capital.

**Table 7:** annual average of inflation rate and savings rate in USA since 1980 (grouped in classes of 10 and 15 years)

USA		
	Average inflation rate	Average saving rate
<b>80's</b>	6,15%	5,02%
<b>90's</b>	3,30%	4,95%
<b>2000-2015</b>	2,24%	2,00%

Source: *OECD* data elaboration

Also in this case the assumption of this thesis are reflected in the data. The tendency of inflation toward lower values in the course of the last few decades has generated in the consumer behavior change, destining for consumption a wafer always greater than their income.

**Figure 22:** Real GDP per capita in the USA (1980-2015)

Source: <https://data.oecd.org/>

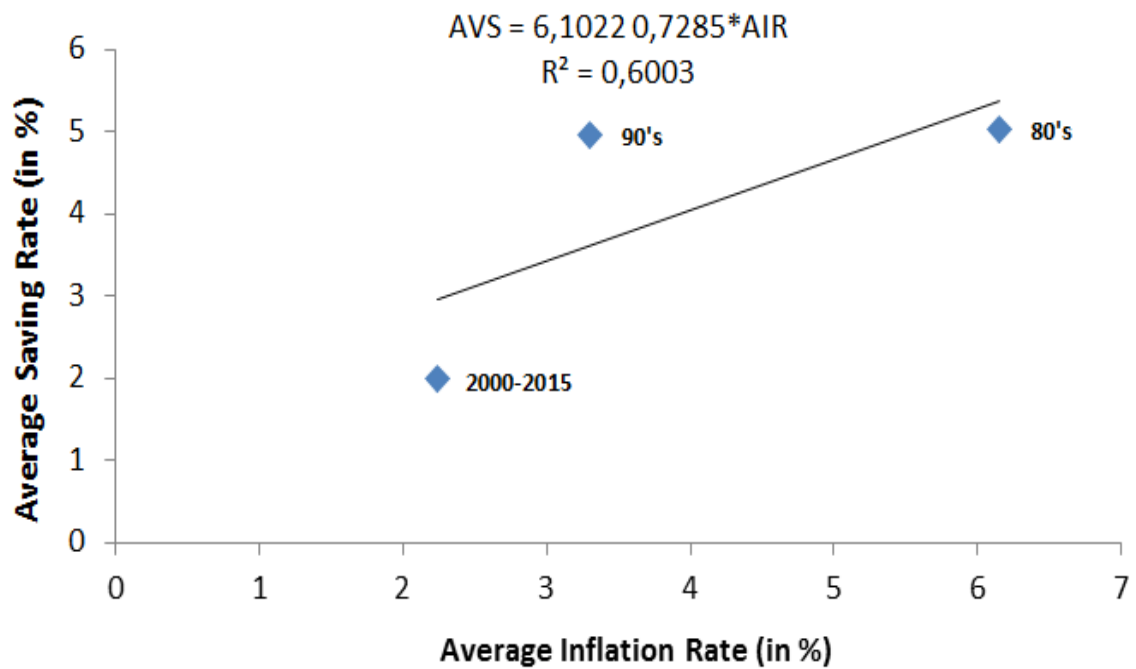
The USA have recorded without doubt a great economic growth in recent years that have emphasized its leading position in the world economy. Despite savings rates very high not registered in the USA, the ease for the USA to attract foreign capital enabled the State and with US companies to make huge investments in physical and human capital (and then to a technological progress very high); these factors have led the US economy to an impressive economic growth.

**Table 8:** annual average of growth rate of GDP in USA since 1980 (grouped in classes of 10 and 15 years)

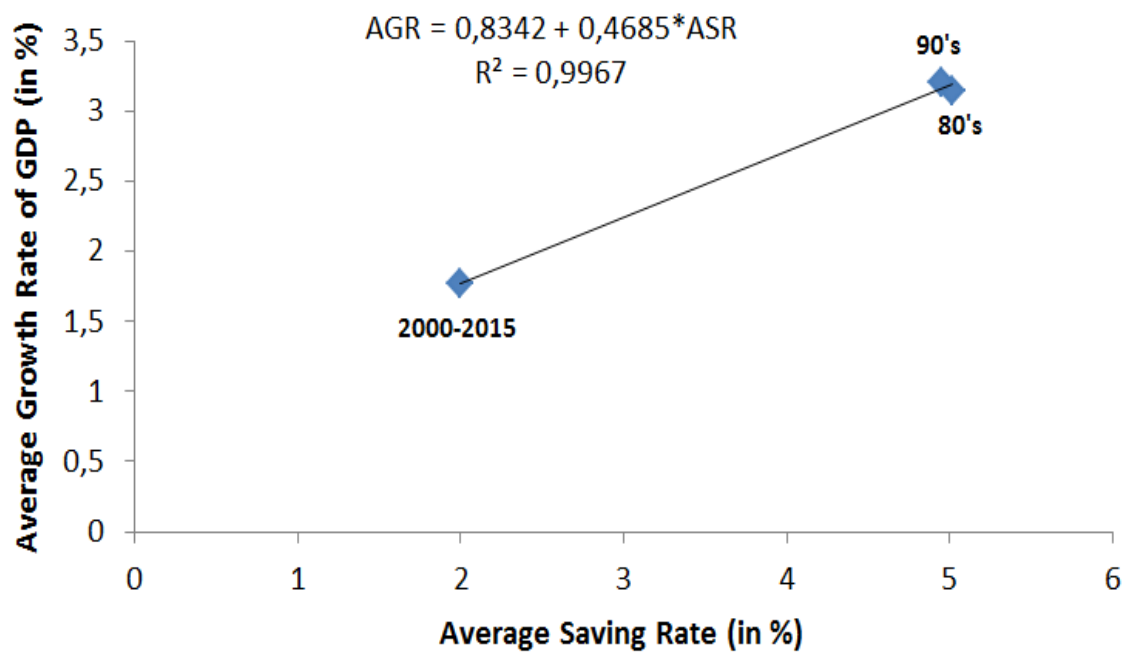
<b>80's</b>	3,14%
<b>90's</b>	3,20%
<b>2000-2015</b>	1,77%

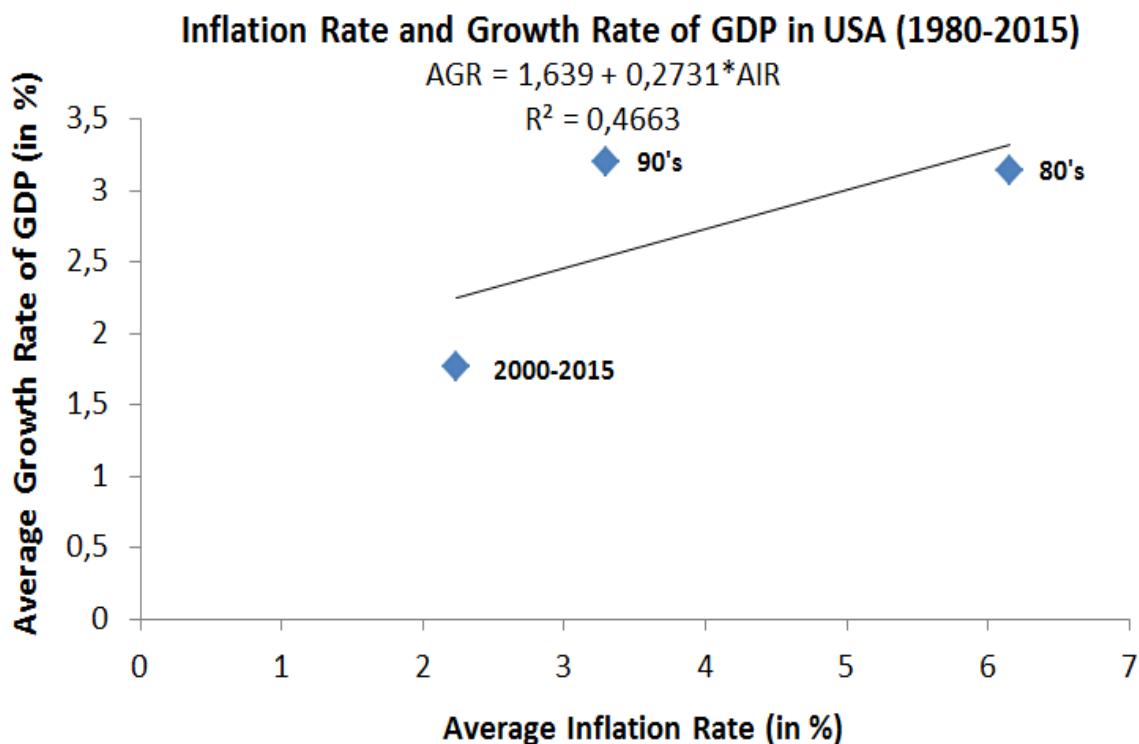
Source: *OECD* data elaboration

### Inflation Rate and Saving Rate in USA (1980-2015)



### Saving Rate and Growth Rate of GDP in USA (1980-2015)

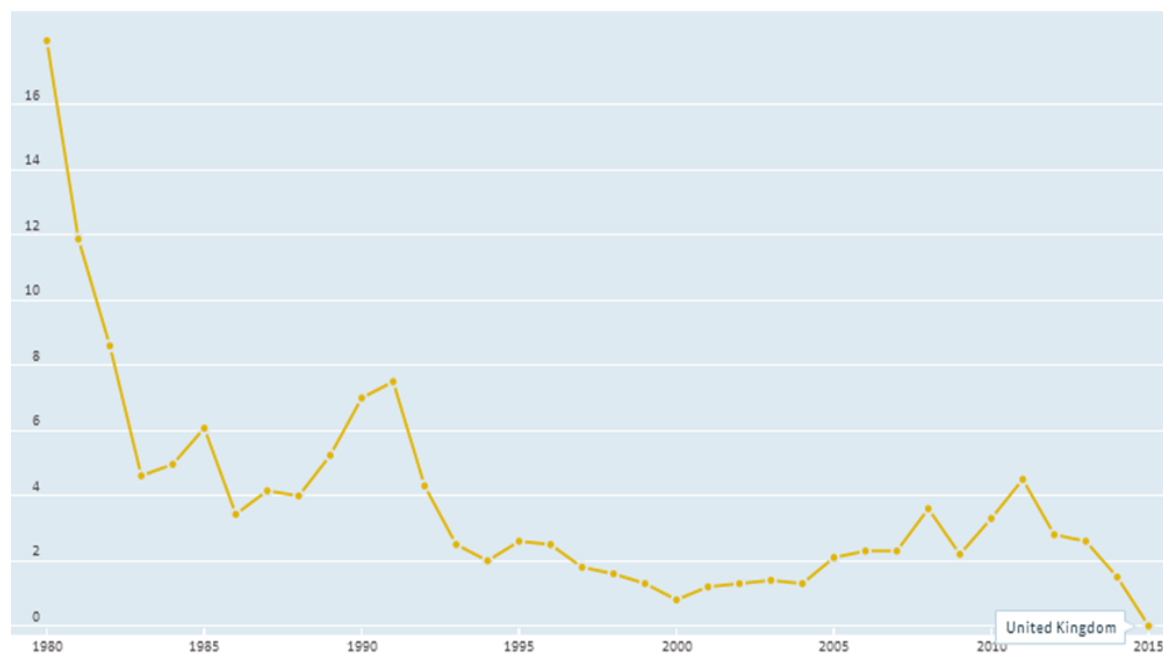




As we can see from the linear regression, over the years there was also in USA a trend in the relationship between inflation and savings rate. Very strong is the relationship found between savings rate and growth rate of GDP (with a  $R^2$  index near 100%) while the relation found between the inflation rate and the GDP growth rate is middle

## 5.4 The case of United Kingdom

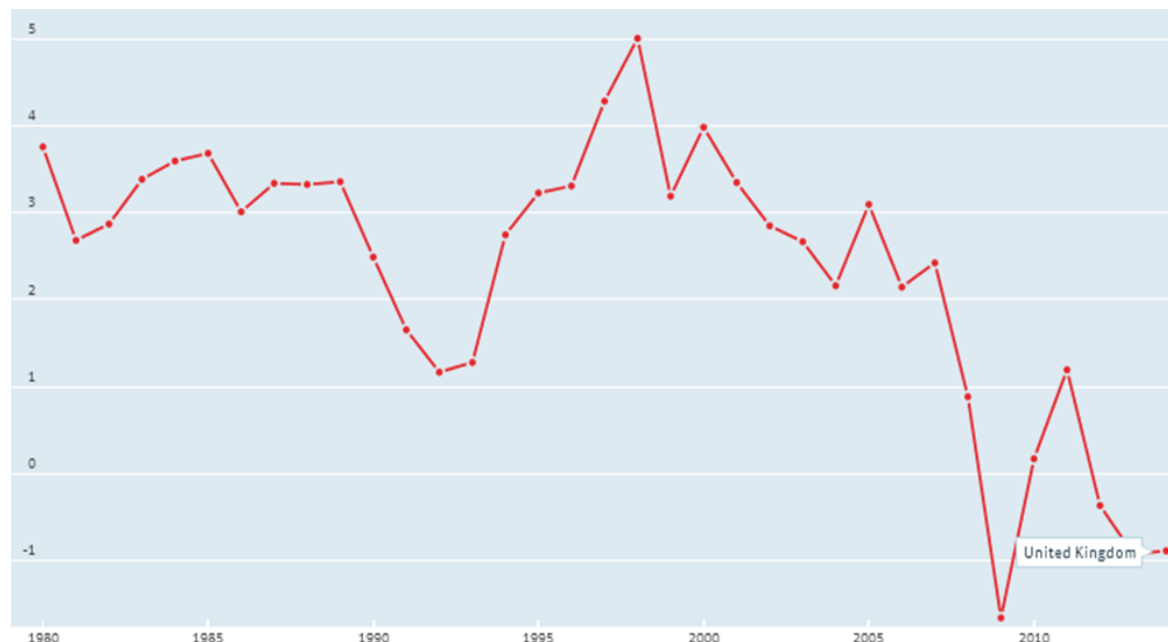
Figure 23: Inflation rate in the United Kingdom (1980-2015)



Source: <https://data.oecd.org/>

In 1980 the inflation in the United Kingdom was 18% but then the pound sterling has acquired a strong value in the years (especially around 2000) and inflation in this nation has been maintained tendentially low, with a peak rather unusual of 4.5% achieved in 2011 but in 2015 inflation recorded was almost 0%.

**Figure 24:** saving rate in the United Kingdom (% of GDP, 1980 - 2014)



Source: <https://data.oecd.org/>

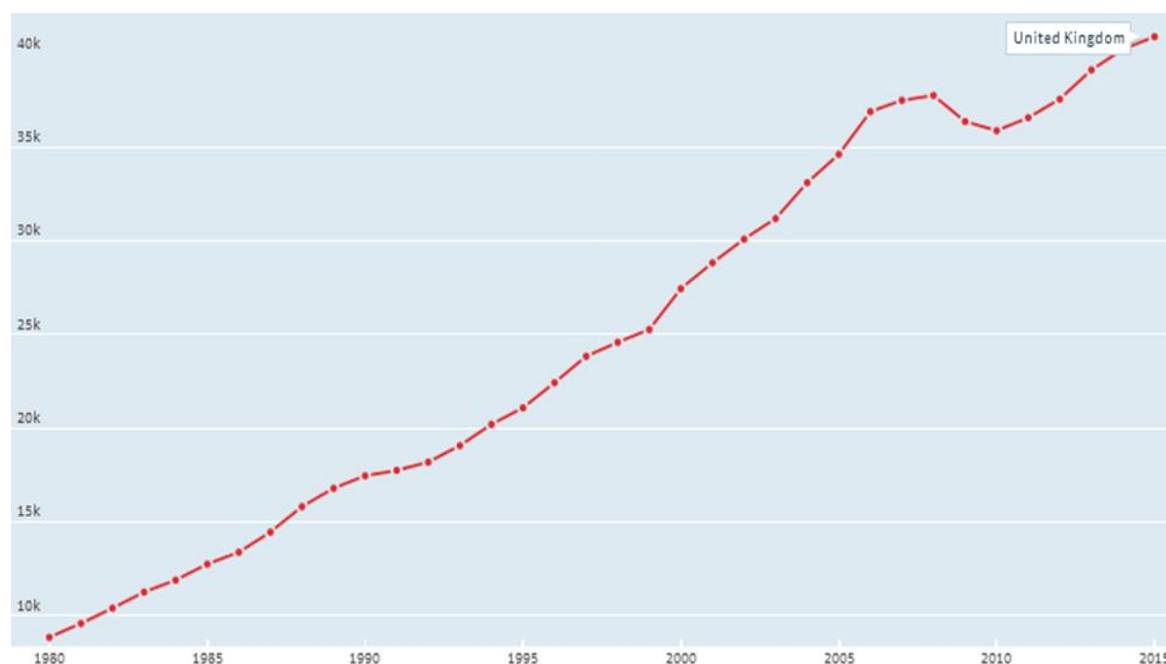
These levels very stable in the rate of inflation have given great confidence in consumers who have maintained the level of savings always rather low.

**Table 9:** annual average of inflation rate and savings rate in United Kingdom since 1980 (grouped in classes of 10 and 15 years)

United Kingdom		
	Average inflation rate	Average saving rate
<b>80's</b>	7,87%	3,67%
<b>90's</b>	3,31%	3,15%
<b>2000-2015</b>	2,61%	1,39%

Source: *OECD* data elaboration

The average inflation for the eighties was very influenced by anomalous value found in the year 1980. However the level of inflation is always kept rather low and has decreased over the years, generating an ever-greater confidence of British consumers, which in the course of the decades have increased more and more power at the expense of savings.

**Figure 25:** Real GDP per capita in the United Kingdom (1980-2015)

Source: <https://data.oecd.org/>

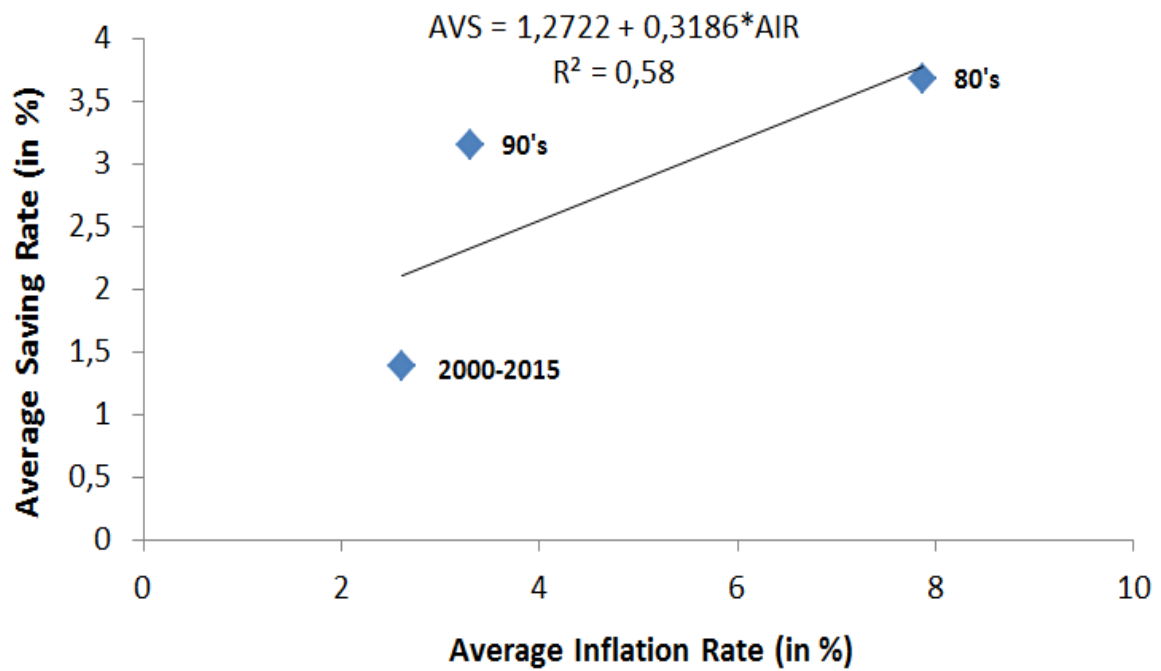
Both the rate of growth that the levels of growth recorded in the United Kingdom are rather high. My confidence in the British economy and the great power of the Pound Sterling have allowed to government and the British companies to attract easily large foreign capital. The situation observed is therefore similar to that of the United States: foreign capital have allowed the United Kingdom to make huge investments in physical and human capital (and therefore a high technological progress), and then the economy recorded high rates and levels of growth of per capita GDP.

**Table 10:** annual average of growth rate of GDP in United Kingdom since 1980 (grouped in classes of 10 and 15 years)

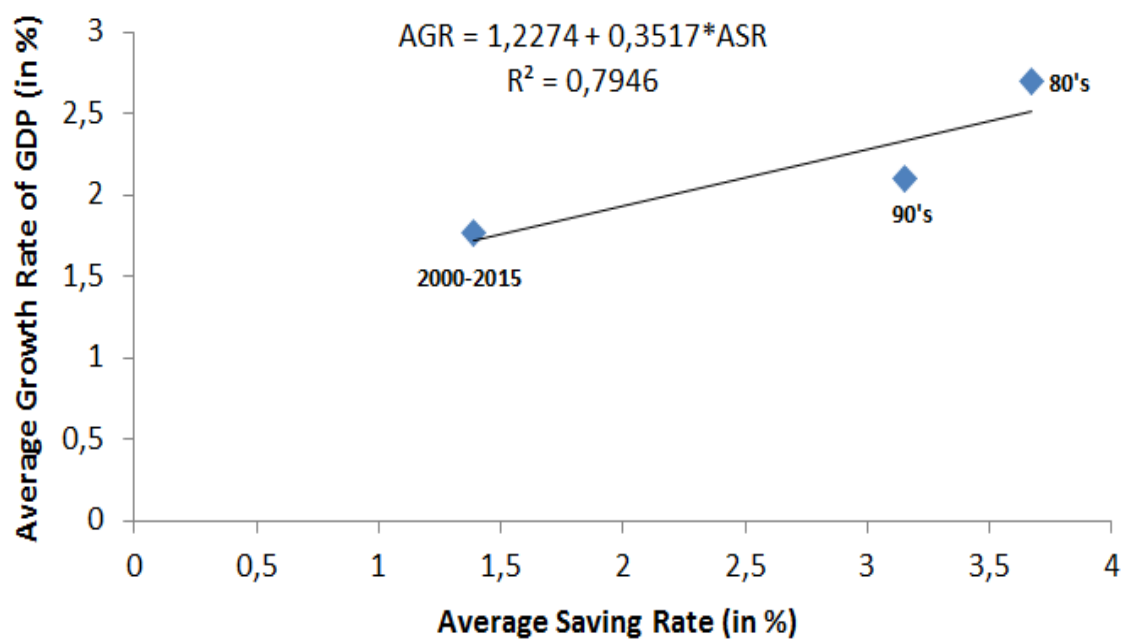
<b>80's</b>	2,70%
<b>90's</b>	2,10%
<b>2000-2015</b>	1,77%

Source: *OECD* data elaboration

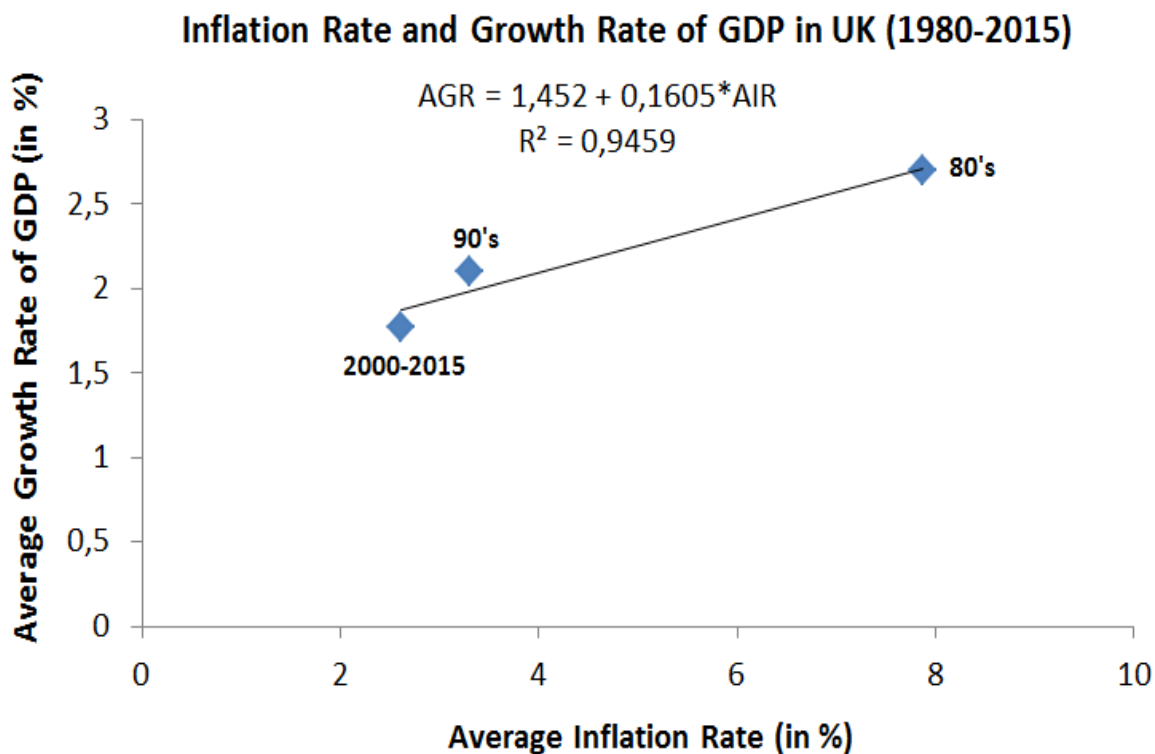
### Inflation Rate and Saving Rate in U.K. (1980-2015)



### Saving Rate and Growth Rate of GDP in U.K. (1980-2015)



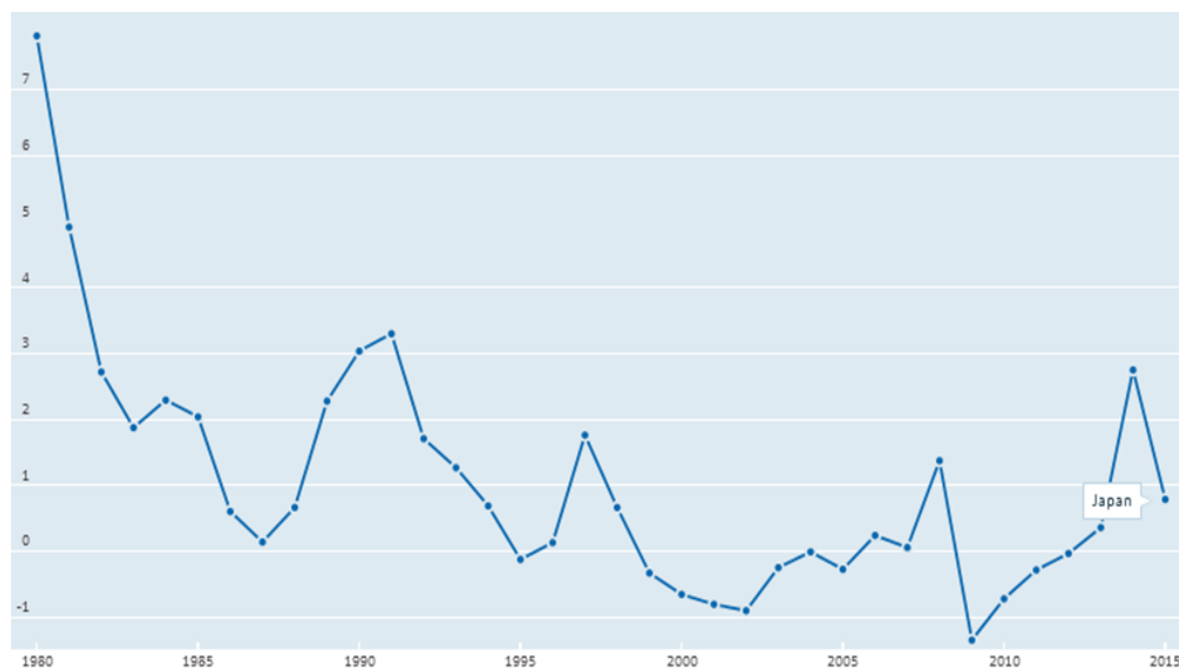




The relationship registered in the United Kingdom from 1980 to 2015 between inflation and savings rate is middle, while it is medium-high the relationship between savings rate and GDP growth rates. Finally, the relationship between inflation and growth rate of GDP is very strong, with an  $R^2$  index at 94,59%.

## 5.5 The case of Japan

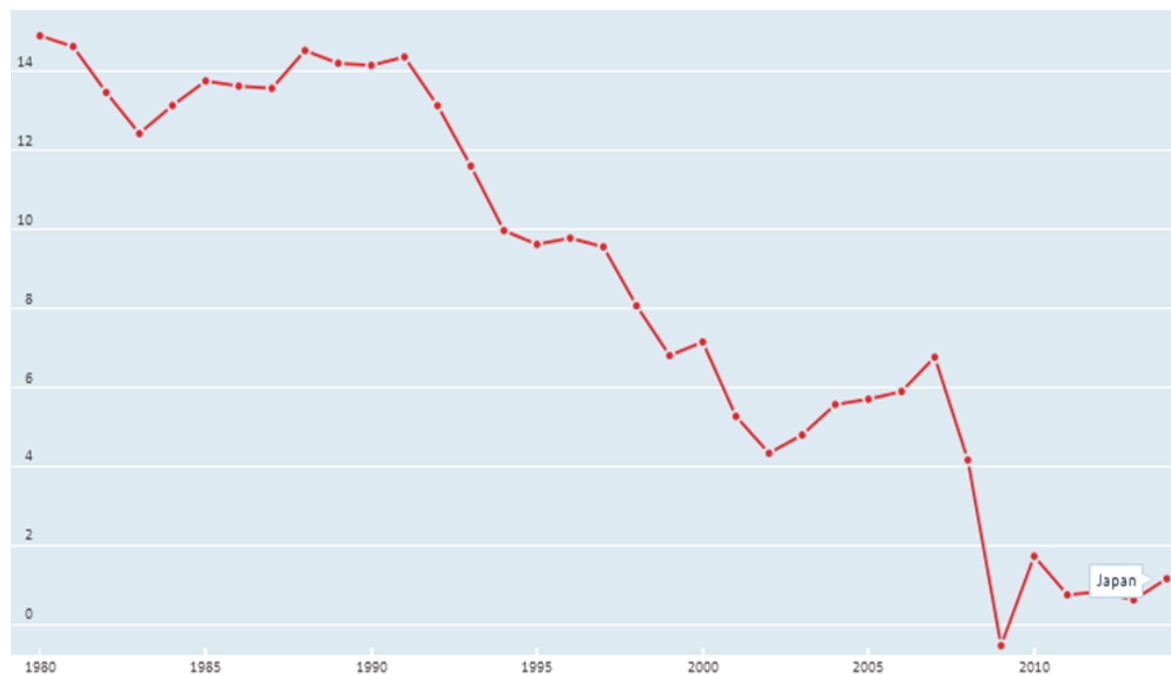
**Figure 26:** Inflation rate in Japan (1980-2015)



Source: <https://data.oecd.org/>

The speculative bubble formed from 1986 and broke out in 1991 caused a long period of deflation in Japan resulting stably the inflation level at a level around 0% (with periods in which the values were negative). However this stability of inflation (it would be better to call it deflation) certainly was not due to a high value of the Japanese currency, indeed the causes were due to diseases of the economic system. The speculative bubble burst at the beginning of the Nineties has caused an economic crisis plunging Japan in the so-called "lost decade", where the annual rate of economic growth was equal to 1.4% of GDP, rate considerably lower than the 4,1% of the eighties. This situation of deflation is protracted even in the last 15 years. We see in the next graph as replied consumers to this situation.

**Figure 27:** Saving rate in Japan (% of GDP, 1980 - 2014)



Source: <https://data.oecd.org/>

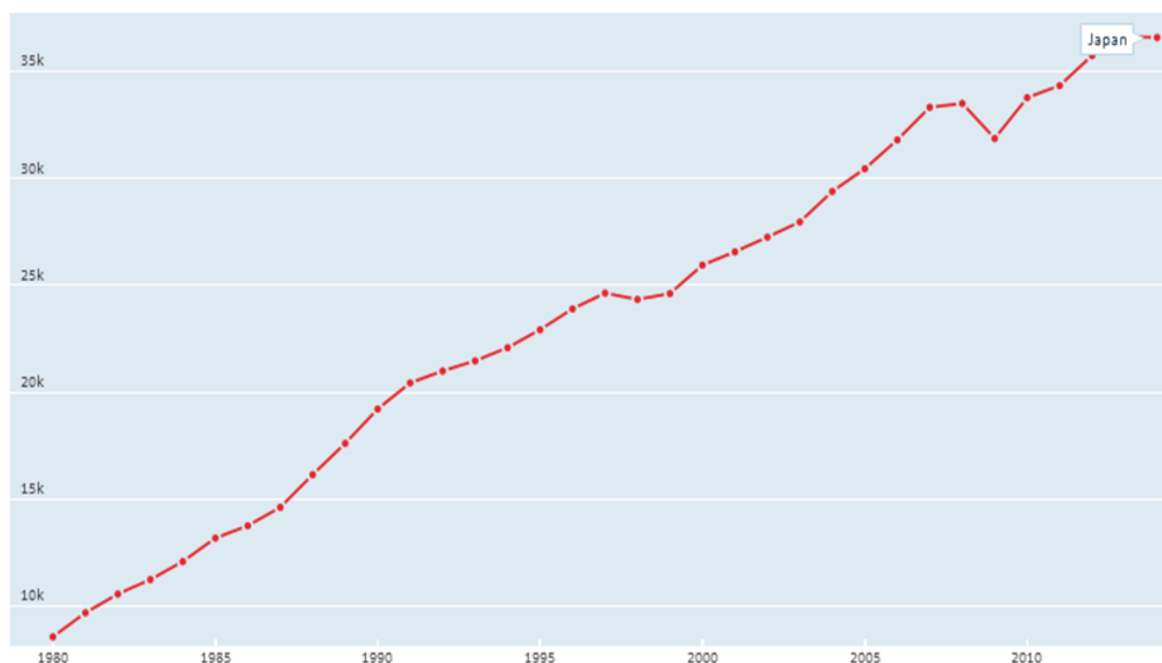
Japan is historically known as a country in which consumers have the tendency to save a lot. These high levels of savings are maintained even during the period of crisis which caused the deflation: this situation was seen by consumers as a "slowing down of the economy" and then as a risky situation for the future, so as to encourage them to maintain a high marginal propensity to savings, even if it has fallen significantly over the last 15 years.

**Table 11:** annual average of inflation rate and savings rate in Japan since 1980 (grouped in classes of 10 and 15 years)

Japan		
	Average inflation rate	Average saving rate
80's	2,81%	15,35%
90's	1,35%	11,91%
2000-2015	0,02%	3,61%

Source: OECD data elaboration

Whereas the "deflationary crisis" that hit Japan in the years '90, such data are not in contrast with the hypothesis of this thesis, indeed the corroborates if we give to the inflation the role of "regulator of consumer expectations": if a high inflation creates instability, a deflation that lasts for a long period is synonymous with some pathology of the economic system, and this negatively affects the consumption, in the same way in which negatively affects the consumption an inflation level high and unstable for a considerable period. The dramatic fall in the savings rate in the last fifteen years may be due to slight signs of recovery of GDP and the policies of the Japanese authorities aimed at increasing consumption.

**Figure 28:** Real GDP per capita in Japan (1980-2015)

Source: <https://data.oecd.org/>

Despite the crisis that has hit Japan in the 1990s, it has recorded good levels of growth (similar to those of the Italy) even if at a very low rate if we consider the period from 1990

onwards (indeed from 1990 onwards the line that represents the per capita GDP in Japan is less inclined with respect to the period of the 1980s). The factors that have allowed to Japan to have however an economic growth (albeit at a very low rate with periods of negative growth) is attributable to 2 factors:

- The high savings rate in 1980, whereas in that period the Japanese economy was in strong growth, has led to the accumulation of high levels of saving in those years;
- the high indebtedness of Japan: the high demand for foreign financing has led Japan to be the nation most indebted in the world. According to data from the International Monetary Fund, from the 1996 Public Debt Japanese was of over 93% on GDP and went always increasing arriving, in 2014, to touch the 240% of its GDP.

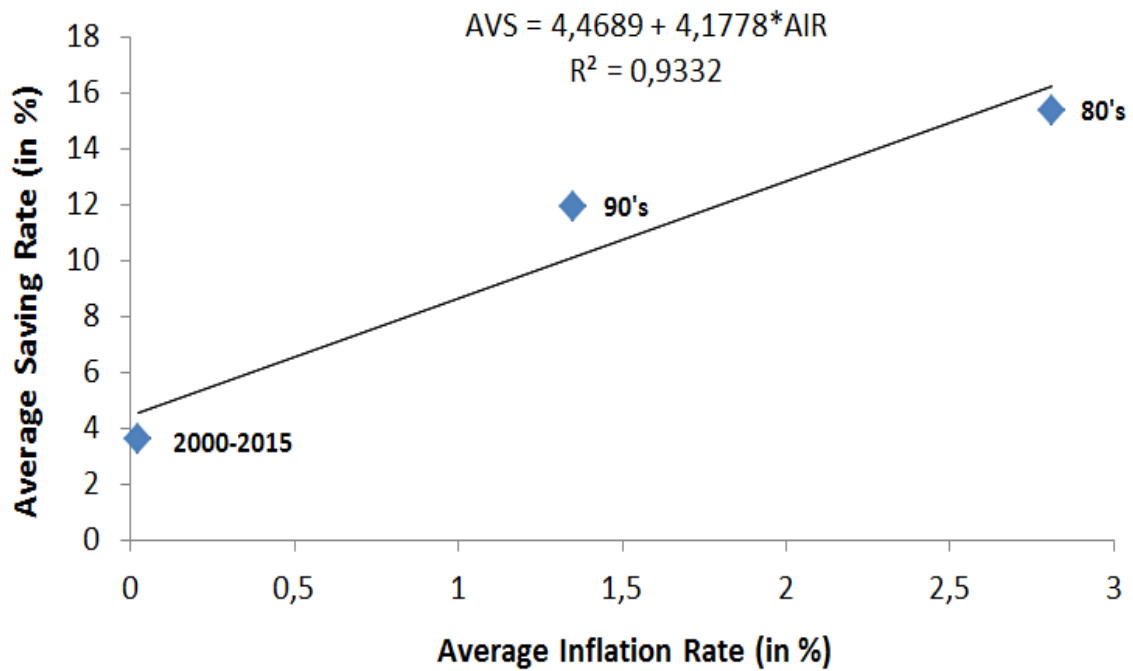
Although the very high indebtedness of Japan now represents a major problem for the economic policy authority Japanese, it has allowed to Japan to carry out, in the course of the last few decades, important investments in capital, especially in human capital: in fact, Japan has always reported high levels of technological progress. In 2015, according to the estimates reported in this thesis in the paragraph on the accumulation of human capital, Japan was ranked in fifth place in the ranking of the Human Capital Index. These factors explain why the Japanese economy has continued to grow, albeit at a very low rate, despite the crisis.

**Table 12:** annual average of growth rate of GDP in Japan since 1980 (grouped in classes of 10 and 15 years)

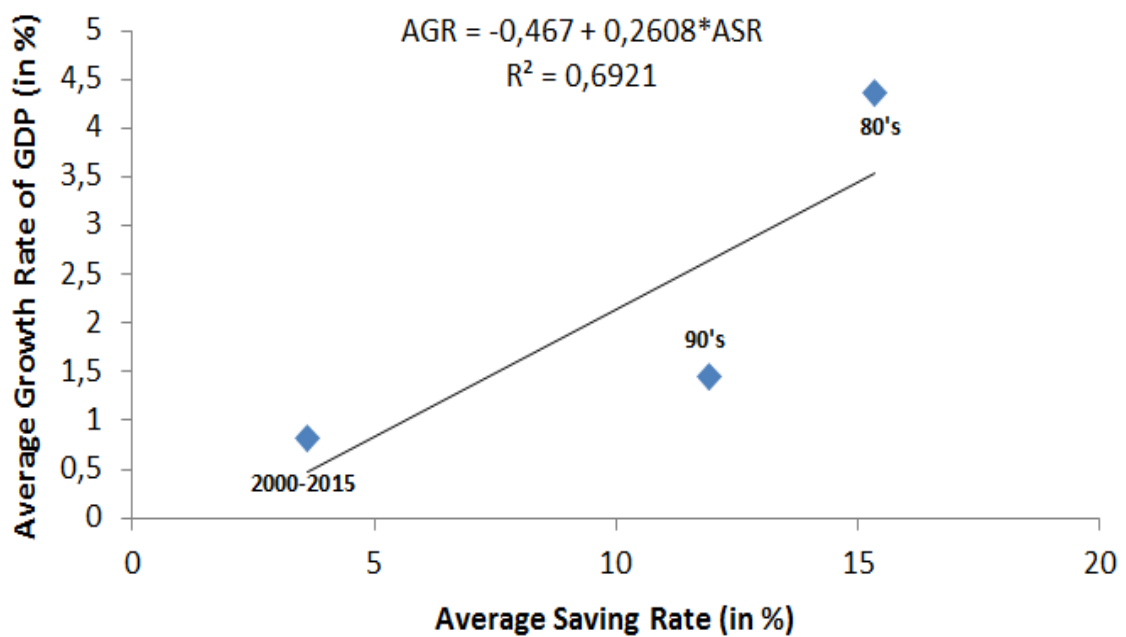
<b>80's</b>	4,37%
<b>90's</b>	1,46%
<b>2000-2015</b>	0,82%

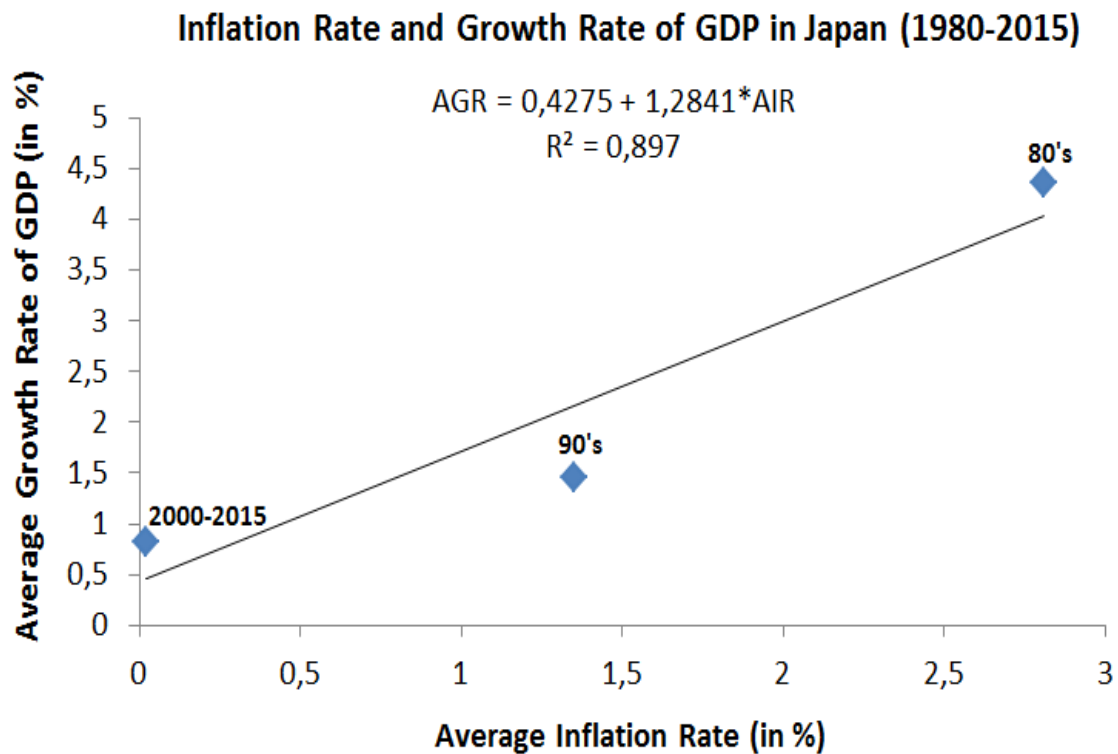
**Source:** *OECD* data elaboration

### Inflation Rate and Saving Rate in Japan (1980-2015)



### Saving Rate and Growth rate of GDP in Japan (1980-2015)





In Japan, the relationship between inflation rate and the savings rate is very strong: this means that since 1980 the Japanese consumers have decreased their marginal propensity to save as inflation has declined. Since the 90s, inflation rate in Japan is very low because of the crisis broke out in the early 90s; this led the Japanese economy to experience deflation and since 2000 inflation is firmly on average close to 0% (with some periods with negative inflation). In fact, Japanese consumers are holding low savings rate, despite the low inflation in Japan is due to the Japanese crisis and not to a situation of economic and financial stability.

The growth rate of GDP in Japan has been very low, virtually around 0% by 1990: therefore, economic growth was suppressed significantly by the Japanese crisis for this, the relationship between savings rate and GDP growth rates is not very strong.

Finally, the relationship between the inflation rate and the growth rate of GDP is very strong: the two rates are detected quite low since the 90s but they still followed a common trend. In fact, the crisis in Japan and its GDP growth rate around 0% is due to the Japanese crisis, and inflation constantly close to 0%, probably a rise in inflation would allow Japan to record a growth rate of GDP higher.

## 6 Discussion of results

From the results obtained in the previous paragraphs, it is possible to encounter, as in all countries analyzed, that the decrease in the average inflation rate in the course of the years has always been accompanied by a reduction in the savings rate and therefore to an increase in consumption and this result is in line with the hypotheses situated at the base of this thesis. In all cases, in the 1980s there was a more high inflation, and then it decreased gradually over the years (although often with irregular patterns). These results are evident from the study of the relationships carried out with the regression linear model: in almost all cases, the index  $R^2$  has shown a strong dependence between the variables, despite the heterogeneity of the time intervals and of the Nations taken into account. However even cases of instability in the economic-financial followed by long periods of deflation (as in the case of Japan), and cases of uncertainty political-social (like the political division of Germany during the Cold War) have led to a loss of confidence on the part of consumers.

In general, the highest savings rates recorded in the 1980s have generated an important economic growth in subsequent decades thanks to the capital investments made by governments and enterprises (first of all in the case of Germany). The economic growth that is significant, is determined by the accumulation of capital in the long term - which is why, as can be seen from the results, the effects on the economic growth of a high level of savings were felt inside a long time interval. This result is consistent with the model of Solow.

However, in the recent years the GDP per capita of economic systems analyzed is continuously grown, with the exception of some periods of recession. It is important to stress however as this growth has taken place at rates very different between nations (growth of GDP per capita in Japan has been very slow by 1991, while the United Kingdom grows at a high rate from 2000). It is even more interesting to ask why the Japan, albeit at a very slow rate, is growing over time rather than decrease.

In general, despite a savings rate continuously decreasing (especially in the last 15 years), nations continue to grow although on average at lower rates than the eighties and nineties. This phenomenon seems to be based on the following reasons:

- the effects of high savings rates result in investments in the long term whose positive effects on economic growth are embodied in a very long temporal arc, and then still the nations grow also thanks to the investments that would have been able to carry out thanks to the high levels of savings recorded over the years more inflation (1980s);

- economic growth has been accompanied by a lower tendency to saving but levels of savings positively depend not only from the savings rate, but also on the level of production-income;
- the nations in which it is recorded in the last few years a high propensity for consumption (e.g., US and UK) and then A low savings rate, have had the ability to attract many foreign financial capital, so having the financial resources to invest widely in physical capital human/thanks to debt with foreign institutions;
- in recent years there has been a greater tendency to invest in human capital and this has generated a technological progress in continuous and substantial increase: these factors allow the nations to have a greater marginal productivity under equal conditions and so creating favorable conditions to continue to grow beyond the point of steady state assumed by Solow (and this result is in line with the new theories on economic growth which consider the technological progress as endogenous factor and no more as exogenous).

However the savings still plays a central and essential role: the physical capital already existing depreciates from year to year has to be covered with new investments and investments in human capital are still financed from sources of savings; moreover the continuous technological progress requires constant investment in physical capital.

Thus although in recent decades the growth of human capital and technological progress have increased the marginal productivity of capital per capita, growth and innovation of the latter are fundamentals elements so that they can maximize the positive effects on the economic growth of investment in human capital and technological progress. So the savings still covers today a central and fundamental role for economic growth in the long term. An indirect but fundamental role is also held by all those endogenous and exogenous phenomena that influences the saving/consumption of savers/consumers.



## 7 Conclusion

The aim of this thesis was to look for a relationship between the stability of inflation rate and the economic growth in the long run.

We started with the analysis of the main factors that influence the growth economy in the long term both from the point of view of Solow, thus emphasizing the role of savings and investments, and from the point of view of new theories of growth, which introduce technological progress as endogenous rather than exogenous factor: even in the latter case, the savings rate, on equal terms, is essential to allow State and firms in a given economic system to invest in all those factors that positively affect the technological progress (such as *R&D*, human capital, investment in education and training, etc.).

Then we analyzed the inflation data of a group of OECD countries and we discussed the main factors that influence this phenomenon. We also analyzed how inflation can affect the behavior of consumers/savers in consumption/saving choices.

In the concerned results we have considered five OECD countries (Italy, Germany, USA, UK and Japan) considering the time period from 1980 to 2015. Then we studied, through historical data and linear regression models, the following relationships for each country and for the same period under consideration:

- relationship between the inflation rate and savings rate;
- relationship between the savings rate and growth rate of GDP;
- relationship between the inflation rate and the growth rate of GDP.

These reports have been performed in order to test the validity of the assumptions of this thesis, which is to find a relationship between stable long-term inflation and economic growth in the long run.

In all three cases, and in all analyzed economic systems, we have highlighted medium-high correlation indices, with some results close to 100% (in particular in Italy and Japan).

Considering the structural heterogeneity of these countries, as well as economic conditions from which each of them has been hit over the past few decades, we can say that the hypothesis of this thesis have match found in the data. In fact, the results of these reports in the five countries analyzed have put in shows a common tendency of such relationships, albeit with slightly different intensities.

To summarize, the indirect relationship between inflation and economic growth in the long run can be summarized through the following interim reports:

- high inflation rates cause uncertainty among consumers and so they lower the fuel consumption and increase the marginal propensity to save;

- under equal conditions, a higher savings rate is accompanied by higher levels of savings and thus increased investment;
- according to the analysis of Solow, greater investments have a positive effect on economic growth in the long run;

We can therefore conclude that high rates of inflation, on equal terms, can lead to greater economic growth in the long run.

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